ADVANCING
SOUTHEAST ASIAN ARCHAEOLOGY 2019
Selected Papers from the Third SEAMEO SPAFA International Conference on Southeast Asian Archaeology
Editor: Noel Hidalgo Tan
Advancing Southeast Asian Archaeology 2018 is published by SEAMEO SPAFA, a regional centre established by SEAMEO (Southeast Asian Ministers of Education Organization) which consists of 11 Southeast Asian countries. SEAMEO SPAFA (Regional Centre for Archaeology and Fine Arts) focuses on archaeology and fine arts in Southeast Asia, and promotes awareness and appreciation of the cultural heritage of the region. Its member-countries are Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam, and Timor-Leste; and its associate member-countries are Australia, Canada, France, Germany, the Netherlands, New Zealand, Spain and the United Kingdom.
ADVANCING SOUTHEAST ASIAN ARCHAEOLOGY 2019

Selected Papers from the Third SEAMEO SPAFA International Conference on Southeast Asian Archaeology, Bangkok, Thailand 2019

SEAMEO SPAFA
Regional Centre for Archaeology and Fine Arts
2020
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Archaeology continues to grow as a field of research in Southeast Asia, with increasing participation and leadership of home-grown archaeologists, researchers and cultural heritage professionals. As such, there is an emergent need for a dedicated venue for archaeological research to be presented and shared in the region. The SEAMEO SPAFA International Conference on Southeast Asian Archaeology (colloquially known as SPAFACON) was conceived to provide a forum to discuss new discoveries and updates of archaeological developments in Southeast Asia, particularly from researchers native to this region.

The 3rd SEAMEO SPAFA International Conference on Southeast Asian Archaeology was held in Bangkok, Thailand and jointly organised with the Fine Arts Department of the Thai Ministry of Culture. Some 300 archaeologists, researchers and students from the Southeast Asian region and beyond attended this conference, and 180 papers were presented over the course of the conference. The volume contains a selection of 41 papers from the conference, including the country reports on recent archaeological developments in Southeast Asian countries. The papers in this volume are arranged thematically, and represent the breadth of exciting archaeological research projects and discoveries ongoing in the region.

We were fortunate to be able to undertake a number of adjacent activities in conjunction with the conference. The Fine Arts Department hosted site visits to the Ayutthaya Historical Park and World Heritage Site to learn about ongoing conservation efforts and the water management at the site. There were three post-conference workshops on academic writing, creating heritage trails and grant writing, the latter two organised by Tuklas Pilipinas and the National Geographic Society. At the same time, a consultative meeting was representatives from university archaeology departments and other educational stakeholders. We are certain that this week-long activity of collegiality, collaboration and sharing is a good sign for the potential and vibrancy of cultural heritage appreciation in the region.

This event would not have been a great success without the help of many stakeholders and supporters. We would like to thank the strong support of the Fine Arts Department of Thailand as the main partner for SPAFACON2019; as well as sponsors Beta Analytic, Helm Solutions and the Cultural Relationship Study of Mainland Southeast Asia (CRMA) Research Center.

Finally, we wish to extend our thanks to the Organising Committee from SEAMEO SPAFA and the Fine Arts Department for their hard work. We also wish to thank the academic committee: Assoc. Prof. Rasmi Shoocongdej, Asst Prof Podjanok Kanjanajuntorn, Mohd Sherman Sauffi, Tran Ky Phuong, Assoc. Prof. Armand Mijares, Prof. John Miksic, Sommay Singthong, Prof. Gyles Iannone, Dr. Kyaw Minn Htin, Dr. Im Sokrithy, Dr. Karina Arifin and Dr. Noel Hidalgo Tan for their role in selecting the papers for the conference.

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Country Report: Archaeological Research in Indonesia in 2016-2018
Laporan Dari Masing-masing Negara Penelitian Arkeologi di Indonesia 2016-2018

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Udayana University

Introduction
Archaeological Research in Indonesia is coordinated by the National Archaeological Research Centre (Puslit Arkenas). Due to large areas and cultural diversities in Indonesia, the National Archaeological Research Centre is supported by 10 branch offices. These includes: the Branch office of North Sumatra in Medan, the Branch office of South Sumatra in Palembang, the branch office of West Java in Bandung, the branch office in Yogyakarta (Central and East java), the branch office of Bali (West Nusa Tenggara and East Nusa Tenggara), the branch office of South Kalimantan (Banjarmasin), the branch office of South Sulawesi in Makasar, the branch office of North Sulawesi in Manado, the branch office of Malucas in Ambon, and the branch office of Papua in Jayapura (Figure 1).

There are three main issues or themes of archaeological research in Indonesia: 1) Maritime and inter island trade or exchange; 2) Cultural diversity and local development, and 3) Research in border areas. Based on these issues or themes, several topics have been studied in 2016 in for instance: the pepper agribusiness in the Banten Sultanate between inland and coastal areas in 15th-17th century; Cultural basis of Sangiran civilization; the research on Kojken moddinger in Aceh; the relationship between Hoabinian and Early migration of Austronesia; Water management on Balinese culture; Hindu-Buddhist civilization during the Singosari period; Austronesian culture in East Sumba; Ancient Mataram civilization (10th-11th Century) at Magetan, in East Java; Research on Majapahit civilization in East Java; and to trace civilization at Lake Matano, South Sulawesi (Pusat Penelitian Arkeologi Nasional 2016-2018).

Fig. 1 Map showing the distribution of rock arts in Indonesia, developed from Arifin and Delanghe (2004). Source: Simanjuntak 2016: 275.
The research topics in 2017 include: Human civilization during Pleistocene at Kobatuwa site, Soa dome, in East Nusa Tenggara; Maritime trade routes in early historical period at Plawangan; Majapahit civilization at Mojokerto in East Java, Hindu-Buddhist civilization at the Batanghari River, at Dharmasraya, West Sumatra; Diaspora and prehistoric cultural diversity at East Sumba; Trade networks in Central Moluccas from Hitu to Ambon; Archaeological research at Natuna; Hindu-Buddhist civilization during Kedirii-Singosari period in East Java; and ancient trade patterns during Hindu-Buddhist period at Nganjuk, East Java.

Several research topics were conducted in 2018: Hindu-Buddhist civilization during Kadiri-Singhasari the fourth period at Kadiri in East Java; The Characteristic of Islamic maritime culture at the Lamreh coastal area at Aceh Besar Regency, Aceh Province; Tracing maritime activity and cultural diversity at karst in Misool Island; Human diaspora and cultural diversity during prehistoric period in East Sumba; Hindu-Buddhist civilization along Batanghari River systems; Shipping pattern in Central Moluccas: from Haitu to Ambon; Archaeological research at Kendal in Central Java; The characteristics of human civilization during Pleistocene; Tracing civilization at Matano Lake, in South Sulawesi; Majapahit civilization at Mojokerto, in East Java.

Apart from archaeological research which were conducted by National Archaeology Research Centre in Jakarta, all the branch offices of archaeological research in Indonesia have also conducted research programmes. The branch office of North Sumatra or Medan have conducted an archaeological survey at North Bintan island, Riau Province; Archaeological research at Samosir island; Maritime archaeological research on coral midden of Bukit Kerang Kawal Darat; Research on archaeological landscape at Biara Sangkilon; Archaeological excavations at Ngaluh Tompok Syohiah I at Nagari Situmbuk, Distric Salimpang; analysis of macro environment of Bukit Barholo site at Regency of Dharmasraya; Research on Austronesia at Gayo, Aceh Province in West Indonesia.

Meanwhile, the Branch office of Archaeological Research in South Sumatra researched the roles of Southern Belitung in maritime trade routes; Tracing ancient port site along riverine of Lumpur; the cosmology of temple system at Muara Jambi; Archaeological landscape of Religious sites along riverine of Lematang; Ground plan of Megalithic settlement sites at Tanjung Aro; Trace of prehistoric settlement at Bukit Bulan limestone; Exploration of archaeology at Enggano island; and Identifying ancient scripts and language in South Sumatra.

The research by the branch office of archaeology of West Java include: Function of structures at Telagajaya site IV, at Teluk Buyung, Pakisjaya district in the Regency of Karawang of West Java; Tracing early migration at Carlang, in West Java; The diversity of forms of gravestones at Ciamis, West Java; and the cultural landscape of sites along the Semangka river in West Lampung.

The branch office of Yogyakarta have done several research topics as follows: The existence of small islands in North Java in relation to migration during the prehistoric period; the settlement pattern of occupation at Kidangan cave during prehistoric period in Blora karst; Bridge technology and drainage system at Van Den Bosch fort; Megalithic remains in relation to Megalithic culture at Banywangi in the Eastern tip of Java; Ngurawan site as remains of ancient kingdom; Settlement patterns during prehistoric and protohistoric periods in the northern coast of Java; and Management of archaeological resources in the City of Banyuwangi.

The research programs of the branch office of Archaeological Research of Bali includes: Investigation of ancient settlement at Tanjung Ser, in the village of Pemuteran, Buleleng Regency; Maritime archaeological research at Sikka, Flores; Archaeological research at Belu, East Nusa Tenggara; Archaeological excavations at Doro Bata site; Archaeological Survey at Petanu Rivers; Archaeological survey in North Bali; Excavation at Gelang Agung site; Archaeological excavations at Doro Mpana;
Archaeological survey on rock arts at Alor; Archaeological excavations at Goa Gede cave in Nusa Penida; and Archaeological excavations at Doro Bente.

Several research programs have been conducted by the Branch Office of Archaeology in North Sulawesi/Menado include: The distributions of Austronesian cultural elements; Spatial research on Megalithic sites at Matuluntung; Prehistoric settlements at Morowali regency in Central Sulawesi; Megalithic sites at the border areas of North Sulawesi; and Ancient Settlement patterns at Kurid Karayan Barat, Nunukan Regency in North Kalimantan.

The Branch Office of Archaeological research of South Sulawesi conducted several research programmes such as Megalithic culture at Bone; Archaeological research on prehistoric caves at Maros and Pangkep; Archaeological research at Kuta Bataguh, Kapuas Regency, Central Kalimantan; Early Austronesian culture and contact with local culture at Mallawa areas; and Irrigation at Ajatapareng tracing early agriculture in South Sulawesi.

Archaeological researches have been conducted by the Branch Office of Archaeological Research at Maluku/Moluccas includes: People, environment, and prehistoric culture at Province of Maluku (the Moluccas); Megalithic research in North Maluku/Moluccas; Islamization and cultural contacts at Kei islands in Maluku/Moluccas; Research on ancient manuscript in Ambon and Lease; and Austronesian cultural elements at Maluku.

The Branch Office of Archaeological Research at Papua or Jayapura conducted several researches include: The trace of Austromelanesian and contact with Austronesian at Raja Ampat Regency, West Papua; Prehistoric cave at Keerom; and Archaeological sites at Srobu Mountain.

There is a committee board which review the proposals and final reports of these researches. The committee members consist of professors and researchers from universities that have archaeology departments such as the University of Indonesia, Gajahmada University, Udayana University, and Hassanudin University. In addition, researchers from the Institute of Science and Technology of Indonesia (LIPI). The aims of committee is to develop the quality of proposals and archaeological researches in Indonesia.

**Archaeological Discoveries**

There are several significant archaeological discoveries in the last five years research in Indonesia. These discoveries include the finding of rock arts sites, particularly in the western part of Indonesia for instance the rock art at Goa Harimau in South Sumatra (see Figure 1, site 10). Rock art at the Harimau Cave site were associated with 78 tombs and estimated to be over 3,000 years and is thought that at the funerals were accompanied by a drawing process on cave walls. In addition to Goa Harimau in South Sumatra, rock arts site were also discovered at Sangkulirang, Mangalihat karst sites, in East Borneo or Kalimantan (site 2 in the map). Sangkulirang sites were dated from 40,000 years which are considered as among the oldest rock art in the world. Study on rock art at Kei island in South Moluccas (site 7 in the map) and Lembata island in East Nusa Tenggara are still in progressing at time of writing. More information on rock arts will be available in near future.

Archaeological research on diaspora and migration of Austronesia have been conducted in East, Central, and Western parts of Indonesia. Archaeological excavations at Lambanapu site in East Sumba have been conducted in multiple years. Primary and secondary burials were discovered at Lambanapu site and the dated from 3000 years ago. In terms of genetic, the burials at Lambanapu indicate a mixed of Australomelanesoid and Austronesia (Handini et al 2018). The genetic mixed at this site suggests migration and interaction between Austronesia and Australomelanesoid. The discovery of a
burial of a fair embracing each other at Lambanapu was published at Kompas newspaper 29th April 2019.

At Mallawa site, Maros in South Sulawesi were also found similar phenomena namely interaction and contacts between pre-Austronesian people and the migration of Austronesia (Hasanuddin 2018). These interaction was represented by the hybridization of artifacts forms at the site.

Research on migration and interaction between pre-Austronesian and Austronesians have also been conducted at Gayo in Aceh Province (Wiradnyana 2018). The discoveries at Gayo also indicate that genetic and cultural mixed also occurred at the area. This archaeological results at Gayo or Aceh suggest that the migration of Austronesia to the western part of Indonesia.

The discovery of stegodons in several islands in East Nusa Tenggara such as Flores, Sumba, and Timor is quite interesting (Bagus 2018). There are six dates of stegodon from Atambua site in Timor has been published. The dates range from 130k up to 168k. A stegodon fossil was also discovered during survey last year at Belu site in Timor. It is hoped that more information will be gained on stegodon in Timor island. Archaeological excavations have been conducted since 2011 at Soa basin in Flores, which has yielded 2973 specimens include crocodilia, Varanus komodoensis, muridae (rat), aves (birds), ranidae (frog) and stegodons.

**Bibliography**


Summary of Lao archaeological work from 2016-2018

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Introduction
Laos is a Southeast Asian country with rich histories and a lot of archaeological sites throughout the country both in the prehistoric and historic period. All archaeological evidences is found by chance or by archaeological surveys and excavations by the Archaeology Division. The Division of Archaeology is working under the Department of Heritage, Ministry of Information, Culture and Tourism and is responsible for the survey, excavation, inventory and analysis about archaeological work through country.

Historical Work
Archaeological work is quite new for Lao P.D.R, and so we also have cooperative projects with foreign countries to learn more new technology of archaeological work. In the past and also the present we need more cooperation and support funds from government and NGO as well. From 2016-2018, Laos have done archaeological research such as survey, excavation, inventory in many site through country as following:

Northern part of Laos
Xiengkhouang Province
Xiengkhouang province is located in the northeast part of the country, in the Xiengkhouang plateau, 1,200 m above sea level. The weather is cool and windy through the year, with beautiful nature and sightseeing places. The most popular place that is well-known to people is the Plain of Jars, that make many tourists pay attention to the site also archaeologists as well. While Xiengkhouang province was heavily bombed during the Indochina war era, The Plain of Jars site was listed as a UNESCO World Heritage site in 2019.

In 2016 – 2018, the Division of Archaeology had been cooperating with the Australian National University (ANU) and James Cook University (JCU) in Australia for archaeological exploration and excavation some Plain of Jars sites such as:
- Archaeological survey at Plain of Jars, Xiengkhouang province, joint project between ANU, Australia and Department of Heritage.
- Excavation at Plan of Jars, joint project between JCU Australia and Department of Heritage.
- Gathering information about stone jars at Xiengkhouang province.
Huaphan Province

Huaphan province is located in the northeast region of Laos, the terrain is rugged with dense mountainous forest forming much of province. The province has a lot of caves and the extensive network of caves were used by the Laos Revolution Party during the Indochina War. One of the most important prehistoric caves is Tham Hang, and this cave was excavated by the Division of Archaeology, Department of Heritage and the University of Pretoria (France), since 2003 to present. In 2017, human skeleton fragment was found which was about 80,000 years old. These human fossils are the oldest known remains of modern humans in mainland Southeast Asia.
Central Laos

Savannakhet Province

Savannakhet province is the biggest province and located in south-central Laos. The people are very kind and they have their own traditional style of living which persists into the present day. Savannakhet province is important because of its abundance of mineral deposits. Since 2002, the LXML company had begun to invest in Savannakhet and it has become the biggest mining company in the Southeast Asia. Before starting the project, the Department of Heritage had done an archaeological survey and found many evidences of archaeological remains such as mining shaft, crucible, slag and cord-marked pottery. Recent archaeological work includes:

- Salvage excavation on mining shafts at Sepon, Savannakhet province, joint project between LXML company and the Division of Archaeology in 2018
- Excavation at Sepon mining area, Savannakhet province, joint project between Institute of Archaeological Research and Relic, Yunnan province, China and the Department of Heritage, Lao P. D. R. in 2018

Southern Laos

Champasack Province

Champasack province is located in south-western Laos and has a beautiful landscape. The people are lovely with their traditional culture. Champasack province has a long history from 1st – 9th centuries as part of the Funan and Chenla kingdoms as we can see the Wat Phu which was listed by UNESCO in 2001. Apart from Wat Phu there are many archaeological sites that are very important. Lao and foreign archaeologists have worked in these sites for research. Since 2016-2018, the Division of Archaeology, Department of Heritage had cooperated with Ecole Française d'Extreme-Orient (EFEO) France and also Waseda University of Japan to excavate archaeological sites such as:

- Wat Sang O site, Champasack province, joint project between EFEO, France and Department of Heritage, 2017-2018
- Excavation at Ban Nongsa site, Wat Phu, Champasack province, joint project between Waseda University, Japan and the Department of Heritage, 2018
Conclusion

There is many archaeological sites in Laos that are not yet explored, and it is very important and urgent to do a survey in the future and to have a database for conservation. We need more knowledge of new technology for future archaeological work. The important thing is that Laos is lacking in budget and modern equipment for archaeological research, so we have to make a good relationship and cooperation with other country in order to help and support our research of archaeological work.
Archaeological studies in Malaysia since 2017-2018 cover a wide range of scope, time and fields. During this period, there were three important and interesting archaeological findings that contributed to the development of archaeological disciplines in Malaysia. First, salvage studies and underwater archaeological excavations in Bidong Island, Terengganu in 2017 found a shipwreck site filled with cargo load of artefacts. What is interesting here is that the study was conducted by local researchers headed by Asyaari Muhamad from Universiti Kebangsaan Malaysia (UKM). The study was called underwater archaeological study of the Bidong shipwreck. Among the artefacts found are ceramics, believed to be originated from Thailand dated between 14th to 17th century, metal materials, fabric flakes, glass and others. Second, prehistoric archaeological studies in Malaysia by Mokhtar Saidin in 2018 have discovered the first Neolithic archaeological site in Jelebu, Negeri Sembilan representing archaeological sites in the southernmost part of the peninsula of Malaysia. The site is located at Gua Pelangi, Felda Pasoh 4. Among the artefacts found included the form of hand-held axes and animal bones. Archaeological studies conducted in Ulu Kelantan in 2018, have discovered a complete and important ancient human skeleton. The study was carried out by research teams from UKM, National Heritage Department and UPSI. Apart from archaeological research activities, over the course of this period, several activities to uphold the archaeological field in Malaysia have been carried out by The National Heritage Department.

The development of Archaeological Research and Activities of Malaysia 2017-2018

Over the past two years, there have been some archaeological research and archaeological findings in Malaysia. The archaeological research and activities in Malaysia are conducted by several local public universities and the National Heritage Department of Malaysia. Since 2006, activities related to antiquities in Malaysia have been taken over by the National Heritage Department. Prior to then, all the activities related to heritage and antiquities, is the activities were held under the responsibility of the Malaysian Museum & Antiquities Department. Hence, the role played by the National Heritage Department and the local universities in Malaysia is to preserve, preserve and uphold all forms of national heritage whether the tangible heritage, intangible heritage and natural heritage.

During the period of 2017-2018, there were three archaeological studies conducted in Malaysia in collaboration with the National Heritage Department and local public universities. The research project includes Surveys, Salvages and Underwater Archaeological Excavation in Bidong Island, Terengganu, Archaeological Excavation Research Project at Pelangi Gua, Jelebu, Negeri Sembilan; and Gua Chawan, Kelantan.

Activities to further enhance the archaeological field in Malaysia have been designed and performed by the Archaeological Unit at the National Heritage Department (Jabatan Warisan Negara, or JWN) from 2017-2019, including archaeological seminars, either national or international, organized by JWN. Additionally, a series of workshops and courses as well as training to strengthen the country’s archaeological field are also carried out by responsible agencies.

1. The Bidong Shipwreck in Pulau Bidong, Terengganu

In line with some of the maritime archaeological research developments in Malaysia from early 1990s to 2000s, there is a good reason to plan a maritime archaeological research in Malaysia holistically. An accidental discovery of a shipwreck located in the waters of Pulau Bidong, Terengganu became the catalyst for the idea. The location of the shipwreck is approximately two nautical miles
from the Pulau Bidong and 30 nautical miles from Kuala Terengganu, at a depth of 18 metres below sea level. The ship’s size is approximately 25 metres long and 10 metres wide (Asyaari 2019:290).

The discovery of the shipwreck known as “The Bidong Shipwreck” has opened up new pages in the history of shipwreck investigation in Malaysia. These include the information on the number of shipwrecks in the South China Sea, the origin of the ships, the cause of ships sinking, ship building technology and the direction of the ships. The study on the premises that the shipwreck most likely originated from central of Thailand, maybe from Singburi, Menam Noi, Chonburi or other parts of Thailand based on the artefacts that were found. The sunken ships perhaps was due to weather or technical problems but further investigations need to be carried out (Asyaari 2017: 2).

A preliminary survey was conducted by the team from Universiti Kebangsaan Malaysia, Universiti Malaysia Terengganu, UZMA Sdn. Bhd. and the National Heritage Department for two weeks on “The Bidong Shipwrecks”. The survey resulted in an incredible discovery. The team was leader led by Associate Prof. Dr. Asyaari Muhamad, maritime archaeologist from the Universiti Kebangsaan Malaysia. The result of this initial analysis found that the most stoneware and porcelain are originated from Thailand and somewhere else in Asia country perhaps during the 15th to 18th century CE. Specifically, the ceramics are the Sawankhalok and Sukhothai types and are believed to have originated from the northern and central regions of Thailand. Perhaps from Sukhothai, Sawankhalok or Menam Noi kiln site. Most of these ceramics were found in large numbers, presumably from a merchant ship sailing in the waters of the South China Sea from the Gulf of Siam to Southeast Asia.

In additional, other artefacts found were metal tools, ship nails, human and animal’s figurines, statues and the remains of ship timber. All the artefacts found on this cargo ship are believed to be traded in the region.

The overall expectation is that there is still an abundance of ceramics and artefacts at the bottom of the ocean. Thus, underwater archaeological excavation is urgently needed to avoid loss or damages. However, further study is needed to determine the type, size, shape, and name of the ship and its sailing whereabouts.

In addition to field studies, a series of site and museum visits, particularly at the National Museum of Maritime Archaeology in Chantaburi, Thailand, the University of Bangkok, Sukhothai and Sawankhalok were also made. The purpose of these visits was to carry out some comparative studies especially on aspects related to the discovery of ceramics and the various artefacts which were found to have similarities with those found in the specified area.

In fact, to this day, no Malaysian has conducted a comprehensive programme or research on maritime archaeology in Malaysia especially on the excavation of shipwrecks. This has only been done by researchers from the west and assisted by some local museum staff. Names like Sten Sjostrand, Michael Flecker, and Michael Hatcher are often referred to as shipwreck’s field-experts not only in Malaysia but also in the Southeast Asia.

Sten, for example, has managed to uncover nearly 10 ships in Malaysia waters including Sabah and Sarawak. The shipwreck sites like Turiang, Nanyang, Royal Nanhai, Xuande, Singtai and Desaru wrecks have been successfully salvaged by him. Shipwrecks that were uncovered had valuable artefacts such as ceramics from China, Thailand, Vietnam, and European metal products, weapons and others are priceless (Sten Sjostrand 2002: 34). Although there is a 30% concession agreement for the Government of Malaysia and 70% to the companies that operate the project, these artefacts are all regarded as still incompatible with what we have been thinking about.
Fig. 1  Thai ceramics on the surface of the Bidong Shipwreck. Source: Asyaari Muhamad.

Fig. 2  The Bidong shipwreck was found since 2012 by the local fisherman. Source: Asyaari Muhamad.

Fig. 3  The Sawankhalok statue were found at the wreck site. Source: Asyaari Muhamad.
Fig. 4  Elephant statue (Sawankhalok). Source: Asyaari Muhamad.

Fig. 5  Jarlet and cover box since 16th -17th century. Source: Asyaari Muhamad.
2. **Gua Pelangi, Jelebu, Negeri Sembilan**

The existence of this cave was reported by ATOA Enterprise ecotourism businessman Madam Noorazlina Mohd Ali, who is also resident of Felda Pasoh 4, near the Gua Pelangi site in 2014 to Pusat Penyelidikan Arkeologi Global (PPAG), Universiti Sains Malaysia (USM).

Field and geophysical surveys were conducted on 11-13 April 2014 to discover the potential of this cave to carry out further studies. Surveys have found artefacts of rock tools and food waste on the surface while geophysical analysis finds that the sediment thickness is about three meters high. In this regard, three phases of excavation have been carried out at this time:

*11-30 April 2015: Excavation Phase I*

Excavation is intended to assess the situation, function and site layout. The result of the excavation provides proof of site use based on the findings of lithic artefacts and fauna residues. A total of nine plots were excavated at this phase. Two of the entire open squares have found cave floor layers.
May 28-June 12, 2015: Excavation Phase II

Excavations continued in the parcels that still have no cave floor layers. Three new plots were opened. Lithic artefacts and fauna remains are found in the excavation compartment associated with burning ash. The chronometric dating of organic charcoal samples, shells and sediments gave the site a starting point of 14,000 BP to 9,000 BP.

18-20 July 2017: Pasoh Forest Reserve Cave Survey

Field surveys around the limestone complex in Gua Pelangi were carried out to map the limestone caves that may be potentially be for further study. As a result of the survey, there were at least five caves found around the site.

1-20 August 2018: Excavation Phase III

Excavations continued with allocation from the Negeri Sembilan Government. A total of ten new squares were opened in the front and back of the cave. Three excavation plots that have yet to find a cave floor layer in the second phase were excavated. Apart from the workforce by PPAG and local residents, excavations are accompanied by the Negeri Sembilan Museum Board and the National Heritage Department. As a result of the excavation, the space in the western part of the excavation site of phase I and II also found the same artefacts and findings. The southern parts of the cave show the most end area that is based on the distribution of artefacts.

In total, 23 square meters were excavated from the entire cave space. Scientific analysis is still ongoing at USM as part of a PPAG undergraduate thesis. Generally, Gua Pelangi reveals a palaeolithic evidence of from 14,000 to 9,000 years ago, which is the southernmost Palaeolithic site in the Malaysia Peninsula.

Fig. 8 Prehistoric sites distribution at Peninsular Malaysia. Source: Mokhtar Saidin, PPAG, USM.
3. **Excavation at Gua Chawan, Nenggiri Valley, Ulu Kelantan.**
Archaeological research was conducted by B. A. V. Peacock and H. A. Lamb in 1963. Based on the report Peacock had discovered fragments of pottery and stone tools from the late Palaeolithic period. Peacock concluded that the Chawan cave was once used by hunters and gatherers. In addition, research and excavations have also been conducted by Adi Taha in 1994-1995. This site is located on the bank of the Jenera River.

On 2 November 2018, researchers from Universiti Kebangsaan Malaysia (UKM) led by Zuliskandar Ramli together with a group of archaeologists from the Department of National Heritage (JWN) and researchers from the Department of History, Universiti Pendidikan Sultan Idris (UPSI) found a complete prehistoric human skeleton with some other artefacts during the archaeological excavation at Chawan cave, Ulu Kelantan.

Based on surface surveys and excavations that have been carried out, many artefacts have been found such as lithic tools, food waste in the form of animal bones, and snail shells, (brutia costula) and earthenware. Among the lithic tools found include hammer stones, grindstone tools, grindstone-pounder tools, anvil stones, uniface stone tools, separator tools, stone tools, spearheads and
reptile remains. The discovery of the prehistoric human skeleton of Gua Chawan, the Nenggiri Valley is an important finding for the country’s archaeology as it provides new facts about prehistoric practices in Malaysia.

This human skeleton was buried in a slightly folded state with the front side towards the north while the knee is to the south. This frame is believed to be a woman based on pelvic bones found in the framework. It is buried with a foot portion covered with limestone and the head is also coated with limestone. The right hand holds snail food and reptiles. There is also a grinding stone – (grindstone pounder) placed on the leg as the accompaniment of the deceased. Based on a relatively early date, it is believed that the frame was estimated to be between the ages of 6,000-8,000 years ago. Dental samples and snail shells were sent to Beta Lab in the USA to obtain a chronometric dating.

![Human skeleton at Gua Chawan, Lembah Nenggiri, Ulu Kelantan. Source: Zuliskandar Ramli, ATMA, UKM.](image)

**Heritage Value Justification:**

**a) Historical significance, relationship with the history of Malaysia**

Discovery of the prehistoric human skeleton of Gua Chawan, the Nenggiri Valley is an important finding for archaeological state as it can provide new facts about prehistoric practises in Malaysia.

**b) The potential to educate, clarify or provide further scientific investigations into Malaysia’s cultural heritage**

The site has the potential to carry out further studies to find out the prehistoric culture around Kelantan and in Malaysia.

**c) Any other matters relating to the determination of important cultural heritage**

Based on an early relatively early date, it is believed that the skeleton is estimated to be between 6000-8000 years ago.
4. **Activities of National Heritage Department 2017-2019**

*Workshops, Seminars, Conferences at national / international levels*

### 2017

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<td>Seminar of Archaeology Negeri Sembilan, Kuala Pilah, Negeri Sembilan</td>
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<td>Archaeology Talks</td>
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<td>2.</td>
<td>Merdeka Heritage Trail 2018</td>
<td>22 September 2018</td>
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<td>3.</td>
<td>National Archaeological Seminar 2018</td>
<td>9-10 October 2018</td>
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<td>4.</td>
<td>Archeological Relic Conservation Workshop</td>
<td>24-25 October 2018</td>
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<td>5.</td>
<td>Basic Skills Diving Course National Heritage Department 2018</td>
<td>29-30 October 2018</td>
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### 2019

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<td>1.</td>
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<tr>
<td>2.</td>
<td>The Old Kedah Festival &amp; the Heritage Movement of Merdeka 2019</td>
<td>24 August 2019</td>
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<td>3.</td>
<td>International Archaeological Seminar 2019</td>
<td>September 2019</td>
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**Conclusion**

Since 2017-2018, several archaeological research projects have been implemented in Malaysia. Two land archaeological research projects are prehistoric periods in Negeri Sembilan and Kelantan are the latest archaeological studies in Malaysia. In addition, an underwater archaeological research activity was also successfully implemented in the early stages. Underwater surveys and archaeological surveys in the waters of Pulau Bidong, Terengganu were conducted by a team of researchers from Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Terengganu (UMT), UZMA Sdn. Bhd and National Heritage Department (JWN) since 2016-2018. The study was fully conducted by local experts with the latest equipment facilities. Nevertheless, underwater archaeological excavation studies have not yet been conducted as they involve well-planned and thorough preparation. Hopefully in 2019 this underwater archaeological excavation study can be successfully pursued. Additionally, the role played by the National Heritage Department in upholding and promoting archaeological activities in Malaysia is considered to be important and highly relevant to the needs of the country. Some programs have been planned, others have been executed and still, some will be carried out. Hopefully in the future, the development of archaeological research in Malaysia can be implemented rapidly and thrived in line with the current archaeological research development in the region.

**References**


Archaeological Developments in Myanmar (2016-2018)

Kyaw Myo Satt
University of Yangon

In 2015, a new civilian government appeared in Myanmar by fair election. The new government has been trying to change the policies of important sectors including the protection and preservation of cultural resources. In 2016, government enacted the “Rule of Prohibiting of Cultural Heritage” and “Rule of Prohibiting of Ancient Monuments”. In Myanmar, the Ministry of Religious Affairs and Culture is the responsible ministry for cultural heritage. The Department of Archaeology and National Museum under this ministry is the main department of archaeological works; exploration, excavation, maintenance of ancient monuments, collecting antiquities and museum exhibition, etc. Moreover, implementing the management plan of ancient sites to be world cultural heritage becomes an important sector of this department. This department was implementing archaeological works according to policy. During 2016-2018, archaeological works were done at Bagan, Tanintharyi, Halin, Sri Ksetra, and Nyaunggan, among others. Significantly, international and local university archaeologists closely collaborated in archaeological excavations and research works which were impossible in former governments.

Archaeological works in Myanmar have begun since the days of Myanmar monarchy. King Bodawpaya (1782-1819) commissioned one of his Ministers Twinthin Thaik Wun Maha Sithu U Htun Nyo to collect stone inscriptions around the country. The main purpose of this assignment was to differentiate between glebe lands and royal lands and to register them accordingly. In 1885, the whole of Myanmar was annexed by British. During the colonial period, archaeological works were more developed than the days of Myanmar monarchy. Western scholars published a considerable number of research papers and articles on Myanmar archaeological sites. Dr. Emil Forchhammer, a German archaeologist, wrote research papers on Shwedagon Pagoda, Kyaukku Ohmin of Bagan, ancient Arakan and Old Pyay. Six volumes about the Inscriptions of Pagan, Pinya and Ava were his great archaeological works during the colonial period. Some Myanmar archaeologists also participated in archaeological research works during the colonial period. The first Myanmar archaeologist was Mr. Taw Sein Kho and his interests was in the preservation and maintenance of Mandalay Palace. The archaeological works of Myanmar developed further after independence in 1948.

Although successive Governments carried out archaeological works after independence, policies and visions on archaeological works of governments were different. Up to now, there have been six governments after independence in Myanmar. The government policies have a large effect on archaeological works. Although some policies create good result, some may not have gotten good result for cultural heritage. Therefore, the present situation of the cultural heritage management might be reflected the policies of previous Myanmar governments and level of knowledge on cultural resource management of high-ranking officers.

In 2015, a new civilian government appeared in Myanmar by fair election. This new government has been trying to change the policies of important sectors including the protection and preservation of cultural resources. In 2016, new government enacted the “Rule of Prohibition of Cultural Heritage” and the “Rule of Prohibition of Ancient Monuments”. In Myanmar, the Ministry of Religious Affairs and Culture is the responsible ministry for cultural heritage. The Department of Archaeology and National Museum under this ministry is the main department of archaeological works responsible for exploration, excavation, maintenance of ancient monuments, collecting antiquities and museum exhibition. This department was implementing archaeological works by following policies:

(a) To discover and protect historical sites, monuments and antiquities
(b) To support the discovering of authentic Myanmar history
(c) To deliver information by museums and libraries as knowledge centres
Bagan and World Cultural Heritage Procedure

Bagan is a famous archaeological and historical site and situated in the central belt of Myanmar. It was founded by King Anawrahta in 11th century CE on the east bank of the Ayeyarwady River and has a total area is 104 square kilometres. Bagan is a treasure trove of cultural heritage: palace sites, brick and stone monuments, wall paintings, masonry arts, glaze arts, gold and silver arts, stone inscriptions, stone and bronze images, terracotta votive tablets and brick monument ruins. About 3140 ancient monuments and archaeological mounds are scattered in the Bagan area. Previous governments tried to get Bagan to be world cultural heritage. Unfortunately, Bagan was not included in the world cultural heritage list because of the many criteria required by UNESCO. After the ascension of the present government, the Department of Archaeology and National Museum has tried to make Bagan become world cultural heritage since 2014. The Department of Archaeology and National Museum under the Ministry of Religious Affairs and Culture had drawn up the Bagan Management Plan with the assistance of the Federation of Myanmar Engineering Societies, Association of Myanmar Architects and other scholars. There are 10 possible criteria to be included of UNESCO’s list. Among them, Myanmar scholars highlighted three criteria- numbers (iii), (iv) and (vi) for Bagan. The main issue in implementing the Bagan management plan is building of hotels and motels in the cultural heritage zone. Awareness of cultural heritage of authorized persons and local people is also important for the Bagan World Heritage Process. Sometimes, they did works which harmed the process. Therefore, the staff of the Department of Archaeology and National Museum had made the awareness program on cultural heritage for the local people. An expert team of ICOMOS assessed the cultural value of Bagan in September 2018. In July 2019, ICOMOS recommended that Bagan, Myanmar, be inscribed on the World Heritage List on the basis of criteria (iii), (iv) and (vi). This is a large victory of Myanmar for the cultural heritage sector.

Exploration and Excavation at Bagan (2017/2018)

Bagan is an interesting ancient site for researchers. A recent research team which was composed of local and international scholars carried out exploration and excavation at Bagan in 2017 under the IRAW@Bagan Project. This research team aims to uncover the residential patterning, agricultural practices and water management of classical capital of Bagan. The following research works have been conducted by this research team:

- **May 2017**: Initial settlement reconnaissance was conducted at the four traditional palace sites and the Shwe Creek, Otein Taung, South Wall, and Kiln #4 occupation sites, collection of epigraphic and iconographic data related to domestic life and settlement patterns was carried out, and preliminary investigation of Nat Yekan sacred water tank, on the Tuyin Hill was initiated.
- **December 2017**: Ethnoarchaeological study of settlement patterning and agricultural practices in ten traditional villages in and around Bagan’s pre-urban settlement zone was completed, further reconnaissance at the Shwe Creek and Otein Taung occupation sites was carried out, and 3-D mapping of Nat Yekan Tank and hydrologically focused reconnaissance of the Tuyin-Thetsoe range and Mya Kan Reservior were conducted.
- **May 2018**: Excavation of a proposed dam feature and associated spillway in the northeast corner of the Nat Yekan Tank and GIS-based mapping and hydrological analysis of the Tuyin-Thetsoe range and Mya Kan Reservoir; Ethnoarchaeology of socio-religious practices associated with water.

The IRAW@Bagan Project is not yet finished and it will continue to 2023. We believe that the visions of this research will be fulfilled after the project’s completion.
**Excavations at Halin (2017/2018)**

Halin is the first World Cultural Heritage site of Myanmar with Beikthano and Sri Ksetra, inscribed in 2014. It was one of the ancient Pyu cities located nearly at the centre of Myanmar. Although it is accepted that Halin was an ancient Pyu city, later archaeological excavations extended the period of this city from the Proto-historic Period to Prehistoric Period. Therefore, it became one of the significant archaeological sites in Myanmar not only for local archaeologists but also for international scholars among the Pyu cities. A total of 44 sites have been excavated at Halin up to 2017.

Archaeological excavations were conducted at Halin by Franco-Myanmar research team in 2017. This team was composed of scholars of Department of Archaeology and National Museum of Myanmar and National Center for Scientific Research (CNRS) of France. Excavations had been carried out in Halin from January 2017 to February 2017. The aims of that excavation are as follows:

(a) To carry out archaeological researches on Bronze Age and Iron Age Cultures between Ayeyarwady and Chindwin Rivers, Sagaing Region
(b) To compare with other excavated sites of Bronze and Iron Ages
(c) To establish the Bronze Age period of Myanmar by the references of scientific method

The excavated sites are located on the outside of south-western part of the old city named HL-29-1 and the deepest place is 280 cm. After excavation the following cultural materials were uncovered:

(a) Skeletal remains
(b) Animal bones
(c) Bronze tools (axes)
(d) Domestic materials
(e) Stone and bone beads and stone rings

Thirty one skeletons were excavated skeletons. Although some skeletons could be differentiated by sex and age, some could not be identified because of deterioration. Among them it could be identified that the three are babies and one male. Moreover, a distinct feature about the skeletons could be seen for that site in that most of the skeletal remains were uncovered as piles or randomly placed. Therefore, field archaeologists assumed that these kinds of skeletal remains might be concerned with a secondary burial practice.

The Franco-Myanmar research team made a second season of excavation at Halin in January 2018. The excavated sites are located on the north and south of HL-29-1 and named as HL-29-2 and HL-Test Pit-1. To reveal the settlement pattern of prehistoric period by scientific method is the main purpose of that excavation. In that excavation, a university archaeologist participated in that research project. Pyu burial urns, skeletal remains, animal bones, polished stone tools, stone rings, bronze tool, potteries, charcoals, potsherds, bone and stone beads were recovered after excavation of HL-29-2. However, the evidence from HL-Test Pit-1 which included a fire place, post holes, charcoal and potsherds did not seem to be connected to the prehistoric period but with the later historic period. Nevertheless, the final and complete report of National Center for Scientific Research (CNRS) of France will be more detailed in mentioning the nature of settlement pattern and dating of the Halin ancient site.

**Excavation at Tanintharyi (2018)**

In 2018, the Franco-Myanmar project ‘Tanintharyi and the Maritime Silk Roads’ carried out its first season of excavations at Maliwan and Aw Gyi in Myanmar’s southernmost region, Tanintharyi. The project is collaboration between the French National Centre for Scientific Research and the Myanmar Ministry of Religious Affairs and Culture, and is supported by the French Ministry for Europe and Foreign Affairs.
This project aims to define the economic and political role that this region played in the first ‘trans-continental’ maritime exchange network. The research seeks to determine to what extent and in what manner long-distance exchange fashioned peninsular populations’ social, economic and political trajectories. Terracotta female figurines, a stone ring with flower petals, and a frieze of animals made in the Mauryan-Sunga style were yielded from that site. Radiocarbon tests expressed that the occupation period of Maliwan is from the fourth to second centuries BCE.

Aw Gyi is situated approximately 15 km on the west of Maliwan. A significant discovery of that site is beads and their elemental composition are similar to beads of Arikamedu in India and Phu Khao Thong in Thailand. More research is needed on the two port-settlements to understand their occupation sequences and wider relationships.

**Conclusion**

The Department of Archaeology and National Museum had carried out archaeological works around the country during 2016-2018. International and Myanmar university archaeologists participated in research works. During this period, Department of Archaeology and National Museum submitted nomination dossier of Bagan to be world cultural heritage of UNESCO. Exploration and excavation at Bagan to investigate the residential patterning, agricultural practices and water management are next archaeological developments of that department. But, this investigation is ongoing process. In 2017 and 2018, Franco-Myanmar research team made archaeological excavation at Halin to the study of Bronze and Iron ages between Ayeyawady and Chindwin rivers, to the beginnings of the Bronze Age period and to discover the prehistoric settlement patterns. Their research works is ongoing and the aims of that project will be uncovered at the end of the project in 2020. The Franco-Myanmar team extended their research work from central Myanmar to the southern edge of territory near Thailand border. They presented the importance of two trade centres: Maliwan and Aw Gyi between the Indian and Pacific Ocean trade network. In conclusion, the Department of Archaeology and National Museum had done archaeological works on prehistoric and historic cultural sites during 2016-2018.

**Bibliography**


Mga Arkeolohikal na Pananaliksik sa Pilipinas (2016-2019)

Bobby C. Orillaneda
(Museum Researcher II), Maritime and Underwater Cultural Heritage Division,
National Museum of the Philippines

This country report summarizes the archaeological research projects of the National Museum of the Philippines (NMP) and the University of the Philippines-Archaeological Studies Program (UP-ASP) for the years 2016 until the early part of 2019. The research findings produced significant information of the country’s cultural past from deep prehistory towards the Second World War.

Introduction
Archaeological research in the Philippines is spearheaded by the National Museum of the Philippines (NMP) and the University of the Philippines-Archaeological Studies Program (UP-ASP). The National Museum was appointed as the lead government agency in implementing the provisions of legislative laws such as Republic Act (RA) 4846 Cultural Properties Preservation and Protection Act, Presidential Decree (PD) 374, Amending Certain Sections of Republic Act No. 4846, Otherwise Known as the ‘Cultural Properties Preservation and Protection Act’, RA 8492, the National Museum Act of 1998 and RA 10066, the National Cultural Heritage Act of 2009 that includes archaeological research and management. The Archaeological Studies Program, on the other hand, was “designed to oversee and coordinate instructional, research and extension activities pertaining to the systematic discovery, reclamation, analysis, presentation and preservation of the material remains of past cultures” (http://asp.upd.edu.ph/program.html). The program offers masters and doctorate degrees in archaeology and is in the Top 150 Archaeology Schools in world rankings as of 2018 (https://ovpaa.up.edu.ph/world-rankings-up-strongest-in-humanities-social-sciences-agriculture/).

Since 2016, these agencies have conducted a number of archaeological projects that generated revolutionary and significant data of the Philippines’ cultural past from deep prehistory towards the Second World War. In addition to the National Museum’s Archaeology and the Maritime and Underwater Cultural Heritage (MUCH) research divisions, the Cultural Properties and Regulatory Division (CPRD) is also tasked with regulating and monitoring archaeological researches conducted by local and foreign archaeologists in the country. This paper highlights a number of stand-alone, multidisciplinary and collaborative projects that have been carried out by NMP and UP-ASP.

Research on Philippine Prehistory
Early Man Projects
The Early Man Projects are research programs aimed at unearthing prehistoric sites in the Philippines since the 1930s and currently has validated theories about early human occupation in the country. Under its banner are research programs in Rizal Municipality in Kalinga Province, Callao Cave,
Peñablanca Municipality in Cagayan Valley Province as well as the Tabon Caves in Quezon Municipality and the Dewil Valley Sites in El Nido Municipality in Palawan Province.

The Rizal Municipality, Kalinga Province Archaeological Project
The Cagayan Valley in northern Luzon is an important area in understanding the peopling of the Philippines as it yielded mammal fossil finds (Elephas sp., Stegodon sp., Rhinoceros sp.) and stone tools that may provide evidence of early human occupation. Since the 1930s, a number of geological and archaeological investigations have been carried out. In 2013, an international team revisited the area and re-evaluated its paleontological and archaeological potential in the articulation of the Philippine Pleistocene period (Ingicco et al. 2013).

In 2014, Dr. Ingicco from the Muséum National d’Histoire Naturelle (MNHN) and a team from the NMP’s Archaeology Division along with local and international volunteers conducted archaeological investigations at the site named “Elephant Hill” in Rizal Municipality, Kalinga Province (Ingicco and Manalo 2014). The clayey fossil layer contained faunal remains (Rhinoceros skeleton, fragments of deer, tortoise, lizard and Stegodon sp.) as well as 13 bones from an almost complete Rhinoceros philippinensis that displayed butchery marks (cutmark and percussion marks) along with 57 stone tools in the same layer. This provided an indirect evidence of the presence of ancient humans when this Rhinoceros philippinensis was living. An Electron Spin Resonance (ESR)/uranium-series dating analysis of the enamel of the rhinoceros’s right maxillary third premolar yielded a date of 709,000±68,000 years old.

The finds are revolutionary as it suggested that hominins were present in the Philippine Islands as early as 709,000 years ago, pushing back as much as 10 times the date of the first hominin colonization of the Philippines from the present evidence of hominins at Callao Cave with a date of 67,000 years ago (Ingicco et al. 2018). Furthermore, they may belong to a species of human older than Homo sapiens, likely related to, if not actually, Homo erectus.

The Callao Cave Archaeological Project
The Callao Cave site has been the subject of archaeological excavations for decades. However, the 2007, 2011 and 2015 collaborative excavations between UP-ASP and NMP’s Archaeology Division recovered fossil bones and teeth of three different individuals nearly three meters below the current cave floor. Uranium series dating puts two of the fossils in the range 50,000- and 67,000-years BP, marking the earliest known human remains in the Philippines (Mijares et al. 2010).

Dr. Florent Detroit from MNHN carried out extensive comparative analysis including the use of 3D imaging and geometric morphometrics that resulted in the identification of a new hominin species named Homo luzonensis (Detroit et al. 2019). This new species exhibited a singular mosaic of morphological characteristics different from other species of Homo and emphasizes the major role played by Island Southeast Asia in the evolutionary history of hominins. Its origin and arrival modalities in Luzon Island remain largely speculative at this point and will be investigated in future studies.

The PREHsea Project
The PREHsea Project (Managing Prehistoric Heritage in Southeast Asia) is a long-term scientific and academic collaboration between Indonesia, the Philippines, and France since the 1980s. It “aims to strengthen the cultural sector of Prehistory and Human evolution and its actors in order to promote cultural diversity, international cooperation, and sustainable economic, social and human development” (http://prehsea.mnhn.fr/). It was funded by the European Union and involved multiple collaborators such as the NMP, Muséum National d’Histoire Naturelle, Sangiran Museum - Conservation Office of Sangiran Early Man Site, and UNESCO HEADS - Human Evolution: Adaptations, Dispersals and Social Developments (Ansyori et al. 2016).
The project activities involved excavations at Tabon Caves in Palawan, Philippines and in Pucung, Sangiran Dome in Indonesia that resulted in the collection of archaeological and environmental data crucial in understanding past human populations and interaction with ancient landscapes. The results and management strategies were discussed in meetings and conferences in Spain, Indonesia and the Philippines. Field and research documents, scientific and academic publications as well as brochures, posters were produced along with an exhibition under the theme “Legacy of the Islands” (Ansyori et al. 2016).

**The Palawan Island Paleohistory Project**
The Palawan Island Paleohistory Project has been ongoing for more than a decade with the year 2016 as the culmination of a research program that aimed at substantially contributing to the knowledge base on Palawan’s human history (Paz et al. 2016). The project’s initial phase focused on paleoenvironmental sampling in line with the objective of gathering material evidence towards a better understanding of people-landscape relationships through time. The last few seasons focused on the excavations of Ille, Pasimbahan-Magsanib and Makangit-Pabintana in Dewil Valley, El Nido Municipality. Research results yielded archaeological evidence of burials and ritual practices such as cremated human bones, shell disc beads, pottery, animal bones, and shell midden deposits (Paz et al. 2016). The resultant radiocarbon dates taken from the stratified archaeology of Ille and Pasimbahan-Magsanib revealed human cultures were utilizing and likely flourishing in the El Nido area as far back as at least 16,000 years ago. The project also had a heritage component through an exhibition hall of research results, tours to locals and tourists as well as other inclusive community activities.

**Other Researches**

**The Ifugao Archaeology Project**
The Ifugao Archaeology Project (IAP) is a multidisciplinary and collaborative project that highlights the fragile relationship between archaeologists and local communities working in a large archaeological area that produced results questioning the dominant historical narrative and the basis of ethnic identity, in this case, the Ifugao (Acabado et al. 2017). Prior to IAP, it was widely believed that the beginnings of the Ifugao Rice Terraces, one of the more famous tourist Philippine attractions, dates back to 2,000 years ago. The findings of multiple excavation seasons and analysis of materials using multiple datasets including radiocarbon determinations, faunal isotopic signatures, human osteological remains, archaeobotanical data sets, energetics assessments, and spatial data however, provide a much later date (17th century CE) that coincided with the arrival of the Spanish in northern Philippines and may have been built as a local response to colonization (Acabado et al. 2017, Acabado et al. 2019). This was initially and expectedly met with antagonism by the local stakeholders. As a response, the IAP actively sought the inclusion of local stakeholders as project co-investigators with their voices resonant in the interpretation of the research investigations. Further, a number of related publications came out that delved into studies on status differentiation, agricultural intensification, and pottery production among others (Acabado et al. 2018).

**Mt. Kamhantik, Mulanay Archaeological Project**
The Kamhantik Archaeological Project is a continuing research of the NMP’s Archaeology Division at the Mt. Kamhantik Site in Mulanay Municipality, Quezon Province (Dizon et al. 2017). The project started in 2015 that resulted in the findings of sarcophagi, human and animal remains, archaeological features (postholes and box-like holes) and associated objects. The discovery of sarcophagus in Kamhantik revealed another important information regarding burial treatment that involved multiple primary internment using stone cutting or carving in a limestone formation. The Kamhantik site is dated to cal. AD890 to 1030 (cal. BP 1060 to 920) or 1070 +/- 40 years based on the human tooth enamel of Burial 5. A late 9th century CE Chinese Changsha ware ceramic dated to the Tang Dynasty period (618 – 906 CE) was retrieved in-situ from sarcophagus #6 corroborated the C14 dating of the site.
The Bacong Archaeological Project

The Bacong Archaeological Project (BAP) started in 2010 as a collaborative research project between the NMP’s Archaeology Division and the University Illinois at Chicago with support from the Municipality of Bacong, Negros Oriental (Dizon et al. 2016). It “aims to understand the prehistory and protohistory of Bacong and its vicinities through systematic gathering of archaeological data, and to develop cultural heritage in Bacong through building archaeological and site museums in the main town and in some of its barangays” (Dizon et al. 2016: 1). Previous archaeological investigations in the area yielded a number of Metal Age (ca. 500BCE – 800–1000 CE), Protohistoric (1000 – 1600 CE) and Historic (1600 – 1900 CE) artefacts. The 2016 project carried out excavations in barangays Combado and Buntod. Four excavation squares yielded artefacts such as three earthenware burial jars with one containing human teeth remains, earthenware bowls, two iron tools and 36 pieces of glass beads of varied forms, sizes and colours as well as plain and decorated earthenware sherds, stoneware sherds, glass shards, nails and a coin (Dizon et al. 2016). The researchers deemed the site significant as “they suggest clearer social connections with the wider Southeast Asian region” and also reveal different burial practices.

The Mindoro Archaeological Research Project

The Mindoro Archaeological Research Project was a multidisciplinary project between UP-ASP, NMP and the University of the Philippines National Institute of Geological Sciences (UP-NIGS). Its goal is identifying “traces of early human colonization of the Philippine archipelago, how changes in landform and sea levels might have influenced the mobility of human populations, and how they utilized and adapted to the different environments they encountered in Mindoro” (Pawlik 2016: 1). The project entailed doing archaeological excavations of caves and rockshelters in Ilin Island that produced paleobotanical remains, faunal remains, lithic artefacts, and a shell midden site among others. The site also contained the first fossil evidence of the now-extinct Philippine cloud rat (Reyes et al. 2017). The research results demonstrated that human populations occupying the sites has adapted to changes in climate and environment during the end of the Pleistocene period (Pawlik 2016). Its substantial cultural deposits contained valuable and new information on human subsistence strategies and paleoenvironmental changes for this area. As of the 2017 season, the Bubong II archaeological site has already reached Late Pleistocene deposits while the Cansubong has a burial context dating to the Philippine Metal Age period (500 BCE – 1000 CE) (Pawlik 2019).

The Catanauan Archaeological and Heritage Project

The Catanauan Archaeological and Heritage Project (CAHP) is a project by UP-ASP aimed at “advancing primary archaeological research in the Municipality of Catanauan for both local and international audience while also advancing the capability of the community towards self-reliance in articulating culture and history” (Paz et al. 2016: 2). The project also includes an archaeological field school for students from ASP and the Australian National University (ANU) in Canberra. The 2017 field season was the 9th season focused on excavations in Barangay Tuhian that yielded human remains, cultural and natural objects related to burial practices and settlement sites (Paz et al. 2017). An isotope dating from the human teeth samples gave dates of 1900 to 1800 years ago or the first and second century CE (Paz et al. 2016). The heritage component entailed holding a series of lectures to the archaeology students and the local community and also distributing children’s books to the local inhabitants (Paz et al. 2017).

The Jesuit House Archaeological Project in Cebu

Archaeological research in the Parian District of Cebu City sponsored by the Department of Anthropology, Sociology, and History, University of San Carlos, was launched in January 2018 to include excavations in the bodega floor of the Jesuit House and in the Casa Gorordo Annex project nearby. The former was conducted to monitor artefact recovery and to document stratigraphy underneath five molave posts that were replaced as part of the historical structure stabilization. The house was
built in 1730 over a wetland that was documented by the project. The early Spanish period and the late pre-Spanish period settlement was well-represented with Asian export porcelain as well as local earthenware pottery. A previously undocumented historical trade pottery thought to be from Myanmar is being analysed and will be the subject of collaborative research with John Miksic and Goh Geok Yian in Singapore. The Jesuit House results and a comparative excavation obtained monitoring construction of the Casa Gorordo Annex provides chrono-stratigraphic data to characterize the transition from the mid-Holocene high sea still-stand ca. 2,000 – 6,000 years before present, and the transition of an embayment at the mouth of the Lahug River into a brackish and later freshwater marsh. Faunal recoveries include both marine and freshwater species as well as a set of late pre-Spanish tamaraw horn cores, late pre-Spanish dog and chicken remains, and a very rare artefact recovery of a tari or cockfighting blade holder. The chicken remains have been submitted for DNA analysis with Mike Herrera’s lab. Seventeen radiocarbon ages from a variety of materials including marine shell, wood and charcoal provide constraining ages for the marsh and marine sediments. Of that, five were obtained from an alignment of wooden stakes that may have been part of a fish corral at the edge of the marsh or bay. Oysters and other molluscs were collected from the same age sediments in one of the units that may have been cultured in the late pre-Spanish or early Spanish period.

The Establishment of the Maritime and Underwater Cultural Heritage (MUCH) Division

The MUCH Division was established in 2016 after the NMP underwent an institutional reorganization that created new research and administrative divisions. The division’s tasks encompass archaeological research not only with shipwrecks but also with coastal and foreshore archaeological sites related to ancient maritime activities as well as the assessment, investigation, and protection of World War II shipwrecks. From its inception, the division has carried out a number of shipwreck and maritime archaeology investigations including the excavation of shipwrecks off the shores of Boac Municipality in Marinduque Island (Jago-on et al. 2014), and in Catanauan Municipality in Quezon Province (Jago-on et al. 2016). Another project was the archaeological and maritime landscape surveys in Sulu-an Island, southern Leyte by MUCHD personnel along with teams from the Archaeology and Ethnology Division teams (Lacsina et al. 2017). This resulted in the survey of a WWII-period lighthouse and the Pinaglihiyan and Minamanok Caves where a number of stoneware, celadon, and porcelain ceramic sherds and possible human bone fragments were found (Lacsina et al. 2017).

A new component for the MUCH Division is the archaeology of World War II shipwrecks. Thus far, three World War II-themed projects were carried out: The Battle of Surigao Strait and Ormoc Bay surveys as well as the El Capitan shipwreck investigation in Subic Bay, Zambales Province. The first two projects have been conducted in collaboration with a foreign partner while the third was done solely by MUCH Division personnel.

The Battle of Surigao Strait and Ormoc Bay Projects

The Battle of Surigao Strait and Ormoc Bay projects were carried out with Navigea Ltd., a subsidiary of Vulcan Inc., owned by former Microsoft co-founder Paul Allen. The projects aimed to locate, classify and identify submerged wrecks in the Surigao Strait and Ormoc Bays (Orillaneda et al. 2017). Discovered shipwrecks were documented using multibeam and side scan sonar, video and photography. The project also assessed the current condition of the shipwrecks with the aim of developing measures in their protection and preservation.

The surveys used R/V Petrel, a research and exploration vessel equipped with side scan and multibeam sonars as well as a 6,000m automated underwater vehicle (AUV) and a 6,000m work-class remotely operated underwater vehicle (ROV). The side scan and multibeam sonars were used to locate the shipwrecks. The AUV provided information about the shipwrecks’ condition and orientation while detailed visual inspection and video documentation were carried out by the ROV.
The Battle of Surigao Strait during the World War II period took place on October 25, 1944 and was part of the larger Battle of Leyte Gulf in which Imperial Japanese Navy (IJN) forces attempted to regain control over Leyte from American and Australian forces. This event was significant in world naval history as this was the last pure battleship-to-battleship naval engagement (Tully 2009). The exploration activities from November 23 – 27, 2017 resulted in the discovery and documentation of battleships Yamashiro and Fuso as well as the Asashio-class destroyer Asagumo, Michishio and Yamagumo (Lacsina 2017).

The Battle of Ormoc Bay, on the other hand, occurred as a series of air and sea battles from November 11 to December 21, 1944 as American forces successfully neutralized the flow of Japanese supply to their troops in Leyte (Kappes 2003). One ship that was lost in the battle carried a special significance in the Pacific War. The USS Ward, a destroyer under the command of William Outerbridge, fired two shots and sunk an IJN submarine in Pearl Harbor, hours before the devastating IJN air raid of the US naval base took place. During the Ormoc Bay engagement in December 07, 1944, USS Ward was incapacitated by kamikaze fighters and later intentionally scuttled by USS O’Brien (“RV Petrel explores” 2017).

The actual survey was carried from November 29 – December 2, 2017 (Lacsina 2017). Shipwreck remains identified as the USS Ward was found at a depth of 208 meters and was severely damaged, likely caused by kamikaze attacks. The USS Cooper was later discovered at a depth of about 190 meters. The IJN destroyer Shimakaze, a super-destroyer as well as the IJN Yumugumo-class destroyer Naganami were also located as is a rare bluntnose six-gill shark that was first documented in the Philippines (“Rarely seen shark” 2017).

The El Capitan Shipwreck Investigations
From March 14 – 19, 2019, MUCHD personnel travelled to Subic Bay Freeport Zone in Zambales Province to carry out assessment and photo documentation activities at the El Capitan shipwreck located inside Subic Bay (Orillaneda et al. 2019). This activity is part of the larger research program entitled “Cultural Heritage Management of Subic Bay Shipwrecks” that aimed at protecting, preserving and managing historically and archaeologically significant shipwrecks dated from the late 19th century until the World War II period (1941 – 1944).

El Capitan was a vessel constructed in 1919 and deployed as a military supply ship during World War II (www.arizonadivesubic.com/wreck-diving/el-capitan-uss-majaba-subic-wreck). She ran several supply missions in the South Pacific and was later towed to Subic Bay in 1946 after sustaining severe damage from two torpedoes fired by the Japanese submarine HA-11. She finally sunk in Ilanin Bay in Subic after a storm. The team made successful multiple dives over a period of six days and carried out orientation dives, still photography and video documentation of the whole shipwreck as well as the measurement and photo documentation of selected unique features at the stern (rudder) and bow (possible forward gun platform) (Orillaneda et al. 2019).

Other Research Activities
ASP Field Schools
The UP-ASP continues to conduct archaeological field schools all over the country. In 2016, the field school was held in Infanta, Quezon Province. The next year, the field school was conducted in Bordeos, Quezon Province and in 2018 in Budiao, Albay.

Non-Research Activities
The Cultural Properties and Regulatory Division of NMP regulates and monitors archaeological researches conducted by local and foreign archaeologists in the country as well as help in the preservation and protection of the country’s natural and cultural properties. The division’s activities en-
tailed enforcement, registration of cultural properties, issuances of licenses, certificates and permits, surveillance, information dissemination, development of heritage sites and research. The division has been also involved in the prevention of illicit traffic of cultural property, which is the third most common form of illegal traffic after drugs and arms trafficking.

From 2016 to 2018, CPRD has accomplished policies and programs in the realm of 1) Law enforcement, capacity building, information exchange and international cooperation, 2) Modus operandi in the illicit trade in cultural objects, illegal treasure hunting, 3) reporting of the number of cases of illegal activities related to natural and cultural property and the number of cases filed, and 4) efforts, plans and programs and or accomplishments in dealing and combatting the illicit trade.

Following the mandate of the Cultural Heritage Preservation Act of 2012, the Department of Anthropology, Sociology and History, University of San Carlos, has been contributing cultural heritage and community mapping to municipalities and barangays that are now required under that law to conduct cultural heritage inventories for their jurisdictions. DASH-USC has contributed assistance to many of the communities of Cebu as well as some in Leyte and other provinces to fulfil this obligation and to provide training exercises for students. The cultural heritage resources range from intangible cultural practices to landscapes and sites that are then recommended for documentation. This activity has already resulted in the emergency documentation of Song dynasty burials and discovery of tektites in Badian, Cebu.

CPRD also issued Permit to Explore/Excavate as well as Special Authorization Permits to authorized local and foreign researchers and research associates for both land and underwater archaeology projects as well as Archaeological Impact Assessments (AIA). For the Special Authorization Permits there were 12 permits in 2016, 14 permits in 2017, eight (8) permits in 2018, and nine (9) permits were in 2019. Non-NMP and UP-ASP research associates that were issued permits included Dr. Laura Junker of the University of Chicago at Illinois, Dr. John Peterson of the University of San Carlos, Dr. Stephen Acabado of the University of Guam, and Dr. Tomas Ingicco of the MNHN. Dr. Peterson is conducting investigations at the sites of Plaza Cuartel and Cabanatuan in partnership with History Flight, Inc. to develop plans and proposals to recover Missing-in-Action and Prisoners of War remains from those sites.

**Status of Education in Archaeology**
The number of professional archaeologists has significantly increased for both offices. For NMP, there are now four people with doctorate degrees and two people completing their doctorate studies. For UP-ASP, nine people have doctorate degrees while 17 people are doing their doctorate studies.

**Bibliography**


The archaeology of Singapore is still very much in its infancy and led by a small fraternity of archaeologists. Over the last 35 years, professional archaeologists numbered no more than two or three individuals at any point in time. Today the situation remains very much unchanged since the first inaugural investigation in 1984 (Lim Forthcoming). Unlike other Southeast Asian countries, in Singapore there is presently no dedicated archaeological department under the Ministry of Culture, or the National Heritage Board. Archaeology as a discipline continues to reside within the domain of academic and research institutions with only two organizations retaining archaeologists on staff – ISEAS-Yusof Ishak Institute (ISEAS) headed by the author, and the Southeast Asian Studies department National University of Singapore (NUS) with John Miksic. Despite the want of a national level or state agency for archaeology in Singapore, over the past three years since the last 2016 SPAFA country report, modest strides have been made advancing archaeological activities in the country.

Archaeological Investigations
Archaeology in Singapore traditionally are predominantly development-led and conducted as part of a burgeoning impact assessment framework (Lim 2016). In recent years the author together with the Heritage Research and Assessment Division of the National Heritage Board have been identifying sites of historical significance for future pre-development investigations. Over the past year impact assessment projects occupied much of the time for the ISEAS archaeology team.

Singapore Art Museum
Situated along the Bras Basah arts and culture district, the Singapore Art Museum closed its doors for redevelopment and expansion work in mid-2018. An impact assessment was conducted to coincide with the Singapore Heritage Festival where the excavation became part public engagement program, permitting the public and passing pedestrians to interact with the ISEAS archaeology team. Titled ‘Live Dig! Don’t Feed the Archaeologists!’ the program had several excavation units on the front lawn of the museum along the busy sidewalk of Bras Basah Road (Figure 1). The excavation pits were designed to explain the different phases of an archaeological dig, elucidating on the excavation methods, interpretation of stratigraphy, and recording processes. The excavation was accompanied by an exhibition on archaeological finds from recent projects, and a series of public talks on archaeology and the history of the neighbourhood, as well as scheduled ‘Meet an Archaeologist’ artifact handling sessions. Notwithstanding little marketing for the program, the response was overwhelmingly positive, and some 4,000 people attended the various events and activities. This impact assessment and Singapore Heritage Festival program was funded by the National Heritage Board and the Singapore Art Museum.

Sultan Gate, Kampong Gelam
Retrofitting and remodelling work on a pair of late 19th century terrace shophouses at Sultan Gate enabled an evaluation and rescue excavation to take place in the historical Kampong Gelam conservation zone. In April 2017 the author led a short evaluation to ascertain the significance of the site and determine the stratigraphic sequences. The yield and density of materials uncovered from the assessment warranted a larger rescue excavation in May 2018. The excavation was limited to the impacted areas surrounding the buildings where a tree root sump and drainage system was constructed (Figure 2). Large amounts of 19th and 20th century artifacts attested to the rich domestic and commercial activities of the neighbourhood were recovered. A total of 378kg of artifacts and ecofacts were collected from an excavated area of 22m². The Urban Redevelopment Authority and National
Fig. 1  Archaeological impact assessment as part of the Singapore Heritage Festival at the Singapore Art Museum April 2018. Source: Lim Chen Sian.

Fig. 2  Rescue excavation at Sultan Gate Kampong Gelam May 2018. Source: Lim Chen Sian
Heritage Board sponsored the rescue excavation, while the project archaeologist privately funded the evaluation.

**Fort Canning**

2019 marks the bicentennial commemorating the 200 years since the establishment of the East India Company trading post on Singapore island. The traditional historical narrative of the country portrays 1819 as the birth of modern and contemporary Singapore. As part of the Bicentennial celebrations, Fort Canning Park will serve as a major venue for the exhibition and storytelling of the bicentennial story. As such, large-scale development and landscaping are underway at the park. ISEAS is conducting a series of impact assessments at Lewin, Farquhar and Raffles terraces on the south of the hill, as well as by the new subway station along River Valley. Later in the year, a community themed archaeological excavation will take place over the months of June and September 2019, where students and park-goers may participate in fieldwork uncovering part of the colonial period fortification. Separately, the NUS team revisited and cleaned up the existing Keramat archaeological exhibition site, prior to the outdoor display undergoing a facelift.

**Pulau Ubin**

Between December 2017 and December 2018 a series of surveys were conducted on Pulau Ubin, an island to the northeast of Singapore in the Johore Strait. The island managed by the National Parks Board featured some of the last rural village settlements of Singapore. A three-season project funded by the National Parks Board documented the archaeological potential and assets over several areas. A detailed survey was completed on World War Two coastal defence artillery emplacement creating an inventory of surviving structures and features. A pair of Anti-Motor Torpedo Boat (AMTB) gun emplacements was constructed in 1936/7 as part of the eastern defences for the Royal Navy Singapore Naval Base at Sembawang, and the Royal Air Force seaplane aerodrome at Seletar harbour (Figure 3). The ISEAS team successfully inventoried the AMTB positions and ancillary infrastructure such as search light casements, engine room, fire direction towers, and accommodation blocks. Aside from investigating military remains, a study on the boundaries of the village settlement at Kampong Bahru, and individual household compounds were attempted. Two abandoned homesteads at Kampong Melayu were probed to identify activities and functional zones of past occupiers and their relationship with the immediate environment. A final thematic interest of the project was the study on resource extraction and the identification of a late 19th century municipal granite quarry site.

Separate from the aforementioned project, a limited survey was conducted to assess past reports of prehistoric Neolithic finds at the western end of Ubin island at Tanjong Tajam. In the early 20th century, surface and chance finds of alleged prehistoric adzes were purported to originate from the area. A small excavation in 1949 was carried out by the Raffles Museum in search of these stone tools, but the investigation was unsuccessful and did not uncover anything. A survey in October 2018 sponsored by the National Heritage Board attempted to locate the site of past excavation as well as identify any prehistoric materials. American consultant Dave Clinnick and the author conducted this latest assessment. Surface finds recovered during the pedestrian survey and shovel tests were encouraging and suggest that several lithics specimen might be anthropogenically worked. The prehistory of Singapore is under-studied and further investigations may yield new light on the subject.
World War Two Defenses

In late 2016 damage to a historical World War Two concrete pillbox at Pasir Panjang by road development works prompted the ISEAS archaeology team to document remaining infantry defenses in Singapore (Figure 4). In the summer of 2017, three pillboxes at Pasir Panjang, Sime Road, and Labrador Point were measured and recorded. Machine guns and other small arms were emplaced in these reinforced concrete infantry defense positions that served as blockhouses along major roadways leading into Singapore town or as beach defenses against amphibious landings. This is part of an ongoing project to catalog remaining 19th and 20th century military infrastructure in Singapore when resources such as personnel and access to sites are available to survey and document the features.
**Post-excavation Work**

Over the last three and half decades, the accumulated archaeological assemblages from past excavations have been incrementally stockpiled, and in recent years the archaeology teams at ISEAS and NUS have devoted significant resources to tackle the processing of finds from the massive backlog. Post-excavation work on the finds is a most time consuming and tedious process, and Singapore based archaeologists struggle with available resources to overcome this issue. Modest gains have been made over the last three years. At ISEAS some three-tons of artifacts from the 2015 Empress Place Rescue Excavation – the largest archaeological excavation in the history of Singapore – have been duly cleaned. Over 10,000 man-hours have been clocked to accomplish the feat with grateful assistance from hundreds of students and volunteers. Presently sorting and classification of the Empress Place materials are underway. However, it will be many years before this will be complete. Separately the NUS team also made headway with the Singapore Cricket Club materials where a small excavation was conducted back in 2003 yielding some 155kg of artifacts from the pre-modern period. The basic classification of the finds has been accomplished for some 2,000 items as a public accessible database (see publications below).

**Publications**

Apart from the early excavations at Fort Canning, few excavation reports were produced in the first two decades between 1986 and 2006 (Miksic 1985; Choo 1986). Site reports do exist, but these are typically unpublished ‘grey literature’ that were submitted to government agencies and landowners. These unpublished reports characteristically come with varying degrees of confidentiality classification and publication embargo imposed by the developers or landowners until completion of the development. Nonetheless the teams at ISEAS and NUS are determined to address this crucial issue on want of accessible archaeological literature and lately have been successful in rolling out several publications. At ISEAS, Archaeology Report Series No. 5 ‘Preliminary Report on the Archaeological Investigations at the National Gallery Singapore’ was released in January 2017 (Lim 2017), followed by No. 7 ‘Archiving Archaeological Materials’ in December 2017 (Lim et al. 2017), and No. 9 ‘Preliminary Report on the Archaeological Investigations at the Victoria Concert Hall Site’ in October 2018 (Lim 2018). The NUS Press also released the ‘Southeast Asian Archaeological Site Reports’ in February 2018 with ‘Singapore No.1: The Cricket Club Excavation’ (Miksic 2018) being its first electronic issue.

**Archaeological Legislation and the Future**

Singapore is perhaps the only country in Southeast Asia without any legislation or regulation pertaining to antiquities and archaeology. At present, laws dealing with impact assessment, protection of archaeological sites, addressing ownership of artifacts and ecofacts are non-existent. Over the past decade and half, the author has been lobbying state agencies and ministries, and is pleased to report some advances in this important area. The Ministry of Culture is currently reviewing its remit on heritage, arts and culture in Singapore. An ambitious 5-year Heritage Plan is underway and featured as one of the prominent components of this plan is to ‘Safeguard Archaeological Heritage’. This approach covers four elements (i) Review Legislation (ii); Conduct Survey to Identify Sites of Archaeological Interest; (iii) Development of Archaeological Capabilities; and (iv) Reach Out to the Community.

While the review of existing heritage policies is timely, two areas in the policy arena require careful consideration. One critical area is the lack of qualified archaeologists represented on government committees responsible for heritage and land development. A professional archaeologist need not have executive powers but should minimally serve in an official advisory capacity to assist with the review of related policies. The other area to address is that the growing and nurturing a pool of future Singaporean archaeologists needs adequate resources to ensure a proper career development
Present archaeologists and their assistants are woefully under-remunerated and under-funded compared to peers in other disciplines and professions. This discourages younger Singaporeans from embarking on archaeology as a career and devotion to the discipline.

**Acknowledgement and Appreciation**

Singapore archaeology has made positive strides over the past years that cannot be accomplished without the continued support from the National Heritage Board. State agencies where large tracts of land and sites under management such as the National Parks Board and Urban Redevelopment Authority are also gratefully recognized for their proactive roles in initiating and funding archaeological investigations. Lastly, a record of thanks must be made to the hundreds of volunteers, students and supporters who enable archaeological work in the country to soldier on.

**References**


In 2018 the Fine Arts Department organized an international symposium on Maritime Cross-Cultural Exchanges of Asia, focusing on archaeological research which led to the completion of 12 quality research papers discussing various aspects of new archaeological findings and sites in Thailand (Srisuchat and Giessler 2019). Several remarkable findings of the papers as follows.

Ancient Hill Temples and Holy Caves in Upper Southern Thailand and the Trans-peninsular Route Connection by Phanuwat Ueasaman

Research was conducted to explain why and how the hill temples and/or holy cave communities across the eastern coast, western coast, inland and the trans-peninsular routes in upper southern Thailand were related between the late sixth and tenth century CE. Information on twenty-six sites from previous researches since 1902 and the 2009-2018 archaeological surveys and excavations were systematically reviewed. The research highlights new findings from archaeological excavations at a hill temple site on the eastern coast (Khao Si Wichai) and a holy site on the western coast (Khao Nui, Figures 1 and 2).

Fig. 1 Khao Nui (No.7), a Buddhist holy cave. Source: Phanuwat Ueasaman.
The results obtained from a comparative analysis of findings and analytical methods were used to dating sites are discussed. They support the hypothesis that the adoption of Hinduism, the main Indian religion and contemporary of Buddhism appeared at plain sites between the late fifth and mid-sixth century CE. Hill temple and holy cave’s tradition of either the Mahāyāna Buddhists or Hindu Śaiva and Vaiṣṇava followers started since the late sixth century CE and it was maintained and spread through upper and lower southern Thailand in the mid-seventh to the mid-tenth century CE before and after Śrīvijayan political influence.

The ideal geographical locations of hill temples and holy caves made them become landmarks and/or centres of community for both locals and foreign voyagers who came from far-flung destinations by land routes (including trans-peninsular routes) and sea routes, leading to the glory of ports on the eastern coast and the western coast.

Archaeological Sites and Findings on the Lower Peninsular Thailand from the Seventh to Thirteenth Century Reflecting Maritime Silk Road by Siriporn Sanghiran

The aim of her article was to present an overview of archaeological sites and findings in the lower peninsular Thailand in early to historic periods between the seventh and thirteenth centuries CE. Archaeological findings from six sites and twenty-nine sites from surveys suggest that prehistoric cave-dwellers dating back to 9,000 years ago moved to settle to the lowlands from at least 300 BCE and the historic tradition from overseas was adopted by the indigenous people from 7th century onwards. Findings from two main distinctively geographical areas, the Sathing Phra Peninsula (modern-day Songkhla Province) and the Pattani basin (the modern-day provinces of Pattani and Yala) that featured overseas contact of locals as well as export-import, commodities, point of contact, trans-peninsular routes and overseas route are discussed.

Prior to being a part of Srivijaya kingdom in the late eight century CE, the early historic states of the two main areas adopted Hinduism and Mahāyāna Buddhism. Owing to being a city port of several periods and contact with several countries in Southeast Asia and overseas, Singkhanagara state on the
Sathing Phra Peninsula absorbed various foreign influences whereas Langkasuka state in the Pattani basin featured the impact of the Mahāyāna Buddhist state of the seventh to eighth centuries CE.

**Remark by Pakpadee Yukongdi**
The clay votive tablet phase 2 from Khao Nui remarkably confirms some of votive tablets from monuments in Ancient Town of Yarang (Figure 3-4) which, I myself was the official archaeologist responsible for the Project of Yarang during 1988-1993. After re-analysing some of the artefacts of Yarang archaeological sites excavated at that time, then in 2018 I have clarified the two main phases of Yarang’s settlement with its geographical appearances, mounds and the destruction of man-made features.

**Phase I**
The Fine Arts Department excavated three of five Ban Chalae Ancient Monuments (No. 1-2-3-8 and 9); namely Ban Chalae Ancient Monument No. 2-3 located parallel on the left side of the eastern ditch and Ban Chalae Ancient Monument No. 8 on the right side. It was discovered that all of them are square structure buildings, made of brick and enlarged later (phase II). They are medium in size. Several miniature stupas and votive tablets were found in Ban Chalae Ancient Monument No. 3 especially in its central chamber (Figures 3 and 4). Some of them adopted the Pallava script in “ye dharma” inscription which is dated to about the 7th century. The most significant artefacts of Ban Chalae Ancient Monuments No. 8 are the bull sandstone sculpture, the pottery cover in turtle figure, and cylinder sandstone bases at each of the three/four corners of the inner stupa. According to their architectural structure, archaeological evidences and positions, it was presumed that they could belong to the same complex, and of which Ban Chalae Ancient Monuments No.8 was the main building (Figures 5-7).

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**Fig. 3 (left)** Ban Chalae Monument No. 3 at Ancient Town of Yarang, Pattani Province. Source: Pakpadee Yukongdi.

**Fig. 4 (right)** Votive stupa from Ban Chalae Monument No.3 at ancient town of Yarang. Source: Songkhla National Museum.
Fig. 5  Upper left: Plan of Ban Chalae Ancient Monument No. 8. Upper right: A reconstruction model of the first phase main stupa (Source: Office of the 11th FAD Songkhla). Bottom: Overview of Ban Chalae Ancient Monument No. 8 at Ancient town of Yarang, Pattani Province, from the west. Source: Pakpadee Yukongdi.

Fig. 6 (left)  Head of Bodhisattava from Ban Chalae Monument No. 8. Source: Songkhla National Museum

Fig. 7 (right)  A stone cow represent ‘Gotama’ from Ban Chalae Monument No. 8. Source: Pakpadee Yukongdi.
Phase II

Other set of the Pallava script were also found; “(dhu)k smudhay nirotha mar ke” inscription but was not identified until the finding of votive tablets at Khao Nui (No. 7). It was later identified as a Buddhist holy cave, the same inscription of the identical types of Yarang’s Ban Chalae Monument No. 3 votive tablets and dated to 8th-9th century, which was clearly Mahayana Buddhist sanctuary in order to expansion some part of the prior sanctuaries to more functional both in Ban Chalae and main Ban Wat area.

Ban Wat is in the south of the ancient community, surrounded by ditch and earthen dikes. The inner part of the site resembles an island with the connected ditches. Its centre is a large square court of the Ban Wat Ancient Monument No. 3, where the floor was paved by the serrated tiles and up-levelled by 3-4 layered bricks. Four ancient monuments are standing in the eastern part. The other 18 ancient monuments are distributed throughout the southwest, but only two are found in the northwest, and one of them is the largest mound called Ban Wat Ancient Monument No.15. It could be the earliest settlement of Buddhist monk community which can be dated around the 6th - 7th century. However common people would more probably be living at the harbour of Bra-O, 9 kilometres to the north (Figures 8-10).

Fig. 8 Map of Pattani rectangular area marking Chalae-Ban Wat Buddhist community and temples. Source: Thiva Supachanya and Google Maps.
Fig. 9  Yarang Ancient City. Source: Google Maps
Yarang Ancient City is a large protohistoric community, located at the Pattani River Basin on the Malay Peninsula, presumed to be the same location of “Lang -Ya - hsiu” or “Langkasuka” which were mentioned in the Chinese, Arabian, Indian, Javanese and Malay records. This ancient city is seven meters above mean sea level, located on the plain formed by sediments of the lower Pattani River. This plain resulted from the shallowed waterway on the east. Archaeological sites in the city have been found on the right side of the Pattani River, starting four kilometers away from the river where at present located in Yarang Sub-district to the then Pitumudi, Rawaeng, Wat and Yarang Sub-district, Yarang District, 15 kilometers to the south of Pattani Province.

Yarang Ancient City has a large oval shape and placed in North-South direction. There was a natural waterway as the city ditch on both sides. The city approximately covered the area nine square
kilometers. From an archaeological survey, the city comprised both singular and clustered buildings, including almost 44 ancient monuments and two earthwork towns were found.

A group of Ban Wat Ancient Monument is in the south of the ancient city, surrounded by ditch and earthen dikes. The inner part of the site resembles an island with the connected ditches. Its center is a large square court of the Ban Wat Ancient Monument No.3, where the floor was paved by the serrated tiles. 18 ancient monuments and four basins are distributed throughout the southwest, but only two are found in the northwest, and one of them is the largest mound called Ban Wat Ancient Monument No.15. The other four ancient monuments are in the eastern part. Ban Wat Ancient Monument could be the earliest community settlement in the ancient city which can be dated around the 6th - 7th century.

According to the excavation of Ban Wat Ancient Monument No.9 conducted by the Fine Arts Department, the remains of its square structure with the stairway on the east and west sides were found. Some fragments of elephant figured stucco, pottery shards, and beads discovered in the site indicated that this monument had been a Buddhist sanctuary.

Ban Chalae Ancient Town is located to the north of Ban Wat Ancient Monument, in the trapezoidal area surrounded by large ditches and earthen dikes on three sides. The north appears as a narrow ditch. The ditch in the eastern part cuts through the middle of a group of ancient monuments which is probably a group of Ban Wat ancient monuments, and connect with the southern ditch then flow into the natural waterway in the western part. The center of Ban Chalae ancient town is a large basin with four ancient monuments scattering in the northern area.

Ban Pra Wae Ancient Town is located in the north or uppermost of Yarang Ancient City. It has a quadrilateral shape, surrounded by ditches on all four sides, with a fort at each corner. In the south of the town there was a ditch dug from the fort to connect with the ditch in the north corner of Ban Chalae Ancient Town. In the west a small ditch connected to the natural waterway which flowed from Ban Wat was found. Inside the town, ditches and dikes separated the southwest area as the main part. There were also two ancient monuments and five basins in the town. According to archaeological excavation, it was demonstrated that this ancient town was established in the early Ayutthaya period. But the archaeological evidences such as lingums, fragments of Kudu and miniature stupas are similar to those found at Ban Chalae and Ban Wat. Thus it can be presumed that the first settlement could belong to the same period of Ban Wat, and a small fortified town was rebuilt in this area for the second time during the 14th century CE.

**Recovery of a Lost Arab-styled Ship at Phanom-Surin, the Wetland Excavation Site in Central Thailand by Preeyanuch Jumprom**

Archaeological findings from excavations at Samut Sakhon Province, Central Thailand, and its scientific and comparative analysis data of the Phanom-Surin shipwreck and its trading route are discussed. The wetland excavation revealed that the sewn-planks technique using on the ship structure is the outstanding characteristic of the Arab-styled ship (Figure 11). The analysis result suggests the relation between the origin and function of its cargo. The presence of the Arab-styled ship at the site supports the hypothesis of using the type of ship sailing in trade routes between the Middle-East and the Far East (China) via the Southeast Asia. The evidence supports the hypothesis of the Arabian merchants and the Middle-Eastern trade contact with several towns of the Dvāravatī culture in Central Thailand during the ninth century CE.
The Phanom-Surin ship is considered to be the evidence of the oldest ‘dhow’ found in the wreck site of the Southeast Asian water which has given an informative data on the ancient construction method of sewn-plank technique used in shipbuilding in the ninth century CE. At present the ‘dhow’ was needs a well preservation and conservation in situ for the sake of historical knowledge. Experts’ practical advices for the salvage project are welcome to save one of the most important sites of the maritime cross-cultural exchange of Asia.

**Si Thep: An Early Town of Intersection between Indigenous Tradition and External Influence by Suriya Sudsawat**

The aim of this paper is to highlight the ancient town of Si Thep, a significant inland town which is an early town of intersection between indigenous tradition and external influence traditions in the early history of Southeast Asian region. Geographical and environmental of the site as well as a sequence of settlements inside the town and vicinity obtained from archaeological findings from surveys and excavations will be discussed. Academic reports on the site and findings from surveys and excavations from 1904 to the present are referred to in brief in the paper. The chronology of the site is much more realizable as confirmed by relative and absolute dating of samples from archaeological finds. It is suggested that the first occupation of the land of Si Thep was done by the late prehistoric people dating back to 240 - 390 CE. The moated site was first set up between 414-602 CE and had developed continuously to be a town of either Hindu or Buddhist devotees for approximately eight hundred years. As an inland town near a waterway’s connecting port towns of the Dvāravatī kingdom at the south and linking a landmass of the north-eastern region into Zhēnlà and/or the Khmer kingdom, therefore, distinctive traditions from overseas, particularly, Buddhist and Hindu cults as well as local traditions of neighbouring towns or kingdoms that reflected on cross cultural influences and socio-political development of the town of Si Thep will be discussed in the paper.

**A Reappraisal of Tao Thuriang: Recent Findings from Excavations at Sukhothai Ceramic Kilns by Thongchai Sako**

Recent archaeological excavation (2016-2018) conducted at the Tao Thuriang kiln cluster of the ancient town of Sukhothai and analysis of findings is the main aim of this research. The scientific and relative dating of kilns suggest the periods of operation of the production and gives a new insight of the kiln construction of two types (Fig 12). The data allow the comparison of ceramic dating of the kiln and those found from the sunken ships for trade.
The result provides a remarkable information that the operation of the Tao Thuriang of Sukhothai dating back to the mid-fourteenth century CE, was firstly managed by local artisans and lasted to the early sixteenth century CE. It confirms the hypothesis of prior studies about the starting point of production of the Sukhothai’s Sangkhalok in the mid-fourteenth century CE. However, the longer period of production for oversea trade is considered a new discovery in the history of the ceramic used and exported.

Fig. 12 A plan showing Location of The Sukhothai Ancient Town and Thuriang Kilns Site. Source: Thongchai Sako.

References
Archaeological Developments in Vietnam in 2016-2018: Achievements, Challenges and Perspectives

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Significant Achievements (2016-2018)

Vietnam archaeological research activities in 2016-2018 took place widely in all regions of the country and in a variety of research fields of different periods and cultures. The study subjects can be divided according to the following periods and areas: Prehistoric period, Historic period, Champa-Oc Eo period and Underwater Archaeology. These archaeological activities are mainly new findings of relics, artefacts, excavations, surveys, and a number of specialized archaeological projects. All findings and research results were announced at the Conference of New Archaeological Discoveries which is held in September every year and then published in the annually series “New Discoveries of Vietnamese Archaeology”. There are major agencies involved in archaeological research and excavation, namely the Archaeological Institutes in Hanoi and Ho Chi Minh City, the National Museums of History in Hanoi and Ho Chi Minh City, the School of Archaeology - University of Social Sciences and Humanities, Hanoi and HCM City National Universities. Besides, there are museums and heritage management boards of provinces (mainly with a coordinating role) which take part in excavation. According to the Law of Heritage, the person who manages the excavation must have graduated with an archaeology major and had a certain period of time working in research institutes, museums and universities. Excavation permits are issued by the Ministry of Culture, Sports and Tourism after obtaining the agreement from the local authority. Only Vietnamese archaeologists are allowed to preside the excavation while foreign researchers can cooperate in excavation and publication of results.

Prehistory and Protohistory

The discovery of Palaeolithic site complex in An Khe town, Gia Lai province

During the time (2015-2019) of implementation of the project “Research on the System of Stone Age Sites in the Upper Ba River in Gia Lai province” which is conducted by the researchers from Việt Nam Institute of Archaeology, the Novosibirsk Institute of Archaeology – Ethnology (Russia Academy of Sciences) and the Department of Culture, Sports and Tourism of Gia Lai province, 24 sites have been found in An Khe town, four of which have been excavated including Go Da, Roc Tung 1, Roc Tung 4 and Roc Tung 7.

The An Khe area is a relatively wide depression (which was formed in Miocene) and lies along the Ba-river basin. One of its special feature is that it includes many denudational surfaces at various altitudes and usually the weathered shell exposed on the top. With a few river terraces and no sediments (Nguyen and Nguyen 2019).

According to the excavators, these sites serve as habitation and workshop for making stone tools. The cultural layers of all the Palaeolithic sites are rather thin (20-40 cm thick), well preserved and composed of weathered soil in situ from granite or vein-quartz rock (Nguyen et al. 2019). All the archaeological artefacts in An Khe seem to be found so far were made of rocks, quartzite pebbles separated from granite bedrocks, which were smoothed by waves (Nguyen and Nguyen 2019). The lithics represent a homogeneous industry, characterized by Lower Palaeolithic primary and secondary reduction techniques. Cores and tools were made using pebbles, and some tools were manufactured on flakes. The tool-kit includes bifaces, picks, spurred implements, carinated end-scrapers, various types of side-scrapers, choppers and chopping tools, and denticulate and notched pieces. Bifaces and picks
are the predominant tool types. Tektites found with the lithics were dated by 40K/38Ar-method to 806 ± 22 and 782 ± 20 ka BP. The researchers suggest that the An Khe emerged through convergent evolution of the pebble-flake industry associated with the first wave of Homo erectus migration from Africa 1.8–1.6 Ma years ago, and is unrelated to the Acheulean tradition introduced by the second wave of migration to Eurasia (Derevianko et al. 2018).

Early Agriculture in Vietnam and MSEA (2014-present)
This joint research program between Australian National University and Vietnam National University, Hanoi is conducted by Prof. Peter Bellwood, Prof. Philip Piper and Prof. Lam Thi My Dung with the aim to investigate the shift from foraging to farming in northern Vietnam through excavations of sites with key archaeological potential including Thach Lac, Ru Diep, Quynh Van, Den Doi, Dau Ram sites in Red River Delta and Northen Costal of Vietnam. The new radiocarbon dates from Thach Lac suggest to us that sedentary lowland agricultural societies became firmly established in northern Vietnam by as early as 3000 BCE, rather than closer to 2000 BCE like most of the currently dated Neolithic sites in Southeast Asia, including Man Bac and Xom Ren, two key sites in the north. This suggests that northern Vietnam was perhaps the first region to provide good environments for agricultural development south from Guangxi and Guangdong. The numerous archaeological settlement sites that exist in northern Vietnam thus offer an unparalleled opportunity to address this missing millennium and to understand how populations practicing agriculture first moved into, and interacted with indigenous Mainland Southeast Asians (Lam et al. 2015). From these excavations an absolute C14 and AMS chronology was established systematically, scientifically and objectively about the transition from hunting to production economy.

Metal Age
There are no major excavations but there are still small discoveries and excavations at several sites of the cultures of Phung Nguyen, Dong Son and Sa Huynh to help clarify the distribution and date.

Historical Archaeology in Northern Vietnam
Excavations at Lung Khe (Luy Lau) citadel (Thuan Thanh district, Bac Ninh province) from 2016-2018.
The excavations carried out by USSH, VNU Hanoi in cooperation with Sun Yat Sen University (China) in 2016, 2017, 2018. The results of excavation in the Inner Citadel confirmed that Lung Khe / Luy Lau is a residence site dating back to a long time in the anti-Chinese domination period (Dang Honh Son et al. 2019). It can recognize four stages of residence: Eastern Han Period, Six Dynasties Period, Sui-Tang Period and Tran-Le Dynasties Period. Yielded relics include bricks and tiles, end-tile decorated with human faces and lotus, pottery, porcelain, glass beads. The excavations carried out by National Museum of Vietnam History, Hanoi joined with Dong-A University (Japan) and Department of Culture, Sports and Tourism of Bac Ninh province in 2014, 2015, 2016, 2018 identified the Eastern Wall of the Inner Citadel and the related trench which was constructed in two periods. The earlier period dated about 2-3 centuries CE (Late Eastern Han and Early Six Dynasties), it is the time that Shi Xie (士燮; 137 – 226) the head of the Jiaozhi Commandery settled here and established the Citadel Luy Lau. It is considered as the peak of the urbanization of Luy Lau. The later period dated about 4-6 centuries CE (Six Dynasties). Accordingly, the Inner Citadel is defined as located in the centre of the outer citadel, slanting to the north. The citadel’s west-east border estimated to be 180 m wide and 110 m from north to south. In particular, 923 pieces of bronze drum casting moulds have been secured. Those moulds have different sizes and various patterns such as tangent circles, parallel lines, rice flowers, brooch shaped or feather. Also found the evidences for bronze drum casting such as fragments of crucible, mould, blow pipe and slag. The decorative patterns on these mould fragments bearing similarities with the Late Heger I (or type C) Dong Son bronze drum, especially, Thon Mong (Ninh Binh), Phu Phuong I (Hanoi), Thon Bui (Thanh Hoa) and Dac Glao (Kontum)
drums which were dated about the 3rd century BCE to 1st century CE. With this discovery, it must be necessary review the established chronological sequences for Dong Son bronze drums. The absolute dates of these moulds found at Luy Lau are about 3rd to 6th centuries CE (Truong 2019). Prof. Huang Xiaofen, head of Dong-A University said “it is an important archaeological discovery, which confirms the indigenousness of the Dong Son culture. The Luy Lau ancient citadel was an integration of native culture (the Dong Son culture) and alien culture (the Han culture)” (Excavation proves values of ancient citadel 2019).

Excavation at Ho Dynasty Citadel
The Ho Dynasty Citadel locates in Vinh Loc District was the capital of Dai Viet State (the old name of Vietnam) under the Tran Dynasty (1389-1400) and the capital of Dai Ngu State under the Ho Dynasty (1400-1407). The dimensions of the citadel, which was built in 1397, are 870 m by 883 m. The complex includes an inner citadel, outer citadel and worship foundation on a total area of 155.6 ha. The results from the 2016 excavation at the trench of the Citadel Wall have further clarified the system of reinforced embankments on both sides of the trench area. The width and the depth of the trench also are more clearly defined. The artefacts discovered in the reinforced embankment and in the trench include stone blocks, rectangular red bricks, white glaze ceramic bowls, blue and while ceramics, tile, net sinker ... most of them belong to the period of Tran-Ho Dynasties and a few of the Early Le Dynasty. The excavation at reinforcement of the wall site provides a source of material about the true ground reinforcement with the macadam system covering the entire site, indicating that there is a site for refining the rock in place before bringing up the citadel. The reinforcement outside the water gate shows that those planning and construction had focused on water supply for the inner city as well as the stability outside the spill area.

Besides, many excavations were carried out at pagodas, communal houses and mausoleum belonging to Dai Viet Ly Tran Le Nguyen monarchies. It was conducted with the aim of researching to make scientific bases for conservation, restoration and promotion the value of these monuments and works in the life in contemporary society.

Champa Archaeology in Central Vietnam

Excavation at Cha/Tra Citadel by The Research Centre for Imperial City
The second excavation (2016) at the vestige of the Cha citadel in Nhon Loc commune in the south central province of Binh Dinh has revealed the foundations of temple-tower and rampart structures constructed by Champa people which was revealed in 2015 excavation. The initial results show that it could to recognize three architectural phases dating in the period from the 4th to the 6th centuries CE. The first temple-tower architecture related to the Vijaya as the centre of the Vijaya Perfecture (4-6th centuries to before 10th century), the following architectural phase could be built when the Cha became the capital of the Vijaya kingdom (from the 11th to 15th centuries). The excavation at Cha Thanh in 2016 also discovered some Sa Huynh burial jars, the remains considered as the residence place of the late Sa Huynh - early Champa period and was dated by the excavators in the 2nd and 3rd century CE (Lai 2017).

Excavation at Phong Le Temple-Tower by Department of Archaeology, USSH, VNU Hanoi and Museum of Champa Sculpture in 2018
Excavation with an area of 308 m² in the eastern part of Phong Le tower-temple has revealed most of the ground of the architectural foundation of the gate temple, the north and south wall of the gate temple architecture, the vestiges of the long house architecture (mandapa) which is located east of the gate temple and some sub-architectural vestiges inside the wall. Artefacts revealed include bricks and tiles and architectural decoration made of sand stone, end tiles decorated with human face, coarse pottery, Song porcelain, sandstone statues and reliefs. Based on ground layout and the combi-
nation of construction materials, coarse pottery and porcelain puts the date of Phong Le back to the 10-12 centuries.

Excavation at Bai Lang Port/Landing in 2017-2018 by Department of Archaeology, USSH, VNU Hanoi, Hoi An Center of Heritage Management and Showa University (Japan)
The results of 2017-2018 with two previous excavations (1998, 1999) show that Bai Lang is a residence site of Champa people with major relics including everyday items such as pots, bowls, cups, pots and beads. At the same time this is a landing at the trans-shipment point of Arab and Chinese traders; the products carry the characteristics of trade routes on the Eastern Sea (Bien Dong in Vietnamese or South China Sea) like Islamic glass and pottery, the Indo-Pacific beads and Tang pottery which prove Bai Lang is also a trading port along the China - Southeast Asia - West Asia route in the 9-10th centuries. Bai Lang is located on the Southeast Asian port chain which includes Laem Pho, Ko Kho Khao (Thailand), Mantai (Srilanka) and so on.

Excavation at kiln complex of Champa glazed pottery (Go Sanh pottery), An Nhon town, Binh Dinh province
The complex consists of six pottery production areas/kilns, namely Go Sanh, Truong Cuu, Go Cay Me, Go Ke, Go Hoi and Go Giang. These kilns are located along the banks of the Con River, associated with the history of prosperity and development of the Vijaya Kingdom. Ancient pottery kilns in Binh Dinh existed and developed mainly during the Vijaya period and ended around 1471. The excavations at Go Cay Me town (2017, 2018) with the area of 300 m² provided ceramic wares (white glaze, brown glaze, iron-brown glaze), stoneware and architectural materials such as glazed tile, pottery making tools ... the excavators agree that Go Cay Me kiln was the production centre for royal needs and was managed by the authority of the kingdom. In the second year of the Go Cay Me excavation, the fire system was discovered, which is a traditional pottery burning technique very popular in North Vietnam. Additionally, a lot of high art pottery in Go Cay Me was discovered; the exchange, the relationship between Go Go Me and Chinese pottery has also been confirmed.

Oc Eo Archaeology in Southern Vietnam
Excavation of Go Thap site (Dong Thap) of the University of Social Sciences and Humanities, VNU, Ho Chi Minh City with a total area of 334 m²
More architectural monuments including sacred ponds, temples belonging to the early and late periods, and residential place dated of three periods from the 2nd century BCE to the 3rd century CE were discovered; from the 4th to 6th centuries CE and the period from the 7th-12th centuries CE, in addition to the residence traces, shipbuilding factory vestiges were found in the survey and excavation area. However, the report does not provide information about the age of the workshop. The excavation at the Visnu temple on Thap Muoi mound discovered that the architectural complex here consists of the main temple on the top of the mound, in the east and west parts there are two large sacred ponds, in the north there was also the existence of two smaller temples (Dang et al. 2017).

Study of Oc Eo - Ba The and Nen Chua archaeological sites (Oc Eo Archaeological Culture)
This project was assigned by the Prime Minister of Vietnam and the Academy of Social Sciences with the coordination with other Ministries, Departments and two provinces of An Giang and Kien Giang, and have been developed and implemented in three years (2017-2019). In this project, two archaeological sites in the Oc Eo - Ba The site (An Giang) and Nen Chua (Kien Giang) was studied including excavations at nine points in the Oc Eo-Ba The site, and five points at the Nen Chua site.
The project is in the process of being implemented at time of writing so no specific results have been announced.

Dr. Pham Van Trieu, Institute of Archaeology, Vietnam Academy of Social Sciences said, from August 2017 to January 2018, after the time of archaeological excavation and preservation of the site at Linh Son Pagoda at The Oc Eo relic area, the Institute of Archaeology has completed the construction of 15 milestone coordinates; two pits were excavated, one pit was nearly 300 m² wide, five cultural layers were recognized belonging to five different periods of continuous development. These cultural layers date from about the 2nd – 12th centuries.

**Underwater Archaeology**

Underwater archaeology is a new field of Vietnamese archaeology and in the past year there have also been some remarkable research activities. In particular, the Maritime Archaeology Research Cooperation Program (VMAP) from 2016 to present has conducted a series of research and survey activities in the sites of Quang Ninh, Hai Phong and Quang Ngai provinces.

The Institute of Archaeology and Quang Ninh Department of Heritage and Management had excavated and surveyed the entire area of Ben Cong Cai-Son Hao relic, which played an important role in Van Don trading port system. The result has revealed many vestiges related to the harbour, water wells and prehistoric vestiges and the huge amount of artefacts. In September 2017, the Institute of Archeology and the Department of Culture and Sports of Quang Ninh Province unearthed the Dam Lai site. This excavation has also discovered valuable relics and artefacts, it is worth to note the traces of wooden pillar system. Initially, the excavation team said that the pillar system discovered here may be related to the riverside architectural works. Because these wooden pillars carry many different features in comparison with the wooden poles discovered in relation to the Bach Dang battlefield during the time of Tran Dynasty anti-Chinese Aggression.

In addition to VMAP’s activities, many other studies related to the ancient port trade were also conducted, in particular Department of Archaeology, USSH, VNU Hanoi in collaboration with Ha Tinh Museum and the Japanese Human Culture Research Institute carried out the second excavation at Hoi Thong commercial port. The excavation results initially confirm a number of important material vestiges in accordance with historical records of a period of “open door” of the Hoi Thong port on the trade route in the Eastern Sea in the 13-18 centuries. The records of Hizen pottery discovered for the first time here, together with fieldwork and genealogy materials provides more information about the relationship of the Hoi Thongt with Japanese merchants in the late 16th and early 17th centuries.

**Challenges and Perspectives**

As a developing country and in the period of intensive urbanization and industrialization, Vietnam faces many problems and difficulties in order to make the harmony and balance between the conservation and development, between the economy and culture. There are no private research units to carry out the archaeological excavations despite having private museums. There no contract archaeology. When there are large construction projects, the Institute of Archaeology in Hanoi and Ho Chi Minh City will conduct excavation investigation. The organizational structure follows a strict system from central to local levels, from top to bottom with concentrated investment for central research institutes and regional institutes. The state budget is mainly for the Institute of Archaeology and National Museums. The local research and investment often only have a coordinating role, although this organization has had some changes to suit the changes from a subsidy period to a period of market economy but in fact the current research investment still coming mainly from the state budget, the socialization of archaeological research and heritage conservation is almost unavailable.
Lack of high qualified staff, lack of analytical and laboratory research centres, technical facilities out of date and not enough equipment...No or not yet diversified forms of archaeological research. Published documents mainly are in Vietnamese and lacking a standard terminology system. Domestic and foreign private economic groups for economic benefits should not strictly enforce the Law of Heritage so many archaeological sites were destroyed to make room for building projects. There are no effective plans to build archaeological parks for preservation and promotion of the values. The theft of antiquities and the illegal sale of archaeological artefacts have not yet been effectively controlled.

**Perspective and Activities:**

- Training of staff with the high and competent skill and knowledge
- Forming new archaeological specialties such as: Urban Archaeology, Sea and Island Archaeology, Agricultural Archaeology, Archaeology of Religion
- Organizing large-scale and multi-year research projects with the participation of many different agencies
- Cooperating the research projects with foreign scholars
- Strengthening the application of natural and thorough scientific research achievements in excavation technique and analysis
- Diversification, privatization and socialization of archaeological activities
- Efforts to formulate and develop Community Archaeology in addition to policies and measures of the authorities at all levels in the enforcement of the Law of Heritage.

**References**


New Interpretations on the African Presence in Southeast Asia 700-1700CE

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The African presence in Asia was documented by various late medieval written sources and peoples assumed to be Africans have been depicted in Asian art and European art produced in Asia in a variety of mediums. This evidence points to the little understood African presence in Southeast Asia between 700 and 1700 CE. The paper visits pre-colonial sources alongside archaeology, art and linguistics, while embracing early colonial sources as first-hand observations. The resulting paper adds another relatively unknown external cultural aspect to a region known for its diversity and cultural assimilation and provides themes for future archaeological and historical investigation.

Introduction

Important research on the presence of Africans in Asia has been conducted since the nineteenth century by European “Orientalists” such as Richard Burton (2006[1885]) and Albert Terrein de Lacouperie (1894). Emil Bretschneider (1871) and Frédéric Hirth (1885) theorised on African locations mentioned in Chinese texts. Two academics who spent time in Asia - Charles Boxer and Joseph Needham - mention Africans in East Asia. Caribbean and African-American historians of the African diaspora such as Joseph Harris led the way in the 1970s. In the last three decades this subject has been taken up by many academics from across the globe. However, the African presence in Southeast Asia remains unknown apart for a significant work on Africans in the Dutch colonial context by Ineke van Kessel (van Kessel 2008: 361-382).

The definition of Southeast Asia considered in this paper includes the mainland states of Myanmar, Thailand, Laos, Vietnam, Cambodia, and the island states of Singapore, Indonesia, Brunei, Timor Leste and the Philippines. Straddling the two geographies is Malaysia. However, given the geographical proximity of Hainan Island and the historical relevance of Guangdong and Fujian provinces and the Macau SAR, the southeast region of China is also considered within this study.

The history of Southeast Asia has been influenced by China to the north and India to the west both of which provide archival evidence of an African presence. But beyond India is Southwest Asia (i.e. The Middle East) and ultimately Northeast Africa (i.e. The “Horn of Africa”) that provide much of the archaeological, textual and cultural evidence in this research paper.

Methodology

The inspiration for this research came from the viewing of artefacts from China that are labelled as “Kunlun Slave” and are popularly thought to represent Africans or possibly some dark-skinned people from Southeast Asia. Four questions were highlighted; Are these K’unlun really Africans? Were the K’unlun slaves? And did they come through or from Southeast Asia? Notions of ethnicity, migration and agency therefore framed the research.

The original methodology involved taking random sample of seventeen depictions that have been assumed to represent Africans in a variety of mediums (i.e. ceramics, cave paintings, parchment paintings, etchings, screen paintings, lacquer-work and miniature paintings on paper). The evidence (media) was mapped geographically and chronologically by the place of discovery (for ceramics) or of known manufacture in Asia. One exception was an etching produced in the Netherlands but based on an accurate eye-witness account. Due to copyright restrictions it is impossible to show these images and this research paper will therefore concentrate on archival sources.
The results demonstrated that different media representations were dominant in different geographical regions and periods. However, four groupings are discernible: The K’unlun up to the tenth century, the Zenqqi or Zanji from the eight to around the fourteenth century, the Abyssinians and Barbari from the sixth to the seventeenth century and finally the Africans described variously as Moors and Kaffirs by the Iberians and the Dutch in Asia from the sixteenth century onwards. It is these four groups of Africans in Asia that are discussed in the analysis, before we reach a conclusion that focuses specifically on Southeast Asia.

Analysis
The K’unlun
Hundreds of ceramic representations have been found in tombs in China as glazed or unglazed grave goods. They are known as mingqi or “brilliant artefacts” whose function was to provide comfort for the deceased in the afterlife. These were buried between the fourth and tenth centuries (Valenstein 2014: 8-30). There are hundreds of mingqi that represent the Chinese and Central Asian Sogdians, and a smaller number that may represent Arabs, Turkic-speaking peoples, Mongols and others. Three different types of mingqi labelled as “Kunlun slave” exist and these will be discussed herewith.

Early references such as that from the fifth century of a K’unlun called Baizhu do not provide any evidence of their ethnicity (Anshan 2015: 20). However, the location of the K’unlun mingqi finds are alongside an early trade route from the Indian Sub-continent past the Kunlun Mountains and via the inland trade route called the Hexi Corridor or Gansu Corridor to the Chinese imperial cities of Louyang and Xi’an. A “Kunlun slave” in the Louyang Museum and two others at in the Tsui Collection at Hong Kong Heritage Museum depict people with wavy hair, small sharp noses, heavy metal (perhaps gold) necklaces and dhoti-like clothing which suggests that they are from South Asia. Coincidently a set of eight century cave paintings on the walls of the Mogao Caves near Tun Hwang in Gansu Province depicts South Asian Buddhist pilgrims in similar attire to that depicted in the Mingqi. The K’unlun are usually shown wearing red “Zhaoxiabu” around the shoulder and tied underarm (Lim 2018: 161). The location of the K’unlun mingqi and the cave paintings indicate people from the Indian Sub-continent traveling the inland Continental Trade Road to the Chinese Imperial cities. These mingqi represent the first type of K’unlun.

Later archival evidence does exist for a maritime route of a K’unlun people into China. The term Kunlun appears in a 636 CE document of the Tang period which states that a place called Gantangguo was “one of the Kunlun”. The term reappears in a document of 665 CE as the name of a country in the work of the Chinese Buddhist monk Yijing who lived between 635 and 715CE and visited Srivijaya in Southeast Asia and India. Yijing mastered the language of the people he called K’unlun while in Southeast Asia (da Silva Jayasuriya and Angenot 2008a: 27). It must be noted that Yijing included the Hindu-Buddhist Cham and the people of Funan and the Malay Archipelago as K’unlun. A K’unlun in Guangzhuo was said to have killed a government official in 684 CE (Lim 2018: 158). Therefore, the term K’unlun was later applied to tropical peoples associated with slaves (Kunlun-nu) and their own shipping (Kunlun Bo). One theory is that these vessels called Bo were southeast Asian sailing ships of Malay-Polynesian design and it has been suggested that the word Bo is a Chinese interpretation of the Malay word Perahu (Miksic 2013: 48). This is a second type of mingqi.

By 977 CE when attendants with “dark sunken eyes and black skin” arrived with an Arab delegation to the Chinese court, they were called Kunlun nu (Anshan 2015: 20). There is indeed a third type of “Kunlun slave” mingqi image unearthed at Xi’an and now in the Shaanxi Provincial Museum that depicts a groom with curly black hair, a short beard and full eyes who wears a white narrow-sleeved tunic and boots like Central Asians. This the third type of mingqi is more likely to represent an African and possibly a Muslim connected to the ninth century Arab overland and maritime contacts.
The Sengqi or Zanji

The Chinese term Sengqi is derived from the Persian term Zangi and was an exonym for a Black African (de Silva Jayasuriya and Angenot 2008a: 9). There is a record of a Sengqi (or Sengzhi) woman being gifted by the Ummayad Caliph Umar Ibn Abd Al-Aziz to the Srivijaya Maharaja Sri Indravarman in 718 CE. In 724 CE the same maharaja offered the Chinese Tang Dynasty emperor two Sengzhi girls. Four enslaved Sengqi people were sent to China in 813CE. Five Sengqi boys were sent in 815 CE and another two Sengqi girls were sent to the Tang Dynasty in 818 CE. (Anshan 2015: 13).

After the 878 CE Chinese rebellion at Quangzhou, when the city was sacked and the foreign community massacred, all trade ceased for almost one century. Instead, Arab and Persian vessels exchanged their goods in Southeast Asia and we hear nothing more of the Sengqi in China or in Southeast Asia (Miksic 2013: 71). The term Sengqi for Africans was replaced by a Chinese generic term for dark-skinned peoples arriving from Southeast Asia – the K’unlun (Anshan 2015: 13).

The term Zanj re-occurs in the eleventh century writings of the Qadi Sa’id al-Andalus as a non-Muslim people who lived in the “extremity of the land of the Ethiopians” (Segal 2001: 48). Simultaneously Chinese sources relate the visit of an ambassador from “Zengistan” to the court the Song Dynasty in 1071. Another Zengistan ambassador visited China in 1082-3CE. In 1088 there was a third mission from Zengistan. In the twelfth century the Moroccan traveller Al-Idrisi described the Red Sea port city of Seyla (or Zeila) and placed this nominally Islamic state at the southeast border of the Abyssinian state (Segal 2001: 96). By the early fourteenth century Ibn Battuta uses the term Zanj for any East African peoples and especially non-Muslims (Gibb 1962: 379).

The Abyssinians and the Barbari

The earliest mention of Barbaria is in the work by Cosmas Indicopleustas written between 547CE and 549CE. This Barbaria is associated with frankincense and cassia (de Vere Allen 1993: 64). There is a considerable body of evidence demonstrating a long-standing connection between Northeast Africa and Sri Lanka where Africans appear to be primarily known as Barbera or Barbareen in earlier periods (Hussein 2013: 104-105).

In the same period the coastal Aksumites appropriated the term Habashat from the highland peoples of Aksum (Ethiopia). This term is the root of the English exonym Abyssinia. The Arabs called the people Al-ahlbash and in time extended the term as Habshi to included other Cushitic speakers while the term Habesha applied to Northeast Africa. As Axum declined, the Dahlab Islands at the south of the Red Sea became a centre of piracy by Habasha pirates who attacked Jeddah in 702-3 CE. The Arabs sent a retaliatory naval force that took the islands and therefore produced a bridge to Islamic expansion into the Northeast Africa (Insoll 2001: 41). The earliest known mosque in Africa is probably the Mosque of the two Mihrabs or Masjid Al Qiblatayn of Seyla (Somalia) that contains the tomb of Sheikh Babu Dena (Insoll 2003: 61).

As the Tang Dynasty expanded westwards it came into contact with the Abbasid Dynasty expanding in Central Asia at the Battle of Talas in 751CE. By this time there were certainly Africans in the Arab (Dashi) armies. Du Huan, a Chinese captured at Talas who acquired the Arabic language wrote of his adventures in Western Asia and Northeast Africa in the mid-eighth century and mentioned Laobosa, which is possibly a version of Al-Habesha and refers to the Christian kingdom of Abyssinia (Smidt 2001).

In the twelfth century, a missionary called Shaikh Najib travelled through the Maldive islands converting people to Islam. He died on Karedu Island and was known as the Habshigefanu (or “Worthy Abyssinian”). An African Sheikh Abu Al-Baraket [Al-Barbari] is credited with the Islamisation of
the Maldives. He was also known as Yusuf bin Ahmed Al-Kawneyn and was a Somali scholar from Seyla and associated with the Sultanate of Ifat (Forbes 1983). There are shrines to this sheikh in the Maldives, at Beruwala (Sri Lanka) and in Northwest Somalia at Aw Barkhadle and Qoranyale. Interestingly in local folklore this Sheikh is attributed to have converted the first Somali clans to Islam and to have converted the Maldivian ruler Ranna Maari to Islam. Zhua Rukuo writing in the early thirteenth century China mentions a place called Bi-b’a-lo that is certainly the same area mentioned a century later by Ibn Batutta as Barbari. Rukuo’s mention of camels and the Dragon Blood tree (Dracaena cinnibari) endemic to Socotra makes Northern Somalia the most likely location of Barbari (Hirth and Rockhill 1911: 128-132).

Muslim peoples including Africans were very much part of the Mongol or Yuan Dynasty in China and were painted by famous artists such as Liu Guangdao in 1280 CE (Anshan 2015: 20). The Venetian traveller Marco Polo appears to have never visited Africa but must have encountered Africans in Asia between 1271 CE and 1295 CE since he provides a very detailed account of the Abyssinian Kingdom. He mentions that it included Jews, Christians and Muslims each with specific facial markings (known as nikisat). Polo also mentions a battle at Aden between the Abyssinians and the Arabs, and that the Abyssinians imported elephants from India (Waugh and Bellonci 1984: 176-178).

Battuta visited the Horn of Africa around 1332 CE and noted that the city of the Barbari people was Seyla, which was at that time part of the Kingdom of Awfat. These Barbari were Sunni Muslims of the Shafi’I school who occupied the coast of the Northeast Africa. Battuta suggests a dynastic connection between Seyla and Mogadishu (Gibb 1962: 856). Battuta also makes ample mention of Abyssinians as crewmen, militia, musicians and rulers in the Western Basin of the Indian Ocean (Gibb 1962: 799-856) and this is confirmed by Indian sources (Pankhurst 2003: 192). Abyssinians were employed in the fifteenth century Bahmani Kingdom (Chauhan 1995: 19-29) and the Bengal Sultanate (Robbins & McLeod 2006: 131-133). By the end of the century the Abyssinians dominated a territory to the south of Bombay which was called Habsan (Chauhan 1995: 4-19).

In the sixteenth century the Portuguese used the term Mouro for the Muslim Africans they encountered in the Indian Ocean. The term was used extensively for East Africans but they reserved the term Abexines for Muslim, Christian or Jewish Abyssinians. In the sixteenth century the port of Seyla was the main exporter of enslaved and free Abyssinians destined for India where they were called Habshis. Some Abyssinians in India were engaged in trade as noted by the writer de Barros in 1533 (Boxer 1997: 250). In order to endure their hold of Chaul and Bassein near the islands of Bombay, the Portuguese had to fight the Abyssinians in the armies and navies of the Indian rulers and take the Abyssinian bases at Damman and Panera (Chauhan 1995: 24-25). Armed with Portuguese weaponry and aided by Portuguese renegades the Abyssinians of Janjira transformed their base into a granite fortress between 1567 and 1571 (Chauhan 1995: 8).

The Dutchman Jan Huygen van Linschoten who was secretary to the Archbishop of Goa between 1583 and 1588 (1563-1611) mentions that the coast “unto the Red Sea is commonly called the coast of Abex, and divers men of Prester Johns land do send men of that country, some being slaves and others free, into India, which they serve for Saylors in the Portingalles shippes” (Burnell 2005: 34). Linschoten goes on to mention that in Goa there are “Abaxijns some of them Christians, and some Moores.” He goes on to describe that “the Abexiins that are Christians have on their faces. Burnt markes in a manner of a crosse, one over their nose in the middle of their forehead…., on each of their cheeks, …under their neather lip to the chin” (Burnell 2005: 222-265). This is a clear reference to the nikisat that is still worn by Ethiopians today and is portrayed in a sketch produced in the Netherlands in 1596 based on the account of Linschoten (Burnell 2005: 265). However, most interesting for this study is Linschoten’s remark that “These Abexins and Arabians such as are free doe serve in al India for saylers and sea faring men, with such merchants as saile from Goa to China, Japon,
Bengala, Mallaca, Ormus and all the Oriental coast: for that there they [the Portuguese] have no other saylers,” (Burnell 2005: 266-267). This explains the Africans depicted on the Japanese Nanban Byobu or “Southern Barbarian screens”. Abyssinians have been documented and depicted by Indian and Western sources of the sixteenth century. They include Malik Ambar the Abyssinian commander of cavalry for the Sultanates of Bijapur and Ahmednagar, and Siddi Masood Khan who established a dynasty that was part of the Bijapur Sultanate. (Chauhan 1995: 41-218). In fact, the Moghuls established political and trading relations with the Abyssinian kingdom and received envoys to the court of Akbar and subsequent rulers in the seventeenth century (Robbins and McLeod 2006: 164). Africans were also present and painted at the courts of Hindu rulers such as Maharaja Jaswant Singh I of Marwar. By 1669 the Abyssinians had a formidable base at Janjira Island and were now known to the Europeans by the autonym Siddi. They became players in the territorial ambitions of the Portuguese, English and Dutch on the one hand, and the Marathas on the other (Chauhan 1995: 8-86).

The Portuguese found customers for enslaved Africans among other European powers (Spanish, Dutch, British French and Danish) and Asians of all religious denominations. Through the Iberian network Africans travelled to other parts of Asia as far as Japan (Lockley and Girard 2019: 52). After the expulsion of the Portuguese, the only Europeans allowed to trade and remain in Japan were the Dutch. In their base on Dejima Island (now part of Nagasaki) the Dutch brought slaves and servants from their colonies in present-day Indonesia, South Africa and Ghana.

**Conclusion**

This paper concludes by considering the agency of Africans in Southeast Asia outlining their role as slaves, crewmen, militia and clergy. The term K’unlun was originally a toponym for darker-skinned South Asians coming to China through the Himalayan passes near the Kunlun Mountains. Since slavery was endemic in much of Asia since ancient times, there is no doubt that enslaved people were gifted or imported into China and known as Kunlun-Nu (Heejung 2015: 27-52). The commencement of a maritime trading route during the Tang Dynasty between Southern China and Southwest Asia precipitated the arrival of dark-skinned Southeast Asians on their own vessels (i.e. Kunlun-Bo) who were also called K’unlun. The connection between the archival evidence and the archaeological artefacts would suggest that only those Tang Dynasty mingqi with wavy hair, one-piece of red clothing and gold ornaments could be referred to as K’unlun, and that the noun “slave” should be omitted unless there is actual evidence of this. The presence of mingqi allegedly depicting K’unlun are analogous with those mingqi of a several ethnicities described by Western researches and art historians (Valenstein 2014: 43-44). However, only the mingqi depicting people of colour have been designated as depicting slaves and possibly Africans.

The evidence in this paper suggests that by the Tang Dynasty (618-907) the term K’unlun was applied by the Chinese mainly to Southeast Asians. Simultaneously the term Sengqi is specifically applied to enslaved Africans that the Arabs called Zanji. These enslaved people were “gifted” to the Chinese court through the Southeast Asian state of Srivijaya who had received them as “gifts” from Arabia. These Sengqi boarded vessels originating in Northeast Africa and were transported via the Maldives or Southern India to Southeast Asia along the Maritime Trade Route.

Perhaps it is worth considering that archaeology at Barus in Western Sumatra has uncovered West Asian glass artefacts that appear to belong to two different periods and regions; The earlier group from the Persian Gulf dates from the ninth or tenth centuries, but the other group is from Egypt or Syria and date to the twelfth century and its Chinese ceramic assemblage at Lubu Tua near Barus is more like that of Fustat (Egypt) than that of Siraf (Iran). The general consensus is that Barus (or Farus) was a port with Arab-Persian, Indian and Chinese mercantile presence (Miksic 2013: 81-83). After the 878CE rebellion at Guangzhou and the Zanj Rebellion between 869 CE and 883 CE in
Mesopotamia (Segal 2001: 43-44) there was a shift in trade from the Persian Gulf to the Red Sea. Perhaps there was also a decline in enslavement of the Zanji.

It is possible that Srivijaya ceased to exist after 1025 CE, perhaps as a result of the Chola incursion. However, the increasing presence of Muslim traders from Arabia, Persia and/ or India may have played their part in the decline of the state. Miksic suggests that the first Chinese traders of this period arrived in Southeast Asia on Muslim ships (Miksic 2013: 81-83). If this is the case, Persians, Indians and Malays are obvious crew. However, the evidence suggests that Africans known as Habeshi may just as likely to have been crewmen and could be both Muslim and Christian. Some were undoubtedly enslaved, but others would be free men. The famous painting of the Arab or Indian vessel with African crew from Iraq is from this period. Ibn Battuta visited Sumatra in 1335 and mentioned Barus, Palembang and Malayu. (Miksic 2013: 121).

Abyssinians were clearly part of the crew compliment of Portuguese vessels and it is in the position of crew or stevedores that they are represented by the Kano school of painting and included in the famous Bōnyu Namban. The Portuguese brought large numbers of enslaved Africans to Goa, Damascus and Diu in India and then transhipped them to Sri Lanka and Pathien (Myanmar) and Macau (Pankhurst 2003: 216). Friar Domingo Navarette recorded the presence of Africans in Guangzhou in 1618 (de Silva Jayasuriya 2008b: 118), some of whom acted as interpreters between the Cantonese and the Portuguese (Pankhurst 2003: 216). There has been some suggestion of a small African presence in the Solor Archipelago and Timor in the mid-seventeenth century (Andaya 2010: 405). By the sixteenth century Abyssinians acquired the best of Portuguese military technology and combined it with Portuguese and Arab-Indian naval skill that proved them to be a formidable force by the seventeenth century when the British and Dutch companies moved into the Western Indian Ocean. An account exists from Indonesia of an Abyssinian slave of Sultan Iskander Muda (1607-1636) of Aceh in Sumatra who became the mother of the Panglima Sagi (head of three districts) under the title of Panglima Polim Muda Setia Perkasa meaning “The young commandant of Polim from Perkasa” (Leyten 2004: 65). There is no indication of how this young woman arrived in Northern Sumatra, though given the location it is likely that she arrived through an Islamic or possibly an Abyssinian network.

Clearly from both archival and visual sources Africans and specifically those identified as Abyssinians in Asia were major players in the Western Basin of the Indian Ocean. The Portuguese who were short of soldiers in their Eastern Empire looked to free African mercenaries and slave-soldiers as a militia. By the early seventeenth century Africans were defending the Portuguese empire from Hormuz to Macau (Boyer 1997: 301-302) and clearly these men were guards for the Jesuit clergy in Asia as far as Japan (Lockley and Girard 2019) where they were depicted on gunpowder flask or Kayaku-ire and on a writing-boxes or suzuribako. There is a reference by Fernão Mendes Pinto of “Abyssins” and “Moors” in the Burmese army during a siege of Ayutthaya in 1548 (Gent 1692/1614: 279). Undoubtedly other Africans were in the Portuguese militias of Ayutthaya (Thailand). There were also Africans in the Spanish Philippines. These areas deserve further investigation.

Islam appears to have arrived in China overland by Arabs and other converted peoples. However, the Dashi who sailed to China in the Song Dynasty (960-1276) did so by sea via Kollam (India) and Sri-vijaya (Haw 2018: 732-734). Presumably the Zangistan ambassadors took the same route. This paper suggests that the introduction of Islam by sea, was conducted on vessels that were manned at least in part, if not all the way from South Arabia and Northeast Africa by Muslim Africans, the ancestors of modern Eritreans, Ethiopians, Djiboutians and Somalis. Battuta confirms the existence of Shafi’i Islam in Samudra in the fourteenth century. This explains the dominance of the Shafi’i school in Yemen, the Northeast and East Africa, the Maldives and most of Southeast Asia.
The paper also hints at the possibility that Islam was introduced to the Sumatra, the Champa Empire, China and perhaps as far as the Southern Philippines in part by Africans. This may explain the find of a coral stone (*poritis*) stele at Tengqiao, near Haitang in Southern Hainan. The carved coral stone stele is presently in the Guangdong Museum. Further research on the spread of the use of live *poritis* coral in East Africa, the Maldives, Southeast Asia and on Hainan Island may add archaeological evidence to this theory. It is clear that Africans were present at the court of the Mughal Emperor Shah Jahan as Islamic theologians and the Dutch produced at least one engraving of an African cleric or “Moorse” and his Javanese wife in eighteenth-century Batavia. The Portuguese were acutely aware of the differences among Africans and were keen to involve them in their evangelical work in the Indian Ocean World. “Kaffirs” (pagans), Abyssinians and Moors (former African Muslims) were Jesuit pupils in Goa (Boxer 1997: 250). It would not be surprising that Africans found themselves attached to the Portuguese as clerics in Malacca, Macau, Solor (Indonesia) and in Timor Leste.

Slavery was in fact endemic in Asia from 700 to 1700 CE (Segal 2001). Twentieth century historians from Fredreich Hirth onwards have rightly tended to concentrate on slavery as the process by which the majority of Africans arrived in Asia (Hirth and Rockhill 1911). Yet, in doing so they have neglected the role of free and emancipated Africans to the point where the free African narrative is absent. Charles Boxer, a foremost historian of the Portuguese Empire suggested that the Portuguese vessels in “the Indies” were “entirely crewed by Asians and negro slaves” (Boxer 1997: 57) despite providing evidence of Abyssinians as captains, admirals, sailors and merchants. Chauhan’s writing fails to consider his own historical evidence that Africans were anything other than enslaved peoples or their descendants (Chauhan 1995: 19-23). This paper opens a dialogue beyond enslavement, on the African presence in Southeast Asia as free sailors, soldiers, religious clergy, emissaries and merchants.

References
Gent, HC (1692) *The Voyages and Adventures of Ferdinand Mendez Pinto*. London: Richard Bently, Jacob Tonson, Francis Saunders and Thomas Bennet. (Originally published in 1614)


Long Trumpets, Their Use and Significance in Java before 1500 CE

Trompet panjang, pemakaian dan maknanya di Jawa sebelum 1500 AM

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Long trumpets and their use in pre-Islamic Java are discussed in detail. First documented in the 9th century CE, the use of long trumpets was limited at this early period on the royal and princely environment, where they figure in the court ceremony and war rituals. Around 1200 CE, a novel type of long trumpets, called tarayan in Old Javanese texts, were introduced from South India. These trumpets differed from earlier models by their prominent metal bells. There is a distinct possibility that Old Javanese tarayan was a trumpet with two tubes (‘double-trumpet’), which is depicted on a famous, and unique, representation of this musical instrument at Candi Jawi (13th century CE) in East Java. In the 13th and 14th centuries CE, other novel types of wind instruments, such as the shawm, were introduced to Java from the Middle East. Appreciated for their shrilling sound, and typically associated with Islam, shawm was introduced to Java at least a century or two before the mass Islamisation of the island started.

Introduction

Javanese pre-Islamic wind instruments have received relatively little attention. Two monographs on ‘Hindu-Javanese’ music by Jaap Kunst (1927, 1968) still provide the best account of the history of wind instruments in Java before 1500 CE. This essay is focused on Javanese long trumpets, though other types of wind instruments will be briefly discussed. Little has been added to our knowledge since the English edition of Kunst’s book was published in 1968, though a number of important studies appeared that discuss other classes of Indonesian musical instruments, in particular gongs and membranophones (Ferdinandus 2004; Griffiths and Lunsingh Scheurleer 2014; Nicolas 2009, 2011, 2017; Salmon 2003; Wrazen 1986). This lack of interest is probably not surprising, for no actual specimens of Javanese trumpets from the early period have survived. Yet, as we will see, long trumpets played an important role in religion, war rituals, as well as in the royal ceremony. I use Old Javanese texts as my major source, and in addition I draw on a limited body of visual evidence, mainly the depictions of trumpets on Javanese temple monuments. This essay develops its argument in two parts: in the first section, I review the available textual and visual evidence, which indicates that the use of long trumpets was limited, mostly – if not exclusively – at the royal and princely courts. In the second part, I demonstrate that around 1200 CE, if not earlier, novel types of metal trumpets were introduced to Java through South Indian cultural influences. In the 14th century CE other novel types of wind instruments, such as shawm, were introduced to Java via Middle Eastern influences, and it is only in the early-Islamic period that long trumpets were used outside the court environment.
Before I discuss long trumpets, let me briefly mention shell-trumpets first. Judging by Old Javanese textual evidence, one would conclude that a major form of trumpet in Java before the 14th or 15th century CE was a shell-trumpet, denoted by a Sanskrit loanword śangkha. Kunst (1968: 30) observes that ‘shell-trumpet has been an important Hindu-Javanese instrument in temple services as well as in the business of war’. Being animal remains, conches differ, often significantly, in size so that there is no standard pitch for a shell-trumpet. This would make it rather difficult to integrate the shell-trumpets into musical ensembles, and the function of these sounding devices was mostly in the field of ritual and military signalling, which was, however, also true for long trumpets before 1500 CE. There is a number of depictions of shell-trumpets on Buddhist as well as Hindu religious monuments, such as Borobudur, Prambanan, Panataran, Candi Jawi, and Candi Sukuh, whereas depictions of non-shell trumpets on Javanese temple monuments are rare in extreme.

Old Javanese terminology for non-shell trumpets is ridden with problems, only partially solved by Kunst and scholars working on Old Javanese texts. Generally, related words kala, kahala/kāhala, and kālaha have been interpreted as denoting ‘trumpet’, generally assumed to be long trumpets. As for kālaha, Kunst (1968: 31) has suggested that kālaha denoted a ‘crooked trumpet’. Zoetmulder (1982: 769), well-aware of the complexities of Old Javanese textual record, glosses kālaha simply as ‘trumpet’. Importantly, in most cases the word is an element of a compound word śangkakālaha, which would translate ‘shell-trumpets and kālaha-trumpets’. Old Javanese language, however, makes possible an alternative translation ‘trumpet(s) of the kālaha-type’. In the case of crooked trumpet, or horn, we are little helped by visual sources. Looking at this evidence, Kunst (1968: 32) has observed:

> there may be a representation of a curved trumpet (at Borobudur) ..., but the relief is damaged and therefore somewhat indistinct. This could also be a horn, an instrument which is mentioned in Old Javanese literature – be it only once – under its Sanskrit name śrnga.

In my view, we should reconsider in this context the interpretation of Old Javanese term sungu, which Kunst (1968), based on modern Balinese parallels, has taken to be one of the terms for shell-trumpet. In Old Javanese, however, sungu denotes ‘horn’ or ‘antler’ (Zoetmulder 1982: 1859), and this meaning is attested in modern language, too (Robson and Wibisono 2002: 707). We actually do have at least one Old Javanese text in which sungu refers to the horn used as a type of sounding ritual device. Horns denoted sungu are blown during the equinox war rituals in the Bhāratayuddha, a kakawin (court poem) composed in 1157 CE. Though the text is based on the Sanskrit Mahābhārata, stanza 10.6 (where the war ritual is described) is an addition of Mpu Panuluh, the Javanese author of this part of the text (Supomo 1993: 16).2 Interestingly, the ritual and ceremonial importance of horns had survived in Javanese courts until the early-modern times: the horns called Kyai Nakula and Kyai Sadewa were among the royal pusakas owned by Pakubuwana I in 1708 CE (Ricklefs 1998: 182, n. 75). Curved trumpets were also used in other parts of Southeast Asia: end-blown horns or curved trumpets are shown extensively in the military context at Angkor Wat, a Vaisnava temple complex built in the 12th century CE (Knust 2010: 40-43).

One of the Old Javanese musical terms that is not fully understood is the compound-word kalaśaṅka, interpreted by Kunst (1968: 42) as a type of trumpet when kala occurs in connection with śaṅka. While one admires Kunst’s work on Javanese music, it is not necessary to take his interpretation of Old Javanese texts at face value. Zoetmulder (1982: 767) rightly disagrees with Kunst on this point and introduces textual references that disapprove this norm as generally applicable, observing that in

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1 I plan to discuss shell-trumpets, and especially their ritual use, in a separate study.
2 Interestingly, the Bhāratayuddha is unique among Old Javanese court poems, for it was authored by two poets,
different contexts *kala* denotes either a type of trumpet or ‘drums, cymbals or a kind of gong’. One of the most interesting passages where *kalasangka* is mentioned is found in the account of the ‘Waking of Kumbhakarna’ in the *Kakawin Rāmāyana*, Old Javanese court poem composed in the late 9th or early 10th century CE. The demon king Rāvana, feeling that his troops are no match to Rāma and his simian soldiers, decides to wake his giant brother Kumbhakarna. In a humorous vignette, a number of musical instruments and sounding devices are used to wake up the giant from his deep slumber:

\[
təka\;\text{manabɔh}\;ta\;\text{kondang}\;\text{anulup}\;\text{kalasangka}\;\text{waneh}
\]

\[
murawa\;\text{tuwung}\;\text{rəgang}\;\text{padahi}\;\text{mandra}\;\text{mahāswara}\;\text{len}
\]

Some were beating drums, while others blew *kala*-trumpets and shell-trumpets,

*Murawa*-drums, *tuwung*, *rəgang* and *padahi*-drums, some soft, others with a penetrating sound.4

The interpretation of the compound-word *kalaśangka* as ‘*kala*-trumpets and shell-trumpets’ suggested here is supported by stanza 22.4 – still in the same context of waking Kumbhakarna – where *kala*-trumpets are mentioned, while we hear nothing about *śangka* shell-trumpets. Due to the complete lack of any material evidence, we remain incognizant what was the actual shape of Javanese *kala*-trumpets. It is, however, probably not far-fetched to identify trumpets denoted *kala* and *kāhala* with depictions of long trumpets on Borobudur, even though visual depictions give us no idea what kind of material was used to make them. We know that in medieval India long trumpets were common, and at least trumpets used in the military context seem to have been made from metal (Deloche 1988: 67). It is plausible that long trumpets with a flaring bell depicted at Khmer monuments were also fashioned from metal.5

Old Javanese textual evidence indicates that the major function of long trumpets should be looked in the field of the royal ceremony and pomp. In the *Kakawin Rāmāyaṇa*, *kāhala*-trumpets are sounded to announce arrival of demon king Rāwaṇa into the audience-hall, where he takes a seat on his bejewelled throne:

\[
sawətu\;\text{nira}\;\text{rikang}\;\text{sabhā}\;\text{śighra}\;\text{monikang}\;\text{kāhala}
\]

\[
dadi\;\text{tumama}\;\text{sirang}\;\text{patih}\;\text{wrddha}\;\text{lāwan}\;\text{ta}\;\text{senāpati}
\]

\[
satəka\;\text{nira}\;\text{parəng}\;\text{masö}\;\text{gorawātwang}\;\text{tumungkul}\;\text{kabe}\]

When he had entered the assembly-hall, immediately the *kāhala*-trumpets sounded,

And the venerable *patih* and the commanders-in-chief entered;

Having arrived, they came forward together, all bowing respectfully in reverence.

The sound of trumpets announces the arrival of the ruler, and the passage suggests that it was perceived as a signal for the courtiers and other people in the audience-hall to bow before the king. Even though the scene is framed in the mytho-poetical time and space, we can assume that it reflects the royal protocol followed in Java at the time the *Kakawin Rāmāyana* was composed as an alle-

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4 All translations are mine, unless stated otherwise.
5 I am grateful for this information to Patrick Kersalé (personal communication, June 2019).
gory of royal power. The ‘imperial’ context of this vignette certainly suggests that kāhala-trumpets were made of metal, which would be not surprising if we take into account the very high level of Javanese metal production, especially bronze-making, in pre-Islamic period. In the Arjunawiwāha, a kakawin composed in the first half of the 11th century CE by Mpu Kaṇwa, long trumpets (kala) and shell-trumpets (śangka) figure in the context of the royal consecration and worship of the gods. Arjuna, who has killed the demon king Niwātakawaca, is brought as his reward to Indra’s heaven, where he is led to the throne-hall and consecrated as the king, as we learn in stanzas 29.3-4. Arjuna is honoured by Indra and other gods (as well as divine beings, such as heavenly sages and musicians) by thundering sound of various musical instruments;

\[ \text{barəbət kala śangka murawa gumuruh stuti dewagana} \]

Cymbals, long trumpets, shell-trumpets, and murawa-drums resounded with the praises of the hosts of gods.

This scene suggests that in the Javanese imaginaire, long trumpets and shell-trumpets were associated with the royal pomp and ritual. Very important are two references to the use of long trumpets in the Deśawarṇana, a court chronicle-poem composed by Mpu Prapañca in 1365 CE, and taken by many scholars to be a reliable reflection of the politics and culture of Java under the king Hayam Wuruk (r. 1350-89 CE). In stanza 59.7, long trumpets and shell-trumpets (kala-śangka) are blown to welcome the cavalcade of Hayam Wuruk returning to the court from one of the inspection tours conducted by the king. Interestingly, long trumpets and shell-trumpets serve as fanfare: there are no other musical instruments mentioned in this description. Let me quote the first two lines in full:

\[ \text{When the King arrived, the long trumpets and shell-trumpets rang out,} \]
\[ \text{And all the people in the streets bowed humbly in fear and awe.} \]

We can note that in all of these literary vignettes, long trumpets are closely associated with human or divine rulers, and it is certainly not far-fetched to say that in pre-Islamic Java metal trumpets served as a sort of royal paraphernalia, and were thus closely associated with the kingship. In Deśawarṇa 65.1, long trumpets and conch-trumpets (kāhala śaṅkha) are blown in the context of the Śrāddha posthumous ritual conducted in 1362 CE for the departed soul of the Mother-Queen Rājapatnī. It may be significant that at this particular occasion, kāhala-trumpets and shell-trumpets accompany the rituals conducted specifically by the Buddhist officiants.

Another context in which long trumpets figure in Old Javanese literature is warfare and military parade. We should be cautious, however, to interpret these literary passages as reflections of musical practice: Old Javanese martial scenes are very often dependant on Sanskrit literary models. Yet, in martial scenes, too, the function of trumpets is mostly in the field of ritual and/or ceremonial: in pre-Islamic Java, trumpets do not seem to have been used for military signalling in battles, which mostly relied on drums and easily portable gongs. In Kakawin Rāmāyana 23.72, ‘long trumpets and shell-trumpets’ (kala saha śangka) are blown as part of war rituals conducted by the ‘battle-priests’ for Rāwaṇa before he personally departs for battle. In Arjunawiwāha 20.6, overpowering (ghūrṇita-tara) sound of long trumpets marks the departure of Niwātakawaca’s warriors for the battle against Indra. Long trumpets (kala) also accompany the military march of heavenly troops of Indra, as we learn from stanza 23.2 in the same text. In the Bhomāntaka, a kakawin composed in the late 12th
century CE, long trumpets (kāhala) are blown at the moment the King of Magadha departs to the battlefield. In the large corpus of Old Javanese texts I have found only a single reference in which long trumpets are blown indisputably during the battle. This rare literary vignette is found in the Kṛṣṇāyaṇa, a text composed by Mpu Triguṇa in the late 13th century CE. In stanza 50.11, long trumpets (kala kāhala) are blown in the course of the battle, and their sound seems to accompany the din of clashing swords and daggers. We can conclude that in pre-Islamic Java, long trumpets were mostly used in the context of royal ceremony and ritual.

Metal Trumpets: Extended Use of Long Trumpets after 1200 CE, and the Middle Eastern Influences

Javanese and Malay textual record, as well as depictions of musical instruments on Javanese temple reliefs, strongly indicate that important new developments in the field of wind-instruments were underway in the Indo-Malay world in the 13th to 14th centuries CE. Let me start with a remarkable relief at Candi Jawi, dated to the late 13th century CE, which reveals an existence of an instrument with two tubes, provided with distinct bells (Kunst 1968). Bernet Kempers (1976: 267, pl. 206) has aptly called this instrument ‘double trumpet’. The scene, which has been only poorly understood, shows what seems to be a ritual or ceremonial setting, with two men blowing double trumpets among a group of villagers. One of the peasants is seen leading a pig on a rope, and though Bernet Kempers has suggested that the figures are heading to the market, a single pig led on a rope would rather indicate a ritual setting of this vignette. Kunst (1968: 32) has suggested that the trumpets are similar to ‘the Indian double-kāhās’. Furthermore, Kunst (1968: 32) finds parallel for the (Javanese) trumpets in Nepal:

In appearance they are identical with the straight trumpets still used in Nepal (fig. 97) (and perhaps also in India), called kāhā. On the Indian subcontinent they have always been used exclusively in the religious sphere; they are typically ritual instruments, and appear with one or with two tubes.

Similar type of trumpets is also known in Dravidian South India. Denoted tirucinnam in modern Tamil, the instrument is about 75 cm long and has a narrow conical bell but no mouthpiece to facilitate the simultaneous blowing of two tubes (Sachs 1940). Usually a pair of these long, slender instruments are blown together, whereas in Nepal it was a standard practice for one musician to play both of them simultaneously. Yet another parallel to the trumpets depicted at Candi Jawi may come from ancient Cambodia. At one of the ‘musical reliefs’ at Angkor Wat, a man can be seen who blows either a double trumpet or two trumpets simultaneously. The type of double trumpet depicted at Candi Jawi has not survived in modern Java, and we remain incognizant of its Old Javanese name. There is, however, a chance that the name of this musical instrument has survived undetected in Old Javanese textual record.

To consider this possibility, let me now turn to an enigmatic musical instrument denoted in Old Javanese tarayan. Kunst (1968: 32) has come to the conclusion that Old Javanese tarayan ‘stands for the trumpet itself, whatever the form of this trumpet may have been’. Zoetmulder (1982: 1952) has glossed tarayan as ‘a kind of musical instrument’, suggesting it is possibly some type of trumpet, a guess obviously based on the musical context in which tarayan figures in Old Javanese texts. Robson (1995: 86) has translated tarayan as ‘trumpet’ but noted that ‘the translation with ‘trumpet’ is no

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9 Bhomāntaka 85.12.
10 Soewito Santoso (1986: 203), the editor of the text, has interpreted the phrase kumisik ikang kala kāhala mura wa as ‘the sounds of trumpets, drums’.
11 I am grateful for this information to Patrick Kersalé (personal communication, June 2019).
more than a guess’ (1995: 141). There is, however, lexical and insessional evidence that enables us to be more specific about the identity of this musical instrument. In Tamil, one of the meanings of the word tārai is ‘long brass trumpet’, and we can be quite sure that Old Javanese tarayan is actually a loanword from Tamil and must have denoted a metal trumpet.

I would also like to draw attention to Old Javanese epigraphical record. In several inscriptions we encounter a term tarai. It denotes a type of vessel that is always listed among the metal objects, mostly containers, and the word seems to refer to a kind of funnel-shaped vessel made from metal, probably copper. Zoetmulder (1982: 1953), for one, has interpreted tarai tentatively as ‘copper plate or bowl’.

It seems to me that tarayan, formed from tarai by adding a common Old Javanese suffix -an, implies that the tarayan-trumpet had a prominent metal bell. Hence I suggest to render Old Javanese tarayan as ‘metal trumpet’ or ‘trumpet with a metal bell’. We do not know whether Old Javanese term tarayan can be identified with the double trumpets depicted at Candi Jawi, but such possibility should at least be taken into account. Both the term tarayan, and the type of double trumpet seem to completely disappear after the 14th century CE. When we turn to only two known literary references to tarayan, we can glean more details about this enigmatic type of trumpet. The first attestation is found in the Sumanasāntaka, a kakawin composed by Mpu Monaguṇa at the beginning of the 13th century CE. In stanza 52.6, musical instruments are sounded to greet and impress the crowds of people who gather at the palace common (ləbuh) of the court-city Widarbha, where they arrived to participate at the wedding of Princess Indumatī and Prince Aja:

\[ \text{sangka mwang tarayan mRdangga kumisik mamaji talinga ning mwang angrəngō}\]

The shell-trumpets, metal trumpets, and barrel drums roared deafeningly, splitting the ears of those who heard them.

This literary vignette is set, like the whole story, in the mytho-poetical time and space, yet we are offered a description of Javanese pre-Islamic court, its buildings, officials, and customs. It is clear that the musical instruments enumerated in the passage quoted above are selected for their prominent, loud sound: they serve to impress the crowds of onlookers, many of them peasants, and mark the arrival of royal and princely guests. Mpu Monaguna, the author of the text, emphasizes that the instruments ‘roared’ (kumisik) loudly. In fact, the noise was so frenetic that the drums and trumpets were literally ‘splitting the ears like with a wedge’ (mamaji talinga), and those who attended must have experienced the sound of metal trumpets which were possibly unknown outside of the Javanese courts. The phrase amaji talinga (‘splitting the ears’) is extremely rare in Old Javanese literature, and we can assume that the tarayan-trumpet must have been in particular appreciated for the powerful sound it would emit.\(^\text{14}\) The other reference to tarayan is found in the Deśavarṇana. It is of special value for the musical history of Java, for it testifies that metal trumpets with prominent bell were used as ceremonial instruments at the court of Majapahit during the reign of Hayam Wuruk (r. 1350-89 CE). In stanza 84.2, wele tarayans are sounded at the onset of the ‘tour of the city’ conducted by the king:

\[\text{Another attestation is Kakawin Rāmāyaṇa 8.152, where the image is explored by way of a literary hyperbole: desperate Sītā, held by the demon king Rāwaṇa captive at Langkā, considers even the mellow sound of bamboo flute (bangsi) to be ‘earsplitting’ (karaṇaśūla).}\]

\(^\text{12}\) This information has been kindly provided by Tom Hoogervost (email, June 11, 2019).

\(^\text{13}\) Sumanasāntaka 52.7. Old Javanese text taken from Worsley et al. (2013: 612).

\(^\text{14}\) Another attestation is Kakawin Rāmāyaṇa 8.152, where the image is explored by way of a literary hyperbole: desperate Sītā, held by the demon king Rāwaṇa captive at Langkā, considers even the mellow sound of bamboo flute (bangsi) to be ‘earsplitting’ (karaṇaśūla).
The drums, tabours and trutika rang out, not to mention the loud shell-trumpets and metal trumpets.

Rivalled by the unbroken chorus of bards uttering the song of salutation.

It seems to me that tarayan trumpets reached Java through the same network that channelled to the Indo-Malay world Middle Eastern products, such as glassware (Jákl 2017a), but also African slaves (Jákl 2017b). In many parts of the world the spread of metal trumpets has been associated with the spread of Islam and Arabo-Persian culture (Sachs 1940). In the Indo-Malay world, metal trumpets are attested at least from the 14th century CE, and they seem to have been introduced under the influences of Islam. Nicolas (2017: 7) has noted that two types of metal wind instruments are mentioned in the Hikayat Amir Hamzah, a classical Malay hikayat dated not later than the early 15th century CE (Braginsky 2004: 179). A Persian prototype of the text, however, was known in Pasai in north Sumatra as early as 1380 CE. The first metal wind instrument mentioned in the Malay text is muri, interpreted by Wilkinson (1959: 789) as ‘a flute or clarionet of metal’, a loanword from Persian. The second wind instrument known to the Malay author is nafiri, a type of oboe. It is a loanword from Arabic where it originally denoted a trumpet for military signalling, a ‘war trumpet’. Interestingly, nafiri was used in the context of the installation of Malay Islamic rulers. According to Raja Halid (2015: 98):

The nafiri of the Malay nobat is a long conical trumpet measuring between 80 and 83 centimetres in length. Its mouthpiece or circular opening is about three centimetres in diameter, and unlike modern trumpets it is part of the main tubular body of the nafiri and not separated.

We have seen above that in pre-Islamic Java, too, metal trumpets figured in the context of royal consecration, which would be an interesting parallel with the Malay Islamic world. Another wind instrument introduced to the Indo-Malay world through Islamic influences from the Middle East or India, and attested first in the Hikayat Raja-raja Pasai is serunai, a type of reed-pipe (Nicolas 2017: 12). The text was composed in the late 14th century CE (Braginsky 2004: 183), and Malay serunai is a loanword from Persian, where we find the form surnay. Raja Halid (2015: 96) describes the Malay serunai as ‘a quadruple-reed shawm with seven or eight holes’. Another musical instrument of Middle Eastern origin is tabal, a royal installation drum (Nicolas 2017: 12). In terms of the Middle-Eastern musical transfers I find very interesting a depiction of shawm at one of the reliefs of the Rāmāyaṇa at Candi Panataran in East Java, which dates to the early Majapahit period. The relief shows a combat between Hanumān and Indrajit, son of Rāwaṇa. Kunst (1968) was possibly the first scholar who has suggested that a wind instrument depicted at the relief is most probably a shawm. Let me quote Kunst (1968: 28) in full:

Nevertheless for the Panataran instruments at least, the balance is in favour of the shawm on account of its characteristically small bell. Indonesian flutes, usually made of bamboo, have no bell at all. The clue is provided by the whole scene. It represents a detail of the fight between Hanumān, (…) and Indrajit, Rāwaṇa’s son. A sweet-voiced flute would be the very last thing to be expected as an instrument of war. The shawm with its wild exciting character is much more suitable.

Kunst (1968: 29) claims that shawm, which he denotes gem(p)rèt, ‘was popular as a war instrument in the Hindu-Javanese period’, quoting as his source a rather late Balinese text Usana Bali. Elsewhere Kunst says that ‘The Old Javanese names of shawm which have come down to us are still used in Java today: prèrèt (parèrèt, pèrèrèt), p(è)lèrèt, and gem(p)rèt. The matter is, however, more complex. The meaning of Old Javanese terms peleret (and its varieties preret, pereret) is actually far from clear. Most importantly for our discussion, all of them only occur in Middle Javanese texts (Zoetmulder 1982: 1350), neither of which predates the 14th century CE. The only exception is pre-
ret mentioned in the Hariśraya (B), an Old Javanese kākawin composed, probably still in Java, in the early 16th century CE. In my view, it was the environment in which Middle Javanese was used as a language of literature, and that was in the close contact with resident communities of people from the Middle East, including Muslims, which introduced originally Middle Eastern musical instruments to Javanese courts, long time before these courts were actually Islamized. This is the reason we see a Middle Eastern shawm at the scene at Candi Panataran. Sam-Ang (2002) has argued that shawm was known in Cambodia by the 12th century CE, for musical instruments similar to modern Khmer sralai are depicted on several reliefs at Angkor Wat. Knust (2010: 45), however, has recently questioned this view. For sure, modern sralai accompanies traditional Khmer boxing and other martial events, and it is also associated with the shadow theatre. We can draw a conclusion that early Majapahit period was the time when a number of originally Middle Eastern musical instruments became known in Java, one or two centuries before Islam became established there.

Conclusion
I have discussed in this contribution one class of wind instruments documented from pre-Islamic Java: metal trumpets. We have seen that long trumpets were known in Java at least from the 9th century CE, but their use seems to have been limited to the environment of royal courts. Long trumpets, most probably made from metal, were used in the context of royal pomp and court religious ritual. Around 1200 CE, if not earlier, novel types of metal trumpets, called tarayan in Old Javanese texts, were introduced to Java from South India. These trumpets seem to have differed from earlier models by their prominent bell, and there is a distinct possibility that Old Javanese tarayan denoted a type of double-trumpets depicted at Candi Jawi. In the 13th and 14th centuries CE, other novel types of wind instruments, mostly appreciated for their loud or shrilling sound, such as shawm, were introduced to the Indo-Malay world from the Middle East, well before the process of mass Islamization started in the late 15th and early 16th centuries CE. In his so far unsurpassed work on Javanese pre-Islamic music, Kunst (1968: 3) has characterized the general evolution of Javanese musical instruments as the one in which, gradually, stringed instruments disappeared, as did some other instruments such as mouth-organs, bamboo instruments were pushed into the background, and steadily increasing and versatile bronze ensembles come into being, known to us as the gamelan. I would add that another innovation was the steadily growing importance of metal trumpets, which only became popular outside of the court environment as a consequence of their strong associations with Islam.

References

15 Hariśraya (B) 23.5. Significantly, preret is listed together with shell-trumpet (śangka).
16 Knust (2010: 45) has pointed out that modern sralai is long, while ‘The ancient instrument on the relief is much shorter, and its funnel-like form more closely resembles a bottle or vase than a cylinder. (…) the ancient instrument always has a flare, while the modern sralai does not necessarily possess one’. 


Retracing the Cult of Lokeśvara in Khmer and Tibetan Art

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This paper seeks to locate Lokeśvara’s cult within the semiotic functioning of his icons and its iconology. In Mahāyāna Buddhism, the Lokeśvara is the visual embodiment of upāya or the wisdom principle. In this regard, Lokeśvara is also bestowed with the honorifics of the māhāsattva or the great essence, and lokesvarārāja or the protector of the world, wherein he derives his cosmological strength from Prajñāpāramitā, Cunḍā, Amitābha Buddha, and Lokeśvararāja Tathāgata. The paper aims to deliberate upon a Mantrayāna Buddhist text called the Kāraṇḍavyūhasūtra Sūtra, while constructing the religio-philosophical and trans-cultural aspects of Lokeśvara’s cult in Indian, Khmer, and Tibetan art.

Introduction

To analyse the visual trope of Lokeśvara’s cult and to discuss his various representations, I would like to begin by introducing the concept of pratibhāsa or appearance as a conscious cognitive principle. The principles of cognition largely govern the iconographic and iconological principles in religious arts. In Buddhist art also there is an inexhaustive system of meanings that are created through the semiotic readings within its vast pantheon. For the scope of this paper, the various manifestations of Lokeśvara’s cult is curtailed within Indian to Southeast Asian Art to Tibetan Art.

The bodhisattva in discussion here is the great bodhisattva, Avalokiteśvara, who has sentient quality of bodhicitta-utpāda which is the thought or the will to enlightenment. In the text Sūtrālāṅkāra by Āsaṅga, on several occasions, the term Mahāyāna is often substituted with Bodhisattvayāna. This points at two distinct aspects for worshiping him, the method of cultivating pāramitā, and the method of invoking the right mantra. Hence, Avalokiteśvara is glorified as the supreme bodhisattva who is well versed with the pāramitās as well as the mantras. In Southeast Asian art, Avalokiteśvara is widely represented as Mahākaruṇā Lokeśvara. He continues to be “revered as an embodiment of pure and absolute compassion for all sentient beings and eternal devotion to their liberation from suffering” (Huntington et al. 2004: 180).

Through an exegetical survey of the cult of Avalokiteśvara we find his mention in various texts such as the Mahāvastu (Jones 1949); the Sukhāvativyuhā Sūtra (Inagaki 2015: 24), the Sadhar-mapunḍarika Sūtra in which the twenty-fourth chapter refers to him as Lokesvarāja-nāyaka (the minister of Lokesvaraja or Amitabha Buddha) (Vaidya 1960: 28). The Kāraṇḍavyūha Sūtra (KS), is an Avalokiteśvara Avatārakāra (greatness) text. In the text, he is hailed as ārya Avalokiteśvara bodhisattva mahāsattva as he enters the avīci hell. He is also represented at par with Bodhisattva Samantabhadra, and also referred to as an emanation of Adi Buddha. He is well versed in reciting the six-syllabled mantra of infinite wisdom or Kṣadakṣrī mahāvidyā (Bhattacharya 2015:108). The text also extolls him as sangha ratna for providing his undivided attention to be a sarvasaṃśodhana or the purifier of everything. The Mahāvairocana Tantra, mentions that the mahākarunā garbhadhātu-

1In the text, Śākyamuni Buddha, while preaching to Ānanda, exalts Avalokiteśvara and his bodhisattva-hood. “The light of a bodhisattva shines a hundred yojanas. There are two bodhisattvas who are the most dignified; their majestic light shines everywhere in the universe of a thousand million worlds.” Ananda asked, “What are the names of those two bodhisattvas?” The Buddha replied, “One is called Avalokiteshvara and the other, Mahasthamaprapta.” Inagaki (2015: 24).
In Mahāyāna Buddhism, Lokeśvara is the visual embodiment of upāya or the wisdom principle. In this regard, Lokeśvara is also bestowed with the honorifics of the māhāsattva or the great essence, and Lokeśvararāja or the protector of the world, wherein he derives his cosmological strength through Amitābha Buddha, and Lokeśvararāja Tathāgata, from the Goddess Prajñāpārāmitā and more discreetly through Cunḍā.

To reconstruct the presence of Lokeśvara within the canonical periphery of KS, the paper proposes to construct the trans-cultural aspects of Lokeśvara’s cult in Indian and Khmer art from 8th to 13th centuries CE. Besides this, the paper also seeks to expand the visual field by taking examples from a Tibetan Buddhist thangka from the National Museum, India to continue the esoteric Buddhist dialogue.

**Lokeśvara in Khmer Art**

In Khmer art, and Southeast Asian traditions at large, Lokeśvara’s iconography follows similar denotative and connotative values as seen in the Pala idiom (Figure 1). In his regal depiction, Lokeśvara is also referred to as lokeśvararāja or the protector of the world, a title that was also taken by Jayavarman VII too as a worldly manifestation of the divine bodhisattva himself. A bronze figurine of Lokeśvara in the Bangkok National Museum depicts similar physiognomy and is attributed to the Bayon style. Lokeśvara’s four arms bears various standardised attributes. Along with the four-armed forms, in Khmer art, we also see the ekadaśamukha or the eleven-headed variant of images with multiple arms. As mentioned in the Kārandaavyūha Sūtra, each level of three heads indicates that the ekadaśaśirṣa is looking at three worlds, the world of desire (kāmadhātu), the world of living forms (rūpadhātu) and the world without form (arūpadhātu); overlooked by Amitabha Buddha himself. The twenty-fourth chapter of Sadharmapuṇḍarīka Sūtra recalls him as samantamukha or facing all four directions to help all beings. In Indian art, one of the earliest representations of the eleven headed form of Lokeśvara is found from Cave 41 dated to 6th century CE, at the rock-cut caves of Kanheri in Maharashtra. The bas-relief is a religious apotheosis of the Avatamsaka tradition, through the daśabhumīsūtra or ten stages of attaining bodhisattvahood (Gokhale 1987: 371-376).
The paper proposes to discuss select Lokeśvara sculptures and *bas-reliefs* from Banteay Chhmar, a 12th century CE Mahāyāna Buddhist temple built during the reign of Jayavarman VII in the Banteay Meanchey Province of northwest Cambodia. The paper seeks to situate the visual modes of depiction of Lokeśvara’s cult in Khmer art with the religio-philosophical order of the text, the *Kāraṇḍavyūha Sūtra* (referred to from here on as *KS*).

*Scene of the Avīci Hell*

![Lokeśvara surrounded by the orbs of water spirits](image)

In one of the *bas-reliefs* is the scene of the *avīci* or the Buddhist hell when the mahasattva Lokeśvara enters the ghostly realm to liberate the people from suffering (Figure 2). In the second chapter of the *KS*, titled *Avīcisōṣoṇaṁ Nāma Dvitiyaṁ Prakaraṇam*, Yama pays homage to the great being and lauds him with many praises, few of them being, “he who brings relief (jagdāśvāsankrāye); who has a hundred thousand arms (śatsahastrabhujaye); who has a hundred thousand times ten million eyes (kotīśatsahastranetraye); who has eleven heads (ekadasaśīrśāye) (Bhattacharya 2015: 49). Having relinquished the hot heat of *avīci*, Lokeśvara proceeds to the world of the *pretas*, which is described in the third chapter titled, *Sattvadhātuparimokṣanaṁ Trīyāṁ Prakaraṇam*.

Seeing the pretas in suffering with skeletal figures, and various deformities, they are at once blessed by the bodhisattva. He gave forth a spring of ten rivers of great force from his fingers (daśabhāyo hastāṅgulībhayo daśa vaitarṇīnirṣkramyati), ten rivers from his toes (daśambha pādāṅgulībhayo daśa vaitarṇīnirṣkramyati) and many rivers from multiple pores of his body (sarvaroma-kūpebhā-
yo-ṣtāṅga-vāripipūrṇa mahānadho nirsikramyanti (Bhattacharya 2015: 50). Drinking from this holy nectar, the pretas were purged and returned to the living a wholesome life.

In the Banteay Chhmar panel, Lokesvara is depicted with twenty-two arms. With his principle hands he holds the sacred text of Prajñāpāramitā close to his chest. As mentioned in the KS, Lokesvara has the ability to practice the seven-pāramitās, the last one being the Prajñāpāramitā. He makes a peculiar mudrā with his remaining twenty arms. Surrounding him are the ten orbs with female deities placed within them. As Boiselier and Sharrock have also already mentioned, the life-giving rivers (vaitārṇī) personified at Banteay Chhmar joyously dance around him holding a garland streamer, which perhaps symbolizes the stream of river as well (Sharrock 2015). This is an unusual manifestation of the gushing rivers and seeing the relief, one can also identify the garland steamer as a life giving force of the river which is being received by the seated devotees with both hands folded in supplication.

The remaining bas-relief around the Lokesvara is arranged in a systematic manner. It is divided in three registers. The flying gāndharvas in the heavenly realms, while the middle register depicts rows of devotees comprising of men and women receiving the elixir of the vaitārṇī. In all probability, this gathering refers to the pretas who were transformed into human beings after consuming the life-giving water. At the bottom of this gathering are seated musicians playing various instruments while the typical Bayon-style apsaras perform their ritual dance around him.

**Samyaksambuddhas and the dhāraṇī**

This second panel from Banteay Chhmar is at present housed at the National Museum at Phnom Penh (Figure 3). I will be discussing a part of this panel with special reference to a cosmic form of Lokesvara which is surrounded a radiating halo of four armed Buddhas. This form of the bodhisattva has six arms and he stands on a viśvapadma with a rising stalk. In his right hands he holds a lotus bud, a text, and a vajra whereas, in the middle left arm he holds a goad whereas the rest of the attributes are not discernable. This style of representation is similar to the four-armed sculptures of Lokesvara, wherein the rising uṣṇīṣa bears an effigy of Amitabha Buddha. surrounding him is a throng on devotees on multiple registers who are witnessing his cosmic aspect with folded arms.

In the second part, chapter sixth of the KS, bodhisattva Sarvanīvaraṇaviṣkambhin urges Lokesvara to teach him the śadakśari mahāvidya or the six-syllabled mantra of oṃ maṇi padme hūṃ. As mentioned at the end of the chapter, Lokesvara appears as white as the autumn moon, with crown of coiled hair (jaṭamukutadharaṇang), an omniscient presence upon his head (sarvagyaśirsikritanga), and a beautiful lotus in his hand (śubhapadmahastanga) further adorned with the splendor of lotuses (padmaśriyālankritanga śariranga) (Bhattacharya 2015: 108). He agrees to confer the śadakśari mahāvidya upon Sarvanīvaraṇaviṣkambhin with the help of an ascetic, Dharmabhāṇaka. This is towards the end of the sixth chapter and as we move to the opening few verses of the seventh chapter, Sarvanīvaraṇaviṣkambhin returns to Buddha Śakyamuni in the Jetavana monastery and announces that his wish has been fulfilled. At that moment, seventy seven times ten million samyaksambuddhas (Namaḥ saptanām saṃyaksaṃbuddhakoṭinām) gathered and recited the dhāraṇī, “oṃ cale cule cunḍe svāhā” (Bhattacharya 2015: 107-108).

Apropos this series of events in the KS, the author would like to study this particular bas-relief in the light of the veneration of the cosmic Lokesvara by the millions of tathāgatas or samyaksambuddhas. Hence, the whirling halo of the four armed buddhas who have come to pay homage and witness this event of having invoked the mahāvidya through the dhāraṇī. The earliest reference to Cunḍā’s mystical cult and prowess is mentioned in the Mañjuśrīmūlakalpa (2nd century CE) and Guhyāsamāja Tantra (4th century CE); Cunḍā is also an embodiment of the cunḍā dhāraṇī which is mostly a string of words to be memorised in secrecy and hence the esoteric function behind it. In the Sādhanamālā,
129, 130, 131 hymns (sādhanās) are dedicated to the goddess Cunḍā (Bhattacarya 1925: 270-273) and she is also termed as goddess (devī) and bhāgvatī.

Hymn 130 of the Sādhanamālā mentions the four-armed goddess, having the colour of autumn moon (saraccandra), an attribute also used for Lokeśvara in the KS. She holds a text among other attributes and mudrās. The text in discussion here is the Prajñāpāramitā sūtra. In India, the earliest representation of the Buddhist goddess Prajñāpāramitā dates back to her sculptures in the Ellora Caves during 7th century CE making vyākhyāna mudrā or the teaching gesture through her right hand and holding a lotus with a manuscript in the left hand (Shaw 2006: 172) also mentioned in the hymn 158 of the Sādhanamālā. Prajñāpāramitā, the embodiment of transcendental wisdom, is often referred to as the mother of all Buddhas and a deification of Buddha’s dharmakāya. She was also a principle deity worshipped along with Lokeśvara in Khmer art. In the Cunḍā dhāraṇī she is also exalted as the mother of the seven Buddhas. Hence, one can see the religio-philosophical acculturation of the cults of both these goddesses, which is uniquely expressed in Khmer art.

In the panel, close to Lokeśvara’s feet is an eight-armed multi-headed goddess (Figure 3). By the Bayon period, sculptures of eleven-headed and twenty-two armed Prajñāpāramitā were envisioned in an extremely rare esoteric form in Khmer art. This form of Prajñāpāramitā alludes to the iconographic manifestation of Ekdaśamukha Avalokiteśvara ensconced within the larger depiction of a multiple armed goddess of wisdom. The author proposes the seated goddess close to Lokeśvara’s right foot is the manifestation of the goddess Prajñāpāramitā. She makes a dharmacakra mudrā with her principle hands and she holds lotus buds in the remaining hands.

As seen in Khmer art, from 9th century CE onwards, sculptures of Mahākaruṇā Lokeśvara is paired with Prajñāpāramitā, while attending to Buddha on Mucalinda. By pairing wisdom with compassion the Māhayanist ideal of enlightenment is achieved through the worship of this triad. Various steles and bronze triads have been found in Cambodia and Thailand of Lokeśvara and Prajñāpāramitā. In the Aṣṭasāhasrikā Prajñāpāramitā Sūtra (dated to 1st-2nd century CE) itself, Avalokiteśvara is referred to as the one who inculcates the altruistic virtues of bodhisattva and the teachings of Pra-
In connection to his qualities, the concept of Prajñāpāramitā has been introduced in Chapter XXI of the Aṣṭasāhasrikā Prajñāpāramitā Sūtra as, “she has abstained, she has caused to abstain. That is why she is called perfect wisdom. From what has she abstained, from what has she caused (others) to abstain? From the skandhas, and elements, from conditioned coproduction, from the perfections, the 20 kinds of emptiness, the applications of mindfulness, etc.” (Conze 1974: 194).

**Maheśvara and Umā**

The KS does not directly mention bodhisattva aspirations but emphasizes the practice of the six pārāmitās. Of the many aspirations, one bodhisattva aspiration is the receiving of an assurance of enlightenment (vyākaraṇa) from a living Buddha. In the seventh chapter of the second part, towards the end is an episode of Maheśvara requesting Buddha to predict his enlightenment but instead the Buddha assigns Lokeśvara to undertake this task himself. This is another reference to similar qualities of Avalokiteśvara to the Buddha as described in the KS.

Towards the end of the chapter, Lokeśvara journeys from the Sukhāvatī to the Jetavana Monastery to pay obeisance to the Buddha. In this gathering, Maheśvara urges Buddha for a prophecy who then accords this task to the bodhisattva. The prophecy of Maheśvara’s conversion leads him to be the tathāgata, the samyaksambuddha, an arhat by the name of Bhasmeśvara in a world named, Vivar-ta. He will be the sugata, the knower of the world, the unsurpassable guide who tames beings, the teacher of gods and humans, the Buddha, the bhāgavat. The subordination of Hindu deities seen in esoteric Buddhist texts yields a forceful transition from esoteric Śaivite to Buddhist realms. As compared to the forceful submission of Maheśvara and Umā by Trailokyavijaya, in the Sarvatathāga-tatattvasamgraha Tantra, by trampling on their bodies (Chandra 2002: 364, in the KS, the subversion of the Hindu gods is more self-renunciatory and expressive in nature.

He is accompanied by Umā, his consort, who also pays homage to Lokeśvara and prays him to be the keeper of dharmas (dharmadharāye). Then the Bodhisattva announced that the goddess will rule the southern slope of the Mount Himavat. She will be the tathāgata, the samyaksambuddha, the arhat, the one with wisdom and conduct, the sugata, the knower of the world, the unsurpassable guide who tames beings, the teacher of gods and humans, the Buddha, the bhāgavat Umaśvara. This prophecy as per Lokeśvara is the highest complete enlightenment for Maheśvara and Umā (Bhattacharya 2015: 111).

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The archival photograph is from the 1965, the bas-relief does not exist in-situ and has been lost since (Figure 4). In the photograph and the sketch prepared by Boisselier (Boisselier: 1965, Fig.3), we can see both Umā and Maheśvara seated on the right and left hand of Lokeśvara’s feet. Maheśvara is shown in his multi headed form with a prominent beard and holding various attributes in his nine arms while making the *anjali* mudrā with the principle hands. He sits next to an attendant and a prominent figure of Nandi. Uma is shown with hands folded in supplication paying homage to the bodhisattva. Around them, on various tiers is a gathering of people who probably refers to the assembly at the Jetavana monastery.

**Radiant Lokeśvara**

During the reign of Jayavarman VII, a unique depiction of Lokeśvara emerged in the Khmer art. The sculptures of this form have a body radiating with multiple seated Buddhas. Louis Finot was perhaps the first to have coined the term ‘Lokeśvara irradiant’ in his published essay in 1925 (Finot 1925). The phrase has ever since come to be used by scholars studying Lokeśvara sculptures in Khmer Art. The irradiant or radiating Lokeśvara sculptures are colossal and are largely eight-armed. A Preah Kahn inscription (1192-1193 CE) the reign of Jayāvarman VII, K.908, mentions a statuary of twenty-three radiant Lokeśvaras, consecrated as *Jayābuddhamahānātha*, which were sent to far off extent of the Khmer kingdom, such as Lavodayapura or Lopburi, Srī Jayārājapuri or Ratchaburi, or Jayasiṃha in Kanchanaburi province, etc. (Coedès 1941:255-301).

![Sculptures of Radiant Lokeśvara. 12th-13th centuries CE, Cambodia. Source: (left) WikimediaCommons (middle-right) Sama Haq.](image)

In the radiant Lokeśvara sculptures, Lokeśvara is shown with eight arms projecting or radiating from his broad shoulders (Figure 5). All the arms are broken from the elbow and so the respective attributes cannot be studied. The striking aspect of the radiance of Lokeśvara is manifested through the various tiers of seated Buddhas which represents the cosmic aspect of the Lokeśvara himself. He is blessed by a prominent female deity on his chest and a row of her eight emanations holding each other’s hands and seated in a semi-circular formation around Lokeśvara’s navel. As already established by various authors, the sculpture radiates with the minutely carved images of Buddhas and Prajñāpāramitā while creating a religio-philosophical connection with the *KS*. This form of Lokeśvara co-relates with the concept of the hair pores of Avalokiteśvara’s body.

In the seventh chapter, after propitiating the meaning and merit of the *Kṣadakṣrī mahāvidya, oṃ manipadme hūṃ*, the seventy-seven times ten millions *samyek-sambuddhas* recites the Cunda dhāraṇī (discussed already). While explaining to the bodhisattva Sarvanīvaraṇaviśkambhin about the
ten pores of Lokeśvara, in which resides multitudes of devas, gāndharvas, yakṣas, samyaksambuddhas, etc. Out of the ten pores, the Buddha explains about the ninth pore called the Cittarāja, resides the various prateyakabuddhas (tatrānekāni prateykbuddhakotiniyutatsahastraṇī prativasantī) (Bhattacharya 2015: 109). In the tenth pore, Dhvajārāja, is the blissful realm where many palaces with precious jewels houses various tathāgatas who teach dharma to the humans of the Jambudvīpa. They teach the six perfections: of generosity (dāna), conduct (śila), patience (ṣānti), diligence (vīrya), meditation (dhyāna), and wisdom (prajña) (Bhattacharya 2015: 109). In the text, the multitude of Buddhas are protected by the Prajñāpāramitā who provides a cosmological strength to the Lokeśvara and the multitude of Buddhas residing in each and every pore.

The Radiant Lokeśvara sculptures also bears a stylistic, aesthetic, and regal affinity with the portraits of Jayavarman VII’s (Figure 6). Sculptures found from the subsidiary shrine of Prang Phromathat at Prasat Phimai in Thailand also houses a robust portraiture of King Jayāvarman VII. The sculpture speaks of a simplistic, detached persona of the god-king and is similar to the sculptures of Jayāvarman VII commemorating esoteric Buddhist temples as seen in the Phnom Penh Museum sculpture as well.

**Sriśṭikaṅtha or Rakta Lokeśvara**

Among the various meditational forms of Lokeśvara worshipped in South, Southeast, and Far-East Asia, Sriśṭikaṅtha or Rakta Lokeśvara is a very distinct form. The earliest reference to this cosmic form of Lokeśvara is mentioned in the *KS*, wherein the text does not make any mention of such appellations. However, this form of Lokeśvara is widely visible in the scroll paintings of Tibet and Nepal and requires further study towards its iconological significance and colour symbolism. In Indian art, the earliest reference to Rakta Lokeśvara is seen in a seated sculpture from Cave 10 at Ellora in Aurangabad (Dhavalikar 2003: 23). While the Sriśṭikaṅtha aspect is largely white and standing, the Rakta aspect is seated and in red colour. The Ellora Lokeśvara is a seated sculpture with multiple arms. A rare representation of this form is found in Banteay Chhmar as well. Till this date no other sculpture or bas-relief of this format has been found from Cambodia or Thailand.

In the fourth chapter of *KS*, the bodhisattva Sarvanīvaraṇaviṣkambhin converses with the Buddha lauding the qualities of Lokeśvara. The Buddha iterates Lokeśvara in his viśvarūpa form, for the genesis of some of the major gods of Hindu pantheon. He informs that both Aditya and Candra came from his eyes, Maheśvara came from his forehead, Brahmā came from his shoulders, Nārāyaṇa came
from his heart, Devi Sarasvatī came from his canines, Vāyu came from his mouth, Dhāraṇī came from his feet, and Varuṇa came from his stomach (Bhattacharya 2015: 53). At Banteay Chhmar also, the creation of Hindu deities through Lokeśvara can be seen (Figure 7). The sixteen-armed and nine headed Lokeśvara is shown with a wide-span of arms holding various attributes such as a four-armed goddess probably signifying Prajñāpāramita, a goad, lotus bud, rosary, text, vajra, water pot, lasso, and a staff (Boisselier: 1965, Fig.2). Close to his head are the two orbs with the sun and moon gods representing Aditya and Candra, who sprang from his eyes; Mahēśvara with a trident stands in between the tiered foreheads, who sprang from his forehead; Nārāyaṇa who sprang from his heart is placed on the right shoulder; Devī who sprang from his canines is placed on the left shoulder; three-faced Brahmā who sprang from his shoulders is placed on the far left shoulder; Varuṇa who sprang from his stomach is seen on the left-side of his stomach above the girdle-belt; and lastly, Dhāraṇī who sprang from his feet is also aptly shown. Among all the gods, Vāyu who came from his mouth, as mentioned in the text, is not shown.

In the painted scroll or the thangka tradition of Tibet and Nepal, this manifestation of Rakta Lokeśvara are more commonly known. Originally, there is a mention of only nine deities for this manifestation, but over time a number of other deities came to be associated with Rakta Lokeśvara. The central image of Avalokiteśvara, generally white in colour, is seen here in a red form. He wears a five-pronged crown with an effigy of Amitābha Buddha seated in the centre. For a cross-reference with the Banteay Chhmar relief, the Rakta Avalokiteśvara representations in the thangka tradition explores the continuity of this form in Tibetan and Nepalese art.

In the National Museum thangka, carefully placed outside the Lokeśvara’s body halo are the Hindu deities who are being blessed by various Buddhist beneficiary deities on the heavenly realms of the upper registers of the painting (Figure 8). The various Hindu deities are placed on a bed of clouds, being born or emerging from the Lokeśvara’s body. Although, the iconographic placement of the gods is in disagreement with the textual reference. Some of the prominent gods are, from the right-hand side, a white Śiva, who is three-eyed, bearded, adorned with a serpent, crescent moon, and a tiger-skin loincloth. He holds a damaru and trident, in different hands.

Fig. 7 Sriśṭikaṅtha Lokeśvara, Western gallery, Banteay Chhmar. Source: (left) Hing Pov (right) Musée Guimet and Persée.

Below him is a four-armed form of the white Moon-god, Candra, followed by Vāyu in green holding his attribute, a banner. A four-faced Brahmā is also easily visible on the right. Close to Lokeshvara’s feet is Vaiśravaṇa, guardian deity of north with an umbrella as his iconographic attribute. On his left-hand side, the red Sun-god, Aditya is shown in similar posture like that of the moon god. He is accompanied by the white river goddess Sarasvati holding a crystal rosary. Close to Lokeshvara’s torso, is Nārāyaṇa, with a crown of serpent heads. Directly below him is the red fire-god, Agnī, with his attributes of a fire-oblation ladle; followed by Virupakṣa, guardian deity of the west direction holding a stupa, and finally the white water-god, Varuṇa.

![Rakta Lokeśvara, Tibetan Thangka - Reserve Collection, 18th-20th C.E., National Museum, New Delhi](image)

At the bottom level, on either side, are White and Green forms of Tārā, as consorts of Lokeśvara. They are followed by a host of guardian deities such as a six-armed Gaṇeśa, Uṣṇīṣavijayā, and Mahākāla punctuated by the two donor families seated under canopy. In the Rubens Museum thangka for discussion here, also bears similar stylistic features. The spatial treatment is less crowded here. The heavenly realm exhibits the paṇcatathāgatas. Circling around the Lokeśvara’s body halo are the emanations of the Hindu gods which are also identified in the similar stylistic pattern. A similar thangka of Rakta Avalokiteshvara is in the Ruben Museum of Art dated to c.1842 CE.

To conclude, in this paper I have tried to contextualise some of the visual forms of Lokeśvara seen in Khmer art with an interpretive analysis based on textual traditions. While the representational forms are largely Khmer, I have also tried to co-relate Lokeśvara’s cult with the Tibetan and Nepalese tradition to continue the esoteric Buddhist dialogue. The connotative and denotative values of understanding the semiotic dialogue of Lokeśvara’s cult is also utilised to see the trans-national aspects of his visual representation and his deification in different cultures.
References
The historiography of Old Burma is more like myth than history, and it has been reconstructed by modern scholars including Professors G. H. Luce, Pe Maung Tin, and Colonel Ba Shin based primarily on the few original inscriptions and other sources such as Chinese records. The current view of the history of Old Burma assumes that King Anawrahta was the founder of the Pagán Empire and brought Theravada Buddhism from Lower Burma to Upper Burma. Some new inscriptions have been recently discovered from Burma and, accordingly, the history of Old Burma needs to be reanalysed by analysing epigraphic sources and arranging the chronology to improve our understanding of the ancient history. There is no original epigraphic evidence about the King Anawrahta's conquest of Thaton in Lower Burma. According to the newly discovered Myittha Inscription, King Bajrābharaṇadeva was not actually the son of Anawrahta. His father was Mahabbadhi Pajrantadeva and his grandfather was Majjadeva. From the other epigraphic point of views that it was the king Kyansitha who seized the state power from King Bajrābharaṇadeva in 1084 CE and built the Pagán Empire, then Kyansitha should be the first Burman king and the Bajrābharaṇadeva was the last Mon king in central Burma.

Introduction

There is no doubt that the historiography of Old Burma from Burman and Mon chronological records such as the U Kala Chronicle and Rājavamsa Gāthā Chronicle are vague. Some notions from the chronicles are hardly acceptable in what we in the modern world think of as “history”. It is because the chronicles were written very late after the periods they were based on and were likely based on stories or myths. The modern scholars such as Professors G. H. Luce, Pe Maung Tin, the Colonel Ba Shin, and Professor Than Tun thankfully reconstructed the history of early Burma, particularly the kingdom of Pagán, which was based on the few original inscriptions and other records such as Chinese records. There is more work to be done. For example, there is no original epigraphic evidence that mentions about the King Anawrahta’s conquest of Thaton, Ramaññadesa, in Lower Burma.

We know from Mon inscriptions that the king Śri Tribhuvanāditya Dhammarāja became a king of Pagán in ca. 1084 CE and the King Bajrābharaṇadeva reigned the city around 1079 CE. Earlier than those eras the legend of Pagán was more like myths. Burmese historians believe that King Bajrābharaṇadeva was the King Saw Lu. According to the Burmese chronicles the Saw Lu was the son of the King Anawrahta. King Anawrahta was the founder of the Pagán Empire which united Upper and Lower Burma to roughly the modern-day Burma (Myanmar). He was the one who brought Theravada Buddhism from Lower-Burma, Thaton, to Upper Burma, Pagán.
In this paper I would like to introduce the inscriptions in Burma, and its characteristics of writing in different languages. By the dating and analysis of inscriptions from the area from different periods of time we can provide the geographical and chronological range of ethnicities, especially for the Mons, Pyu and Burman, from Old Burma which means in this paper the period of the first millennium and the beginning of the second millennium CE.

Writing and Scripts in Burma

The history of writing in Burma is essentially coextensive with the history of the Brāhmī script and its many derivatives. As far as we known about the writing and scripts in Burma, generally of Buddhist content, are found in fair numbers from about the sixth century onwards. Even though the writing system might be introduced to the area from Asoka’s time.

Brāhmī script

The earliest inscription that had been found in Burma is one-line text engraved at a rock wall in Myitkyi village which is about 40 km south of ancient Mon city Thaton. The inscription was written in Brāhmī script and the language is still unknown, possibly Prakrit. It should be belonging to the time of Asoka, ca. 240 BCE (Monzel 2014: 42).

Grantha script

Grantha script is usually called Pallava or Kadamba, is one of the scripts from the southern part of India from the sixth century and was the most influential script used from early Burma. The script was used in writing Pāli inscriptions, generally of the Buddhist canon, that had been found in both Mon ancient city Thaton and Pyu ancient city Śrī Kṣetra. The Mon people also used this script to write their own language. This script was used not only in Burma, but also widely the whole region of Indo-China.

The modern Mon and Burman script nowadays was evolved from this Grantha script. The way of its development was very similar with the early Kawi script in Old Java. The Pallaya-Grantha script in Java was developed to the so-called early Kawi script in eighth century CE (Casparis 1975:28). There are many epigraphically evidences that the Mon from Old Burma had contact with Old Japanese as merchants from the early ninth century. The Kaladi inscription of 909 CE from the Brantas Delta mentions the Mon as Rman. From Palĕbuhan (928 CE) notes the Mon as Rĕmĕn (Ramañña). An earlier ninth-century copper plate inscription from Kuti mentions the Mon as Rĕmĕn (Ramañña) (Mukherjee 2011:75).

Siddhamātṛkā script

The Siddhamātṛkā script was evolved from the so-called Gupta script of northern India around the late sixth century, and which was later transformed into Nāgarī script. During its time Siddhamātṛkā was used as an epigraphic script not only in northern and eastern India but also in the west (Salomon 1998:39).

The Siddhamātṛkā script has been found in Burma in Tircūl or Pyu inscriptions which were discovered from Pyu ancient cities in central Burma. The Pyu adopted Siddhamātṛkā script to write their own language. This might have occurred around the late sixth century. The script that was used in Pyu was discussed since the beginning of the study of Pyu. Even C. O. Blagden, the first person who studied the Pyu epigraphy, had doubts in identifying this script (Blagden 1913-14:127-128). I would like to suggest that the Pyu script was derived from a form of Siddhamātṛkā of about the late sixth century, adapted to the phonetic structure of the Pyu language, because their alphabet was practically the same as the Siddhamātṛkā, including the Siddham sign 𑀅 which is written at the beginning of a text. However, the vowel signs while similar are not identical. It is still not known if this script and writing system was only used by Pyu or by some other ethnic groups in Old Burma.
Another ancient script and writing that had been found in Burma are Sanskrit inscriptions from Arakan, Rakhine State. The inscriptions were written in Nāgarī script. The most important inscriptions from Arakan were the three Sanskrit inscriptions on stone from the reign of the Candra kings of Arakan dating from about the sixth to eighth centuries. The Sanskrit with Nāgarī script was alone with other script used until the 12th century CE in Burma, and most examples were passages from Buddhist canonical texts on clay votive tablets.

**Dating inscriptions in Burma**

The dating of inscriptions is important on two grounds. Firstly, the dates presented in the inscriptions provide invaluable sources for different aspects of the reconstruction of history. Most importantly dates provide clues to understanding the patterns of evolution of script within a span of time in a specific or given geographical region. I would like to divide into three segments to dating inscriptions of Burma. In the cause of dating inscriptions from Burma, I would like also to suggest that all of segmentations might be analysed.

**Epigraphic dating**

Epigraphic dating method is a system of year dating that we get from the records such as the Buddhist Era (BE), Śaka Era, regnal years, etc. The year records from old Burma had been used both in chronograph and numerous forms. For example, the year record in chronograph for 1628 from a four-lingual Myazadi inscription is as follows:

(Mon) “sās kyek buddha tirley kuli ‘ār moy l’nim turow klaṁ băr cavś diñcām cnām tuy
သာသ်ကျေက် ဗုဒ္ဓတိလေႝယ် ကုလိအာရ် မောယ်လ္ငိမ် တုရောဝ် က္လံ ႝ် စွသ် ဒိည္စာမ် စႝ ာမ် တုယ်၊

After the religion of the Lord Buddha had gone on for one thousand six hundred and twenty-eight years

Even though the epigraphic dating is a primary and important source in understanding of early Burmese culture, the records should be also analysed by other dating methods. Because, in some cases there are some pseudohistorical inscriptions which were engraved absolute dates about a historical event that was happened from a very later than the time of making the records.

**Palaeographic dating**

The most of inscriptions, especially among earlier inscriptions, has no explicit date, or only a date whose absolute value cannot be definitely ascertained, epigraphists must resort to estimating the date on the basis of palaeographic analysis by comparing the script of the undated record with specimens of similar scripts from other dated or datable inscriptions. Because this method is inherently imprecise, palaeographic dating should in general be treated as a last resort (Salomon 1998:168-169). Especially for the case of Pyu inscriptions we need to be more careful in using this method, because the Pyu script seems to have remained nearly unchanged from one period to another. For instance, Myittha inscription which we know from epigraphic dating that the inscription was written in the Śaka Era 441 (=1079 CE). From the Pyu side in the part of Pāli version the characters were belonged to the alphabet that was used during the middle of the tenth century CE in southern India.

**Linguistic dating**

Linguistic dating is the dating method which analysed phonetic, morphological and syntactic changes at the concerned language. Such kinds of change can find from every language. Even the Pyu which script was remaining nearly unchanged from one period to another, we can see some phonetic and morphological changes from their inscriptions, even if we do not know much about this language. For example, the word for “one” in Pyu from Myazedi inscription is “ta:” (CE 1113), and from
Myittha inscription is “då” (CE 1079). But this method is only possible to use when one has a great knowledge about the concerned language.

*The Mons*

The earlier form of Mon language is called Old Mon (ca. 5th to 12th century CE). Old Mon developed from the region we know nowadays as Thailand, and Central and Lower Burma. During this period the Mon writing characters can similarly be divided into two or three types, but the language was not much different. For example, the word for ‘seven’ from Phra Pathom inscription (6th century) is ‘duṁpoh’，from Pagán (12th century) also (duṁpoh）。The word for ox from the Lop Buri inscription (8th century) is ‘jlov’，from Pagán and Thaton are (12th century) also ‘jlov’等.

In the period from the late 12th to the early 13th century, Old Mon gradually transformed through language contact into Middle Mon. Middle Mon is often arbitrarily defined as beginning with the reign of King Wariwu who restored independent Mon authority in Martaban, Muttama, in 1287 CE, but it developed further in the period (from the reign of King Dammacedi (1471-1492)). Middle Mon was characterized by the Great Vowel Shift where the long vowels of Old Mon changed to short vowels. For example, the word ‘duṁ-poh’ (for seven) became ‘tha-pah’.

*Early Epigraphy from Old Burma*

The most of Mon inscriptions from Old Burma are not dated or dated by palaeographical and historical points of view. The earliest Mon inscriptions were the four plaques of votive tablets that were excavated from the brick structures in Winka, about 28 km northwest of ancient city Thaton, by U Myint Aung from the Department of Archaeology (Burma) in 1974-78. They were dated to the sixth century CE by Dr. Nai Pan Hla (Myint Aung 1999: 52-53, Nai Pan Hla 2011: 77-87; U San Win 2015:197). It was the same period of Old Mon that had been found in Dvaravati (present Thailand).

A number of Mon stone inscriptions have been found in Thaton and its environs, Lower Burma. All of them have no date. H. L. Shorto (1971: ix) and other scholars assigned them to the eleventh century but could possibly be earlier. When I make linguistic analyses of the inscriptions all of them belong to Old Mon. Especially the inscription on the robe of a statue at Kawgun Cave. Its writing style is very similar to the Dinaya inscription of 760 CE, written in Sanskrit, with the Kawi script of Old Java. Another two important inscriptions are labelled by Luce: Trāp and Paṇḍit. The inscriptions are written about the name given to a king of Thaton and the texts might be read during the coronation ceremony. The king’s regnal name on Trāp inscription is shown on the line 39-41 which is Rājādirāja Parame Svar Isvar Rāja Abeya Mahārāja Devātideva Bahūnāna Sāgaragambhir Sri-ynyiththa Dhammardhara Dhanesvara Sakalatāmbāy Viseah Trey Lokadhamma Trāp Tilok. The king regnal name is contained in Pāli, Sanskrit and Mon, beginning with in Pāli, Rājādirāja (the king of the kings) and ending with in Mon, Trāp Tilok (the ruler of the three worlds). The regnal name tells entirely that Thaton was an independent Mon kingdom during this time (Monzel 2018:41).

Another inscription from central Burma that I want to discuss here is the Kyauksé Mon inscription. This inscription had been known by scholars for many decades. But there are some translations need to be critically edited. Luce (1959:81) believed that Kyauksé was mainly inhabited by Mons and being a desirable oasis, ‘a rice-bowl in the dry zone’. The inscription is about an archbishop (mahāthera) who came to live in Kyauksé and built a Buddhist ordination hall (baddhasīma) after informing the archbishop of Pagán and the king.
Text:
(1) || o || wo’ ey mahāther - -
(2) Loṅ kāl ey tuñ dmoṅ ha(n)
(3) Klok-syoṅ wo’ ey
(4) munas mahāther Buṅkām ey mu-
(5) nas smin goh|| ma ey [sro]ũ
(6) baddha-sim wo’ tinlũ[y]jr(’)
(7) ku ey ma kloṅ (ku kyek)
(8) wo’ piñjaṅ mahā(de)w(| mba ḍe-
(9) h| mbo’ ō[deh] lvaf’ ō[deh] | - -
(10) mbo’ Na-lwoy| (Yawāṅ kon)
(11) Čamrik| Ņagandā| goh da e-
(12) y cut k[e]l| [ku] kyek ey
(13) ma kloṅ tilūy zra’ku’| e-
(14) y tí bña’ mahādān 7 bnaṅ (kar)
(15) ma kon sambeṅ Daleṅ ke-
(16) l ku ey goh ci ey
(17) kel kyek kum rāsi
(18) piun go[h] [je]n pūjā[w] - ma
(19) ke[l] - [car]t kusa[kala]
(20) [satva guṁ]liuṅ da || o ||

This is my translation:
(1-5) I am Mahāther - - Loṅ. When I came to live in this Klok-syoṅ I informed the archbishop of
Buṅkām (Pagān) and the king (to build a new ordination hall). (5- 7) When I built this Buddhist
ordination hall (baddhasīma) I made a Buddha image with the size of my own body.
(8-11) Those are the merit of the king; (a person name)
(11 - 17) I also give seven bnan of cultivated land, which was the son of the lord Daleṅ donated
to me, to the Buddha image that I made as the size of my own body.
(17-20) All of the merit distributed to all kind of beings.

This inscription grammatically and linguistically belongs to Old Mon. The early scholar(s) were mis-
takenly thought that piñjaṅ mahādew was a title of a monk. Because of this they dated this inscrip-
tion after and around 1084 CE. The word Mahādew is derived from Pāli Mahā Dewa. It means the
king. We had found this word as a king from other Old Mon inscriptions. Traditionally, of course, it
is only a king who can make human donation. From the year 1084 CE which was when the king Śri
Tribhuvanāditya Dhammarāja became a king of the Pagān, the name of the kings of Pagān changed
from deva to rāja. That means this inscription much be written before this year.

We know that Kyaukse, the name of the town where this inscription had been found, means in Bur-
mese “stone weir” (Brown 1916:491). From the inscription the name of the town was “Klok-syoṅ”.
Syoṅ means ditch or gutter in Old Mon and in Modern Mon carauṅ and carauk is used. The word
for stone in Proto-Tibeto-Burman is *rak. In Old Burmese *luk/ luṅ. It is the same with Austroasiatic
language from South Bahnric, North Asian group. In Modern Mon the word for stone is tma’. The
Mons also has another word for stone. It is kroh. Thus, the town name “Klok-syoṅ” means “store
gutter” in Old Mon. It is nearly the same meaning with the modern Burmese. The name in Burmese
Kyaukse might be translated from Old Mon Klok-syoṅ when the Burman has controlled the town
during the beginning of the second millennium CE.

The Myittha inscription is significant. It contains four languages, Mon, Pāli, Sanskrit and Pyu and
four different scripts, Old Mon, Nāgari, South Indian script (Pyu Pāli) and Pyu. There are only three
or four word readable in the Sanskrit part. The inscription is about a king by name of Majjadeva (the
The king of wisdom) who built a pagoda in Myittha. His son was Mahabbaḍhi Pajrantadeva. During the
time his grandson by name Bajrābharaṇadeva became a king of Pagán, the king Bajrābharaṇadeva
came to the granary town Myittha. He had heard about the ravaged pagoda which was built by his
grandfather and he considered to rebuild the pagoda. He donated two golden Buddha images and two
silver Buddha images which were made by his own hands. The time of dedicating was in the year
of 441 (= 1079 CE) on the full moon of Pusyā, Wednesday. The king made a Buddha statue with the
size of his own body. And he once again donated ten persons, ten pairs of oxen and carts, a hundred
*bnan* of cultivated land and thousand baskets of the paddy to the pagoda. He prayed for becoming a
Buddha.

From this inscription we know very clear that in the year of 1079 CE, Pagán was reigned by the king
Bajrābharaṇadeva. He was the son of the king Mahabbaḍhi Pajrantadeva and his grandfather was the
king Majjadeva. According to the Burmese chronological records the king Bajrābharaṇadeva was the
son of Aniruddhadeva (Anawratha). The question is, who was Aniruddhadeva? Was he a great-grand-
father of Bajrābharaṇadeva, when they all had “*deva*” in their names? It is a question still remained
unknown.

The Taung-khasi-thapin (Toṅ kacaṅ sabaṅ) inscription is registered as an earliest inscription in Bur-
mese which was inscribed in the Śaka Era 443 (=1084 CE) on the full moon of Pauṣa Wednesday and
Myazedi inscription was inscribed in 1113 CE. The characters of the script from those inscriptions
were not identical with the Pyu Pāli from this Myittha inscription, it is identified with Mon script.
By making comparation and analysing of used script and writing system from those languages we
are certainty known that the Burmese (Burman) script and writing system were evidently developed
from the Mons, not from Pyu and Pyu Pāli.

*The Pyu inscriptions from Old Burma*

The inscriptions with the Pyu script have been found in the Pyu city states in the valleys of the cen-
tral Irrawaddy River: Halin ancient city, the ancient cities in the Mandalay region, around the ancient
city of Śrī Kṣetra and Thandwe from Rakhine State.

There are very limited knowledge about this extinct language. The study of Pyu epigraphy began
with the fourth text of the Myazedi inscription of Pagán by C. O. Blagden in 1911 (Blagden 1913-
14:127-128). Myazedi inscription were written in four different languages: Pāli, Mon, Pyu and
Burman, which all tell the story of Prince Rājakumar and his farther, the king Śri Tribhuvanāditya
Dhammarāja. In Śrī Kṣetra there are more than twenty Pyu inscriptions had been discovered, but
most of them remain untranslated. The short inscriptions on four stone urns that have been found
near the Payagyi Pagoda, north-west of the city wall, were translated by C. O. Blagden and all of it
were the record of the deaths of members of the city’s ruling élite between 673 and 718 CE.

I identify the Pyu version of Myittha inscription by comparing it with the Mon version and confirmed
with the other languages of the Tibeto-Burman family especially Proto-Tibeto-Burman words. From
this inscription some new Pyu words and Pyu number system were identified. The Pyu glossaries,
syntax and number system from Myazedi and this Myittha inscription were a great help for Pyu epi-
graphic study. Even if we cannot translate the whole text, we are able to decipher some other untrans-
lated inscriptions.

One inscription from Śrī Kṣetra, Shwegyopin Village, mentions the name of the city Śrī Kṣetra as
*Sī:Śī*. It is the same that what we have seen *Sisit* from Shwezegon Mon inscription. A stone
urn discovered from the relic chapel of a smaller pagoda near the Payataung pagoda in March 1993,
with a largely inscription. The inscription is about a list of élites built the pagoda in 649 CE and the
case of their good deed they wish to meet Maitreya, the coming Buddha. The stone urn was not a burial urn, it should be the urn of relic (Monzel 2018:46-47).

**Aniruddhadev or Anawrahta (Anorathā)**

The modern name, “Anawrahta (အနော်ရထာ)”, comes from “Aniruddhadev”; “Aniruddha” in Sanskrit become “Anawra” which means ‘unobstructed’ (Luce 1969:14) and “dev” is the Old-Mon word for king, which also derived from Sanskrit or Pāli “deva”. This name had seen several times on votive tablets which are written in Pāli, Sanskrit and Mon from central Burma. The two tablets which were written in Mon were; one was discovered at Momeit in Northern Shan State, Burma in 1971 and another one was from Kalaymyo, a small town on the Chindwin River some 300 miles northwest of Pagán on March 8, 1983 (Nai Pan Hla 1971). Both were written the same text as the follow:

Text:

wo’ kyāk aniruddhadev gna smin jum nok ma lā (na) tey kum

Translation:
This Buddha the great king Aniruddha made even (with) his own hands (Nai Pan Hla 1971).

There are two very controversial inscriptions which are in the main inscription shed on the grounds of the former royal palace in Mandalay, (မန္တလေးနန်းတွင်း ကျောက်စာရုံး). It calls Pagán Let-The-Shey (Lak sañ rhañ) inscription (ပုဂံ လက်သည်ရှည်ကျောက်စာ) and The King Manuha’s inscription. Both of them are in Burmese (Burman).

Pagán Let-The-Shey inscription is written in the Śaka Era 420 (1058 CE) about the king Anawrahta who built a monastery or a pagoda and donated an elephant-cart, a horse-cart and cultivated land to the monastery after he conquered Thaton. The inscription is contained 23 lines.

By making palaeographic and linguistic analysis this inscription might not be written from the 1058 CE, but more likely from 14-15th century. For example, the word for the great king, from this inscription is “man kyi မင်ကြိ” and in the Myazedi inscription is “min Śrī မင်ၐြီ”. The modern Burmese word for great kyī is from Sanskrit Śrī, mainly the way of spelling the king name as “Anoradhā အနောရဓါ” is very much from the 15th century.

The King Manuha’s inscription is written about the king Manuha who owned thirty-one white elephants, who received water from dragon land, and possesses a powerful drum which was made of a frog skin named Eṇi and a drumstick which was made of lion bone. He built a shrine in 1059 CE after getting six carts loaded silver coins when he sold his precious ring with Manawmaya ruby to a rich man from Myinkaba and he prayed “Whithersoever I migrate in samsāra, may I never be conquered by another!”.

In the year 1829 King Bagyidaw of Burma appointed a committee of scholars to write a chronicle of the Burmese kings. The committee made a collection of all available books and inscriptions. For the inscriptions, some original inscriptions were brought to Mandalay, and some were made true copies i.e. authorized versions of the originals. Of others they made revised versions, altering the spelling and in some cases the contents also. This kind of versions may generally be recognized by the ‘modern spelling and the artificial style and grandiloquent phraseology of a later and pedantic age’ (Pe Maung Tin and Luce 1921: x). However, I would like to call it a pseudo version, for the inscriptions that the original inscriptions were not exist, which both of Pagán Let-The-Shey (Lak sañ rhañ) inscription and the King Manuha’s inscription are included. I believed that the committee created those inscriptions in order to confirm the legend of King Anoradhā. I also believe that Myittha inscription
which is the original text and bear a different information from the legend and myth had been destroyed during this time by the King Bagyidaw’s committee.

Śri Tribhuvanāditya Dhammarāja (Kyansittha)
The king Śri Tribhuvanāditya Dhammarāja is known today as Kyansittha, (Kyan is from Old Mon kalan, means military leader, Sittha is in Burmese a military man.) According to the Myazedi inscription he became a king of the Pagán in 1084 CE and died in 1112 or 1113. His son Prince Rājakumar built Kubyaukgyi Temple, shortly after his dead. He has left a dozen original store inscriptions in Old Mon, some of great length. All of them are included a legend of him. His legend was clearly fictionalized for political purposes and influenced by Buddhism and Hinduism. The legend said that he was a sage Vishnu in the time of Buddha Sakyamuni. Of him, Buddha prophesised that in his next human incarnation he is to become the founder of the city of Sisit (Śrī Kṣetra), and in a subsequent rebirth he became a king at Pagán. During his reign Indra, Nāga and devas helped him to protect the reign (Duroiselle 1960: 86-87).

His inscriptions were found in central Burma and lower Burma. One of his officers, Samben Yankhī, in Tavoy, Southern Burma, wrote on a votive table that “this Buddha was made by Samben Yankhī, the governor of Tavoy, under king Śri Tribhuvanāditya Dhammarāja. When our Lord become a Buddha may I be his pupil.” It is so clear that during his reign the power of Pagán had control over nearly the whole of the modern-day call Burma.

A passage from his legendary inscription in Shwezegon mentions that “The men of the four castes that dwell in the city of Arimaddanapûr, Pagán, who are (taken as) captives downstream, (and) who go to other countries, by (virtue of) the strength, power (and) energy of King Śri Tribhuvanāditya Dhammarāja quickly shall they return upstream, shall they take (their) pleasure in the city of Arimaddanapûr, Pagán, again. (Duroiselle 1960:116-117)”. This give me a sense that Kyansittha was the one who strengthened his own territories and enlarged his sway over the area of modern Burma and carried his captives to the Upper Burma. Nearly all of his inscriptions were written in Mon, a few and short of writing was in Pāli, because Mon was the common language at that time. But he named his great lake (Mya Kan Lake) in Burmese, Mahā-nibbān Lak Chuy Khi Riy (Duroiselle 1960:131-143), even though he made the record in Mon. These make me to believe that he was Burman and the first Burman who became a king in Old Burma. He might possibly be the first Burman who become a king the whole of their history. Before that he was a military officer and he seized state power from the king Bajribharanadeva who was the last of Mon king in Upper Burma. I am also believe that the Pagán king who occupied the Thaton, Ramaññadesa, was the king Śri Tribhuvanāditya Dhammarāja.

Conclusion
The writing and script were first introduced to the Mons in Old Burma from India about the time of King Aśoka, ca. 240 BCE. It is evident from the one-line Brāhmī inscription on a rock wall in Mytkyi village which is about 40 km from the south of ancient Mon city Thaton. Another time the writing and script came to the area was about 6th century CE from southern part of India, the Grantha script. By this script and writing system the Mons started to write their own language about 6th century CE. The Mon inscriptions by this script from this period had been found both in Burma and Thailand. From Burma the four plaques of votive tablets that were excavated from the brick structures in Winka, about 28 km to the northwest of ancient city Thaton and from Thailand were Phrathath Mon inscription. The Pyu who lived in Old Prome (Śrī Kṣetra) in the 7th century also adopted this script to write Pāli but kept their northern Indian script to write their own language.

The Grantha script in Old Burma was already gradually changed to so called Old Mon script around 8th century CE. It was happened by influence of Old Java. There are a lot of epigraphic evident in
Old Java from the earlier ninth century that the Mons from Ramaññadesa had contact with Old Java
inese as a merchant.

The Mon language is linguistically classified from c. 5th to 12th century CE as Old Mon and from
there on to fifteenth century as Middle Mon. The different between those two were the long vowels
from Old Mon were shifted to short vowels. Those kind of old Mon inscriptions had been discovered
the whole region from central Burma through the far south of Burma. That means the whole region
was mainly inhabited by the Mons during the first millennium.

The inscriptions with the Pyu script that was evolved from the Siddhamātṛkā script had been found
a limited area in central Burma mainly in the Halin and Śrī Kṣetra ancient Pyu cities. All of Pyu
inscriptions from those two ancient cities were belonged to the time between the 6th to 8th century.
Halin is in the far north of central Burma and Śrī Kṣetra is in the edge of southern central Burma. A
few of Pyu inscriptions had been also found in Pagán ancient city. Most of it were combined with
other language such as Mon. From this epigraphical point of view, we can say that during between
6th - 8th century the inhabitation of in the central Burma was not only the Mons but also some small
parts were the Pyu.

According to the Myittha inscription, in the year of 1079 CE the king Bajribharanādeva was the
monarch of Pagán. The power of the Pagán during his time was expanded around the area. It should
be the whole region of central Burma. The King power was seized by a military officer Kyansitha
and the military officer became king Śrī Tribhuvanādityya Dhammarāja in 1084 CE. The king Śrī
Tribhuvanādityya Dhammarāja was the first Burman king and the king Bajrābharanādeva was the last
Mon king in central Burma. The king Śrī Tribhuvanādityya Dhammarāja became a mighty king and
he conquered Thaton, in Lower Burma. The Pagán Empire spread its power and influence over the
whole Burma as we known today (excluding the Shan area) during the reign of the king Śrī Tribhu-
vanādityya Dhammarāja.

References
Ireland: 491-496.
de Casparis, JG (1975) Indonesian Palaeography A History of Writing in Indonesia from the Begin-
nings to c. A.D. 1500. Leiden: Brill.
Duroiselle, C (1960) Mon inscriptions, Archaeologica Survey of Burma, Epigraphia Birmanica Vol-
Nai Pan Hla (1971) Two Recently Discovered Mon Inscriptions of Aniruddha [Unpublished work].
Nai Pan Hla (2011) Oldest Mon Inscriptions on votive tablets. Archaeological Aspects of Pyu, Mon,
Luce, GH (1959) Old Kyaukse and the Coming of the Burmans. Journal of the Burma Research
Society, 42(1).
Mukherjee, R (2011) Pelagic Passageways: the Northern Bay of Bengal Before Colonialism. Kundli,
Haryana: Primus Books.
Pan Way Way.
Hla Kyin - 02249.


The Materiality of Writing: Script on Artefacts from Early Sites in Southern Thailand and in Southern Myanmar
ความเป็นเนื้อของการเขียน : อักษรบนวัตถุโบราณจากโบราณสถานยุคแรกในภาคใต้ของประเทศไทยและภาคใต้ของประเทศประเทศพม่า

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People in southern Thailand were in contact with script already in the late centuries BCE as finds of inscribed artefacts at archaeological sites attest. The paper will give a brief overview of the different classes of artefacts with script which are of great cultural diversity. Focusing on two artefact groups in particular – seals with Brahmi inscriptions and imitations of Roman coins used as pendants –, it will also discuss certain aspects of their impact on local interaction and reception.

บุคคลในภาคใต้ของประเทศไทยรู้จักวิธีการเขียนตั้งแต่ในช่วงปลายยุคก่อนคริสต์ศตวรรษที่มีตัวข้อเขียน บทความนี้จะให้ภาพรวมของวัตถุโบราณชนิดต่างๆที่มีตัวข้อเขียน บทความนี้จะเน้นเฉพาะกลุ่มวัตถุโบราณที่มีตัวข้อเขียน นั่นคือตราประทับที่มีอักษรในภาษาบรฮัมี และเครื่องร้อยคอที่เลียนแบบเหรียญโรมัน แล้วจะกล่าวถึงด้านต่างๆ และผลกระทบต่อการติดต่อและการต้อนรับระหว่างกลุ่มนี้.

Usually, discussion of inscribed artefacts from early Southeast Asian sites concerns identification of their scripts, their date and their possible role as evidence for the networks in which the respective sites were integrated, all aspects that form the basis of any further interpretation. Here I shall look at a few groups of inscribed artefacts from archaeological sites in southern Thailand, dating from the late centuries BCE to the early centuries CE, discussing certain aspects of their context and use, as well as their impact on local interaction and reception. Any approach to script in early contexts should keep in mind that “in principle, ancient societies were oral societies” (Kolb 2018: 9). The cultural medium of script was confined to certain parts of society, i.e. professionals, and/or certain activities, mainly administrative but also commercial. In the following I will present a brief overview of the different classes of artefacts with scripts which are of great cultural diversity. For a full understanding not only the reading of the inscription and its meaning are relevant, but also the artefact itself and its manufacture, i.e. its physical appearance and shape, its material, and the craftsmanship involved in making it.

Artefacts with Brāhmī script
Seals form the largest group among the early artefacts with Brāhmī script found in southern Thailand. It is thought that Brāhmī script was most likely created during the Maurya Empire, possibly under Aśoka himself, in the third century BCE (Salomon 1996: 178-179; Falk 2018: 581). It appears to combine two different lines of descent from Western Semitic scripts, from Phoenician to Aramaic to Kharoṣṭhī and from Phoenician to Greek. The oldest datable Brāhmī inscriptions are found in South Asia and date from the middle of the third century BCE. Brāhmī script, which provides a clear kind of spelling useful also for non-Indian languages, became the “parent of one of the major script families of the world” (Salomon 1998: 7) including most scripts of Southeast Asia.

1However, graffiti on pottery sherds from excavations at Anuradhapura and Tissamaharama (Sri Lanka) have been found in strata assigned to the early 4th century BCE on the basis of radiocarbon dates. The chronological significance of these finds of graffiti sherds for the date of the creation of the Brāhmī script is still under discussion (Salomon 1998: 12; Falk 2014: 45-47).
The most common material used for seals inscribed in Brāhmī is stone, often a softstone, but also hardstone like carnelian. For engraving on the stone, the inscription had to be mirrored. However, a variety of engraving mistakes has been observed on surviving artefacts (Figure 1) (Falk 2011: 16-17). Generally, the seals from sites in southern Thailand are personal seals with the name of the owner in the genitive. Such seals were used in everyday activities and business transactions. They would be impressed on soft clay laid over the fastenings of documents or packaged goods to secure them. Thus, every seal had the potential to produce an unlimited number of artefacts with script. The sealings were meant to be seen and recognised by persons involved in handling the sealed goods or documents. However, not all the persons recognising the sealing necessarily needed to be literate in the strict sense.

The archaeological site of Khao Sam Kaeo yielded at least nine stone seals with Brāhmī inscriptions, and at least two are known from Khao Sek. Suggested dates on palaeographic grounds for the earliest seals from these two sites point to the late third to second centuries BCE (Borell 2017a: cat. 3, cat. 12; Bellina 2018: 7-8 fig.3-4). Figures 2a-2b show a small stamp seal from Khao Sam Kaeo and one from Khao Sek assigned to this period. A finely crafted carnelian prism seal from Khao Sam Kaeo with four incised sides (Figure 2c) has on one side the name of the owner in the genitive, whereas the three other sides are decorated with various auspicious motifs (ewer, fourfold ‘taurine’, trident / peacock to left, triangle-headed standard / lion to right, śrīvatsa). Based on the style of the Brāhmī inscription and the motifs, Harry Falk suggests a date in the second to first centuries BCE. From Khlong Thom (Khuan Lukpad) comes a well-crafted carnelian stamp seal (Figure 2d). Engraved on its rhomboid face is the name of the owner in the genitive and above a tortoise. Based on the script, Harry Falk (pers. comm. Nov. 2014) suggests a date within a period from the second century BCE to first century CE.

The finds of such seals attest that people in southern Thailand were in contact with script and its possible uses already in the late centuries BCE. Many of the seals, in particular the earlier ones, are to be considered as overseas imports that arrived in Southeast Asia together with their South Asian owners. However, some seals with suggested dates from the second to first centuries BCE onwards may have been engraved locally (Borell 2017a: cat. 9-10). Various irregularities on a softstone prism seal from Khao Sam Kaeo (Figure 2e) point to an unskilled engraver and possibly local manufacture. A well-crafted stamp seal from Khlong Thom with a conch motif and three Brāhmī characters (Figure 2f) suggests a date within a period from the second century BCE to first century CE.

2Previously, Falk had suggested a different reading for the Khao Sek seal (here Figure 2b) when read from inside (see, Bellina 2018: 7 fig. 3). However, renewed consideration led to a different reading from outside which includes the ‘taurine’ as the Brāhmī character “ma” (pers. comm. Nov./Dec. 2018/Nov. 2019).
2f) is inscribed with a name in the genitive which seems to be local name. Harry Falk (pers. comm. Aug. 2018) suggests a date for it in the second to third centuries CE.

Inscriptions on seals were multiplied by impressing them on soft clay. These clay sealings usually did not survive, unless they happened to be fired by accident. However, the terracotta disc from Aw

**SRF KSK 250:** Stamp seal
Reddish stone. Perforated handle.
Pres. H 11.5 mm. Face 14.5 x 7 mm.

Reading by Harry Falk:
*ba-ma-ša-mo*
“Bamašamo” (Prakrit for Sanskrit Brahmaśamā)

From Khao Sek
Private collection
Dark brown stone.
H 20 mm. D face 16 mm.
Two motifs (four crescents around a dot; an arrow) and five Brāhmī characters

Reading by Harry Falk (read from outside as incised on the stone): *ma-[ ]-du-ca-ba*
Suggested Prakrit reading *ma-[na]-du-ca-ba* for Sanskrit *mānadītyavā*
“Officer in the service of standardisation”

Figs. 2a and 2b   Seals with Brāhmī inscription. Source: B. Borell (a) and B. Bellina (b).

**SRF KSK 607**
Rectangular prism, lengthwise perforated.
Carnelian
13.5 x 7 x 7 mm.

Reading by Harry Falk:
*a-si-la-sa*
“Of Asila”

**SRF KLP 288:** Stamp seal, perforated handle (broken)
Carnelian, H (pres.) 10 mm
Face 14.9 x 10.5 mm

*bahmadinasasa*
“Of Brahmadinna”

Figs. 2c and 2d   Seals with Brāhmī inscription. Source: B. Borell.
Gyi\(^3\) belongs to a different category. Its circular face has an inscription in Sri Lankan Brāhmī, dating from the late centuries BCE (Figure 3), its convex reverse is plain. Such tokens are supposed to have been used for identification like a kind of passport (Falk 2011: 13).

Other categories of artefacts with Brāhmī inscriptions include a stone sphere of possibly first century BCE date from Khao Sam Kaeo (Borell 2017a: cat. 18), a pot sherd with a fragmentary graffiti inscription from Phu Khao Thong (Chaisuwan 2011: 93 fig. 4.19) with a suggested date in the second century CE, and the well-known stone from Khlong Thom inscribed in Tamil-Brāhmī script, interpreted as touchstone of a goldsmith and dated to the third to fourth centuries CE (Borell 2017b: 169-170 with n. 38). Khlong Thom yielded at least five early Pallava copper coins with a bull on the obverse and the motif of a two-masted ship on the reverse, probably dating from the third to fourth centuries CE, among them one with an inscription (Figure 4)\(^4\).

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\(^3\)For the current excavations by the Franco-Myanmar team at Aw Gyi on the coast of the Andaman Sea in the Kra Isthmus region in present-day southern Myanmar, see the paper by Bérénice Bellina et al. presented at the 3rd SEAMEO SPAFA International Conference on Southeast Asian Archaeology Bangkok 2019.

\(^4\)On early Pallava coins, see Krishnamurthy 2004. For the other four coins from Khlong Thom, see Srisuchat 1996: 40, 217 (= Krishnamurthy 2004: 53 no. 26); Indrawooth 2004: 125 fig. 6.5; Pongpanich 2009: 226-227, in row 5 from top, first left (SRF KLP 399, weight 3.11 grammes).
Artefacts with Chinese script
Two Chinese bronze seals with Chinese characters on their square faces come from Khao Sam Kaeo, both apparently private seals (Peronnet 2013: 155-156). The elaborate way of their making, being cast in bronze, reflects the wealth and status of their owners, probably well-off merchants. The one with a tile-shaped knob has not yet been deciphered. The other more elaborate one belonged to a certain Lü Yougong and has been dated to the first century BCE (late Western Han dynasty) (Figure 5). It consists of two nested seals, the outer seal with tortoise-shaped knob, the small inner seal with a tile-shaped knob. Owing to its corroded state, the inner seal has not yet been taken out and read.

Artefacts with Latin inscriptions
Recently, a Roman gold coin has been found near the beach at Bang Kluai Nok. Currently, it represents the only find of a genuine Roman gold coin in Southeast Asia (Figure 6a). It is an aureus of the emperor Domitian (81-96 CE) struck in the year 86 CE. Its state of preservation obviously points to a long history of use (Borell 2019a). The two holes indicate its use as a pendant in the characteristic Indian manner which is encountered on numerous Roman coins found in southern India. Its worn
state attests to such a use as a pendant over a long time, in particular its very worn reverse, which would have rubbed against the skin of its wearer. The coin inscription is in Latin script, another descendent from the West Semitic Phoenician script. However, the Latin inscriptions on Roman coins are of a formulaic character using many abbreviations. They would have been hardly comprehensible for the uninitiated even for a person with a basic knowledge of the Latin alphabet.

Interestingly, the archaeological site at Khlong Thom yielded a number of gold pendants imitating the design of Roman coins, presumably a local production (Borell 2014; Borell, Bellina and Chaisuwyan 2014). Their discs are cast, a loop made of a gold wire spiral has been added for suspension. Some reproduce rather faithfully the image of a Roman coin indicating that a direct moulding process was involved. The Latin inscriptions of their prototypes can still be recognised. Others, like an example from Khlong Thom with a free adaptation of a Roman coin design, have pseudo-letters instead (Borell 2014: 18 fig. 9). According to the prototypes imitated, the gold pendants cannot be dated earlier than the late second or early third century CE.

One of the best-preserved pendants (Figure 6b) imitates on its obverse a coin of Antoninus Pius (138-161 CE) issued after the marriage of his daughter Faustina to Marcus Aurelius his designated successor, which took place in 145 CE. It shows the portrait head of Faustina and an inscription that translates as “Faustina Augusta, daughter of the Pious Augustus”. In contrast, the reverse is taken from a different coin of Antoninus Pius. It is a reverse type which frequently appears in his coinage showing the emperor standing and clad in a toga. The inscription here seems to point to a prototype issued in 155/156 CE, the year when Antoninus Pius held the tribunician power for the nineteenth time and the consulship for the fourth time.

Three such coin imitations, apparently all made up as pendants are known from Khlong Thom. For their six sides at least five different Roman coins would have been needed as models; only two of the images – used on two different pendants – might stem from the same coin. I have argued elsewhere that the production of these pendants with their hybrid imitations of Roman coins has to be seen in the context of cast imitations of Roman aurei in southern India (Borell 2014; forthcoming). They are predominantly found in the present-day states Andhra Pradesh and Tamil Nadu on the south-east-
ern coast. These Indian imitations of mainly second and early third century Roman coins likewise include hybrid combinations of obverse and reverse. It seems likely that the production of the gold pendants from Khlong Thom derives from there. The moulds used in their manufacture might have been moulded directly from Roman coins imported to India or their Indian imitations. Alternatively, they might have been made from an assortment of moulds brought to Khlong Thom from India.

Khlong Thom also yielded cast tin pendants with crude imitations of another Roman coin type, the so-called PONTIF MAXIM type of Tiberius (14-37 CE), the most common coin type of his reign (Figure 6c), showing on the reverse a seated female figure on a chair. From Indian coin hoards and isolated coin finds, at least 2,871 silver coins and at least 222 gold coins of this Tiberian type are known (De Romanis 2012: 180-183). The design was copied in India for pendants made from cheap materials like base metals and fired clay (Borell 2014; forthcoming b). The terracotta imitations are the most numerous, found at Sātavāhana sites in the Indian Deccan and probably dating from about the mid-first to the second century CE. They appear to have been rather popular, presumably, they were worn as amulets. Such an amuletic character may also be assumed for the pendants from Khlong Thom. They appear to have been locally made. This is indicated not only by the use of tin, but also by the find of a stone mould at the site. Nevertheless, their manufacture is best understood as an offshoot of the production of the very similar pendants made of terracotta and base metals in the Indian Deccan area in the Sātavāhana period.

That is to say, neither the gold nor the tin pendants imitating Roman coins found at Khlong Thom are to be claimed as evidence of direct contact with Roman traders, but rather as evidence for contacts across the Bay of Bengal to the coast of south-eastern India. However, they certainly manifest an entanglement with the imagery and script of the Roman world. The same applies to the recently found gold coin of Domitian. Its use as a pendant in the Indian manner attests contact with India, presumably southern India, therefore, only an indirect contact with the Roman world.

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**SRF KLP 628**

Gold, cast

D. c. 22 mm; 5.02 grammes (with loop)

Pendant imitating a Roman gold coin

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**For comparison two genuine struck Roman aurei**

(examples from a coin hoard found in Trier, Germany, in 1993)

For obverse type: RIC III Antoninus Pius 503b, 145-161 CE
Bust of Faustina the Younger to left,
FAUSTINA AVG | PII AVG FIL
for: Faustina Aug(usta) Pii Aug(usti) fil(iae)

For reverse type: RIC III Antoninus Pius 256a, 155/156 CE
Antoninus Pius, holding globe in right and book roll in left,
TR POT XIX | COS III
for: tr(ibunicia) pot(estato) XIX Co(n)s(ul) III

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Fig. 6b  Gold pendant from Khlong Thom and genuine Roman gold coins of Antoninus Pius (137-161 CE)

Source: B. Borell; GDKE/Rheinisches Landesmuseum Trier, Th. Zühmer.
It is unlikely that the formulaic Latin inscriptions on Roman coins would have been understood by peoples in distant regions. However, there appears to have been a notion of the importance the inscriptions had. They were either faithfully copied by a moulding process, or, alternatively, pseudo-letters could take their place. Such pseudo-letters appear on the gold pendant mentioned above as well as on some of the tin pendants, where, in the place of the inscription, a few simplified pseudo-letters can be seen, clearly not being ornamental but intended to imitate script. The presence of script was important, even in the form of pseudo-letters. Exotic script even if replaced by pseudo-letters may have added to the magical power of these amuletic pendants.

**Gold coinage from Khlong Thom with Brāhmī inscription**

The struck gold coinage from Khlong Thom deserves special attention (Borell 2017b; Borell 2019b; 2020). The eight-ratti denomination of these coins shows on the obverse a head in profile to right and on the reverse a Brāhmī inscription, the honorific śr(ī) followed by a personal name, presumably that of the local ruler (Figure 7). The Brāhmī inscriptions indicate a date around 200 CE or somewhat later. These coins are to be connected with a group of smaller gold coins of four-ratti weight from the same site struck with different motifs, mainly a variety of conch motifs, but also swastika and śrī-vatsa motifs. The numerous die links among them suggest a relatively short period for their minting. These coins from Khlong Thom appear to represent the earliest gold coinage that originated from Southeast Asia. They manifest, how manifold inspirations from different cultural spheres and different classes of artefacts had been used to create something new. The use of Brāhmī script is clearly adopted from India, like the choice of motifs on the smaller coins. The inspiration to have the ruler’s head in profile on a coin might likewise have been transmitted from India. From southern India we know the portrait coins of the Sātavāhanas or early Chera kings. This ultimately western concept might have been derived either from Greek coins like the Graeco-Bactrian or Indo-Greek coins in northern South Asia or from Roman coins like those imported in their thousands into India.

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5On the basis of another gold coin of eight-ratti weight recently found at Khlong Thom, which came to my knowledge in December 2019, Harry Falk revised the reading of the inscription to śr(ī) viṣuvamasa, “Of Śr(ī) Viṣṇuvarma”.

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References

Struck gold coins from Khlong Thom

Wat Khlong Thom Museum
D 10 mm
Weight not available

Private Collection, Krabi Province
D 9-11 mm
0.87 gramme

SRF KLP 089
D. 10 mm
0.94 gramme

Reading by Harry Falk:
śr(ī)-vīṣuvamasa
“Of Śr(ī) Viṣṇuvarma”

Fig. 7 Gold coins with Brāhmī inscription from Khlong Thom. Source: Borell 2107b; 2020).

Borell, B (In press) Imitations of Roman Coins as Pendants in South and Southeast Asia. In: S Börner and C Witschel (eds.), Imitatio delectat: Die soziokulturelle Bedeutung von Nachah-
mungen römischer Münzen [Imitatio delectat: The Socio-cultural Significance of Imitations of Roman Coins].


Cakrasaṃvara or Trailokyavijaya: Ascertaining the Identity of a Tantric Deity at Phimai through Sanskrit Manuscripts

The lintel situated above the eastern portal of the garbhagṛha (sanctum sanctorum) at Phimai depicts a three-headed deity with eight arms dancing on an elephant’s head. As Phimai is confirmed to be a temple for Esoteric Buddhist practices according to the inscriptions attributed to various kings of the Khmer Empire, this deity unquestionably belongs in the Tantric Buddhist pantheon. While most agree that the deity is Tantric, some scholars have mixed opinions about the identity of the deity, which has been thought of as either Cakrasaṃvara or Trailokyavijaya. Hence the primary objective of this paper is to verify the identity of this deity through the studies of Sanskrit texts on Tantric Buddhist iconography. The results demonstrate that Tantric Buddhism once flourished in Thailand and that Buddhist Sanskrit texts on iconography may have been used in the creation of Tantric iconographies at Phimai.

Background

Built, patronised and renovated by various Khmer kings from the 10th to 12th century CE, the Phimai Temple complex situated on the Khorat Plateau in North Eastern Thailand is a stone temple that encompasses Khmer architecture of different periods, namely the Baphoun, Angkor Wat and Bayon styles. According to inscriptions (K. 111, K. 397, K. 952, K. 954 and K. 1158) found at the temple and in the surrounding area, the Esoteric/Tantric form of Buddhism was widespread and practised by both the people and kings. The iconography of various deities belonging to the pantheon of Buddhist Tantric deities, such as Buddha with the seven-headed nāga, Prajñāpāramitā, Vajrapāṇi, Hevajra, Tārā and various forms of Avalokateśvara as well as ritual objects such as ghanṭās (bells) with handles decorated with the vajra motifs and bronze śaṅkhas (conches) also corroborate the presence of Tantrism there.

Esoteric Buddhist Iconographies at Phimai

Images of Tantric Buddhist deities are found on five lintels inside the temple; four are located above the entrance to the central cella/mandapa and one above the entrance to the vestibule (antarāla). The lintel in the northern direction depicts two rows of deities. The upper row comprises five identical deities seated in the vīrāsana pose. The central image, seated on a pedestal above a group of five attending deities, some holding a staff, is bigger than the others. The lower row consists of eight dancing yoginīs and other attending deities. The central deities and figures in the upper row have three visible heads and six arms. The two hands in front are placed one above the other showing the dhyānamudrā (meditation gesture), the uppermost right hand holds the āksamālās (rosary) and lotus flowers are seen in the hand below that. A ghanṭā (bell) is held by the uppermost left hand and the remaining left hand seems to hold a jewel. These attributes are misleading as they do not correspond to any particular Sanskrit source. Nevertheless, scholars namely Boisselier (1966: 302), Dagens (1995: 19), Woodward (1981: 171) and Conti (2013: 384) have identified the images as Vajrasattva and the four Jinas while admitting that the attributes do not agree with any textual source.
The lintel in the eastern direction depicts the protagonist of this paper: a deity with three visible heads, standing (or dancing) with the left foot on an interlocking image of a male and female lying on a head of an elephant (Figure 1). The deity has eight arms; the two front hands clearly show dhar-

macakramudrā (teaching/the wheel of dharma gesture), the two uppermost hands seem to be stretching the skin of the elephant whose head is being trampled by the deity. The rest of the attributes are not easily discernible although I could vaguely make out two of them: one is the vajra (thunderbolt) and the other is the aṅkuśa (elephant hook). Similar to the northern lintel, the central deity is flanked by two rows of ten Buddhas (top row) and ten yoginīs (bottom row). The Buddhas are seated in the vīrāsana pose, each sporting the dhyānāmudrā – they are probably the images of past and future Buddhas. The yoginīs dance in a similar pose to the ones on the northern lintel. This pose is known as the ardhaparyāṅka but, in contrast to the northern lintel, the yoginīs seen on the eastern lintel stand on the left foot. Moreover, each of them holds a ghaṇṭā in the left hand below chest level and the other hand is held above the head, holding a vajra. Like the deity on the northern lintel, the standing pose and the attributes of this deity do not entirely match any Sanskrit text. But in contrast to the deity of the northern lintel, earlier scholars seem uncertain of his true identity. Vallibhotama (1961), a Thai art historian expresses this in the following passage:

At the centre of the lintel is represented an image with 4 heads and 8 arms, trampling with his right leg two figures who are lying inversely on an elephant head. Behind this four-headed figure is extended an elephant skin with its tail curving above his head. This central personage has been identified as Trailokyavijaya, a Mahāyāna god, but this figure differs from other representations of the same god in India and Tibet as it is protected by an elephant skin. In India
and Tibet, the god attributed with elephant skin is Saṃvara or Saṅvara who has 12 arms. The difference in iconography remains to be further researched (p. 31).

Hence with Vallībhotama’s lead, the identification of the deity can be narrowed down to either Trailokyavijaya or Cakrasaṃvara. In a similar manner, Prapanvidya (2017) observes that the ardhaparyaṅka pose of the deity does not agree with any Sanskrit text, particularly not with the Sādhanamālā, which states that both Trailokyavijaya and Cakrasaṃvara should stand in the pratyālīḍha pose, but he stops short of identifying the deity. Conti (2013), on the other hand, is the first person to identify the deity, suggesting that the image is of Cakrasaṃvara. She points out that a similar figure (but with twelve arms) is to be seen on a bronze mould found in Poipet (dated 12th-century CE), depicting Vajrasattva at the centre (identified by three heads and the vajra-humkāramudrā); this resembles the image on the eastern lintel at Phimai, already identified as Vajrasattva. Next, a Buddha protected by a seven-headed nāga is seen at the top of the mould and three more deities are in the bottom row; one of them is probably Padmapāni, identifiable by having the lotus as one of his attributes. In the middle tier, to the right of Vajrasattva, stands a figure unmistakably of Hevajra (with heads in three tiers, standing in ardhaparyaṅka) and to the left, a deity standing in the pratyālīḍha pose (with right leg bent and left leg stretched out), the two front hands sport the vajrahumkāramudrā, while the attributes in the other hands are undeterminable. Collectively, this bronze mould seems to depict the same set of deities seen on the lintels at Phimai. Firstly, Conti argues that the mudrā formed at the chest of the deity of the Poipet specimen is the prajñāliṅgānaya, which is seen in Indian iconography of Cakrasaṃvara, who is sometimes embracing a consort (yubyum). Secondly, she suggests that the number of arms depicted on the Poipet specimen, which is twelve, agrees with some of the Indian versions that possess two, six and twelve arms, but the iconography at Phimai is unique, especially as it has eight arms. Thirdly, Conti refers to a literary source; she is of the opinion that the composition date of the Cakrasaṃvara Tantra, the main text on the ritual worship of the deity that was popular in India between the 10th and 13th century CE, and coincides with the time that the Phimai Temple was built and flourished. Conti also interestingly suggests that the eastern lintel at Phimai depicts a “spread-out”, horizontal version of the Cakrasaṃvara Maṇḍala mentioned in the Tantra, which prescribes that the deity be at the bindu (centre), surrounded by three āvaranas (enclosures), each comprising eight yoginīs or dākinīs. Conti finally states that, apart from the bronze mould, the only other iconography of Cakrasaṃvara in Cambodia can be seen in a carving on the stone pedestal at Banteay Samré, but she does not provide an illustration of that image nor a reference to how that image came to be identified as Cakrasaṃvara.

Through a survey of numerous iconographies of Cakrasaṃvara in India, Tibet and Nepal, I have observed that they are quite different from the Phimai example. The first most obvious difference is that nearly all Indian, Tibet and Nepal images depict Cakrasaṃvara embracing his consort, Vajravārāhi. The second difference is the standing pose: all South Asian specimens depict the deity standing in the pratyālīḍha pose while the figure at Phimai stands in the ardhaparyaṅka. The third major difference is that the male and female figures trampled under the feet of the deity are not interlocked as the ones seen in Phimai. I have also noticed that the numbers of heads depicted in images of Cakrasaṃvara from South Asia, which mostly come as bronzes and thangkas, consist of heads ranging from one to sixteen. The number of heads may vary from text to text or they may be the interpretations of the individual artists who attempted to depict various supernatural powers of the deity.

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1 Archer pose; bent front leg and stretched out back leg.
While the *Cakrāsaṃvara Tantra* is the most authoritative text on the worship of Cakrāsaṃvara, the text does not give a clear *dhyānaśloka* (visualisation verse) of the deity. Instead, the verse is clearly outlined in the *Nīspannayogāvalī*², thus:

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asya pūrvasyāṃ diśi vajradanḍo nīlo nīlapītaharitamūlasavyetaravaktraḥ savyabhujābhyāṃ vajramudgaramudgaramudrānvitasatarjanīvatvajram vāmābhyāṃ kapālakhaṭtvāṅge dadhānaḥ | 1
uttarasyāmanalārkah piṭāh pītanīlahaṭhiprānāḥ vajradandaḥ pradhānapānīnā va- 
prādicihinnāḥ vajraundāsya vāśya vakṣyamānāṃ ca | 2
pāścimāyāṃ vajroṣṇīṣo raktaro raktaśtattavaktraḥ kakāraḥ | 3
dakṣināyāṃ vajrakunḍalāḥ harito haritapītaharitamukhāḥ | 4
āgneyyāṃ vajrayakṣo dhūṃrapītaharitamukho ṅkuśadhāri | 5
nairṛtyāṃ vajratālaṇaḥ raktaro raktaśtattavaktraḥ paraśupāṇīḥ | 6
vāyavyāṃ mahākālo nīlo nīlapītaharitamukhāḥ | 7
esānyāṃ vajrābhīṣanaḥ krṣṇaḥ kekarakṛṣṇapītaharitamukhāḥ khaḍgapāṇīḥ | 8
```

He is black and has four faces which are, beginning with the front [and continuing around counter-clockwise], black, green, red, and yellow, each of which has three eyes. He has a tiger skin and has twelve arms. Two arms holding a vajra and a vajra-bell embrace Vajravārāhī. Two of his hands hold up over his back a white elephant hide dripping with blood. His other [right hands hold] a *damaru* drum, an axe, a flaying knife (*kartri*), and a trident. His remaining left [hands hold] a khatvaṅga staff marked with a vajra, a skull-bowl filled with blood, a vajra noose, and the head of Brahma. A garland of fifty moist human heads hangs about his neck. He has the six insignia, and a sacred thread made of human skull. He has a row of five skulls above his forehead, and a crest of black dreadlocks topped by a left-oriented crescent moon and a double vajra. He is endowed with a fierce meditative state and bears his fangs. He brings together in one the nine dramatic sentiments (translation by Gray 2007: 45).

It is evident that the *dhyānaśloka* quoted above matches most South Asian images of Cakrāsaṃvara, but only a few of these attributes are included in the image on the eastern lintel at Phimai, namely the stretched elephant skin and possibly the *vajra* and the noose.

Thus, on the basis of the references from South Asian iconography and the *dhyānaśloka* from the *Nīspannayogāvalī*, I disagree with Conti that the deity on the eastern lintel at Phimai is Cakrāsaṃvara. I argue that the Phimai image is more akin to various iconographies of Trailokyavijaya from South and Southeast Asia and resonates more with verses from two Sanskrit texts, which will be outlined in the next section. Furthermore, I do not think that there is sufficient evidence to suggest that the Cakrāsaṃvara cult and its text, the *Cakrāsaṃvara Tantra*, existed in the ancient Khmer Empire; otherwise the iconography of the deity would have been more widespread and not limited to only two specimens as Conti suggests, namely the bronze mould from Poipet and the carving on the pedestal at Banteay Samré. Additionally, there would have been inscriptions to support both the existence of these images and the worship of Cakrāsaṃvara in the area.

**The Iconography of Trailokyavijaya and the connection to Phimai**

Trailokyavijaya or the “conqueror of the three worlds” is a ferocious Tantric Buddhist deity who came to prominence in India in the second half of the 8th-century CE (Linroth 1999: 270). The deity is regarded as the emanation of Aksobhya as outlined in Sanskrit texts such as the *Sūdharmamālā* and the *Sarvatathāgataattvasamgraha* (hereafter abbreviated STTS). Of the two, the latter text provides a clear visualisation in the deity in the following verse:

² A Sanskrit work by Abhayākaragupta on maṇḍalas and iconographies of the Vajrayāna pantheon of deities.
Facing northeast, Trailokyavijaya has four faces; the main face is filled with anger and passion; the right is furious, behind is heroic and left is disgusting. The faces are blue, yellow, red and white respectively. His eight arms hold: sword, goad and arrow on the right and bow, noose and vajra on the left. He shows vajra and bell in vajrahuṃkāramudrā at his heart. He stands in the pratyāḷīḍha pose with his right foot crushing the breast of Umā and the left, the forehead of Maheśvara (translation mine).

On another sub-continent, a dhāraṇī inscribed on a lead-bronze foil called the Mahāraudranāmaḥdaya found near Borobudur, Central Java in 1976, also gives a vivid iconography of Trailokyavijaya in a form of a Sanskrit mālāmantra (long, garland mantra) written in the Kawi script:

Homage to the Lord, [...] who has a body adorned with four arms, who is of terrible appearance due to (his bearing) sword, club, axe, snare, cudgel (vajra), and flaming fire, whose right foot hangs down over the heap of twisted locks of Paśupati (Śiva), whose left foot is placed on the pair of breasts of Pārvatī! Homage to the Lord, the great cudgel-bearer!

I shall recite the Heart named Mahāraudra, extremely violent, that causes the destruction of all of (Śiva’s) Bhūtas and Gaṇas, of ferocious form, that causes terror, fear and conflict, that causes the success of all undertakings!

O ferocious... Chase away the evil seizure! Destroy the evil thought, the bad thought, the angry thought! Destroy all evil, destroy all enemies, destroy all obstacles, destroy all diseases, destroy all illnesses, destroy all Vināyakas, destroy all those who have bad words, destroy all those who have bad thoughts, destroy the Devas, Asuras, Garudas, Gandharvas, Yakṣas, Kinnaras, Great Serpents, etc [...]! Fierce one, fierce one! Kill, kill! Tear, tear! Slay, slay! [...] Hail! (translation by Griffiths 2014: 27-28).

Interestingly, many Trailokyavijaya images from India and Java (Figures 2 & 3) are identical in terms of attributes and exactly match the verse from the STTS. The major difference between the aforementioned specimens and the Javanese dhāraṇī is the number of their arms and their corre-
Fig. 2  Trailokyavijaya from India, bronze, Patna Museum. Source: Huntington Archives.

Fig. 3  Trailokyavijaya from Java, bronze, British Museum. Source: The Trustees of the British Museum.
sponding attributes (eight in the STTS and four in the dhāraṇī). This evidence suggests that it is highly likely the STTS circulated in both India and Southeast Asia and was used as the source for the making of Esoteric Buddhist images.

Like the Indian and Javanese bronze and stone sculptures, the image of the deity on the eastern lintel at Phimai also comprises eight arms, standing on an interlocking couple and has multiple heads. With the iconographical and literary evidence from India and Java, it may now be confirmed, in contrary to Conti’s interpretation, that the Phimai deity has four heads instead of three. This is probably be-

Fig. 4  Trailokyavijaya, stone, Mahant Monastery. Source: Rob Linrothe.
cause, unlike on bronze statues, the fourth head is not easily depictable on a bas-relief. On the other hand, the gigantic, 10th-century stone sculpture at the Mahant Monastery at Bodhgayā (Figure 4) has four heads, carved on a single slab of stone, but this is because it is a much larger image than the one at Phimai; the additional space probably made it easier to depict the four heads without the sculpture looking off-balance.

Furthermore, it is evident that the cult of Trailokyavijaya was practised at Phimai: the deity is mentioned in two inscriptions found at the temple. Inscription number 3 (K. 397) records that a dignitary by the name of ‘Kamaratene Añ Śrī Virendradehpativarma of Chok Vakula establishes the image of Kamaraten Jagat Senāpati Trailokyavijaya who is the senāpati (commander in chief) of Kamaratene Jagat Vimāya’. Cœdès (1924: 346-350) suggests that Kamaratene Jagat Vimāya was presumably the presiding Buddha of the Phimai Temple, situated in the central garbhagṛha (sanctum sanctorum); this could have been a Buddha image with the seven-headed nāga. The second inscription (number 4, K. 954) is found on a stone pedestal with a hole into which the plinth of a standing stone image must have been inserted to secure it. The inscription reads ‘Śrī Virendradiipati Varma of Chok Vakula establishes Kamaratene Jagat Senāpati Trailokyavijaya’, which leads me to speculate that this stone base may have been the pedestal that the statue of Trailokyavijaya once stood on. These two pieces of evidence strongly suggest that there must have been a prominent image of Trailokyavijaya erected by the aforesaid official as the guardian deity of the main Buddha image and the temple precinct. Moreover, a one-headed and two-armed bronze of Trailokyavijaya (Figure 5), now kept at the Bangkok National Museum, was unearthed at Phimai. Finally, Sharrock (2012: 208) states that the inscription3 found at Wat Sithor (K. 111, dated 980 CE, during the reign of Jayavarman V) suggests that not only Tantric Buddhism, but also the cult of Trailokyavijaya was prevalent on the Khorat Plateau. The inscription mentions a text called Tattvasamgrahatikā, which is a commentary on the STTS in which Trailokyavijaya is the central deity. This archaeological and epigraphical evidence clearly suggests the prominence of the Trailokyavijaya cult in the Phimai area. Thus, I identify the image on the eastern lintel as that of Trailokyavijaya rather than Cakrasanvarā.

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Fig. 5 Trailokyavijaya, bronze, National Museum of Bangkok. Source: Saran Suebsantiwongse.

3 lakṣagraṇṭham abhirajñam yo nvesya pararāṣṭrataḥ |
tattvasamgrahaṭikādi tantrān cādhyāpayad yami ||
Having searched in a foreign country for a great number of philosophical books and treatises, such as the Tattvasamgraha commentary, this sage then spread the study of them (translation by Cœdès 1954: 195-211)
Conclusion/Observation

Inscriptions and iconographies at Phimai confirm that the temple was the hub of Esoteric Buddhist practices, which received important royal patronages between the 10th and 12th centuries CE. Having corroborated the fact that the cult of Trailokyavijaya was prevalent in Phimai and that the deity appearing on the eastern lintel bears similarities to images of Trailokyavijaya in India and Java, the core image of this research, I propose that the central image seen on the eastern lintel is more likely to be Trailokyavijaya than Cakrasaṃvara, even though the image does not adhere exactly to any particular textual rendition. The bronze image of Trailokyavijaya found at the site together with the aforesaid inscriptions also confirm the existence of the cult. Moreover, it is apparent in inscription K. 111 that the STTS, which talks extensively about Trailokyavijaya, was circulated in ancient Cambodia while there is no evidence to suggest the same for the Cakrasaṃvara Tantra.

Although Trailokyavijaya and Cakrasaṃvara are two distinct deities, iconographically speaking they are very similar in terms both of general appearance and attributes. It is by looking into the Sanskrit verses that we get the exact outlines of their characters and attributes. Among the similarities, the most obvious feature always appearing in images of both deities is the *vajrahuṃkāramudrā* held at chest level. Regardless of how many heads and arms the images of either deity may possess, the appearance of this *mudrā* is always consistent.

Among various images of Cakrasaṃvara and Trailokyavijaya, apart from differences in the numbers of heads, arms and attributes, I have observed three, less obvious differences between the two deities, which may help to differentiate them:

1) Cakrasaṃvara images from South Asia are always depicted embracing a consort while Trailokyavijaya images are not.
2) Cakrasaṃvara images stand in *pratyālīḍha* with weight on the left leg; the left leg is bent and the right leg stretched out while Trailokyavijaya images show the opposite.
3) Trailokyavijaya images are shown trampling on an interlocking couple (including the Phimai image), while the trampled male and female figures under Cakrasaṃvara are separated – male under the right foot and female under the left.

In spite of the differences, Trailokyavijaya and Cakrasaṃvara are closely related esoterically – both are ferocious emanations of Akṣobhya and both have the protective function in Tantric Buddhism as seen in the following verse from the commentary of the Cakrasaṃvara Tantra by Indrabhuti:

> In the Paranirmitavaivartin [heaven] he disciplined criminals as the Fierce One Trailokyavijaya; the obstacle demons (*vināyaka*) were disciplined in the Nirmanārati [heaven] by the Fierce One Vajrajvalanalarka, in Tuṣita by Vajragarba, in the Yama [heaven] by the Fierce One Vajra-huṃkāra, and on the peak of Sumeru by Vajrapānī. Then Mahāvajradhara established himself as the manifestation body Śrī Heruka who is inseparable from the Four Bodies [of a buddha] (translation by Gray 2007: 49).

These differences, however, cannot be applied to the image at Phimai because it does not seem to follow any particular text, and even the most common characteristics, such as the *pratyālīḍha* and the *vajrahuṃkāramudrā*, are depicted differently to the Indian and Javanese images. This is perhaps due to the regional interpretation of the texts as well as to the artistic vogue of the place and time. Moreover, the number of heads shown on the Phimai image, which appears in the form of bas-relief, poses another confusion. There is confusion, too, over the number of heads (three or four) as previously mentioned. Nevertheless, as I have demonstrated – the verses from the Nispannayogāvalī, the STTS and the Mahāraudranāmahṛdaya reveal that the common forms of both Cakrasaṃvara and Trailokyavijaya possess four heads.
In the course of this research, I have also observed that the composition of the Phimai image has a lot in common with the sculpture of Gajasamhāramūrti (Figure 6) situated on the prākāra (wall) at the 12th-century Hoysala period temple at Belur, Karṇāṭaka: both are standing on an elephant head with multiple arms and are in the ardhaparyāṅka pose although the attributes and details are different. I venture to speculate that if the Khmer artisans were influenced by Hindu imageries while building the Buddhist temple at Phimai, they may have been led to interpret Buddhist iconographical text with a Hindu flair. After all, many Hindu temples existed in the area and we see numerous examples of artistic amalgamation of Hindu and Buddhist motifs in a few Khmer temples. In fact, Phimai is a fine example of this: while it is, in a sense, a strictly Buddhist temple, the temple’s prākāras (walls) and vimānas (dome) are decorated with countless Hindu subjects, most notably the bas-reliefs of scenes from the Rāmāyaṇa and the Garuḍa motifs.

Finally, besides identifying the deity on the eastern lintel at the Phimai Temple as Trailokyavijaya, this paper also suggests that knowledge of the Sanskrit language is useful in ascertaining the identities of Tantric deities who often possess complex and at times subtle characters and attributes, and which can often be determined through the study of Sanskrit texts and inscriptions.

Fig. 6 Gajasamhāramūrti at the Channakeśvara Temple at Belur, Karṇāṭaka. Source: Saran Suebsantiwongse
References


Exploring Thai Massage from Modern Iconography of Wat Pho in Thailand
การสำรวจการนวดไทยที่วัดโพธิ์ ณ วัดโพธิ์ในประเทศไทย

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Thai massage is one part of Thai traditional medicine and the extensive valuable knowledge of Thai massage is contained in literature such as in manuscripts and stone inscriptions. In these sources, only a small part is presented in the iconography, recorded in 10 Sen lines and Ruesri Datton images, which has become the core of Thai massage and thus it is important to analyse the modern iconography. This study uses the iconography recorded on stone inscriptions and manuscripts of Wat Pho as analysed texts to explore the medical knowledge and cultural meanings of Thai massage. The results are as follows: a) The principles of Thai massage were recorded on the modern iconography of Wat Pho, indicating both healing and health care functions. b) Thai massage represents a unique cultural meaning.

การนวดไทยเป็นส่วนหนึ่งของการแพทย์แผนไทย ความรู้ที่มีคุณค่าอย่าง огрุวัจนาระจึงการนวดไทยมีอยู่ในวรรณกรรมโบราณ เช่นใบลาน สมุดไทยและจารึกศิลา ในข้อมูลเหล่านี้มีเพียงส่วนหนึ่งที่แสดงโดยใช้รูปภาพเช่นเส้นประธานและฤาษีดัดตนซึ่งได้กลายเป็นฐานความรู้ของการนวดไทยซึ่งเป็นสิ่งสำคัญในการวิเคราะห์ภาพโบราณของการนวดไทย การศึกษาเรียบเรียงเป็นนิทานภาพในสมุดไทยและจารึกศิลาของวัดโพธิ์เป็นการวิเคราะห์ข้อมูล วัตถุประสงค์ของการศึกษาเพื่อสำรวจความรู้จากการแพทย์และความหมายทางวัฒนธรรมของการนวดแผนไทย ผลการวิจัยแสดงให้เห็นความเป็นเอกลักษณ์ทางวัฒนธรรม.

Introduction
This study consists of fundamental research to explore the principles and cultural meaning of Thai massage from the modern iconography of Wat Pho. The iconography is important for Thai massage, but related research rarely uses it as a research path. Thai Traditional Medicine (การแพทย์แผนไทย), known as alternative medicine, can be divided into four parts: Thai Medicine (เวชกรรมไทย), Thai Pharmacy (เภสัชกรรมไทย), Thai Midwifery (การผดุงครรภ์ไทย), and Thai Massage (การนวดไทย) (Picheansoonthon 2012: 272). Among them, Thai massage - which includes Thai massage and Thai exercise - Ruesri Datton (ฤาษีดัดตน), is best known. Thai massage, included in the Thai Intangible Cultural Heritage List, takes on several roles as a form of traditional medicine, art, valuable local wisdom (ภูมิปัญญาท้องถิ่น), and so forth (The Department of Cultural Promotion 2011: 15). The reason for the development of Thai traditional medicine is to cure diseases, because diseases not only make people unhealthy but could also possibly destroy a village. As the example Lefferts mentioned that an ancient city in Isan was evacuated due to cholera (2002: 58). Similar cases also occurred several times in Bangkok, and in their desire to protect the people, the ancient kings of Thailand ordered the development of traditional medicine and produced Thai massage iconography in Wat Pho for educational purposes.

There is a very close relationship among Thai traditional medicine, manuscripts (palm-leaf manuscripts included), and stone inscriptions. In the customs of Thailand, Laos, Cambodia, and Myanmar, traditional medical knowledge is usually kept in the family, but it may also be engraved on manuscripts and stone inscriptions that can be found in several related databases, such as the Database-Manuscripts of Western Thailand, The Inscriptions in Thailand Database, and The Digital Library of Lao Manuscripts (cf. Princess Maha Chakri Sirindhorn Anthropology Centre n.d. a; Princess Maha Chakri Sirindhorn Anthropology Centre n.d. b; National Library of Laos n.d.). These databases were established in the 1990s and designed different systems to classify various types of texts col-
lected from various places. What these databases have in common is the collection of traditional medical materials, above all, the proportion of images in traditional medical manuscripts is by far higher than other non-medical manuscripts. This phenomenon shows there is not only a relationship between traditional medicine, manuscripts, and stone inscriptions in Thailand and Laos, but images are also used as a carrier for preserving the skills of traditional medicine from generation to generation.

Among these data, the importance of Wat Pho lies in preserving a number of unique images of traditional medicine which is dominated by Thai massage, recording the core medical knowledge of the ten Sen lines (เส้นประธานสิบ or energy lines) and Ruesri Datton. This is why it could be included in the Memory of the World list¹. Overall, Wat Pho conserves three kinds of modern iconography of Thai Massage: stone inscriptions, statues, and manuscripts. The stone inscriptions are mainly set in the Thai massage pavilion (Figure 1), and 60 pieces (30 pairs) of Sen-line engravings are found on the walls of the pavilion. The statues come from a few Ruesri Datton statues in the temple, and manuscripts are stored in the library. According to the title setting, the author chose the earliest and most complete modern iconography as the analysis text, that is 60 stone inscriptions in the Thai massage pavilion, and 80 images in *The Iconography and Poems of Ruesri Datton* (The Monastic Group of Wat Pho 2015). This study employed field work with the aim of understanding the principles and cultural meaning of Thai massage through the modern iconography of Wat Pho.

![Fig. 1 60 stone inscriptions in Thai massage pavilion, Wat Pho. Source: Ya-Liang Chang](image)

This article notes some proper nouns and explanations as below:

1. **Four elements (ธาตุหลักทั้งสี่)**
   This is the principle of Thai traditional medicine. It is believed that the human body is composed of four elements: earth, water, fire, and wind. If the four elements are balanced, the body will be healthy, if not, the person will become ill.

2. **Sen line (เส้น)**
   The Sen line is used to refer to veins and nerves and any length of filament, fiber, or thread-like structure of organic tissue, which is possibly included in *kilomkang* (กิลอมกัง), connective tissue, or

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¹On May 27, 2011, UNESCO registered 1,431 stone inscriptions of Wat Pho which were made in 1831-1841 as Memory of the World, including traditional medicine, Thai massage and Thai pharmacy knowledge. (cf. UNESCO 2011; Office of Protection of Thai Traditional Medical Wisdom ed. 2014: 3; The Government Gazette 2015).
naharu (นหารู), the sinews and tendons. The human body contains a total of 72,000 Sen which is a symbolically large number rather than an exact one (cf. Mulholland 1979: 95; Salguero 2016: 56).

3. Wind (ลม, literally meaning “wind”)  
This refers to the air running within the Sen line. This concept is very similar to the “Qi-blood (气血)” of Chinese medicine. Many practitioners understand the wind as metaphorically referring to movement, and thus treat the concept of “wind” in the Sen as a reference to the mobility of the body’s muscles, tendons, sinews, and other anatomical structures (Salguero 2016: 57).

4. Pressure point (จุด)  
For Thai massage, it is important to engage the correct pressure points of clients to cause the wind to run smoothly within the body.

Literature Review  
There are several possible origins of Thai traditional medicine, because Thai traditional medicine is not original, and similar medical principles have Indian, Chinese, Khmer, Tai, and Western provenances. Mulholland mentioned that the basic ideas of ancient traditional medicine might have a common origin, somewhere in the unknown past, but thus far there is no clear evidence to point to the source. Ancient traditional medicine may have been transmitted from Europe to Asia, and in Asia through Islamic, Ayurvedic, and Chinese medicine, entering Thailand to the present day. Thai traditional medicine, to a large extent, derives from such concepts (Mulholland 1979: 84). Salguero also agrees with Mulholland and does not deny the relationship between Thai traditional medicine and Indian, Chinese, or other forms of ancient medicine. However, Salguero emphasizes if it is determined that Thai medicine is interchangeable with Indian or Chinese medicine or other Asian traditions based on the view above, it is not correct, because it devalues the tradition and does a disservice to the history and cultural heritage of Thai people (Salguero 2016: 99). Simply put, Thai traditional medicine is a distinctive medical knowledge system that integrates Theravada Buddhism, Ayurveda, Yoga, Chinese, and other traditional medicines with their applicable concepts.

A Brief History  
The golden period of Thai traditional medicine can be found in the Chakri Dynasty (1782 – present day) which created rich related materials. Prior to the Chakri Dynasty, a significant portion of literature about Thai traditional medicine was lost and Thai medical knowledge had not been systematically ordered. The first Siamese medical treatises were recorded might be traced back to the Sukhothai Kingdom, although related inscriptions are few. The earliest record of Thai traditional medicine appeared in the Sukhothai period in a recording about a massage message (cf. Office of Protection of Thai Traditional Medical Wisdom 2014:7; Princess Maha Chakri Sirindhorn Anthropology Centre n.d. c)2). Prior to this, there might already be hospital institutions in the area. According to the evidence of stone inscriptions unearthed from Surin Province in north-eastern Thailand, recorded a Khmer king, Jayavarman VII (1181–1215 A.D.), who built 102 hospitals called Arogayasan (อโรคยาศาล) throughout his kingdom, including in the Khmer-held region that today lies in north-eastern Thailand (cf. Salguero 2016: 3; Pattaramoon 2008:1-2; Kaewkhlai n. d.: 9). These indicate the massage therapy has already been used in Sukhothai Kingdom.

Thai massage was still popular among royal and ordinary people in the Ayutthaya Kingdom. The following two records indicated the social phenomenon. For one thing, in the reign of King Trailokanat (1448–1488), the royal law stipulated the identity and position of people engaged in Thai massage.

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2Please refer to the inscriptions of Wat Pa Mamuang in Sukhothai Province.
In the Buddhist Era 1998 (1455 A.D.), in the medical department for example, people were assigned to jobs according to their different feudal identities, such as working in medicine, herbal medicine, pediatrics, or massage departments. Among them, there is a supervisor whose power came from his feudal status. (Picheansoonthon 2012: 277).

For another, Loubèr visited Siam for several months in 1687 and recorded the use of Thai massage at the time.

When any person is sick at Siam, he begins with causing his whole body to be moulded by one that is skillful here in, who gets upon the body of the sick person, and tramples him under his feet. This likewise reported that great belly’s women do thus cause themselves to be trodden under foot by a child, to procure themselves to be delivered with less pain. (De La Loubère 1693: 63)

Regrettably, abundant ancient materials were later destroyed by the invading Burmese army, resulting in documents of traditional medicine, including Thai massage, to be burnt down. The revival of Thai massage stalled until the Chakri Dynasty. With the support of the kings of Thailand, Thai massage was revived again.

In the Chakri Dynasty, the golden age of Thai traditional medicine and Thai medical knowledge began to be systematically integrated and established. The development of Thai traditional medicine is closely related to the Thai kings. In general, Rama I laid the foundation for traditional medicine, and Rama III carried it forward. Rama IV and Rama V followed in the footsteps of their predecessors and introduced Western medicine to Siam during their reigns. Later, Rama VI supported modernization and Western medicine, which meant that traditional medicine was no longer exclusive and gradually declined. Traditional medicine gained attention once again during the reign of Rama IX.

In order to improve the health of the people, Rama I ordered the reconstruction of Wat Pho in 1789, then regarded Wat Pho as the centre, established the Department of Pharmacy, and began to engrave medical prescriptions on the walls for people to use. Furthermore, the king gave an order to make Ruesri Datton statues, which are akin to gymnastic postures that can help exercise the body and eliminate pain. But these statues were destroyed eventually due to non-durable materials made. Rama II continued to collect medical literature from various places. Many medical textbooks were composed and were extracted essences of the contents, finally were engraved on 30 square centimetres of marble. The marbles were placed in Wat Ratcha Orsaram Ratchaworawihan in 1821, and later most were moved to Wat Pho (cf. Picheansoonthon 2012: 280; Salguero 2016: 8; Sapcharoen 2010: 10).

Rama III is the king who had the deepest influence on the development of Thai traditional medicine. After he ascended the throne, he repaired Wat Pho again and expanded the temple facilities in 1832. The goal was to create Wat Pho mainly as an education institution for all levels of society, akin to a university today. Since printing was not popular in the Rama III period, in order to help more people learn traditional medical knowledge, the king appointed professionals in the medical field as editors to compile medical textbooks and engraved the essence of the textbooks on marble slabs, which were then embedded in the walls of the pavilions of Wat Pho for the public to read and use. It is for the reason that Wat Pho is called a “Library in Stone” (Griswold 1965, as cited in Salguero 2016: 11). Additionally, Rama III imitated Rama I’s practice to reconstruct metal Ruesri Datton statues, which had eighty postures to show a yogi in different positions with descriptions on how to perform the exercises and their benefits (Figure 2). Later, several statues were damaged and some were stolen; only the twenty-four remaining statues have been restored and are now situated in Wat Pho. Ruesri Datton is also painted on manuscripts; like The Iconography and Poems of Ruesri Datton, a black book manuscript from 1838, is the earliest and most complete picture book of Ruesri Datton images
Rama IV, a king who showed great interest in Western civilizations, allowed Western doctors to practice and created the era in which Thai traditional medicine and modern medicine coexisted. Rama V loved Thai massage and continued to develop and establish the Thai medical knowledge system during his reign, especially in the compilation of medical textbooks. The subsequent king, Rama VI (r. 1910–1925), was concerned with modernization and the growing faith in Western medicine which led to The Royal Traditional Medicine Department being forced to dissolve along with the discontinuation of the teaching of traditional medicine to medical students. Because of the prosperity of Western medicine, traditional medicine slowly declined (see Chaithavuthi and Muangsiri 2007: 31-33; Mulholland 1979: 83; Salguero 2016: 16-17).

Thai traditional medicine again received a ground-breaking opportunity during the Rama IX period. Rama IX changed the name of “ancient traditional medicine” (การแพทย์แผนโบราณ) to “Thai traditional medicine”, regarded Thai traditional medicine as a kind of local wisdom, and established the discipline system of traditional Thai medicine. Since the mid-1980s, the Thai government faced up to the importance of protecting tradition and embarked on legislation to protect and promote Thai traditional medicine. For example, in 1999, the king approved the Protection and Thai Traditional Medicine Wisdom Act and established The Institute of Thai Traditional Medicine. Alongside this, the Development of Thai Traditional and Alternative Medicine was established under the Ministry of Public Health in 2002. In 2015, the Draft Intangible Cultural Heritage Act was amended to include “Traditional Medicine” as a new protection project. At present, Thai massage and Ruesri Datton are both included in The Intangible Cultural Heritage Project of Thailand. Thus, Thai traditional medicine became not only an alternative medicine, but also an important form of intangible cultural

*The Preservation and Protection of Intangible Cultural Heritage Act B.E. 2559 (พระราชบัญญัติส่งเสริมและรักษามรดกภูมิปัญญาทางวัฒนธรรม พ.ศ. 2559) was promulgated on March 1, 2016, in Thailand.*
heritage connecting globalization (see Picheansoonthon 2012: 284; The Department of Cultural Promotion 2015; The Development of Thai Traditional and Alternative Medicine n. d.).

Related Research
Prior to the 2000, in addition to the aforementioned historical materials, important research on Thai traditional medicine was based on Western literature. Local research has increased every year after 2000 because of the gradual emphasis on cultural heritage and academic development in Thailand. Although the current topics of research are very wide, there is little literature on exploring the relationship between modern iconography and Thai massage which is the research highlighted by this article.

In the 1970s and 80s, the relevant research focused on the introduction of Thai traditional medicine. After 1990, research on pathology and herbology began to be examined, classified, and organized. Several important scholars include Mulholland, Somchinta Ratarasarn, and Scott Bamber. In order to help readers fully understand Thai traditional medicine, Mulholland (1979) and Ratarasarn (1989) have clearly and concisely written an overview of “Thai Traditional Medicine.” In particular, Mulholland explained traditional medical terminology in Thai which is helpful to readers in order to understand the meanings of the texts. Mulholland conducted another important study about the introduction of diseases in women and children (Mulholland 1987, 1988, 1989), which is usually difficult for foreigners to understand, but it was made easier by Mulholland. Other related studies are, for example, Bamber’s study about diseases and traditional Thai healing (Bamber 1987, 1998), and Brun and Schumacher’s (1994) study of the history of herbal medicine in manuscripts of Northern Thailand. Salguero is a new force whose studies have appeared since 2000. He has many impressive studies such as Salguero (2005, 2011, 2016), including the Thai massage issue. However, one caveat is that Salguero is not familiar with the Thai language, and therefore his studies do not discuss important Thai literature after the millennium which play important roles in the research development of Thai traditional medicine.

The rise of local research of Thai Massage has been subject to cultural policies on the other hand, and has been related to the cross-disciplinary development of traditional medicine. In term of cultural policies, the stone inscriptions of Wat Pho were registered as a Memory of the World; “Thai Massage” and “Ruesri Datton” were included in The Intangible Cultural Heritage Project, which both are influenced by cultural policies of protecting and promoting culture. Moreover, in order to root down traditional culture, Rama IX ordered an edit of the Thai Youth Encyclopedia (หนังสือสารานุกรมไทยสำหรับเยาวชนฯ) which contains the topic of Thai traditional medicine, written by Picheansoonthon, and briefly describes the history, classification, principles, and application of Thai traditional medicine (Picheansoonthon 2012). In line with government policies, Thailand’s Ministry of Public Health also published three books primarily on the stone inscriptions of Wat Pho in 2014. The first volume, titled Thai Massage, contains modern iconography of 60 stone inscriptions in the pavilion of Wat Pho. The second volume is concerned with children’s diseases recorded on the stone inscriptions of Wat Pho. The third volume is a miscellaneous book that records various disease names, prescriptions, herbal properties, and so forth (Office of Protection of Thai Traditional Medical Wisdom ed. 2014: 3). In turn, in terms of cross-disciplinary research, the Ministry of Culture of Thailand amended the Draft Intangible Cultural Heritage Act to include “Traditional Medicine” as a new protection project in 2015, which demonstrate Thai traditional medicine has succeeded in becoming a cross-disciplinary subject with dual values of alternative medicine and intangible cultural heritage. Both the cultural policy and a cross-disciplinary development are factors that has driven local research. The relevant research has continued to be produced, but important research is still based on the above official literature.
In summary, Thai traditional medicine has its own research trends and problems. The trend is to combine intangible cultural heritage and to pursue cross-disciplinary research; the problem is the lack of iconographical research. As mentioned above, “images” are often an important component of Thai traditional medical textbooks, since images help to spread medical knowledge more effectively, especially Thai massage which involves pressing points of the body, something that is more suitable for image instruction. However, in the previously cited literature, it is rare to find Thai massage research in relation to modern iconography, which is the research gap this study attempts to bridge. Consequently, this article uses the modern iconography of Wat Pho as the text (60 stone inscriptions and 80 images of Ruesri Datton) to explore the principles and cultural meaning of Thai massage. This research topic meets the trend of cross-disciplinary research while also filling the current research gap.

**Discussion**

The principles of Thai Massage can be studied from the modern iconography found at Wat Pho, which could help people study medical knowledge through images. The related medical knowledge of the stone inscriptions of Wat Pho and the images of Ruesri Datton are as follows:

**Stone Inscriptions of Thai Massage Pavilion in Wat Pho and Principles of Thai Massage**

Thai massage is the science of diagnosis, treatment, and prevention. The practice of Thai traditional medicine is based on the premises that there is always a cause for an illness, and that a disease can be recognized by specified symptoms. The main principles of Thai Massage, contained in the stone inscriptions of Wat Pho, is to balance the body and mind by pressing and stretching the body’s energy lines to clear the wind inside the energy line. Take sixty stone inscriptions of Wat Pho for example, with the body front and back as a group, divided into 30 groups. The first nine groups introduce the names and locations of ten energy lines, and the tenth group describes the three major types of diseases caused by energy line disorders, namely, relapse, flabby, and disability, all of which are caused by four elements unbalanced, known as fire, water, wind, and earth. Eleven to thirty groups are based on the four elements and describe the positions of the energy lines to address a variety of disease symptoms. The following core principles of Thai massage can be explained through the 30 groups of modern iconography at Wat Pho.

**Energy Lines, Wind and Pressure Points**

The energy lines, wind, and pressure points are the three principles of Thai massage and are interdependent. The human body is covered with energy lines, and the wind runs inside the energy lines. The more smoothly the wind runs, the healthier the body becomes. Conversely, if the wind is blocked, it will cause diseases; in this situation, if people press the correct pressure points, health can be improved. Each of the ten energy lines starts from the navel and its surrounding areas, and all fulfil their proper function to protect health (Patrakard 2012: 8). Since the human body is an energy structure, for keeping the health of the body and mind, it is necessary to practice massage and adjust the breathing to make the wind inside the body run smoothly and achieve the energy balance of the body.

**Four Elements and Five Causes of Diseases**

The four elements: earth, water, fire, and wind, are general rules of the universe, which not only shows the structure of the human body, but also explains the causes of diseases. According to the four elements, the human body can be divided into 42 parts (cf. Salguero 2016: 43; Mulholland 1979: 90-95; Tangtrongchitr date unknown: 5-8). The four elements can be upset as a result of climate change, food intake, emotional or psychological factors, etc. Once the four elements are not coordinated, they will incur *dosha* (โทษะ, literally “defects”) and make the person sick. According to the principle of Thai massage, the element, season, age, time, and environment are regarded as
the five major causes of diseases, which are related to the four elements of the human body; if the four elements are out of balance, people will get sick. (see Mulholland 1979:85; Picheansoonthon 2012:287-288). Therefore, when a therapist understands the relationship between the body and the four elements, the therapist can find the right antidote to cure the diseases. Each stone inscription recorded the name, position, pressure point, and function of the energy line, which is convenient for a therapist to use. As far as the treatment steps are concerned, a therapist observes the condition of the four elements inside a client’s body at first and then determines which one the disease belongs to. When the cause has been found, a therapist can practice Thai massage for the client. Taking Figure 3 as an example, it is a massage engraving for curing the bile disease caused by an imbalance of the water element. A therapist can massage a patient with the bile disease according to the stone inscription for helping the wind inside of the patient run smoothly. Simply put, a therapist must look at the body, mind, and the environment of a client as comprehensively as possible in order to accurately diagnose and treat them.

Fig. 3  A massage engraving for curing diseases caused by imbalance of the water element, Wat Pho. Source: Ya-Liang Chang.

**Images of Ruesri Datton and Personal Health Care**

Ruesri Datton, the foundation of traditional Thai massage, is similar to Indian Yoga (Wells 2012); its main function is health care. Ruesri Datton of Thailand has a total of 80 postures, focusing on breathing, stretching, and meditation. By stretching and adjusting one’s breathing, it reduces personal nerve and muscle tension, keeps the wind inside the body running smoothly, helps eliminate irritability, prevents disease, and prolongs life (Picheansoonthon 2012: 305-306; Sapcharoen 2010:12). There is a list of 80 images of Ruesri Datton handed down from ancient times which can treat a total of 74 illnesses (The Monastic Group of Wat Pho 2015: 7-9). Since the main function of Ruesri Datton is health care, The Development of Thai Traditional and Alternative Medicine has compiled 80 Ruesri Datton postures into the “15 Basic Trickking Moves for Thai Exercise” to encourage people to learn them. The two main points of Thai Exercise are “breath” and “balance”. When you exercise, you need to watch your breath, and according to the structures of your body, stretch your body as much as possible in vertical, horizontal, and oblique directions to maintain the balance of the body and mind (Sapcharoen 2010: 13-14).
In summation, the principles of Thai Massage were clearly presented in the modern iconography of Wat Pho. In terms of treatment, the 60 stone inscriptions of Wat Pho, which represent the core value of Thai massage, recorded energy lines and the four elements of the human body; additionally, causes, symptoms, and treatments of diseases were included. In terms of health care, the vivid modern iconography of Ruesri Datton emphasizes how to keep the health of the body through self-massage and stretching. The essence of Thai massage is to maintain the body’s energy balance so that the four elements of the body can be coordinated. For Thais, Thai massage and Ruesri Datton often supplement and complement each other. Both have long formed part of people’s daily lives.

Local wisdom
The modern iconography of Wat Pho is the practice of local wisdom. It is not an exaggeration to say that these images are a microcosm of Thai art history, since they are closely linked to Thailand’s history. Bovornkitti commented on Thai art is influenced by two factors, “Buddhism” and the “King,” for these two elements are the historical context of Thailand (Bovornkitti 2005: 358). Like Bovornkitti (2005), Krairiksh (2008) and Woodward (2005) have also found the common cognition to Thai art history. However, Bovornkitti has focused less on “the tradition of iconography” (พระเพณีการเขียนรูปลักษณ์) which has been an important way of educating Thais and presenting their ideas since ancient times. “People drew pictures as a way of explaining the Dhamma (Buddhist Teachings) and this has been popular in Siam since the Sukhothai or early Ayutthaya period” (Phra Thepwisutthimethi 2006:2). The tradition of using images or similar artwork to spread Buddhist teachings has existed in Thailand for a long time because they can be understood easily and the communicator can accumulate merit in this way. This is why Rama III ordered to make the iconography of Thai massage. Due to the support of the kings, and the creativity of many unknown artists, the iconography of Thai massage of Wat Pho not only reflects the value of local wisdom and art history of Thailand but also becomes a unique intangible cultural heritage.

Conclusion
Thai massage is one part of Thai traditional medicine, extensive valuable knowledge of Thai massage is contained in ancient literature, such as in manuscripts and stone inscriptions. In these sources, only a small part is presented in the iconography. The importance of Wat Pho lies in preserving many unique images of traditional medicine which is dominated by Thai massage, that shows an important connection between modern images and Thai massage. This study uses the iconography recorded on stone inscriptions and manuscripts of Wat Pho as texts to explore the principles and cultural meaning of Thai massage. The results are as follows: a) The principles of Thai massage were recorded on the modern iconography of Wat Pho, indicating both healing and health care functions and b) Thai massage represents a unique cultural meaning; moreover, it has become an important intangible cultural heritage in Thailand.
References
Pattaramoon, N (2008) "โรงพยาบาล" ใน [The “Hospital” Record in the In- 
Princess Maha Chakri Sirindhorn Anthropology Centre (n. d. b) *The Inscriptions in Thailand Database*. Available at: https://db.sac.or.th/inscriptions/inscribe [accessed 31 August 2019].
Princess Maha Chakri Sirindhorn Anthropology Centre (n. d. c) จากเข็มดัดตน (ภาษาเขมร).
Available at: http://www.sac.or.th/databases/inscriptions/inscribe_detail.php?id=1329 [accessed 18 September 2019].
Flaming Pediments of the Bagan Period

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The Bagan mastery of brick is seen both in the architecture and ornamental elements of the temples (gu). Three features typify the style of the 11-13th century. The use of the true arch enabled large spans to be covered, while the crowning sikhara spire completed the silhouette. The entry to the structure was highlighted with a single, double or even triple pediment edged with flamboyant curves (clec). From the lobed arch, multiple points push upwards to end in small points, sometimes made from stone. At the apex was a small seated figure, of the fertility figure Sri while the ends curved upwards, often ending in the arched figure of a makara. The form of the flaming pediments changed over the centuries making them a significant diagnostic feature, from the rounded forms of the Nanpaya to the glazed example of the Sulamanni. The flaming pediments are also found in temples of the Bagan period outside the capital. This paper defines a typology at Bagan and uses this to assess examples in the wider landscape.

Introduction

Flaming pediments are essential ornamentation of the backdrops of porches, gate ways and perforated windows of Bagan temples. Some scholars say that the arch-pediments was gradually evolved from the graceful home called Srivatsa on coins. It was called “torana” during the Bagan period and the dummy pediment of the archway was called “flaming arch pediments” (Minbu Aung Kyaing 1997: 72). The prototype of the flaming pediments is seen in the false archway of the Be Be and Le-Myat-Hnar temples in Sriksetra. Therefore, although there are different assumptions regarding the origin of the flaming pediments of the archway and windows made during Bagan period, they were created out of the good inspirations of Bagan architects. The Bagan temples built in Early, Middle and Late Bagan periods take on different forms. As the temple of Early Bagan period is low, it conveys the sense of ‘Repose’. As those of Late Bagan period are of many storeys, they look lofty and splendid and therefore bears a sense of ‘energy’. Those of the middle Bagan period take on a hybrid form. Therefore, if comparing just the torana, which is the gateway, of the temples of the three periods, it will be evident that the sense of these temples changed from ‘repose’ to ‘loftiness’. It is also note-worthy to observe that the gateway which was only made up of pillars and lintels changed to the one decorated with a pointed arch in the middle with flaming pediments on its either sides (Than Tun 2002: 259-261).

The centre of the pediments is called the “banana bud”. The projecting edge on the either side of the pediments is called “acroterion”. There are four types of arch pediments can be found. The first type is surmounted by a square tower and a spire. The second type is decorated with only flame pedi-
ments. Some of them are two-layered. The third type is set with a spire flanked by adornments called acroterions. The fourth type is decorated with bands like terrace, on which lotus flowers and stalks are made in the manner of growing (Minbu Aung Kyaing 1997: 69-71).

Such decorations are made not simply to beautify the temples but to symbolize the cosmological concept of Myanmar. The banana-bud of the arched pediments of the porch represents Mount Meru, the dummy pediments the seven mountain ranges, the lotus buds among the dummy pediments the seven seas and the large figures of *Makara* on either side of the acroterions the marine creatures representing the four major continents (Myo Nyunt 2007:19). Therefore, the flaming pediments of the porches and windows are very important works of art not only for decoration but also for the cosmological concept for the temples.

**Flaming Pediments of the Early Bagan Period**

The pediments of Early Bagan period can be found on the entrance of the archway into the Nat-hlaung-kyauung temple which is an Early Bagan period temple. Although there might have been stuccoworks there before, they have detached today. It is a single pediment. The lintel of the gateway is a straight arch, above which there is a radiating arch. But bricks are stuffed between the lintel and the radiating arch. The upper part of the radiating arch is decorated with flaming pediments (Figure 1). However, these flaming pediments are made short in the style of Early Bagan period, which have not yet been soaring and slendering. As the stuccoworks are no longer extant, the types of decoration cannot be identified.

The pediments at the gateway into the Nanphaya temple take on the form of the Early Bagan period (Than Tun 2002: 261). But today, no dummy pediments can be seen at the gateway. Only the radiating arch is extant. The pediments are seen on the windows of the main body. The pediments of the Nanphaya are made of sandstone, on which floral designs and figure are carved. Though the pediment is decorated with beautiful floral designs and figures, the pediments on them are found low-lying and rounded in the style of Early Bagan period (Figure 2).
Seated Deva figures in high relief are found in the place of the banana-bud. A seated Deva figure is found on the lotus flower which above the acroterions on the either side of the pediments on the windows of the Nanphaya temple. These Deva figures are with two hands, one holding a small pot like a kalasa pot and the other assuming the gesture of sprinkling something. The kalasa pot is found between the lintel and the pediments. Therefore, out of the pediments of Bagan temples, those of the Nanphaya are found exemplary and influenced by Indian culture. Besides, beautiful floral festoons, Deva figures, lotus-petals and Makara figures are elaborately carved on the pediment of the exterior windows. But it does not emphasize the soaring sense but only the senses of repose and serenity. Therefore, the pediment of the Nanphaya is found to be a remarkable work (Than Tun 2002: 261).

The way of constructing the pediment of the Early Bagan period can be found at the Abeyadana temple and the Nagayon temple. The pediment of the Abeyadana temple is single pediment and supported by a radiating arch. But, today, the bricks of the pediments are ruined. However, the ornamentations of the pediments can be found on the windows around the main body. The pediments of the windows are decorated with short flaming pediments which are supple and rising gradually, in the fashion of the pediments of the Early Bagan period (Figure 3).

The acroterion is made erected rather than extending outwards. The owl-shaped hole and designs are made clearer. The Abeyadana temple belongs to the late 11th century CE. Therefore, the work of its pediment becomes finer and it attains greater height.
Fig. 3  Flaming pediment of window at Abeyadana. Source: Sanda Linn.

Fig. 4  Flaming pediment of Nagayon temple. Source: Sanda Linn.
Since the Nagayon temple was built in the late 11th century CE, its pediment is found a little higher. The flaming pediments became elongated and upright. In other words, the pediments changed from the low, supple form to the high, upright form (Figure 4). As cement remnants no longer remain, the detailed designs on the brick pediment can be seen. The lower part of the pediment is supported by a radiating arch. As the flaming pediment of the gateway seems high, the main body also appears high and lofty. The ornamentations of the pediment are found on the windows of the main body. The pediments of these windows are similar in form to those of the Abeyadana temple. However, the part above the dummy pediments, banana-bud, acroterions and curving designs on the windows of the Nagayon temple is embellished with stucco floral designs. A stucco lotus-bud is embedded between the acroterion and the dummy pediment on the either end of the pediment. In the place of the owl-shaped hole and curving designs is decorated with a row of pearls. The flaming pediment and the curving and hooked designs are buttressed by a double radiating arch. Therefore, the flaming pediments of the temples which were built in the late 11th century became a little higher. Therefore, it can be generally assumed that even the flaming pediments of the Nanphaya temple, the Abeyadana temple and the Nagayon temple of the Early Bagan period which bear the sense of repose or serenity look high and soaring, they convey the sense of energy to a certain degree (Than Tun 2002: 261).

So the cements on the pediments of the temples of the Early Bagan period very often flaked off and the upper parts of the pediments toppled down. This can be attributed to the gluing capacity of the cement to the bricks of that time and the poor ratio of the ingredients in the cement.

Flaming Pediments of the Middle Bagan Period

Just as the way of constructing temples changed from period to period, so also the works of arts which decorate them changed. It is noticed that the way of making the pediment which are the main part of temples also altered during the Middle Bagan period. The pediment of the Wetkyi-in Gubyauk nge temple built during the 12th century, a transitional period, is a remarkably artistic work. The pediment of the gateway into the Wetkyi-in Gubyauk nge temple is a double one. But the distinctive feature is that it does not have two rows of flaming pediments but two shapes the pediments (Figure 5). In the first phase of the pediment, the edge of the part above the lintel is curved with the owl-shaped holes and curving designs. Above it are the receding terraces rising competitively from the either side and the middle is surmounted by a stupa-finial. As the stucco-work remains, this flaming pediment can be seen as a very beautiful one. The curving designs are decorated with rows of pearls. The receding terraces are also ornamented with lotus-petals and rows of pearls. At the lower corners, in the place of Makaras, large Byalas (mythical antelopes) are found standing on small elephants. Long vertical tassels drop from the mouths of the Byalas (Luce 1969: 348). Above the first receding terrace are found flaming pediments high and soaring. No stucco work remains on this pediment.

On either side of this first step of the pediment remain two half-pediments and Makaras. The flaming pediments and two half-pediments are a little low but rise gradually upwards, suggesting that they preserve the style of the Early Bagan period. As in the flaming pediments of the Early Bagan period, any lotus bud and flowers are not found embedded amongst the dummy pediments. However, like the flaming pediments of the Early Bagan period, it has a lotus-bud between the acroterion and the dummy pediment. In brief, the exterior or the upper flaming pediment looks high and soaring. When it is combined with the beauty of the first or lower pediment, it takes on the appearance of softness and is well-proportioned. The pediments of the perforated windows around the main-body are of two types: one is the backdrop with receding terraces rising step by step tapering up to the stupa-finial above the window (Figure 6) and the other with receding terraces surmounted by a square-tower topped with a sacred umbrella (Figure 7). As the stupa-finial and the square-tower were carved around the walls of the main body, it can be considered that temples and stupas might have been highly revered in those days. Therefore, it is observed that the pediment of the Wetkyi-in Gubyauk nge temple is an architecturally remarkable one, reflecting the change from the early style to the evolutionary style.
Fig. 5  Double-layered pediment in two different styles of the Wetkyi-in Gubyauk nge temple. Source: Sanda Linn.

Fig. 6  Pediment with receding terrace. Source: Sanda Linn.
The Shwegugyi temple can be studied as an evolutionary one. The style of the 12th century can be seen clearly in this flaming pediment. Dummy pediments, banana-buds and acroterions are long and upright (Figure 8). Besides, unlike the pediment of the Early Bagan period, there is a lotus-bud between the dummy pediments. In the lower part of each flaming of the inner pediment is a Deva figure on his knees in the manner of the worshipping the Buddha. The outer flaming pediment is made of plain stucco without any decoration.
The flaming pediments of the lateral porch into the main body are richly decorated with beautiful erecting floral designs (Figure 9). The curving and hooked designs are ornamented with rows of pearls and lotus-leaves. The distinction is that above the owl-shaped holes and curving designs are lotus petals rising gradually up to a big lotus-leaf at the top. Again, this lotus-leaf is superimposed by receding terraces which is topped with a stupa-finial. Therefore, the pediment of this lateral-porch was beautifully carved. Although the way of making this pediment is similar to that of the entrance into the Wetkyi-in gubyauk nge temple, the pediment of the latter is decorated with lotus-leaves in a series and acts as the outer pediment. But it is employed as the inner pediment at the Wetkyi-in gubyauk nge temple. Flaming pediments are carved in the outer pediment of the Wetkyi-in gubyauk nge temple but in the inner pediment of the Shwegugyi temple. Besides, the works on the pediments of the windows around the main body are excellent. The pediments are decorated with flaming pediments and receding terraces, which are surmounted by a square-tower endowed with pennants and buttons. In the place of the acroterion on the either side of the pediment is a big circle of floral designs instead of a makara.

![Fig. 9 Flaming pediment of the lateral porch of Shwegugyi temple. Source: Sanda Linn.](image)

As the 12th century suggests that it is a transitional period, as the temples built during this century, though the aims of constructing them might be different, underwent a lot of changes to make them better in quality and more beautiful in appearance. The Sulamani temple is, an exemplar of the 12th century temple architecture, where many changes and improvements in art and architecture can be found. The pediment of the southern entrance has a double flaming pediment and those of other entrances have a single flaming pediment. These pediments rise from the acroterion on the either side of the flaming pediment until they reach the banana-bud in the middle. However, as the flaming pediments rise abruptly, the pediment looks higher and soaring. Besides, in the place of the pointed end of the flaming pediments, banana-buds and acroterions are decorated with glazed plaques (Figure 10). Below the glazed plaques are Deva figures kneeling in the manner of worshipping the Buddha. Between the acroterion and the lotus-bud are Garuda figures in the manner of worshipping the Buddha. The owl-shaped holes, curving designs and hooked designs are also ornamented with beautiful...
stucco works. As the flaming pediments rises sharply, the owl-shaped holes, curving designs and hooked designs are, unlike those of the Early Bagan period, are fringed heavily. Moreover, pointed flakes of sandstone are wedged into these bricks. Two ogre-heads are made at every corner of the pillar of the pediment.

Fig. 10  Flaming pediment decorated with glaze at Sulamani Temple. Source: Sanda Linn.

A remarkable work of the window-pediment is found at temple No. 1026 assumed to be dated to the 12th century (Figure 11). The pediment contains dummy pediments and acroterion had the figures of makaras. The decoration of makaras is unusual style of Bagan. The makaras spout inwards: Byalas with their heads reverted spring from the makara mouths (Luce 1969: 351). Therefore, it is evident that temples were remarkably decorated with works of art during this period.

Therefore, if taking all improvements into consideration, as the 12th century suggests itself as the transitional period, it is found that all lot of innovations took place, based on the works of art and architecture of the Early Bagan period during this century. If looking casually at the pediments, it will be thought they look similar to one another. But if looking carefully at them, it will be found that their details became different. Figures came to be carved out of stucco so that they would become more beautiful. Moreover, as in the Sulamani temple, flaming pediments were decorated with glazed plaques. The temples changed from the repose-form to the high and soaring one. Their ornamentations were also remarkably changed. Therefore, the Middle Bagan period can be said to be the heyday of Bagan art and architecture.
Flaming Pediments of the Late Bagan Period

During the 13th century, which is the Late Bagan period, the temple construction on architecture as well as ornamentation of their pediments changed. Just as the temples were high and magnificent, so also their ornamentations such as pediments, became high and splendid. The 13th century pediments can be seen at the Htilominlo temple which is the exemplar of the 13th century Myanmar architecture. The flaming pediments of the entrance to the vestibule, the window and the lateral exit from the vestibule of the Htilominlo temple are beautifully decorated. The pediments of the four main porches are double-layered and decorated with flaming arch pediments, which are flanked by acroterions (Figure 12). The figure of ‘Makam’ with a lion treading heavily on its mouth is carved on the acroterion (Figure 13). Some remnants of plaster works suggest that the plantain buds, flame pediments and curved porch pediments were also exquisitely decorated with beads, bosses and floral motifs. Lotus buds in stucco are made exquisitely interlinked with flame pediments. On the remnants of lotus buds in stucco are decorated small statues of seated deva (Figure 14). On the remnants of flame pediments in stucco are carved ogre head at the base and floral designs above the ogre head. The flaming pediments are not only wide but also high. So they match the main body which is high. Lotus buds and flowers are abundantly placed between the dummy pediments. So these artefacts seem to be rising in great profusion up to the banana-bud. Although the pediments at this temple look lofty, as they are wide, they take on the proportionate look.
Fig. 12  Double-layered flaming pediment of Htilominlo temple. Source: Sanda Linn.

Fig. 13  Makara on the acroterion. Source: Sanda Linn.
Another temple to be discussed is the Narathihapate temple or Tayok-pyi hpayagyi. The flaming pediment of its entrance has a double pediment (Figure 16). The pediments in the first steps are still found decorated with stucco works in situ. Therefore, the ornamentations of that period can be studied well. Besides, short pediments rise from the acroterions on both sides and when they reach half of the stupa figure, the pediments become longer abruptly, making the banana-bud look higher. So the pediments at the base and those in the upper part are different in size. They do not rise smoothly as in the Htilominlo temple. According to the stucco works on the pediments of the Narathihapate temple, the ornamentations of that time can be known. The banana-bud at the middle of pediment of the eastern entrance contains a figure of Deva worshipping above a lion, below which there is again
a Byala with an ogre-head at its base (Figure 17). On the either side of the banana-bud is the figure of dancing Devas with the pedestals of a lion and a bull. Above them are festoons of floral designs. Below the row of the pediments are figures of birds and other mythical creatures. The Makara on the acroterion is beautifully covered with scales, on whose jaw a lion is treading. The remnants of the stucco works on the half-damaged backdrop show that the dummy pediments had small mythical creatures and lions seated on the lotus-bud. Although it has a double pediment as the Htilomilo temple does, the distance between the two rows of pediments is greater. Its dummy pediment rises more sharply and its stucco works are more elaborate.

Fig. 16 Double flaming pediment of Narathihapate temple. Source: Sanda Linn.

Fig. 17 Deva, lion, Byala and an ogre-head on the banana-bud. Source: Sanda Linn.
The pediments are made high and pointed. Therefore, it is found that the pediments of the Htilominlo temple rise smoothly upwards whereas those of the Narathihapate temple rise sharply. The flaming pediments of the windows around the main body of the Narathihapate temple are very artistic. Behind the flaming pediments are found the receding terraces rising upwards. They are like the pediments of the Htilominlo temple. As in the Htilominlo temple, the banana-bud of the Narathihapate temple is decorated with the ogre-head and the flowerpot above it with floral designs. Moreover, as the stuccoworks remain almost intact, it can be assumed that the quality of cement of that time was good and the stuccowork was made tidily and carefully.

The stuccoworks on the flaming pediments became different from the early ones during the 13th century. The flaming pediment of the entrance into the Kon-daw-gyi contains a double pediment (Figure 18). The acroterion of this flaming pediment is remarkable, for a Kinnari (mythical creatures) is standing on the jaw of the Makara on it (Figure 19). These birds are assuming the manner of worshipping the Buddha. The body of the Makara is covered with scales. As its two fore hands, two hind hinds and body adjoin curving designs, hooked designs and the decorative projected band, it looks like a dragon. It is also found that the ornamentations on the flaming pediment of the lateral arch of the main body are different from those of others.

There is an ogre-head at the base of the banana-bud in the interior pediment of the lateral arch. The cement above it flaked off. The flaming pediment is decorated with tiny mythical creatures and various floral designs. On the acroterion is found a flying lion with festoons of flowers rising from its mouth (Figure 20). The flaming pediment of this temple has a double pediment and the cement used is a little coarse. Although various figures are carved, they are not elaborate. These figures are not as beautiful as those at the Htilominlo temple and the Narathihapate temple. The temples built throughout the 13th century (Late Bagan period) have a flaming pediment, some are flaming pediments are surmounted by receding terraces topped with a stupa-finial. Besides, it is also noticed that the ornamentations of the flaming pediments of these temples are figures of tiny mythical creatures and Devas. Besides, due to different quality of cements, some stuccoworks still remain intact and some flaked off.

**Conclusion**
To conclude, it is found that many temples were built throughout Bagan period. This suggests that the ancient Myanmars had great confidence in Buddhism and enjoyed making donation. It is noticed that, due to their great enthusiasm about donation, they tended to endeavor to make their merits, which were temples and pagodas, not only magnificent but also beautiful through the use of the temples of the Early Bagan period were dark and reposing, that their decoration was simple and that the pediments which form the important part of a temple’s beauty were made to be in proportion to its size. Therefore, the flaming pediments of the entrances into the Nat-halung-kyuang temple, the Nanphaya temple and the Abeyadana temple were very simple. They were not decorated with pointed ornamentations like dummy pediments. They did not have lofty and complicated ornamentations. So they took on the plain appearance. Therefore, it is observed that the pediments decorated with dummy pediments which convey the sense of repose are commensurate with the reposing temples of the Early Bagan period.

When it came to the transitional period of Bagan architecture, which is the 12th century, ornamentations were made beautiful and varied based on the early tradition and that the double-flaming pediment were replaced with the ones ornamented with the pediments surmounted by receding terraces. In the pediments of the windows around the main-body of the 12th century temples, above the windows are flaming pediments, behind which there are receding terraces surmounted by the stupa-finial or the square-tower. Besides, it is also found that the short flaming pediments of the Early Bagan period became high and soaring during the transitional period. At the time, the flaming pediments
Fig. 18  Flaming pediment of Kon-daw-gyi temple. Source: Sanda Linn.

Fig. 19  Kinnari on the jaw of Makara on acroterion, Kon-daw-gyi temple. Source: Sanda Linn.
became higher and figures of mythical creatures came to be made from stucco. The works of art improved to the extent that beautiful glazed plaques could be inlaid in the flaming pediments of the Sulamani temple. Therefore, it is observed that works of art and architecture of Bagan changed rapidly from the early reposing form to the higher and soaring are during the 12th century. It is assumed that such art and architectural developments could reflect the good economic, social and political conditions of that period.

In the 13th century, the temples became very lofty and big and the decorative arefacts were also made commensurate with the size of the temples. The stuccoworks of the Narathihapate temple are very artistic and hardly flake off. This can be attributed to the good quality of cement and high technology of making flaming pediments and figures of that time. In brief, the works of art and architecture underwent new changes from period to period. It is noticed that although the flaming pediments of the temples of Bagan period look the same, they will be found different when studied in detail. But all the changes are found commensurate with the changing times. Though the technology of making the flaming pediments did not develop during the Early Bagan period, it advanced quickly due to the good inspirations of artists and architects of Bagan period and their confidence in and enthusiasm for Buddhism. The Compression of floral and figural motifs is possibly local workshops and varied forms of religious practice unique to Bagan Buddhism. Moreover, through the study of the artefacts of the flaming pediments, which constitute one of the important works of art and architecture of Bagan temples built up to the 13th century, it can be known that the standard of art and architecture of that time was high, that the people were devoted to Buddhism and that the economic, political and social conditions of that time were favourable.

Acknowledgements
Firstly, I would like to express my special thanks to SEAMEO SPAFA for giving me a chance to read a paper at the 3rd SEAMEO SPAFA International Conference and then to write this research paper. Secondly, I would like to mention my sincere thanks to Professor Dr. Elizabeth Moore, SOAS University of London, ISEAS for her encouragement to write this paper. Thirdly, my special thanks go to SOAS SAAAP for supporting me during my research. Fourthly, I would like to thank Dr. Thida Win, Rector of the University of Mandalay and Dr. Tin Tun Aung, Pro Rector of the University of Mandalay for their moral support. Last but not least, I would also like to thank Dr. Ei Shwezin Myint,
staff-officer of the Department of Archaeology, Bagan Branch for helping me during my research in Bagan to write this paper.

References
Study on The Architectural Decorations of Wooden Buddhist Monasteries in Myanmar

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‘Vihara’ means monastery in Sanskrit and Pali but the word ‘kyaung’ is preferred in Myanmar. This paper discusses the dominant creations of architectural decorations of wooden Buddhist monasteries in Central Myanmar. These decorations can be categorised into: a) the basic decorations by traditional painting, b) nine ornamentations by traditional art c) depictions of mythical and legendary figures, d) decorations with narrative scenes. These ornaments inform aspects of Buddhism and are intended to build a close association with good guidance of Buddha to the society.

Introduction
Monasteries are built as a great works of merit by people, who typically provide better-quality materials and architectural decorations for their construction. These are specifically reflected to characteristics of Myanmar architecture and show the strong sense of religion. The earliest wooden monasteries in Myanmar can be found in the 18th century CE as the majority of wooden structures are destroyed by weather, fires and a series of big fires with the British conquest in 1885 and therefore, most of existing wooden monasteries are built around the 19th century CE. Thus, this paper is focused on the architectural decorations of wooden Buddhist monasteries in Central Myanmar that will become a basic outline for the maintenance and repair of these ancient wooden monasteries.

Study on the Architectural decorations of wooden monasteries in Myanmar
The architectural decorations of Buddhist monasteries in Myanmar are traditionally decorated with the ‘ten floral arts: ten pan arts’ that are also called deco architecture. These ten floral arts are as follows:
1. Pan-be: irons or black smiths,
2. Pan-pu: wood carvings,
3. Pan-yan: brick and stone masonry,
4. Pan-put: wood turnings,
5. Pan-dein: gold and silver smiths,
6. Pan-din: copper, bronze, or brass smiths,
7. Pan-tawt: fresco and stucco carvings,
8. Pan-tamawt: stone carvings,
9. Pan-yun: lacquerware, and
These ten pan arts are called deco architecture that are elaborately created and developed in the architectural decorations of Buddhist monasteries in Myanmar. Basic decorations that especially used in traditional arts, paintings and sculptural carvings of Myanmar architecture are as follows:

1. Kanote: foliage and flora decorations in classical composition,
2. Nari: sculptural decorations in anthropomorphic composition,
3. Kapi: sculptural decorations in propitious composition, and

Four basics of arts and architectural decorations in wooden monasteries

(1) Kanote: foliage and flora decorations in classical composition
Thick and thin floral decorations are widely used in stucco arts of Bagan period and they came to influence the decorations of the Innwa period. Htat-pan, layered floral decorations that go up to eight layers were well-established in Konbaung period. In the Late Konbaung period, the use and creation of Thai floral designs came into fashion. Yhon-sa-ywet (three-forked leaf designs) and ngasa-ywet (five-forked leaf designs) were also found in decorations of Late Konbaung wooden monasteries. The developments of floral designs become the main components of decorations in Myanmar Architecture.

(2) Nari: sculptural decorations in anthropomorphic composition
Buddha statues, human beings and devas in human forms and proportions are especially decorated at the religious buildings in Myanmar (Figure 1).

![Buddha statues in Myauk-lay-zin-yoke-sone monastery, Salin, Magway in Central Myanmar. Source: Field records by author Zin Mar Phyo, 2018.](image)

(3) Kapi: sculptural decorations in propitious composition
Decorations of famous stories, natural scenes, animals, and the guardians of Buddhist myths and legends with style of movements in action are widely decorated at religious buildings (Figure 2).

![Dancing sculptures in Myauk-lay-zin yoke-sone monastery, Salin, Magway in Central Myanmar. Source: Field records by author Zin Mar Phyo, 2018.](image)
Gaza sculptural decorations in gigantic composition
The decorations of mythical animals, monsters and guardians of Buddhist myths and legends in great proportions are usually decorated at the entrance ways of religious buildings in Myanmar (Figure 3).

![Fig. 3 Manuthiha and magan sculptures in religious buildings in Mandalay and Magway in Central Myanmar. Source: Field records by author Zin Mar Phyo, 2018.](image)

Nine types of basic ornamentations in wooden monasteries
The basic ornamentations of Buddhist monasteries in Myanmar are as follows:
1. Shwe-zawa-yae decorations: detail ornaments with gold and silver,
2. A-saw decorations: row of leaf, bird or deva-like motif decorations,
3. Du-yin decorations: finial decorations,
4. Sein-taung decorations: row of projecting decorations,
5. A-pyay decorations: filler or corner decorations,
6. A-htauak decorations: pillar decorations,
7. A-hpone decorations: cover or cap decorations on pillars,
8. A-tin decorations: top decorations in royal and religious accessories, and

Shwe-zawa-yae decorations
Detail ornaments with gold and silver of floral and foliage, fish-like foliage, fruit-like foliage, blossom foliage, dragon-like foliage, lotus-like foliage, beard-like foliage, and nan-byauk for royal uses are actually used at ceilings, and interior structures of royal palaces and Buddhist monasteries (Figure 4).

![Fig. 4 Shwe-zawa-yae in Ma-naw-ya-ma-on-don-pin monastery, Magway. Source: Field records by author Zin Mar Phyo, 2016](image)

A-saw decorations
Pan-saw: rows of floral or leaf-like ornament, nat-saw: rows of deva-like ornament and nyat-saw: rows of bird-like ornament are used at roof corners of royal palaces and Buddhist monasteries Floral shapes are commonly decorated at the projecting ends of gable roof structures of Myauk-lay-zin yoke-sone monastery (Figure 5).
Du-yin decorations
Du-yin-taik: peacock-breast-shaped decorations, and du-yin-laik: corner decorations also called daunt-pan are decorated at doorways and roof corners of royal palaces and Buddhist monasteries. The engraved forms of du-yin ornaments with devas, and mythical creatures are mainly created on the seven-tiered roofs as a representation of sanctuary of the shrine room in monastery (Figure 6).

Sein-taung decorations
Sein-kadone: row of blunt shape-ornament, seinwun: row of round shape-ornament, and sein-choun: row of diamond shape-ornament are traditionally built as boundaries of religious buildings. The row of upward leaf shaped ornaments are used to put on the exteriors and on the interiors, especially on the beams of the monastery (Figure 7).
**A-pyay decorations**
Lin-no-daung: bat-wing like decorations, pazun-tokekwe: curled leaf decorations, and thyat-kin: mango-bud volute decorations are mostly applied at pillars, and stairways of monasteries (Figure 8).

Fig. 8  A-pyays decorations of Myauk-lay-zin yoke-sone Monastery, Magway. Source: Field records by author Zin Mar Phyo, 2018.

**A-htauk decorations**
A-yoke htau: ornaments commonly with naya in royal merits, pan htau: floral ornaments, and put-lone htau: putlone ornaments are mainly decorated at the exterior pillars of monasteries (Figure 9).

Fig. 9  A-htauks decorations of Myauk-lay-zin yoke-sone Monastery, Magway. Source: Field records by author Zin Mar Phyo, 2018.

**A-hpone decorations**
Kyauk-hpone: stone ornaments, sint-hpone: glazed earthen ornaments, and thit-thar-hpone: wooden ornaments on pillars are commonly applied at the exterior pillars of monasteries (Figure 10).

Fig. 10  A-hpone decorations in Salay-yoke-sone, and Bagaya monasteries, Magway. Source: Field records by author Zin Mar Phyo, 2018.

**A-tin decorations**
A-yoke-tin: ornaments mostly of hinhas or nagas, a-byauk-tin: floral decorations, thin-kyaw-tin: line and pattern decorations are decorated at the accessories of royal palaces and monasteries (Figure 11).

Fig. 11  Lacquerwares with a-tins decorations at the Yangon National Museum. Source: Field records by author Zin Mar Phyo, 2018.
A-thoun-khan decorations
A-yoke-khan: ornaments mostly of hinhas and nagas, pan-khan: floral decorations, and thin-kyaw-khan: line and pattern decorations are decorated at the accessories of royal palaces and monasteries (Figure 12).

Fig. 12 Lacquerwares with a-thon-khan decorations at the Yangon National Museum. Source: Field records by author Zin Mar Phyo, 2018.

Mythical and legendary decorations in wooden monasteries
The detail carvings with full of spirits and actions are highly influenced in decorations of Buddhist monasteries in Myanmar. These mythical and legendary decorations are frequently found at the religious buildings in Myanmar such as temples, stupas and Buddhist monasteries. Then, mythical and legendary decorations of some famous wooden Buddhist monasteries in Konbaung period will be explained in the following data.

Decorative peacock
A symbol of sun to represent the growth of patriotism. Details of peacock are especially decorated at the upper parts and doorways of royal palaces and Buddhist monasteries (Figure 13).

Fig. 13 Peacock Decoration at Myauk-lay-zin-yoke-sone monastery, Magway. Source: Field records by author Zin Mar Phyo, 2018.

Decorative Rabbit
A symbol of moon to represent the peaceful of religious place. Details of rabbit are specifically decorated at the higher parts and doorways of royal palaces and Buddhist monasteries (Figure 14).

Fig. 14 Rabbit decoration at Shwe-inn-bin monastery, Mandalay. Source: Field records by author Zin Mar Phyo, 2018.
Decorative lotus
A symbol of purity to represent the birth and the holiness of Buddha. Details of lotus are commonly found at the ceilings and doorways of Buddhist monasteries (Figure 15).

![Lotus decoration](image15)

Fig. 15  Lotus decoration Myauk-lay-zin yoke-sone monastery, Magway. Source: Field records by author Zin Mar Phyo, 2018.

Decorative devas
A symbol of power and protection to show the scarcity of religious places in Myanmar. Pairs of devas are generally decorated at doorways of Buddhist monasteries (Figure 16).

![Devas](image16)

Fig. 16  Devas in Pyay-min-tha, Bagaya and Myauk-lay-zin yoke-sone monasteries in Mandalay and Magway in Central Myanmar. Source: Field records by author Zin Mar Phyo, 2018.

Decorative zawgyi
A symbol of guardian to protect the religious places are frequently decorated at the roof corners, and the walls of Buddhist monasteries (Figure 17).

![Zawgyi](image17)

Fig. 17  Zawgyi in Shwe-nan-daw, Myauk-lay-zin yoke-sone monasteries in Mandalay and Magway in Central Myanmar. Source: Field records by author Zin Mar Phyo, 2018.

Decorative garuda
A symbol of strength to protect the scarcity of religious buildings and also called gallon are decorated at the corners of pillar and roofs of Buddhist monasteries (Figure 18).

![Garuda](image18)

Fig. 18  Garuda in Bagaya and Myauk-lay-zin yoke-sone monasteries in Mandalay and Magway in Central Myanmar. Source: Field records by author Zin Mar Phyo, 2018.
Decorative Pairs of kein-nari-kein-nara
A symbol of love and beauty to represent the truthfulness of affection. Usually created at the roof corners and doorways of Buddhist monasteries (Figure 19).

Fig. 19  Kein-nara in Myanmar arts and kein-nara in Sale-yoke-sone monastery, Magway. Source: Field records by author Zin Mar Phyo, 2018.

Decorative hintha
A symbol of grace and beauty to represent the serene of beauty. Then, the details of hintha are especially decorated at the royal palaces and religious ornaments (Figure 20).

Fig. 20  Hintha in Myanmar arts, Pyay-min-tha and Shwe-nan-daw monasteries, Mandalay. Source: Field records by author Zin Mar Phyo, 2018.

Decorative naya
A symbol of strength and protection to protect evil spirits with a power to turn objects into ash are generally found at pillars of royal palaces and Buddhist monasteries (Figure 21).

Fig. 21  Pyay-min-tha, Shwe-nan-daw and Myauk-lay-zin-yoke-sone monasteries in Mandalay and Magway in Central Myanmar. Source: Field records by author Zin Mar Phyo, 2018.

Decorative magan
Used as a symbol of blessing with a prehensile snout and vice-like jaws are specifically found at the stairways of religious compounds and Buddhist monasteries (Figure 22).

Fig. 22  Magan in Myanmar arts and A-tu-ma-shi Monastery, Mandalay. Source: Field records by author Zin Mar Phyo, 2018.
Typical example of mythical and legendary decorations
These decorations are commonly base on a belief of religion. The lotus as a symbol of purities, devas and flying-men as a symbol of scarcities, peacock as a symbol of sun, nayas or nagas like serpents as a symbol of protections and magans as a symbol of blessings are decorated in Myauk-lay-zin (Figure 23).

![Decorations at the masonry stairs of Myauk-lay-zin-yoke-sone monastery, Magway. Source: Field records by author Zin Mar Phyo, 2018.]

Narrative decorations in wooden monasteries
The religious buildings are used to decorate with sculptural decorations that may differ in styles but give attractions to people. Then, the features of narrative decorations in Buddhist monasteries are:
1. Jataka stories: sculptural decorations of the former lives of Buddha,
2. Dhammapada stories: sculptural decorations of the sermons of Buddha, and
3. Folk stories: sculptural decorations of nature and culture of regions.

Jataka stories
Former lives of Buddha are extracted from 550 Jataka stories that would build up the close associations to basic practices of Buddhism (Figure 24).

- a. Temiya Jataka: story of Buddha show perfection in patience (khanti-parami of Buddha),
- b. Thuwana-thama Jataka: story of Buddha show perfection in kindness (metta-parami of Buddha),

![Sculptural decorations of Jataka stories in Shwe-nan-daw monastery, Mandalay. Source: Field records by author Zin Mar Phyo, 2018.]

Dhammapada stories
Sculptural decorations of sermons of Buddha: dhammapada stories are basically shown a guide way to Buddhism. Examples; Ma-sa-wa dhammapada stories that actually shown the trouble of a man who is captivated by the beauty of Ma-sa-wa (Figure 25).

![Fig. 25 Decorations of Ma-sa-wa Dhammapada story at Salay-yoke-sone and Myauk-lay-zin-yoke-sone monasteries, Magway. Source: Field records by author Zin Mar Phyo, 2018.](image)

Folk stories
Sculptural decorations with nature and culture of regions are benefit to understand the social and daily life of rural people (Figure 26).

- Style of a wealthy woman: creative dressing styles in social and daily life influenced by western style around 19th century CE show the western culture came into rural and influenced to Myanmar
- Style of a man: traditional Myanmar dressing styles in social and daily life show the design and style of ancient Myanmar people
- Style of a town officer: traditional Myanmar dressing styles of royal servants show the design and style of ancient Myanmar royal servants

![Fig. 26 Decorations with culture of regions at Hman-kin-yoke-sone monastery, Magway. Source: Field records by author Zin Mar Phyo, 2018.](image)

Typical example of narrative decorations
These decorations are commonly base on a belief of religion. Six main pillar corners of pyat-that-hsaung are decorated with dhammapada stories: sculptural decorations about the sermons of Buddha, but south-west corner is not existed (Figure 27). Moreover, the common handrails at the other parts of hsaung-ma-gyi are decorated with folk stories: sculptural decorations of cultures, social and daily life of people that concerning the secular ways of regional areas at Salin township in Magway region (Figure 28 and 29).
Fig. 27  Narrative decorations at the corner posts of handrails in Myauk-lay-zin-yoke-sone monastery, Magway. Source: Field records by author Zin Mar Phyo, 2018.

Fig. 28  Narrative decorations at northern and southern part of handrails in Myauk-lay-zin-yoke-sone monastery. Source: Field records by author Zin Mar Phyo, 2018.
Moreover, the narrative decorations in wooden monasteries are used to decorate with the belief of Buddhist cosmology concept that the upper parts are represented to the arupalawka and rupalawka (20 bouns) and the lower parts are realized to the kabalawka (11 bouns) (Figures 30 and 31).

Upper level = Arupalawka and Rupalawka (20 bouns)
Lower level = Kabalawka (11 bouns)

Figure 30. Buddhist Cosmology in Architectural Decorations of Myauk-lay-zin-yoke-sone monastery
Source: Field records by author Zin Mar Phy, 2018
Conclusions

The decorations of ancient wooden monastery in Myanmar have repaired and maintained by the Department of Archaeology and National Museum, Ministry of Religious Affairs and Culture. However, the punctual conservations and restorations are actually need to be developed to maintain their architecture. By studying the architectural decorations, the essential features of decorations in religious monasteries around 19th century CE can be viewed as follows:

(a) Four basic arts and architectural decorations of wooden monasteries,
(b) Nine types of basic ornamentations in wooden monasteries,
(c) Mythical and legendary decorations in wooden monasteries, and
(d) Narrative decorations with Buddhist cosmology concept in religious architecture.

The author believe that this research helps to study, observe and repair the architectural decorations of monasteries. And therefore, this research paper gives an appropriate approach to repair and maintain the architectures of wooden monasteries with regard to the original characters of them.
Acknowledgment
The author deeply offers the gratitude to her teachers, Dr. Thet Oo, Professor and Head of Architectural Department, West Yangon Technological University and Dr. Thet Thet Mon, Professor of Department of Architecture, West Yangon Technological University, for their kind help during the research. Moreover, the author would like to express the sincere thanks to all persons who help during the field studies for this research and gives special thanks to the 3rd SEAMEO SPAFA International Conference on Southeast Asian Archaeology.

References
Understanding the Heritage Significance of Wet-Ma-Sut Monastery in Myanmar

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Myanmar is lucky to possess much tangible and intangible heritage from ancient periods to modern days. Among the tangible heritage, colonial built heritage is one of the noteworthy ones in Myanmar. Colonial architecture can be perceived in different building types such as churches, monasteries, schools, office buildings, commercial buildings. My research discusses the colonial architecture of the Wet-Ma-Sut monastery, located in Myaung, Sagaing region of upper Myanmar because of its heritage significance in historic, aesthetic and scientific aspects. For its historic value, the monastery is now nearly 100 years old because it started construction in 1918 and finished in 1921. For aesthetics, the two-storied colonial building is elegant because of great structure with two grand stairs, distinctive spiral stair, rhythmic and harmonious openings, ornamented ceilings and partitions, adorned veranda, parapet wall and projected edges. The unique composition of colour and texture are well-suited to the monastery. From the scientific standpoint, load-bearing brick walls are used to support the strength of the building. By the combined usage of teak columns, beams and floor in interior spaces expresses the former construction technique. The finest architectural details of wood carving decorative arts enriching the interior and the plaster mouldings enhance the outer surfaces of the buildings, which indicate the intelligent ideas and skill of the workmanship. To retain the cultural significance of Wet-Ma-Sut monastery, a conservation management plan including maintenance, preservation and restoration works should be introduced to responsible organizations and local societies. Disaster risk reduction should also be considered because the monastery can be affected by the natural disasters such as flood, earthquake, fire and man-made hazards such as theft and neglect. The local and regional development will advance by familiarizing the place to tourism development programs.
Introduction
The nation that preserves much of its heritage can enhance its culture and national identity. There are comprehensive examples of tangible and intangible heritages in Myanmar from ancient periods of Pyu, Bagan, Pinya, Inwa, Nyaungyan, Konbaung, Colonial to the modern days. Myanmar was colonized by British in 1885 and so colonial buildings were established all over Myanmar. Colonial heritage (1885-1948) can be found as historic towns and places, ancient monuments and structures, infrastructure, decorative arts and so on. This research discusses the Wet-Ma-Sut monastery which was established during the colonial period in Myanmar. The influences of colonial style can be studied at monastery although the building was built and donated by Myanmar people.

By doing this research, the following aims will be achieved:
- Safeguarding historic places and sites
- Fulfilling the National Cultural Heritage Laws of Myanmar
- Assisting in the conservation of built heritages
- Appreciating the architectural characteristics of colonial buildings
- Promote local and regional incomes by familiarizing the site to tourism development plans

Description
Wet-Ma-Sut monastery is one of the colonial style structures in Myanmar, but is little-known because of being in the remote area. It is located on the southern vicinity of Myaung, Sagaing region, in upper Myanmar. The geographical coordinates of the monastery are 21° 49’ 29” N and 95° 25’ 20” E (Figures 1 and 2).

The monastery complex is bounded by an ancient stupa complex ‘Pae Shwe Gu’ built by King Alaungsithu of Bagan (12th century CE) to the north, the residential area to the west, the Tha-Yet- Pin Monastery to the south and the Ayeyarwaddy river and agricultural fields to the east. Located on the west bank of the river, the monastery compound is annually flooded within the time of rainy season (July to September). The main building is oriented with an east-west direction in the complex. The rectangular plan with projections composes with the dimension of 90 ft on east-west direction and 56 ft on north-south direction. Because of its orientation, ventilation and lighting can flow in the north-south direction (Figure 3).

The ancient banyan tree (Bawdi Tree) is a notable feature located on the southern part of the complex. Another interesting one in complex is entrance gateway with the motto *Dieu Etmon Droit* which means “God and My right” in French, and is also the motto of the British monarch (Figure 4). Some parts of the gateway have tumbled down by weather and neglect.
Heritage Significance of the Monastery

According to Australian ICOMOS’ Burra Charter (2004), Heritage Significance (or Cultural Significance) means the historic, aesthetic, scientific and social or spiritual value for past, present or future generations. Based on the charter, the heritage significance of Wet-Ma-Sut Monastery will be discussed with respect to its historic, aesthetic and scientific aspects. Because of gigantic structure and architectural form, the monastery is dominant in its region.

Historic Value

The monastery was founded on 6 August 1918 and finished in 10 January 1921, so the building is nearly 100 years old. According to the item no. 2(h) of the Protection and Preservation of Cultural Heritage Regions Law (2019) of Myanmar, the definition of ancient monuments mean the structures where are a period of 100 years and above in existence, above ground and underground, above water or underwater, where human has been settled and utilized, including geological environs where fossils are found. Therefore, the monastery would be recognised as regional heritage in near future because of its significance. By studying the descriptions and old photos, the donor of the monastery was U Htin Paw and Daw O, who were the rich persons in that area.

Aesthetic Value

By means of aesthetic significance, two-storied colonial styled monastery can be seen as elegant building because of its gigantic structure with harmonious colour composition and rhythmic openings and projections.
**Spatial organization**

The building is a two-storied structure, but in former times, the monastery had a basement which was linked to the donor’s home using an underground passageway.

In front of the building, the main porch with two side steps that lead to the interior spaces at the ground floor (Figure 7). The shrine area with a large hall is the dominant portion and is surrounded by the chief monk’s room and two storerooms under the upstairs porches. The hall in the ground floor can also be approached from the southern steps.

When studying the first floor, two long and massive stairs lead to the interior areas (Figure 8). The shrine area with the main hall is similar to the ground floor. Around the main hall, the monks’ room, the multifunction room, and the storeroom are organized. The veranda over the porch overlooks the surrounding environment. The spiral stair in the main hall is used to connect the ground floor and the first floor.

The main halls in the ground floor and first floor can be used for multiple functions such as paying homage to the Buddha Image, keeping the Dhamma from the monks, donation ceremonies, and community activities. All spaces can catch good lighting and ventilation because of their orientation.

**Form**

When viewing the form composition of the monastery, the most significant aspect is the stairs. Two gigantic brick stairs from the southern façade approach the upper floor. The handrail of brick stairs was proportionally decorated with Konbaung style stair called Tha-Yet-Kin. A teak spiral stair (Kyaung Lain) expressing late Konbaung style leads to the upper floor.
The openings, veranda, handrails and parapet walls are harmoniously composed all over the monas-
tery. The pilaster design with projected edge is one of the characteristics of colonial architecture. The
modular four-panel wooden doors and windows with colonial caps are rhythmically coordinated on
each facade. Usage of imaginary windows among the real windows has been used aesthetic purposes.
The four-panelled wooden doors are also served as partitions to the interior spaces.

Decorative arts
The architectural details of decorative arts and ornaments enrich all over the building components
especially on stairs, handrails, openings, pilasters, ceilings, curtain walls and parapet walls. The com-
bination of colour and texture is one of the unique characteristics of colonial architecture (Table 1).

Decorative works can be highlighted as;
• Painting design: unique composition of colour and texture all over the monastery
• Plaster and stucco work: Mouldings on exterior walls and parapet walls
• Timber arts: Partitions and stairs in the interior
• Gold decorations: Ornamented Ceilings and capitals of columns
• Glass usage: Decorations on openings, handrails at Shrine

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<td>Colourful Glass over Openings</td>
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Table 1 Decorative arts found in Monastery. Source: Mya Mya Hnist.
Scientific Value
The adventure of brick construction is technical importance. The main structural system is a load-bearing construction three feet wide using brick and stone. The teak floor is supported by joists, beams and columns expressing the former timber construction technique of post and beam. The ceiling is carried under a timber frame. Well-ordered design of openings and pilasters can be seen as the advancement of workmanship and skill in past time.

Approach on Heritage Conservation to the Monastery
Conservation includes the maintenance, preservation and restoration works that should be planned after analysing the existing condition. Conservation works must be carefully prepared not to lose its authenticity and integrity. The research is approached by using SWOT (strengths, weaknesses, opportunities and threats) analysis.

Strengths
The strengths of this property is that the monastery still exists with original characteristics, so that there must be carefully retained not to lose its authenticity and integrity. For Intangible Aspects, religious festivals and social activities are also celebrated as follows:

- Annually Paying water to The Banyan Tree (Nyaung-Yay-Thun-Pwe ) at full moon day of Kasone (within May)
- Weekly Activities, Keeping the Sila (Five precepts, Seven precepts, Nine precepts) of The Buddha from the monks at Sabbath days.

Weakness
The following weaknesses were identified:

- Structural analysis at main porch must be done as soon as possible as it was damaged by earthquake and the main porch can fail at any time. The restoration works must be faithful to the original and the choice of materials must be appropriate with the original construction.
- Leakage of rainwater: Grouting and plastering works must be done for rainwater leakage from the roof slabs.
- The cracks occurring on the walls of main structure and on the porch should be maintained carefully not only for structure but also aesthetics.
- Material failure on handrails at veranda needs to be remoulded and plastered again to the original condition.
- Use of new PVC pipes instead of original rainwater steel pipes is one of the missing original attributes of the monastery. The PVC pipes should be removed and changed with the steel pipes which are the original.
- New reinforced concrete columns have replaced the original teak posts in the ground floor.
- The reconstructed eastern brick step at the main porch is not the original construction.
- Some parts of the building are fallen down because of weather and lack of maintenance. Most of the decorative objects are also needed to be maintenance for sustainability.

Opportunities
Because of the existence of the heritage significance of the monastery, the site has potential for attracting tourists. Community based tourism could be implemented and awareness programs of Heritage value should be introduced to authorities and local communities.

- Some infrastructures such as access roads, pavement and shelter should be provided without disturbing original visual and physical aspects.
- The security and safety planning for tourists.
- The tour plans may be Heritage tour, boat tour in Ayeyarwaddy river (July to September), cart tours in traditional landscape (agriculture fields) (October to June), Intangible Heritage tour (e.g., Seasonal Festivals, local lifestyle and customs)
• Home stay for improvement for community’ economy
• Restaurants and traditional souvenir shops should be supplied

**Threats**
The following threats can be affect the Wet-Ma-Sut monastery:

**Natural disasters**
• Because the monastery is near the Sagaing Earthquake Fault, the building is prone to structural failure.
• Fire is the main disaster in this region because of the hot and dry summer and the residential area exists on the west and east nearby. Flood is an annual event that affects some part of the monastery complex

The monastery can also be affected by man-made hazards
• Theft is a relatively low risk compared to other risks.
• Neglect will be decreased when the local community knows the importance of heritage conservation

Because of affecting above disasters, disaster management plans should be introduced to the cultural heritage site.

**Conclusion**
The Wet-Ma-Sut Monastery should be conserved not to damage its existing cultural significance. Public awareness programs including seminars, training courses, workshops should be implemented to know the importance of Heritage Value. Conservation must be carefully done appropriate with the Protection and Preservation of Cultural Heritage Regions Law (2019) of Myanmar. Conservation management plan including maintenance, preservation and restoration works should be introduced to responsible organizations and local societies. Technical Training courses should be arranged to working groups for heritage conservation. Disaster risk reduction programs should be considered for sustainability of the monastery. By planning tourism development, local and regional incomes would be promoted.

**References**


There is a lack of interest in the colonial architectural heritage in Southeast Asia due to the difficulty in assuming the legacy of foreign cultures as an element of a country’s identity. It has rarely been concentrated on by tourism authorities and developers as revitalizing the historic buildings for commercial or other purposes. Southeast Asian countries was the land of European colonization throughout the 16th and 17th centuries while revealing the well-designed buildings and town planning with the influence of western architecture that can be seen nowadays. Until recently, one may see in Myanmar the harmonious co-existence of important buildings, dating back to 19th and 20th Century with architecture being the most tangible heritage from colonial times representing Neo-gothic, Neo-renaissance and Tudor-style buildings spread across the Yangon Central Business District (CBD). Aside from its vibrant history and rich culture, the identity of typical north-south grid layout of the streets in the Yangon CBD demonstrates an example of Latin American town planning. However the situation is subject to change due to a number of development projects that are creating architectural inconsistency between the historic buildings and modern structures. This paper points out the current research and legislation on the conservation of urban heritage, historic urban landscape and integrated management plan of the historic core of cities from Southeast Asia in general, and Yangon CBD in particular, in accordance with balancing economic, social and cultural aspects. Moreover, it also highlights the restoration or adaptive reuse of old buildings plays an important role in the conservation of historic buildings, both as a source of income as well as increase local businesses.
**Introduction**

Yangon is an exceptional testimony of being a cosmopolitan city from the British colonial era to till now and in particular for the civilization that dominated the trade and economy stretching over across the globe. Moreover, it is a multi-cultural area with the evidence of Buddhist monuments, Christian churches, Mosques, and Hindu Temples stretching over historic downtown Yangon. These buildings were complemented by the largest collection of late nineteenth- and early twentieth-century colonial architecture in Southeast Asia. However the situation is subject to change due to a number of development projects under process creating architectural dissonance between the listed historic buildings and modern structures become very important issue because of economic mismanagement under decades of military rule then condemned the country to poverty, but in the process preserved many of its historic buildings. Yangon, like many other Southeast Asian countries, has no defined zoning for specific function. In 1996, the Yangon City Development Committee (YCDC) in coordination with Yangon Heritage Trust (YHT) undertook an inventory of heritage buildings in Yangon which include all together one hundred and eighty nine buildings for conservation, which covers memorial buildings, elements and religious ethnic buildings. Authorized institutions and respective organizations are seeking to solve the conflict between conservation and new developments in the Yangon central business district. For safeguarding the city’s unique urban heritage and historic urban landscape, it is very important to encourage the long-term sustainable heritage led development that can find a balance between development and heritage conservation that can contribute to solve the problems in downtown.

**Colonial Architectural Heritage in Southeast Asia**

Colonial architecture is the tangible heritage from colonial times, showing evidence with magnificent and elaborate buildings with different styles in Southeast Asia; authorities are reluctant to reveal their colonial legacy in previous time in contradictory they came to realize and initiate to promote their colonial heritage in tourism industry which is one of the sources of income money for local community. Moreover architecture expressed the power and ambition of colonial empires and their desire to drag these colonies into ‘modern’ times.

Looking back to the Malaysia’s history and its culture are demonstrated through its heritage buildings. Unique colonial architectural styles building standing today left behind by colonial powers of Portuguese, Dutch and British colonial rule in Malaysia over three centuries. These unique heritage buildings can be found in all major cities such as George Town, Kuala Lumpur, Kucing, Malacca, Ipoh and Taiping and these were built with different architectural styles such as four major architectural styles namely Moorish or Mughal (Old General Post office built in Kuala Lumpur Malaysia in 1894), Tudor (Royal Selangor club built in 1884), Neo-classical (Municipal council building in George town built in 1879) and Neo-gothic (Carcosa Seri Nagara in Kuala Lumpur Malaysia built in 1897) and influences during the colonial era (1511-1957) (A. Ghafar Bin Ahmad 1993: 3-11).

In Myanmar, the British colonists constructed the vast amount of impressive and splendid buildings in Art Deco, Neoclassical, Queen Anne, Victorian and blend with Burmese traditional architecture and Western architecture so called Burmese British architectural styles are widespread all through the upper and lower regions. Downtown Yangon has dozens of elegant buildings demonstrating with these architectural styles buildings, mostly were built with Victorian styles. Apart from the architectural styles of buildings, the grid layout of the streets in central business district (CBD) demonstrates an example of Latin American town planning.

Similarly, French Indochina carries cultural influences that can still be seen nowadays. Hanoi is dominated by leafy grand boulevards bordered by beautiful colonial villas, mansions and impressive public buildings. And like a jewel, the stunning Opera House holds court in the city centre, emulating in its details the Paris Opera house (Alaydroes 2019). Not only Hanoi but Ho Chi Minh City have
influences showing its Post Office since 1886 is a classic reminder of Gustave Eiffel (Cooper 2000). During the French colonial period in Lao PDR (from 1893-1953), France integrated its architectural elements into traditional Lao architecture and modified them to suit the climate. In Luang Prabang or in Champassak village in Laos, beautiful classic French villas began to influence subtle changes in the design of Lao urban dwellings (Vongvilay et al. 2015).

Looking back to the colonial period of Dutch in Indonesia, Holland seems to have left the least grand structures. Bandung in West Java was Indonesia’s new capital at that time and the city has an abundance of Art Deco buildings that were constructed until Indonesia’s independence, probably the world’s second largest collection after Miami Beach (Passchier 2006).

Singapore has also rediscovered its colonial heritage after destroying many more elegant Victorian buildings in the seventies and eighties. Adaptive reuses were undertaken in historic buildings for public uses such as Peranakan Museum, the Singapore Art Museum or the Museum of Asian Civilizations (Koh-Lim 2019).

Half a century after most Southeast Asian countries gained their independence, interest in colonial architecture has definitely made a comeback; Penang and Melaka were listed as UNESCO World Heritage Site in 2008 thanks to efforts to preserve the traditional architecture and culture (UNESCO 2012).

**International Charter on Significance**

The idea of significance first appeared as an archaeology term in the 1970s, and in the late 1980s and early 1990s, significance begins to appear more frequently in the British and American conservation vocabulary (Emerick 2003). In 1990s, the idea of significance has become commonplace stemming from its use in the Burra Charter, where it is presented as ‘cultural significance’. Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present or future generations (Australia ICOMOS Incorporated 2013). ‘Cultural significance’ is a concept which helps in estimating the value of places and also underpinning to identify the attributes such as ‘historic’, ‘social’ or ‘archaeological’. Significance plays a basic tool to develop conservation policies or principles to protect cultural heritage. In this case, the image of Yangon is associated with its vibrant history, evidence of tangible and intangible cultural heritage showing its historic artifacts and buildings associated with spiritual or social. Much of the architecture in downtown Yangon dates back from the period of British rule which lasted from 1824 through to the creation of Burma in 1948. They constructed a great number of grand, impressive, majestic buildings in Victorian, Queen Anne, Art Deco, British Burmese and Neoclassical style. It is realized that these urban heritages have important and significant architectural styles and are related to the characteristics of the past. Apart from its majestic architectural buildings, Bonnie Burnham, president of the World Monument Fund says “It was a major center of international exchange. Famous writers and famous people lived here and wrote about it and so it has a legacy that is completely unique” (Heijmans 2016). Yangon is regarded as a unique architectural city, having served as a major trading hub for the ethnic Indians that inhabited it in the early 20th Century. It can be said that Yangon is a testimony of multicultural or metropolitan city with the peak of colonial urbanization in 18th and 19th century as well as one of international trading centers of Southeast Asia.

**Potential threat of urban heritage in Southeast Asia**

The historic core areas are classified into four categories in the Operational Guidelines for the Implementation of the World Heritage Convention (UNESCO World Heritage Center 2005a). ‘Historic Centre of Yangon with Living Urban Heritage’ falls into the third category; ‘Historic centres enclosed within modern cities that cover exactly the same area as ancient towns.’ However, globally, most historic core areas are actually today historic districts within larger modern cities (Imon 2006).
According to the Hoi An Protocol, the heritage of Asia is under increasing threat from a variety of forces linked to population growth, environmental degradation, rural-to-urban migration, urban redevelopment, industrialization and globalization of both the economies of the region and the traditional socio-cultural fabric.

Concerning with Changting (China), Wang (2007) mentioned that many historic structures in China are not well preserved and are even demolished to make space for development. Even as tourism is just beginning to develop, economic and residential development is threatening the historic fabric of the city by not including the concept of living community in Chinese law and not relating heritage conservation to economic growth and development (Chan and Ma 2003). Wang (2007) continued that development is placed at the top of the agenda while historic preservation is pushed aside when development or recovery is “urgent”, the only context in which governments tie development with preservation seems to be tourism and pressures from residential, tourism, and industrial development is the biggest problem for heritage preservation in both countries. Finally, there are arguments as historic preservation and economic development can be aligned or that historic preservation is even a type of long term economic development.

Same as Yangon Central Business District, newly built extensive high-rise buildings were replaced in invaluable old administrative and residential buildings with the regardless of pertaining the city’s infrastructure and built heritage’s vista since the military government gained power in 1962 and former Yangon administrative capital moved to Nay Pyi Taw in 2005 respectively. Some standing residential and commercial heritage building were dilapidated due to lack of maintenance and long neglect whereas some were replaced with incompatible design that contributes to change the historic urban landscape. The main issue is that the owners of the old buildings are willing to reconstruct for proper purpose and repair without permission as well as the pivotal problem is lack of knowledge how to gain the benefit or profit by adaptive reuse of colonial-era buildings.

Beautiful residential and commercial heritage buildings, deteriorated from long neglect, are being torn down at an alarming rate and replaced with poorly designed structures that fail to integrate within the historic context. According to Yangon Heritage Trust (YHT), as much as 35% of downtown Yangon was replaced with poorly inhumane high-rise buildings design between 1990 and 2011 that mainly focus on own benefit without considering the maintenance of city’s urban heritage. These highlight in alert rate and need to identify which are colonial listed buildings and stop much more demolition without permission. In 1996, Yangon City Development Committee (YCDC) listed 189 buildings as historic colonial buildings that were protected under the municipal government in close collaboration with YHT in maintenance of built heritage with awareness rising of how importance of urban heritage is.

Reviewing International Charters for Yangon Context

Well known international charters such as the Athens Charter, Venice Charter, ICOMOS Barra Charter and Washington Charters are mainly focused on the conservation of cultural heritage as well as protection and management of cultural heritage sites. The International Charter for the Conservation and Restoration of Monuments was initiated after the heavy destruction of historic buildings by World War II so that architects and technicians were recognized to protect these buildings after war, so-called the 1964 Venice Charter. According to UNESCO’s “Recommendation Concerning the Safeguarding and Contemporary Role of Historic Areas” (UNESCO 1976), and also in various other international instruments, “the conservation of historic towns and urban areas” is underpinned for the protection, conservation and restoration of such towns and areas as well as their development and harmonious adaptation to contemporary life. The Washington Charter points in the conservation process need to develop the conservation plan must address all relevant factors including archaeology, history, architecture, techniques, sociology and economics (ICOMOS 1987).
Regarding to one of the Getty Conservation Institute’s projects, GCI undertook the project in collaboration with Think City (a division of Khazanah Nasional in Malaysia) about Urban Conservation Planning in Southeast Asia to improve urban conservation practice and methodologies. Moreover the Krakov Charter states that “the conservation of built heritage is implemented by the project of restoration, including the strategy to conserve in the long term. This restoration project should be based on a range of appropriate technical options and prepared in a cognitive process of gathering knowledge and understanding of the building or site…..” (De Naeyer, Andre, SP Arroyo, and JR Blanco 2000). In the case Yangon, the concentration of colonial heritage building in downtown Yangon can demonstrate the country’s legacy as well as national heritage which can be promoted similar to Melaka and George Town’s World Heritage attributes. So a conservation and restoration strategy is needed for the historic buildings in accordance with proper guidelines and principles for conservation of urban heritage. According to YHT’s publication named Yangon Heritage Strategy pointed out the eleven majestic colonial buildings of vacant use were proposed to have restoration practice based on proposed Yangon Conservation Guidelines in line based on ICOMOS Burra Charter (Thant Myint-U, Moe Moe Lwin, Mann, R. and Chan, H. 2016).

After broadening the scope from monuments to historic centers in the 1960s and 1970s, the concept of heritage was extended to cultural landscapes and cities as living heritage at the turn of the twenty-first century. UNESCO has introduced concepts that can be related to historic urban landscape, starting from the 1976 Recommendation concerning the Safeguarding and Contemporary Role of Historic Areas, which very pragmatically refers to buildings, structures and open spaces that constitute settlements recognized from ‘the archaeological, architectural, pre-historical, historical, scientific, esthetical, socio-cultural and ecological points of view’ (UNESCO, 1976). In 2011, UNESCO adopted the Historic Urban Landscape (HUL) recommendation and called for the application of a landscape approach to ensure the integration of cultural heritage policies and management concerns in the wider goals of sustainable urban development (Ginzarly et al. 2019)

Historic Urban Landscape Conservation is one of the most difficult areas of cultural heritage conservation and awareness of all stakeholders and community participation is so important. There was widespread agreement that criteria and guidelines for conservation management of the historic urban landscape are urgently needed and that existing charters and recommendations in this regard are no longer sufficient. So an international conference on the subject of “World Heritage and Contemporary Architecture”, which was requested by the World Heritage Committee at its 27th session (Paris, 30 June-5 July 2003, Decision 27COM 7B.108) and held May 2005 in Vienna, Austria, more than 600 experts and professionals from 55 countries were put comments and recommendation for outline such criteria and guidelines what is now labeled as the Vienna Memorandum. The Vienna Memorandum points out the guidelines for conservation management, guidelines for urban development and development and implementation of management plan for the historic urban landscapes (UNESCO 2005a).

Based upon that memorandum, UNESCO studied the possibility for formulating a new recommendation to complement and update the existing ones on the subject of historic urban landscapes that’s why upcoming new recommendations were submitted and finally adopted by UNESCO’s General Conference on 10 November 2011 such as:

• To undertake comprehensive surveys and mapping of the city’s natural, cultural and human resources;
• To reach consensus using participatory planning and stakeholder consultations on what values to protect for transmission to future generations and to determine the attributes that carry these values;
• To assess vulnerability of these attributes to socio-economic stresses and impacts of climate change;
• To integrate urban heritage values and their vulnerability status into a wider framework of city development, which shall provide indications of areas of heritage sensitivity that require careful attention to planning, design and implementation of development projects;
• To prioritize actions for conservation and development;
• To establish the appropriate partnerships and local management frameworks for each of the identified projects for conservation and development, as well as to develop mechanisms for the coordination of the various activities between different actors, both public and private (UNESCO 2005b).

In case Yangon, in 2014, the “Strategic Urban Development Plan of The Greater Yangon” that was conducted by Yangon City Development Committee (YCDC) in collaboration with Japan International Cooperation Agency (JICA) (JICA and YCDC 2013) has been adopted by the regional authorities. JICA’s Greater Yangon Strategic Plan calls for action on ‘heritage and urban landscape’ in five specific areas such as: (1) recording of historical and cultural heritage, (2) establishment of the guidelines for urban regeneration plan utilising heritage buildings, (3) establishment of a management plan for the implementation of conservation, (4) cultivation of human resources and (5) expertise for heritage related construction and implementation to renovate heritage buildings and urban landscape (Su Su and Toe Aung 2016). The Yangon Heritage Trust produced the Yangon Heritage Strategy (Thant Myint-U, Moe Moe Lwin, Mann Rupert, Chan Hugo 2016) which combines immediate action with long-term planning on the principles and guidelines for the conservation of built heritage and historic urban landscape to create Asia’s most livable city.

Reviewing International Documents for Maintenance of Historic Buildings by Adaptive Reuse

Altering existing buildings for new functions is not a new phenomenon; in the past buildings that were structurally secure have been adapted to fit changed needs or new functions without questions or theoretical reflections (Plevoets and Cleempoel 2012). For example during the Renaissance period, monuments from ancient times were transformed for new uses. During the French Revolution, religious buildings were transformed for industrial functions or military uses after they had been confiscated and sold (Cunnington 1988). In contemporary conservation theory and practice, adaptive reuse is considered to be an important strategy towards conservation of cultural heritage (Jessen and Schneider 2003).

There are potential economic and social advantages to adaptive reuse. If the building is in good structural condition and easily adapted to its new program, there are economic advantages. These include the potential for lower construction cost, lower land acquisition cost, and less construction time depending on the extent of the work done. Adaptive reuse has also become a strategy for the conservation of energy, an economic issue in terms of the use of resources. Same as in Yangon Case, architects and conservators find the proper way to stop demolition of good structural background of old buildings is the restoration for another purposes by adaptive reuse in alliance with Yangon Heritage Conservation Law. It can provide the social advantages and a link to the past in addition to revitalizing a neighborhood. As the conservation practice had to deal with these ‘new types of heritage’, interest for adaptive reuse as a methodology towards conservation grew. In 1964, The Venice Charter points out the importance of adaptive reuse within the conservation practice saying that “the conservation of monuments is always facilitated by making use of them for some socially useful purpose” (ICOMOS 1964).
Effectiveness of Current Legislation and Institutional Framework for Conservation of Heritage in Yangon

Heritage buildings in the city have not been as sustainable in the future. Modernizing the city while protecting and promoting its tangible and intangible heritage represents a key challenge. According to the Krakov Charter (De Naeyer, Andre, SP Arroyo, and JR Blanco 2000), the protection and conservation of the built heritage could be better enabled if greater legal and administrative actions are taken. This should be aimed at ensuring the conservation work is only undertaken by, or under the supervision of, conservation professionals.

In Asia, there are many legal protection or conservation principles are enacted for safeguarding of their heritage. For example, the legal protection to a building as heritage in Hong Kong is graded based upon ‘monumental quality’ as outlined in the Antiquities and Monuments Ordinance enacted in 1976). In Indonesia the 1992 Cultural Heritage Ordinance is evolved from and similar to the 1931 Dutch Monumenten Odonantie Stbd No. 283, (Fitri et al. 2017) and in Singapore, the conservation principles of Urban Redevelopment Authorities and In Section 2 of the Malaysia National Heritage Act 2005 (Act 645) and Preservation and Conservation of Cultural Heritage Enactment (1988) (Harun and Ismail 2011) are drawn from international sources such as the Venice Charter, Principles for the analysis, conservation and structural restoration of architectural heritage (ICOMOS Charter 2003) and the Burra Charter (1988 version). These principles or charters point out the conservation requires an appropriate ‘project of restoration’ that defines the methods and aims that requires an appropriate use, compatible with the existing space and significance.

As for Myanmar, “The Protection and Preservation of Cultural Heritage Regions Law” (Ministry of Religious Affairs and Culture, 1998, amended in 2019 (Pyidaungsu Hluttaw 2019) identifies only the urban area under the nominated world cultural heritage site as well as ‘The Protection and Preservation of Ancient Monuments Law’ (Pyidaungsu Hluttaw 2015) are limited to ancient monuments and sites which are more than a hundred years old. In addition, urban heritage categories such as street patterns and landscape etc. are not included in the law. As there is no sufficient legal background for all categories of urban heritage at the national level, the “Proposed Yangon Heritage Conservation Law” (Proposed by Yangon Heritage Trust in 2013) was submitted to the Regional Government however, it has not yet been enacted. Hlaing Maw Oo (2006) pointed out that ‘at present, the law covers only ancient sites leaving out the other categories of heritage sites’. Another piece of legislation existing at the Local level related to the conservation of Urban Heritage is the Yangon Municipal By-Law. It consists of height control restricting the number of storeys in two designated areas that around the Shwedagon Pagoda and Shwephonepwint Pagoda.

Although the Conservation Law has not been accepted by authorities, YHT produced interim legislation to protect built heritage and historic urban landscape of Yangon as well as to assist government in management of urban heritage like:

• Moratorium on demolition of heritage assets
• Establish interim review process
• Identification of all public assets
• Protect and open up key public assets
• Review commercial uses and development threatening public assets
• Interim conservation area designations
• Interim individual heritage place protection

Yangon Heritage Trust (YHT) set up the strategy for action plan for short-term and long-term designation to be one of the livable and comfortable cities in Southeast Asia. The restoration of heritage buildings creates a wide variety of local jobs and generates income for local businesses. The work
of fixing up and adding to heritage buildings is specialized work that requires up to twice as many tradespeople as a typical new development. Although the principles and guidelines are developed, it is need to follow up by authorities and developer and local community.

**Previous, Ongoing Research and Future Planning for Heritage Buildings in Yangon CBD**

For safeguarding the city’s unique urban heritage and historic urban landscape, it is very important to encourage the long-term sustainable heritage led development that can find a balance between development and heritage conservation. In order to protect Yangon’s standing historic buildings, the Burmese government has instated the Yangon City Heritage List. The list contains a large number of historical buildings, mostly schools and government buildings from British colonial era as well as religious and resident buildings in order to prevent demolish or repair without permission. The institutional body of management and conservation of built heritage in Yangon is authorized Yangon City Development Committee (YCDC) in coordination with non-government organization Yangon Heritage Trust (YHT) and Turquoise Mountain Myanmar. YHT was established in 2012 as a center of excellence in urban built heritage and landscape and its management with setting the standard for good heritage practice. In January 2015, an international conference builds momentum in the heritage field looking further positive developments related to Yangon’s built heritage, including the termination of major construction near the Shwedagon Pagoda, the completion of an urban planning training program in the city, and the initiation of several restoration projects. However, continued efforts are needed to protect the historic urban landscape and traditions that make Yangon unique. Recently a moratorium was established, that forbids demolition of all buildings older than 50 years.

Moreover YHT proposed the Yangon Heritage Strategy over the last year with assistance of its staff from various professional backgrounds. Action Plan was produced and a set of principles and guidelines for conservation, restoration and adaptive reuse of the colonial heritage buildings in conformity with Yangon’s culture, social and political context. Currently YHT has been systematically undertaking the conservation of urban built heritage of downtown Yangon and supporting technical assistance to YCDC on policy development for management of built heritage while promoting public awareness about the importance of heritage conservation and gaining profit from adaptive uses of historic buildings. Moreover YHT is currently providing technical support including research activities to 65 historic building conservation projects in line with international conservation principles and provisions. YHT and Turquoise Mountain Myanmar collaborated in heritage building restoration works, for instance, they worked together with local architects, technicians, and craftsmen in the restoration of Tourist Burma Building and the Secretariat Building for adaptive reuse of another functions with setting up the international conservation management plan for each project. In the future they hope to restore historic buildings all over Myanmar with the same procedures adopted in Yangon.

Yangon was included on the 2014 World Monuments Watch, and studies on the economics of its preservation, the character and form of its neighborhoods, and the connection between its real estate markets and historic buildings were undertaken by various institutions with technical know-how over the following year. Hopefully, it will be exploited to increase awareness among authorities, technical bodies and the general public about the need to develop and implement urban heritage consistency. Yangon Heritage Strategy identifies 12 key principles for a livable Yangon including ‘well-conserved unique natural, cultural and built heritage’ as one principle and need to implement with strategic way in long-term planning to be Asia most livable city in the future. Moreover continuous research works need to be done in coming year along with seminars and workshops to find the utmost way to maintain or strengthen the cultural heritage of Yangon. These are the very first steps to collect attributes to meet one criterion to upgrade the national level to world level.
References


Harun, SN and Ismail, I (2011) The conservation plan for the world heritage site: George Town, Penang and Malacca, Malaysia, paper presented at 1st International Conference on Rebuilding Place: From Culture to Art and Architecture, 4 October, University Kuala Sylah, Banda Aceh, Indonesia.


To what extent did geographic determinants and cultural choices influence lithic technology systems? Presentation of the methodology chosen for my future PhD project

Sejauh manakah penentu geografi dan pilihan budaya mempengaruhi system-sistem teknologi lithic? Pembentangan metodologi yang dipilih untuk projek PhD masa depan saya

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This paper exposes the methodology chosen for my future PhD research on the lithic assemblages from Sabah (Borneo), between 50,000-5000 BP. This article focuses on presenting Sabah as a strategical place to understand the adaptation and migration during the last climate change. In this perspective, the study of the evolution of the stone knapping techniques is a pertinent and original approach to decrypt cultural complexities from palaeoecological perspective. Indeed, in the Palaeolithic era, a period marked by major climatic phenomena (before and after the Late Glacial Maximum-LGM around 18,000 BP), new technical developments occurred in response to environmental changes.

Introduction
This article develops the prospective methodology chosen for my future PhD research on the lithic industries from Sabah, during the last important climate change (50,000-5000 BP). We will expose first, the environmental and cultural context. Then, the aim of the project and the reason why to use a crossed technological approach is important. Finally, we will explain the various approaches and their contribution to the problem of ‘to what extent did geographic determinants and cultural choices influence lithic technology systems?’

Between the Indo-Malaysian continental platform and the archipelagos (Indonesia, the Philippines, Borneo), some major terrestrial migrations were possible during marine regression periods (Voris 2000). During glacial stages, the emergence of two supercontinents (Sunda and Sahul) was accompanied by a drop in rain fall that radically changed the biotopes. The most spectacular change was the decline of the tropical forest. In certain areas, it allowed for a type of open savannah vegetation to exist, thus facilitating the access and occupation of certain regions (Bird et al. 2005; Wurster et al. 2010; Wurster et al. 2019). These climatic changes were also the prelude to a behavioural adaptation of Palaeolithic populations, which could be observed in the development of the lithic industries over time (Andrefsky 2005; Forestier et al. 2018).
The particularity of the Southeast Asian prehistoric era is connected to the fragmented geography of the area and the large number of biotopes concerned. This resulted in a multiplicity of forms of human settlement, which ranged from strategies related to the establishment of sites and preferential areas for the acquisition of raw material to those associated with the diversity of the flora and fauna of each island, hunting area, etc. (Forestier and Patole-Edoumba 2000). Lithic industries emerged from these variations and the Palaeolithic groups had to adapt their knapping techniques according to these parameters.

The lithic assemblages of the late Pleistocene early Holocene illustrate a marked contrast between the mainland Southeast Asia (China, Laos, Thailand, Cambodia, West Malaysia, Sumatra), where the Hoabinhian techno-complex occurred between 40,000 and 3,000 BP, which is characterised by the sumatralith (Forestier et al. 2013; Ji et al. 2015; Forestier et al. 2017; Zeitoun et al. 2019) and the eastern archipelago by a great heterogeneity of lithic production (Patole-Edoumba and Forestier 2000; Reynolds 2007; Marwick et al. 2016; Reynolds 2016; Brumm et al. 2018). Borneo, situated between these two technical worlds, could have been the place of transition in terms of lithic production or could be the representation of distinct migrations during the Pleistocene (Forestier and Grenet 2019). Lithics recovered from Borneo, as yet, do not have any Hoabinhian assemblages, however, unifacial pebble tools have been found in the west part of Borneo in Gua Sireh, Sarawak, which might be a sub-sample of a Hoabinhian reduction (Reynolds 2016). The scenario seems to be different in Sabah (Bellwood 1984; Bellwood 1988; Zuraina et al. 1998; Abdullah 2014; Mokhtar 2014; Abdullah 2017) and the eastern part of the islands with various lithic assemblages present (Grenet et al. 2016; Forestier et al. 2018). Is this difference due to response of cultural constraints and/or environmental ones? The research focus of this project will be: To what extent did geographic determinants and cultural choices influence lithic technology systems in Sabah between 50,000-5,000 BP?

**Aims of the Project**

Sabah represents a strategic place in Borneo to understand human adaptation on the edge of the Sunda shelf and network connections or migrations with the Philippine and west-Indonesian archipelago. The Malaysian part of Borneo, especially Sabah, is rich in sites from the late Pleistocene/early Holocene period ranging between 50,000 and 5,000 BP, where humans left a concentration of the principal technological knapping systems (core tools, bifaces, flake tools and (micro-) laminar products). However, the different lithic industries made by the last hunter-gatherers in Sabah have not been the topic of comparative techno-typological analyses.

The Palaeolithic of Sabah requires a detailed overview of the chronology of the cultures present and the time periods, the typologies and the lithic technologies, as well as the cultural movements and their influences. So, while considerable progress has been made in the area of palaeo-environments (Zuraina et al. 1998; Barker 2002; Louys and Meijaard 2010; Abdullah 2017); the technological response to them is lacking. In this perspective, the culturalist approach to the topic needs to be reinforced for the island of Borneo, particularly Sabah. As yet, present studies (Bellwood 1984; Bellwood 1988; Zuraina et al. 1998; Abdullah 2014; Mokhtar 2014; Abdullah 2017) do not provide a chrono-typological framework in the light of the persistence of certain “simple” systems of lithic productions.

Often overlooked, these systems need to be detailed, evaluated and prioritised in order to obtain a comparison between different sites on a similar time scale. Although the objective of this study is to highlight the diversity of technical behaviours and thus to determine differences between inter- and intra-groups variability, it will also provide a technological approach to the lithic industries that demonstrates the way in which the adaptation to the environment impacted upon knapping techniques. The technological study of the lithic industries of Sabah will provide a reference framework that will serve as a comparison in the light of a synthesis of behaviour and human adaptation in the
context of a humid tropical climate. This will provide evidence as to whether the lithic industries of the region follow a logical law of adaptation and/or evolution over a long period, i.e. if one or several technical lineages were retained by the hunters gatherers who populated the forests of the Sabah. In order to create a comparative, inter/intra-site model, we shall opt for a study of sites according to a synchronic and diachronic vision in a similar environment. We shall then integrate the human occupations with a different palaeo-environment. The research will be designed around three main axes:

• Construction of a lithic typology specific to the study area, which could be a reference work (establishment of a repository of the types of tools found, a work that is still lacking, in order to make inter-/intra-site comparisons)

• Determination of the evolution/adaptation of knapping techniques in the Sabah (determination of the operational sequences);

• Creation of a model for future comparisons and evaluations with other Borneo sites, sites from Indonesia and the Philippines.

**Methodology**

*Material of the study*

The Sabah is an exceptional research laboratory in which to understand the evolutionary modes/or adaptation of the technical production of the lithic industries during the end of Pleistocene/beginning of the Holocene. Indeed, Sabah presents an example of broad geomorphological, floristic, faunistic and cultural diversity. The technological choices imposed by humans in varied environments should show a recurrence in the techniques used, but also their relative effectiveness, and the continuity or the abandonment of other less appropriate techniques.

*Sites*

The choice of the assemblages has been made regarding different constraints:

• Sites providing a chrono-stratigraphy, where the whole lithic artefacts have been collected.

• The same settlement pattern, with the same change in the continuity. This should illustrate whether the resource economy (food, raw material) has been the same and, which answer has been found to the needs in terms of technological behaviour.

• Contemporary Sites with different patterns, in order to highlight whether variability could be seen in the resource economy influence the technical behaviour and how.

The following sites have been selected according to the potential of available lithic assemblages, as well as their specific palaeo-environmental contexts and are classified in two categories, which will allow categorisation of the variation within their assemblages (Figure 1).
Sites with similar location specificities
Open-air sites on the shore of the palaeo-lake (the oldest occupation) with a chronological continuity of occupation in the adjacent mountain range (cave, rock shelter)

Mansuli/Gua Samang (Abdullah et al. 2014; Abdullah 2017)
The valley of Mansuli shows indications of a long period of human occupation. The known sequence stretches from 235,000 BP to 15,000 BP according to OSL dating. The oldest site is open-air and situated at the edge of a palaeo-lake, while more recent occupation sites have been found in the Gua Samang cave. The former has produced four cultural layers ranging between 235,000 and 15,400 BP, while the fourth cultural layer of the latter has been dated from 46,000 to 10,970 BP. The different types of settlements show a change in the lithic industries. Those changes are marked by the domination of shaping industries in the oldest occupation, decreasing to almost disappear in the most recent layers, moreover a notable change with an important decrease in retouched flakes appears between 20,000 BP and 15,000 BP. Finally, the cluster analysis has demonstrated a change in flakes size, which tend to be standardised during the more recent phase of occupation, which has been interpreted as results of environmental stress (Abdullah 2017).

Tingkayu/Madai, Baturong (Bellwood 1984; Bellwood 1988) (Figure 2)
The Tingkayu sites (TIN1, TIN2) are organised around a palaeo-lake shore dated from 28,300 ± 750 BP. Around 18,000 BP, drainage of the lake around Baturong led to the digging of habitable rock shelters (Bat1), while Madai sites MAD1, MAD 2 are cave sites located in the next massif, where the occupation occurred between 11,000 and 7,000 BP. The lake was drained around 16,000 BP close to the TIN1 and TIN2 sites. These two sites featured a bifacial industry crafted in a specific tabular chert. However, as the TIN1 site had been disturbed, the results of the study are not as reliably important as those conducted at TIN2. The TIN3-11 sites featured a flake industry with more recent settlements and have more in common with the Madai/Baturong settlements located in the adjacent massif.
The techno-typological study of the lithic industries in TIN1 and 2 demonstrated that the artefacts had been produced using chert, probably from a unique source, but not yet located. In addition, the entire chain of operations is present on the site and provides evidence of a reduction sequence, i.e. preparation of nodules (with a preferential choice for 20–40 mm thickness), shaping out (along one side then the other) and finally, retouching and finalisation. A typology based on the morphology allows classification of the hand-held tools as spherical and rectangular. Finally, this assemblage comprises a relatively high number of tips compared to the bases. Bellwood explains this as a possible reuse of the bases after retouching. The research led by the University Sains Malaysia provided a date for the occupation of TIN2 by OSL as 12,000 BP. Thus, this industry would be contemporaneous to that found at the Baturong sites (Saidin 2014).

The Baturong/Madai massif industries (Bellwood 1984; Bellwood 1988)
The industries of this period (17,500 - 7,000 BP), as well as the Madai, Baturong and Tingkayu 5–11 sites, have similar characteristics contrasting completely with the industries of TIN1 and TIN2.

Techno-typological studies have not provided a clear differentiation between these various assemblages. In general, the industries of these sites were focused on the research of a cutting edge. The debitage was performed by using a hammer stone on flint nodules collected at the edge of rivers situated close to the sites. The raw material of MAD1 is a poor-quality chert, while the TIN5-11 and Baturong sites used chert with better knapping properties.

The largest flakes (10–40 mm) show use-wear. Lithic tools were used to make implement from softer materials, such as wood and bamboo, as well as for the butchery. No regularity in the form of the flakes has been recorded, which contrasts with the TIN1/2 industries. This type of basic size appears to have persisted until approximately AD 200. The Madai/Baturong industries cover a large period (+10,000 years) and do not seem to vary.

Certain cores had several removals and were intensively exploited. By contrast, most cores had no dominant strike platform. Some had a sub-prismatic tendency due to parallel flaking with the majority of these tools originating from the BAT1 site. The Baturong industries have the greatest percentage of flakes with dorsal ridges (approximately 50%). Despite these types of flake and cores, no laminar industry could be identified. The flakes show a transversal break with retouches or use wears on the cutting edge and/or the proximal side resulting from the removal of the striking platform. According to use wear analysis, some tools have a shiny layer on the cutting edge suggesting that they may have been used to cut the palm leaves used in basketry.
Sites with different palaeo-environmental characteristics

Balambangan (Sabah) lithic industries (Zuraina et al. 1998; Abdullah 2014)
Gua Balambangan is a cave settlement located (17,000–8,800 BP) on the coast of North-east Sabah. The marine resources seem to have been exploited only in the early Holocene, while large terrestrial fauna appear to dominate the resources exploited.

Only a brief description of lithic material is available as a preliminary report. Excavation of the site revealed a lithic flake industry where the debitage took place in the cave. The size of stone tools tends to decrease, through the occupation. The raw material is chert, the nearest source being located at approximately 1 km west of the site on the island of Kelutan.

The previous studies show a high potential for determining adaptation to a new environment, as well as the possibility to highlight the impact on the technical behaviour following those changes. Now, results of the research on the lithic industries of the Sabah demonstrated that parts of some sites had received little or no study. In addition, those sites that benefited from in-depth study did not focus on cultural determination using a techno-typological approach. For this reason, it is necessary to adapt the methodology by coupling and crossing the various data from other technological approaches in order to understand the different cultures present, as well as their evolution, revealing their entire dynamic. In addition, some small excavation will be led on the oldest excavation sites, in order to
improve first, the chrono-stratigraphy, and second to increase the palaeo-environmental data. A 2 × 2 metres test pit will be excavated on the sites of Tingkayu, Baturong and Madai.

The Analysis
This research will be based on a study of lithic production systems using a crossed-technological methodology, i.e. techno-typological, techno-functional, techno-economic and 3D scan analysis (volume, structure and mass). This approach aims at the same time to determine the final outcome (the intended goal to respond to the needs) in terms of tools as well as the overall technical behaviour of humans across the different “chaînes opératoires” (Pelegrin 1995; Geneste 2010).

• A typological approach: categorisation and grouping according to the morphological, technical and functional characteristics.
• A technological approach: reconstruction of the expertise used by establishing the knapping technic (Inizan et al. 1995; Pelegrin 1995; Andrefsky 2005; Clarkson and Hiscock 2011; Tostevin 2011).
• A techno-functional approach: structural analysis of the object to determine necessary criteria for the efficient use of the tool (Boëda 2013).
• A techno-economic approach: relationship between the technical systems and the socioeconomic phenomena connected with the different quality of raw material sources and procurement strategy. So these relationships will be demonstrated by studying the management of the raw materials, the blanks and the tools (Inizan et al. 1995; Geneste 2010).

The study of technical behaviours of the lithic assemblages from Sabah between 50,000-5,000 BP should demonstrate (1) the adaptation to a new environment, but also (2) the migration across Sabah and the archipelago. The methodology presented here has been chosen, in order to define the extent of each factor (environment, economic and cultural) involved in the lithic production. In this perspective, the adaptation of lithic productions can be considered as the solution found in order to have the right balance between the constraints (technical, environmental, cultural) at the entrance and the ones at the exit (needs) (Geneste 2010).

The first objective will be to understand, classify and specify the stone tools. In other words, we will determine the procurement and the management of the raw material, techniques and methods of transformation, management of the blank in different tools and their maintenance (Pelegrin 1995; Boëda 2013; Conard and Will 2015). We will determine the variation resulting from different constraints, to highlight the diversity of technical behaviours. It will also provide a technological approach to the lithic industries that demonstrate the way in which the adaptation to the environment impacted knapping techniques. This analysis will be leading sites by sites according to their chronological layers where they have been found.

The second objective will be the construction of a typology of the stone tools adapted to Borneo lithic material. This is the establishment of a repository of the types of tools found, in order to make inter-/intra-site comparisons on the island scale and at other sites in the Philippines and Indonesian archipelago, such as those well dated on the island of Java.

The third objective will be to compare these different assemblages in perspective from a synchronic and diachronic angle with varied and/or similar palaeo-environments. This approach will allow a horizontal and vertical vision of the lithic production of the hunter-gatherers at the end of the Pleistocene/beginning of the Holocene. The diachronic examination of production modes and their intents provide the data to study the presence of one or several technical lineages regulated by evolutionary laws. In this way, we will estimate the longevity of each specific technical system, i.e. in terms of efficiency, transmission, perennity and sometimes, mutation. Using this methodology, we also propose to evaluate the mechanisms and cause of the cessation of certain techniques to the benefit of others.
(e.g. dual shaping/debitage), taking into account external factors (such as the environment, symbolic significance, etc.).

Finally, the creation of a model for future comparisons and evaluations: artefacts vs. ecofact. This allows understanding the diffusion, movement or abandon of certain techniques, highlighting the possible migration in Sabah and the archipelago around.

**Conclusion**

The previous research led in Sabah has highlighted a rich potential to understand the human behaviour in context of environmental changes during late Pleistocene/early Holocene. This has been the start point of this PhD project. The aim is to use a crossed technological approach of the lithic assemblages from Sabah to answer the following question: to what extent did the geographic determinants and the cultural choices influence the technical systems? And secondly to highlight the diffusion, evolution or abandonment of certain knapping techniques.

Borneo located between the mainland and the archipelagos is one of the stops used by the human migrations, on the margin of the axis Malaysia-Sumatra-Java. It could has been one of the ways to Philippines (Pawlik et al. 2014; Neri et al. 2015). Moreover, Sabah has revealed several sites from the late Pleistocene/early Holocene producing a great variety of stone tools artefacts, contrasting with the Hoabinhian techno-complex known for the mainland.

The particularity of the environment and its material culture are key points of this study, we have in some varied and restricted zones, evidence of human settlement during the Pleistocene. These restricted areas of continued settlement are represented by Tingkayu/Baturong, Madai and Mansuli/Gua Samang and are characterised by a change in technology. In addition, this settlement occurred during large climatic variations at the end of the Pleistocene, thus necessitating a rapid adaptation of the means of subsistence. These variations were the catalysts for generating research for technical solutions to respond to changes in the external environment. However, the internal environment could have also influenced the technical behaviour. In order to determine these various influences and thus allow comparison of the data of the lithic industries and palaeoenvironment, the study will integrate coastal site (Balamabangan). Following those determinations, we will explore the possible migration, through comparison of the lithic assemblages on similar time scale, with sites from Philippines and Indonesia. This could help to understand the network connexion between Borneo and the surrounded area, such as Philippines and Indonesia.

**Results Attending**

- To what extent did the geographic determinants and the cultural choices influence lithic technology systems (constraint definition).
- Contribution to decrypt the socio-economical exchange during the prehistory (raw material exchange, between sites region, etc.).
- Possibility to highlight a phenomenon of technical reinvention (technic variation).
- The results will give us a new model in order to make some comparison with sites at larger area (movement, abandon, mutation of technic).

**Acknowledgements**

I would like to thank Hubert Forestier and Tim Reynolds for their advice, support and reviews of this article. I would like also to thank Mokhtar Saidin (director of the Centre of Global Archaeology Research, USM) and Arif Abd Hamid (director of Sabah Museum) for their collaboration in this future project. I would like thank Peter Bellwood to have sent pictures of its field work in Sabah, as well as given me the permission to use his illustrations and pictures. I would also have a special
thanks to National Geographic Society, as I have just been awarded a (RFP) grant, which will enable to continue this research over the next year.

References


30 years after P. Gorecki and D. S. Gillieson in Papua New Guinea: New data on the Holocene settlement of East Sepik, Upper Karawari-Arafundi Region

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Our research at Paimbunkanja (PBK) rock shelter (East Sepik, PNG) uncovered an archaeological sequence dating back to the late Holocene between 2,956 and 1,300 years cal. BP. Two stratigraphic units (SU1 and SU2) contained lithic tools, and the raw materials used for knapping were mainly local. The modalities of the knapping process follow a chaîne opératoire associating debitage and shaping methods. Human occupation in the PBK site is part of the Holocene chrono-sequence proposed by P. Gorecki and D. S. Gillieson in 1989. This confirms a blade production associated to macro-tools from 3,000 years BP in the Sepik lowlands.

The history of research in the East Sepik and the Upper Karawari-Arafundi region

Papua New Guinea (PNG) was first settled in the late Upper Pleistocene at least 50,000 years ago (Summerhayes et al. 2017; O’Connell et al. 2018), as evidenced by deposits from high altitude valleys approximately 1600 masl such as the open-air sites in the Ivane Valley (Summerhayes et al. 2010). Paradoxically, considerably less is known about the first populations that settled in the lowlands, including the Sepik floodplain, due to a crucial lack of archaeological chronological references. Although numerous surveys have been conducted in the lowland coastal areas, because they are easily accessible (Summerhayes et al. 2017), few surveys have been carried out in the inland areas of the northern region. This is due to the wet equatorial forest environment which is difficult to penetrate and rather hostile (Swadling et al. 1988), posing logistical problems when surveying and establishing archaeological sites. The establishment of long term projects has little to do with the physical environment.

Although the lowlands of the Sepik-Karawari region are little known from an archaeological perspective, it has a longer history in anthropological and ethnographic research (see the fieldwork of Mead and Bateson in the 1930s - Mead, 1934 - and others, e.g. Pawley et al. 2005). Apart from the programs started last year in the East Sepik by the French Prehistoric Mission in Papua New Guinea (MPF-PNG), only the excavations conducted by P. Gorecki and D.-S. Gillieson in the late 1980s
(Gorecki and Gillieson 1989), in the nearby Jimi-Yuat Valley, reported archaeological findings from what may be considered the largest wetland in the Indo-Pacific (Figure 1).

The pioneering research of Gorecki and Gillieson (Gorecki & Gillieson 1989) aimed to find archaeological evidence at the highland-lowland transition in the Jimi-Yuat Valley. The Highlands fringe is of scientific interest because the Sepik Basin and its tributaries must have played a strategic role as channels of communication since prehistoric times (Swadling et al. 2008). Thus, the hypothesis that the river may have been transport routes across the plain and the river valleys conduit for communication between the plain and the uplands, guided the preliminary works of the 1980s and also our research thirty years later.

Open-air and rock shelter surveys in the Jimi-Yuat valley provided new cultural, environmental and chronological information (Gorecki and Gillieson 1989), such as the presence of an industry on pebble earlier than 5,000 BP at Yeni Swamp (540 m/alt), and forest clearance dating between 5,000 - 4,000 BP, followed by a blade lithic industry dated to at least 3,000 BP at the QBB rock shelter (Ritaumada, 280 m / alt). The authors concluded that the presence of macro-pebble tools in the Sepik region around 6,000 BP could be comparable to those found in the Central Highlands. From around 3-2,000 BP a lithic blade may reflect the onset of horticultural practices. This could explain why exchanges with the Highlands ceased in the Middle Holocene.

Another consideration is that around 2,000 BP the lowlands were less populated compared with the high-altitude valley sites. This could be a key period of transition in the settlement history of the region, in demographic, economic, social, and technological terms. According to the authors, the Wahgi groups increased their quarrying work to produce axes with a very characteristic “planilateral” shape around 2000 BP (Gorecki and Gillieson 1989). These types of axes were also found in the Jimi-Yuat valley, an observation related to the fact that humans and axes usually travelled together.
The authors of “A Crack in the Spine” (Gorecki and Gillieson 1989) also suggest socio-economic changes in the highlands and lowlands. This reflects the “altitudinal logic” of settlement history; these two geographical areas had been interacting as early as 10,000 years BP. Around 6,000 years BP populations interacted at an increased rate. This increase can be explained by environmental factors (rise in sea levels towards the current sea level) and climatic factors that have, among other factors, affected the physiography of the Sepik basin with the delimitation sensu stricto of a floodplain. This mid-Holocene period is crucial because it marks the end of the “inland sea period” in the Sepik-Ramu region and the maritime connection between it and the Bismarck Sea to the foothills of the central highlands (Chappell 2005; Swadling 2010).

In summary, from this period the Sepik region became a large, swumpier basin, less practicable and probably less viable as a habitable environment (e.g. pathogenic pressures, limited resources). Consequently, this region was probably depopulated in favour of the healthier, more fertile and more prosperous Highlands, where larger populations were organised in more complex ways compared with the simple organization of villages along the Sepik Basin waterways (Golson et al. 2017). Thus, the gradual abandonment of the fringe highlands during the period 4,000 - 2,000 BP was the result and/or the consequence of migration to the highlands where there was an increase in agro-horticulture.

From a palaeo-environmental perspective, the palynological study of sedimentary fills from Jimi-Yuat generated very interesting information on the anthropisation of the landscape. This identified the presence of a closed and dense forest in the mid-Holocene around 5,000 BP, followed by a reduction in forested area over the next two millennia thought to be the result of anthropogenic activities specific to horticulture in the swamp environment (e.g. slash-and-burn practices).

Thirty years after this first archaeological research in Jimi-Yuat, the French Prehistoric Mission in Papua New Guinea (MPF-PNG) decided to survey further west in the Sepik, in the karsts of Upper Karawari-Arafundi region. This region is located about 100 km south of the shoreline of the north coast of New Guinea and Wewak, the capital of the East Sepik Province. The Inyai, Auwim, Ewa, and Meakambut groups, inhabit of this area and have been the subject of various anthropological studies (Buhler 1961; Roscoe and Telban 2004; Edmund and Sullivan, 2008; Sullivan 1998, 2012), but only one reliable archaeological survey (Gorecki and Jones 1987 a and b; Gabriel and Gorecki 2014).

These researchers did not excavate any sites but did carry out systematic surveys of more than one hundred rock shelters with paintings in the vicinity of the Auwim village (Gabriel and Gorecki 2014). Different ethnic groups have used these caves for funerary and ritual ceremonies since the late prehistory until very recently. These caves and the rock art paintings they contain have been the subject of preliminary description (Edwards and Sullivan 2008; Gabriel and Gorecki 2014), but they have never been scientifically studied or dated, due to time and logistic constraints related to fieldwork in a challenging forest environment.

The study and survey area of the MPF-PNG (2017-18) was based on these preliminary data and targeted a karst massif, several ten square kilometres, rich in caves and shelters located intermediate relief zone marking the Highlands / Sepik fluvial transition (Figure 2). The aim of this article is to present the chrono-cultural results obtained in the Arafundi region by the MPF-PNG team from the first survey conducted in the Paimbumkanja rock shelter. This rock shelter is located a few kilometres from Auwim village (Figure 2) and close to the rock painting sites visited over various field seasons, such as Pumdimbung, Aprannakanja, Kundumbu, and Pukang (Tsang 2018).
Environmental and stratigraphic setting of the Paimbumkanja rockshelter

The prehistoric rock shelter site of PBK is at an altitude of 200 m asl, located 3.4 km southwest of the Auwin village (East Sepik Province in the Arafundi basin itself a tributary of the Karawari river that drains into the Sepik river (Figures 3 and 4.1). From a geomorphology perspective (Löffler 1974, 1977), the Sepik river drains the large area of northern New Guinea (Central Intermontane Trough) by receiving the waters from both the Northern Coastal Ranges and those of the northern slopes of the central Cordillera, also known as the New Guinea Highlands. The site is situated in the low altitude foothills (100 - 300 masl) of the foot of the Northern Metamorphic Range. The geological environment of the site is the so-called “Sepik” complex (see the Sepik Complex of Davies 1990, 2012) which groups together volcanic, metamorphic, and sedimentary rocks (produced by the erosion of the two other rocks). Around PBK there are two detrital formations (Figure 3): the Salumei formation and the Karawari conglomerate (Dow et al. 1972). The PBK shelter probably results from erosion of the conglomeratic facies forming the high cliffs along the banks of the Arafundi River. So, the geological context is not karstic, there is no limestone. The site is located in a spur of detrital rocks (coarse conglomerate and sandstone of the Karawari and Salumei formations).

The archaeological excavations revealed a stratigraphic sequence down to 150 cm below the ground surface (Figures 4 and 5). The base of the excavation starts with many blocks on which two stratigraphic units were laid, SU2 then SU1. Each SU is limited by a level of pebbles and contained a black layer. From an archaeological perspective, and excluding the spit 14, 15 and 16, all the other contained lithic remains. Only the ground surface provided other non-lithic types of remains (fragments of shells and ceramics) (Figure 5). We analyzed these deposits to determine the origin and post-deposition history of the shelter’s sediments. Four sediment samples were taken and analyses were conducted including: particle size distribution (Miskovsky and Debard 2002), calcimetry (Cailléux and Tricart 1963), magnetic susceptibility (Djerrab 2002) and water and organic matter contents (CEAEQ, 2003). The facies are sandy-loamy black to brown and dark yellow brown, with
Fig. 3 Geological map of southern Sepik area (Papua New Guinea), locating Paimbunkaja and the main watercourses. Source: Modified from Dow et al. 1972 by S. Puaud.

uniform granular and coarse grain size fractions. The sample contain angular fragments of sandstone (conglomerate matrix) and pebbles; therefore, they are identified as puddingstone. Their lithology is varied: volcanic rocks, metamorphic rocks, and quartz.
The sedimentological study of PBK generated four important results (Figure 5):

1) **Grain size**

The granulometric analysis of each sample showed that in general the global composition of the sampled sediments are very similar: sediments of coarse fraction (> 2 mm) represent a quarter to less than a third of the total mass of the sample. The dimension of the coarse fraction is between 2 and 16 mm. Coarser elements (16 - 31.5 mm) exist but are less frequent. The fine fraction has a sandy (80 %) and silty (20 %) texture. The grain size distribution of the base samples (4 and 3) is identical with a majority of coarse sands (Sg). There is a clear difference between samples 1 and 2; although the percentage of sand is comparable for both, the distributions are very different. There is a difference between the percentage of Sg and other particle types: in sample 2 the latter increases at the expense of Sg.
Fig. 5 a) Stratigraphic column with sedimentary facies, stratigraphic units, archaeological sample locations and radiocarbon dating; b) Grain size analyses: (1) Global grain-size (sector diagrams): for all samples ratio coarse/fine fraction is very close (1/4 to 1/3); (2) Fine fraction grain size (frequency curves): all curves are bimodal, with fine sand (63 to 200 µm) and medium/coarse sand (500 µm); (3) Coarse fraction grain size (histograms): The dimensional classes and their frequency are slightly variable, but the counted pebble number is small, there are only a few units for classes larger than 8 mm. (East Sepik, Papua New Guinea). Source: S. Puaud.
2) Calcium carbonate
The total carbonate content of the sediments is very low, being less than or equal to 0.1 %.

3) Magnetic susceptibility (MS)
Two groups of sediment are classified from the MS measurements: the first group is composed of black layers and the superficial horizon; the second group is only sample 3. The difference between the values is related to the concentration of iron oxide in the sediment.

4) Water and organic matter (OM)
The sediment contains about 10 % water, and sample 4 about 20 %. OM values remain between 2.5 and 4.5. The black layers have the highest values.

Thus, the results of the sedimentological analysis of the sequence of the PBK rock shelter show that all the deposits of the sequence come from the surrounding rock. The weathering of the conglomerate fragmented the sandstone matrix and released pebbles. Variation in the proportion of fine and coarse fractions reflect the heterogeneity of the substrate. The granulometric analysis of the fine fraction highlights variations in the upper part of the sequence. These appear to be related to the leaching of the finest particles of the superficial horizon. This horizon (SED1) is therefore enriched with coarse sands and vice versa for the underlying layers (SED2). OM and SM analyses highlight the most organic and oxidised facies. These two characteristics can be related to the anthropization of the sediment (e.g. remains of meals, feces, vegetable litter, fires) and characterize the two black layers and the superficial layer.

Study of the lithic material at Paimbumkanja

Material and methods
A limited test square extending 2 m², denoted by B and C, was excavated and revealed lithic material in a stratigraphic context (Figures 2, 3, 5, 6). A total of 601 lithic objects were recorded in stratigraphic unit 1 (SU1) and 149 objects in SU2. The Spit 6 contained the most material with 116 objects, which could correspond to a peak in the frequentation and number of knapping activities in the rock shelter during the mid to late Holocene.

Accepting the lithic deposit peaks, the lithic tools are distributed very homogeneously in SU1 and SU2 throughout the stratigraphy. Thus, we do not observe a high concentration of tools, or a particular type of tool, in a given level that could suggest a specific activity or a key moment in the occupation history of the rock shelter.

It is clear that the presence of a layer of blocks between the two SUs, located between the spits 9 and 10, did not generate a difference in the vertical distribution of lithic artefacts, neither in the nature of the artefacts, nor in the raw materials. Thus, whether it is the core, the laminar products or even some remarkable tools like “chisels” (whole or broken), their distributions are random in the archaeological sequence.

In addition, it is difficult to provide more information on the taphonomy of the PBK site given that the excavation stopped at a layer of small boulders, which may not have been the substratum (bedrock).

Laboratory methods included the created an Access database (Microsoft®Access®2016). The access form has 14 records; five are quantitative: excavation year, artefact number, length, width, thickness; and nine are qualitative: square, spit number, lithic code, retouch, burn, use, raw material, heel, and
observations. An individual artefact identification number, (from 1 to 750), was assigned to each lithic piece in SU1 and SU2. For the qualitative data a coding table provided for different characters, such as raw material, which were determined petrographically using a macroscope (x20).

**Procuring and exploiting raw material at PBK**

The raw materials present in the two SUs (SU1 and SU2) of squares B and C are homogeneous throughout the archaeological sequence (Figure 7). The raw material has a local origin; it was collected in the environment close to the site. Pebbles are predominant in the aggregate of the shelter wall, and they could have been detached due to erosion. The dominant material is quartz, which represents half of the archaeological corpus (Figure 7).

The raw materials in the two SUs have similar compositions, for example, a very low percentage of limestone rocks between 0% and 0.5%. This frequency, however, can be around 10% in the case of silicified limestone rocks which reflects the deliberate choice of people to preferentially use rocks of siliceous composition, which are known to be easier to knap. This type of rock is highly available in
the secondary and primary positions in the near environment at PBK. This is also the case for sandstones, flints, and volcanic rocks which, although their frequencies remain below the 5% threshold, have been visibly selected to make tools, sometimes exceptional tools, such as chisels (Figure 11).

Jaspers and quartzites were present at frequencies slightly above 10%. In contrast, quartz is widely represented, between 40% and 60%, because it is an abundant raw material around the site. These are the three predominant raw materials in the PBK corpus. Although the two SUs are clearly homogeneous in terms of their mineral composition, there are some discrete differences that can be observed that reflect the techno-economic, cultural or other dimensions, relative to the way of life of the occupants. Flint, jasper and quartzite sandstone seem to have been more widely selected by the stone knappers in SU1 compared with SU2. To conclude, stone knappers at PBK preferentially used siliceous limestone as the raw material to produce small blades, while quartz pebbles were used to produce macro-tools.

**Typo-analysis of the PBK lithic assemblage**

There is no morphostructural difference in the composition of the artefacts, either retouched or shaped, between the two SUs. For this reason, the typo-technological characters of the corpus were considered in their entirety, by accumulating/combining the objects from the two SUs.

The few cores recovered (Figure 8, n = 13) indicate that the majority of items were created by a direct percussion technique using a hard-stone hammer. Even if these cores are most often in the residual stage (Figure 8, n. 2, 3, 5, 6), it is possible to determine the operational patterns of orientation as preferentially blades and elongated flakes, by observing the stigmas and the dimension. Thus, from a natural striking platform (Figure 8, n. 1) or prepared by flat removals (Figure 8, n. 2, 5, 6), production was often undertaken in an ‘expedient’ way with little technical control and more or less oppor-
tunistically. There are, however, cases were production occurred in a more ordered way of knapping, on larger pieces, with ‘radial’ debitage (Figure 8, n. 2). Finally, an interesting type of prismatic core (Figure 8, n. 2, 4) made it possible to obtain more elongated products of blades or bladelet, identical to those found during the excavation (Figure 9 n. 1-7).

The production system is characterized by unretouched flakes (n=106), but also some with macro-wear traces of utilization (Figure 9, n. 4, 8). Some small flakes were used as micro-drill (bore) or denticulated-notches (Figure 9, n. 8, 9, 4). Others, thicker and stocky, are present as ‘slugs’ (limace in French typology) with an abrupt denticulated retouch on their periphery (Figure 9, 10) or lateral side-scrapers made on thick flake (Figure 9, n. 11). Among the products resulting from the debitage, the blades and bladelets are unique blanks in the PBK corpus because they are the result of the volumetric exploitation from a core, as shown by two classical prismatic cores (Figure 8, n. 2, 4).
Typo-metrically speaking, they are authentic bladelets (Figure 9, n. 1-4, 7), or short blades, which are distinguished here from bladelets by their greater width (Figure 9, n. 6). These elongated products have a well-balanced triangular section without a crest or semi-crest/half-crest.

Fig. 9  Blades (1-7), flakes and small tools (8-11) in the Paimbunkanja corpus. Source: H. Forestier/H. Baills
The majority of the items (> 80%) have visible signs of use (Figure 9, n. 1-6). The dimensions of the blades and bladelets have a bimodal distribution; this is quantitative evidence to categorize two distinct tool types (Figure 10). With respect to the dimension of flakes, the distribution is a broad modal plateau, indicating a greater variation in the length-width of items (Figure 10).

We can hypothesise that the variation in the dimensions of the raw flakes is because a given flake corresponds to a specific stage in the operational sequence. If we isolate the raw flakes and the used flakes, we observe that the occupants of the site chose the largest sized flakes (Average length of used flakes = 29.2 mm; Average length of raw flakes = 20.9 mm) for additional knapping/shaping and use as a cutting edge. Equally, there is a higher heterogeneity in the dimensions of the used flakes compared with their raw counterparts (SD used flakes = 22.7 mm; SD no-used flakes = 20.9 mm). With regard to the statistical data, it can be argued that the choice of a flake intended to be used would have been made according to the size of the required tool. In addition to production, there is the shaping operation: pebbles are the preferred support for shaping big tools (n=22). They are essentially composite tools combining notches and transverse or lateral scrapers. In the group of shaped tools, a special mention must be made to chisels that are considered to be original tools.

**The stone tool in the PBK corpus**

In the PBK corpus an original tool stands out: the chisel (Figure 11). One whole and one broken specimen were found in the shelter section (pieces no. 338 and no. 558) in spits 7 and 8, i.e., in the base of SU1. The morphology of the chisels recovered at PBK (in 2018) corresponds to the definition provided by J. Cauvin (Cauvin 1983): “elongated tools which a narrow cutting edge”. These pieces are known to have been used for woodwork. They are regarded as complex tools because many morphological varieties exist: large and small, more or less narrow, some-
times only shaped or partially polished. The chisel is similar to an elongated “tranchet”; it is narrow and straight at the sub-quadrangular section. This type of tool has many intermediary shapes and structures between the tranchet and the chisel, so the theoretical limit is fixed as: the width ≤ 1/3 of the length.

The silhouette of one of the chisels (Figure 11, n. 2) has certainly undergone morphological changes following successive re-sharpening phases which modified the original dimensions of the object. On the other hand, the whole specimen discovered in spit 7, SU1 (Figure 11, n. 1) was produced by bifacial shaping from an oblong block of volcanic rock with pronounced grains which, without being a pumice. The butt is a large flat surface obviously intended to be struck (which is in line with how
a chisel is used). The sub-parallel edges of both faces have been regularised by an ordinary bifacial and scalariform retouch giving the piece its sub-quadrangular section. The distal end has a slightly sinusoidal transverse bevel. The symmetry of the longitudinal profiles do not suggest a “hoe-adze”, since this tool has an asymmetrical silhouette. So the PBK specimen has for us, all the characteristics of a typical chisel.

**Conclusion**

Our archaeological exploration and excavations of the Highlands fringe in the middle Sepik are only the start, because the area is vast and logistics are challenging. The survey and 2 m² test excavation conducted in 2017-18 by the MPF-PNG in the PBK rock shelter is only the beginning. Our research has revealed a first archaeological sequence with two stratigraphic units (SU1 and SU2), as well as a chrono-cultural landmark for the period between 3,000 and 2,000 BP, which brings new information on the variability of stone tools used during this period.

Producing blades from a siliceous material can support and advance the idea of formal tool technology, perhaps a “Late Holocene blade technology” associated with small tools on thick cortical flakes and with complex shaped tools such as the chisels. Several operational chains characterize the PBK tool-kit: blade and non-blade tools, debitage and shaping methods on various raw materials, but with a preferential use of pebbles. People took advantage of the mineral diversity in the environment close to the site. The typo-technological and techno-economic analysis of the lithic material at PBK reveals a diversity of technical behaviors of the human groups that lived in the rock shelters during the recent Holocene in the remote valley of the Sepik.

The period represented at PBK represents a time immediately following the Lapita cultural complex in the Bismarck Archipelago at 3500-3300 years ago. Others have argued that evidence of pottery in the Eastern Highlands at 3000 years ago suggests some degree of cultural diffusion from Lapita on the north coast of New Guinea (Gaffney et al 2016). While we believe the archaeology at PBK does not primarily reflect Lapita we are cognizant of the impact of Lapita in the region and the potential of further research to investigate notions of cultural contact.

Thirty years after the pioneering work and publications of Gorecki and Gillieson, our results on lithic production patterns in PBK are similar to those obtained in the Jimi-Yuat valley, for the same period. Thus, “blade technology” became widespread in the lowlands of Papua New Guinea during the Holocene, and maybe a techno-cultural marker of a recent settlement phase in the Sepik Basin. This technology is distinct from the older and more massive industries known hitherto, and with the contemporary industries present in the highlands. The study of new sites and lithic corpuses is still necessary to better understand the blade technology and his diffusion around the Fringe Highlands, and also its link to the lithic production of the highlands, at a time when there was a north-south interaction between the Sepik-Ramu region and the highlands.

**Acknowledgments**

We thank all the community from the Auwim village for their help during the excavation and surveys. We thank William Pleiber, Kylie Suseki, Tepsy Beni, and John Muke for their assistance in Papua New Guinea. We also thank Mr des Bordes, first year bachelor’s student (Université de Cergy-Pontoise, France) and intern at the UMR 7194; Mrs Chapon-Sao, Mr Gallet and Mr Tombret research engineers at the UMR 7194, for their help with the calcimetry, magnetic susceptibility, and organic material analyses calculations. We acknowledge the National Geographic Society’s support (Grant HJ-156R-17 to FXR.). Our work was supported by the French Ministry of Foreign and European Affairs (French Prehistoric Mission in Papua New Guinea to FXR), the French Embassy in Papua New Guinea, the University of Papua New Guinea and the National Museum and Art Gallery of Papua New Guinea.
References


Towards a new approach to the spread of Buddhism in the Lān Xāng Kingdom: The first Lao inscriptions

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Archaeological evidence shows that long before the great Lao kingdom of Lān Xāng (second quarter of the 14th – end of the 17th century) was established, several forms of Buddhism were practiced in the territory of the current Lao People’s Democratic Republic and parts of Northeastern Thailand (Lorrillard 2008, 2017a). Local historiography reflects in its own way the antiquity of these practices, bringing Buddhism from Cambodia in the middle of the 14th century. Numerous testimonies reveal, however, that during its golden age (mid-15th to mid-16th centuries), Lān Nā’s religious culture exercised a masterly influence over the middle Mekong Valley (Lorrillard 2003, 2017b). The first Lao inscriptions, little studied so far, reveal extremely significant data on this subject. They not only change our view of the type of Buddhism that was practiced in Lān Xāng from the beginning of the 16th century, but also help us to understand the spread of a new form of religion in a space already strongly imbued with the memory of ancient civilizations.

Within the Tai-Lao epigraphic corpus found in the present-day territory of Laos and nearby area on the right side of Mekong (Thailand), several inscriptions may be considered as being the oldest, but they do not necessarily belong to the politico-cultural area of the kingdom of Lān Xāng, or they do not offer sufficient data to be precisely dated. This is the case for the Tham Nang An and Tham Ting cave inscriptions, whose texts are very short and close to each other – in fact they are only about fifteen kilometres apart, near Luang Prabang - and whose writing appears very similar to that used in Sukhothai in the 14th century.

It is equally the case for the three inscriptions on sandstone steles from Ban Huay Say (January 18th, 1459), Chiang Khong (1513) and Muang Khop (January 20th, 1520) which obviously, given the location of their discovery, but also their so-called ‘fak-kham’ writing and the rhetoric they employ, belong to the ancient politico-cultural area of Lān Nā¹. Several inscriptions on the pedestals of bronze Buddha images, which are dated prior to the mid-16th century and have clearly travelled to Vientiane, must also be placed in this same epigraphic corpus.

¹The first was sent in 1915 from Ban Huay Say to Hanoi, where it is still kept (Historical Museum). It refers however to Muang Seung which could be identified with M. Thoeng in Chiang Rai province (See Vimolkasem, 1991). The second was first kept in Vat Vixun but belongs now to the collections of the Royal Palace Museum in Luang Prabang. It refers to Chiang Khong, in Chiang Rai province, and seems thus to have travelled. The third is in Sayaboury province, close to the borders with Chiang Rai and Nan provinces.
Two other inscriptions on sandstone steles and in Lao script are each precisely dated, but their advanced age (December 8th, 1386 and April 17th, 1494 respectively), the very southern position of the material (near Thakhek city), as well as the relatively ‘modern’ character of the writing, lead us to think that the chronological data are mentioned in a retrospective way, in a period which would not be prior to the 16th century. The problematic character of these two documents therefore requires a deeper analysis (Lorrillard 2019).

Another inscription on a stele, found in Luang Prabang and of which only a single fragment remains today, appears to be a very good case study (Pavie 1898: 381-385). It could equally belong to the group of Lān Nā inscriptions, since the writing is a superb example of the fak-kham script, but its schist material seems to clearly link it to Luang Prabang, as is the case for several other examples where the origin is not in doubt. On the other hand, from a palaeographic point of view, it could date from the 15th century as well to the second half of the 16th century, as demonstrated by a fragment found in Muang Sing (northwest of Laos) which is dated 1569.

Now, if we limit ourselves to perfectly dated documents, we can consider the oldest inscriptions on steles belonging to the kingdom of Lān Xāng, before the sudden expansion of epigraphic production under the reign of King Setthathirat (1548-1571), to be eight in number:

1. Stele No.1 (sandstone) of Vat Gnai Pha Hot in Sanakham, Vientiane province, dated 1510-1511, during the reign of Vixun (1501-1520), but which has retrospective references to Chao Xumphu (about 1496-1501) (Figure 1).
2. The stele (schist) of Vat Sangkhalok in Luang Prabang, dated 1527, during the reign of Phothisarat (1520-1548).
3. A stele (schist) kept a long time in Vat Vixun, in Luang Prabang, presently in the Royal Palace Museum, dated January 8th, 1530 (Figure 2).
4. Stele No.1 (sandstone) of Vat Ban Don Koat in Viengkham, Vientiane province, apparently dated 1530.
7. The stele (sandstone) of Vat Si Phoum in Sanakham, Vientiane province, dated September 9th, 1545.
8. The stele (schist) of Vat Maha That in Luang Prabang, dated May 8th, 1548 (Pavie 1898, 375-379; Finot 1915, 27-29).
Fig. 1  Stele No.1 of Vat Gnaï Pha Hot, Muang Sanakham, Vientiane province (1510-1511). Source: Michel Lorrillard.
Fig. 2  Stele (schist) previously kept in Vat Vixun, in Luang Prabang, presently in the Royal Palace Museum (1530). Source: Michel Lorrillard.
Based on some later Lao epigraphic texts, however, we know that other royal orders related to temples must have been engraved in earlier periods and have now disappeared. Some steles from the second half of the 16th century do indeed make retrospective reference to decisions taken by Phothisarat, Vixun, and even Saiya Chakkaphat Phaen Phaeo (1442-1480?).

It is interesting to note that the few existing inscriptions from Luang Prabang were first engraved on plaques of schist. A close study of historical remains from the Lān Xāng period shows that the Lao, experts in metal and wood production, never excelled in sandstone sculpture, in contrast to the Thais of Sukhothai and Lān Nā who left us various well-crafted forms of stele.

The production of steles in the Lao kingdom was in any case less important than in the north of Thailand. The Lao epigraphic corpus had its golden age during the reign of Setthathirat (about 25 steles) and under some of the reigns which quickly followed. From the second third of the 17th century, the engraving of royal orders seems to have ended, and it is necessary to wait until the start of the 19th century to see the reappearance of some important inscriptions in the Vientiane region. It appears that in the Lao context, the practice of engraving inscriptions did not encounter the necessary conditions for its development.

In fact, our understanding of the production of inscribed steles, even in the 16th century, appears to be somewhat truncated. It quite often happens that the supports used for engraving Lao inscriptions were reused materials, sculpted in a more ancient period. This is the case in the areas close to the two banks of the Mekong, from the Muang Sanakham (opposite Chiang Khan, in Thailand) at least as far as the ancient Muang Lakhon (near the present town of Thakhek and opposite Nakhon Phanom).

Archaeological surveys have revealed thousands artefacts of Mon Buddhist culture in most of northeastern Thailand and in the plains close to the left bank of the Mekong (Savannakhet, Vientiane) — especially large steles (*bai-sema*), most often historiated, notably with the stylised representation of a stūpa, and sometimes even carrying an inscription in an archaic Mon script (Murphy 2010; Lorrillard 2013, 2016).

Given the lack of research on this subject, the fact that the Lao re-used these materials has not really been noted until the present time. However, this is clearly what happened, as shown in conspicuous examples, where the historiated part from the Mon period is still well represented (Figures 3 and 4). Being aware of this phenomenon allows us to reconsider a good number of supports of Lao inscriptions which do not carry such evident marks, as for many of them the Mon workmanship can now be highly presumed (Figure 5).
Fig. 3  Stele previously kept in Vat Sisaket, Nongkhai, presently in the National Museum of Khon Kaen (1569). Source: Michel Lorrillard.
Fig. 4  Stele of Vat Si Phoum, M. Sanakham, Vientiane province (1545). Source: Michel Lorrillard.
Fig. 5  Stele of Vat Vieng Kham, Vientiane province (1549-1561). Source: Michel Lorrillard.
The same phenomenon can be observed in the re-use of materials of Khmer workmanship, in areas further downstream, notably around the mouth of the Se Bang Fai, not far from That Phanom. Khmer temples (Pre-Angkorian and Angkorian) were used for the later practice of Theravada Buddhism. Steles, and even architectural elements such as a door jamb, were also re-used for the engraving of Lao inscriptions (Figures 6 and 7).

Fig. 6 Stele (1494?) and Khmer artefacts in That Sikhot, Thakhek, Khammuane province. Source: Michel Lorrillard.
This specific context in the centre and the south of Laos does, in some respects, recall that of Sukhothai — although in the middle valley of the Mekong there exists a genuine hiatus between the last Mon and Khmer witnesses and the first Lao witness. The ‘Tai’ populations moving down the Mekong thus discovered plentiful remains displaying Buddhist iconography which were no longer associated with the practice of worship, and that must have had a strong impact on their collective consciousness (Figure 8).

It is this tangible ‘memory’ of an ancient and glorious past which probably explains the specific character of the Lao hagiographic tradition (for instance the Phra Bang chronicle and the Urangkhathat), and also that of the historiographical tradition, strongly linked to the former, and clearly derived from it. Hence the Luang Prabang chronicles, which despite numerous archaeological testimonies showing a direct link between Lao Buddhism and that of Lān Nā, hold that the religion was introduced during the reign of Fa Ngum (1353-1373), having been brought from Cambodia, thanks to a ‘mission’ primed with this goal. Hence an also quite mysterious passage in the Nithan Khun Borom, one of the oldest historical chronicles. In this story, members of the famous mission, stopping for several days in Vientiane, ask the older people about the location of some famous sites, because the names of these sites are found engraved in stone in Inthapatha Nakhon (Angkor) “since the beginning of time”. Among these names, we can easily identify the sites of That Luang and Saphang Mo, where a certain number of Khmer remains have actually been found.
The historiography of the ancient Phuan kingdom of Xieng Khuang, on the other hand, places the introduction of Buddhism in the 15th century and arriving from Luang Prabang, or even from a more westerly region. No Khmer or Mon remains can be found in Xieng Khuang; on the contrary certain objects attest to Lǎn Nǎ and Burmese influence.

In the historiographical traditions related to the introduction of Buddhism in the Phuan kingdom of Xieng Khuang, as in the kingdom of Lǎn Xǎng, it is notable that the religion thus came to fill a lack judged to be unbearable by those who were aware of it: this was the ignorance of the Triple Gem and of all the related conceptions and mental dispositions. Buddhism equally came to substitute the previous beliefs which were judged to be barbaric and violent – those accorded to demons and spirits of all kinds – including converting the places which were first dedicated to them through rites of purification.

The first and second thirds of the 16th century, a period where Lao historiography (influenced by the chronicles of precious Buddha images) began to establish itself, offers important epigraphic witness which is not found later. It demonstrates the same spirit in which Buddhist worship must still fight against previous beliefs.

Practically all the Lao chronicles which have been found, when speaking of the ancient events of Luang Prabang, make reference to a measure taken by Phothisarat in 1527 leading to the destruction of an altar dedicated to evil spirits, to be replaced by a Buddhist temple. According to the period of writing, they present this act in a different way and use varied vocabulary. Some also make reference to the presence of one or two religious dignitaries. The study of the collected versions shows that it is the texts written in Pali which supply the oldest data, and that these are therefore very close to the original document commemorating the act of Phothisarat, that is the stele of Vat Sangkhalok which is dated April, between 11th and 16th, 1527 (Figure 9).
Fig. 9  Stele (schist) previously kept in Vat Sangkhalok (Sangkhadevalok) in Luang Prabang, presently in the Royal Palace Museum (1527). Source: Michel Lorrillard.

Analysis of this text reveals some very important contextual data. It is in fact the first royal Lao order which still remains, and it shows an exceptional engagement on the part of the King in order to reform religious practice, even if the measures taken appear to have a local character. The force of these measures leads us to conclude that Phothisarat accomplished at that moment a foundational act, which thoroughly impacted the collective consciousness. In addition to what the chronicles provide, it is however necessary to examine the text with regard to other inscriptions from about the same time, so that certain useful keys to the better understanding of Lao Buddhism become apparent.

A second epigraphic document from around Luang Prabang, the Ban Don Sing stele, commemorates the decision in 1527 and shows a new application in the erection of a stūpa, in 1555 (September 1st), in a location which was once again haunted (Figure 10). But the act does not appear so brutal, since the stūpa keeps the name of the ancient location (Don Sing), this time in a Pali form (Sīhadipakaceti-ya). Certain clues also show that the belief in spirits and in various deities remained, and that the new practice, as in Lân Nā, only assimilated them.
The Vat Daen Muang stele N° 2 of Phon Phixay, referring to all the temples in Vientiane, is dated September 23rd, 1535 (Poonothoke 1987, 236-240) and is the second and last royal order we have for Phothisarat. It also takes up the theme of malevolent beings, through reference to a *sutta* which aims precisely at self-preservation, but it moreover deals with the correct observances of monks and of the necessity for the expulsion of those who do not conform.

Our three inscriptions then – beyond the primordial opposition that they make here, with different nuances each time, between the belief in various deities and in Buddhism – also take place within a context where the practices of the religious community had attained an elevated level. This is shown by other signs attesting to a superior literary culture, notably references to concepts from Pāli *Abhidhamma*.

We should therefore ask ourselves whether the religious quarrels that had been raging between the monks of Lân Nâ for several decades already have not also reached Lân Xâng - of which only the first inscriptions would still deliver some muffled echoes.

**References**


Biaros in Padang Lawas: The Buddhist Temple without Buddhist statue
Biaro-biaro di Padang Lawas: Candi Buddhist tanpa arca Buddha

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Padang Lawas is an archaeological site with no less than 25 temples (biaros), which are located within the Regency of Padang Lawas Utara (North Padang Lawas) in North Sumatra Province. The religious background of those biaros is Vajrayana Buddhism. The temples were built with bricks, while the kalas, makaras, stambhas, and stūpas are made of stone. It is interesting to note that there is not a single stone Buddha statue, which is usually found at the garbhagṛha of other temples, at those biaros. In order to find the answer to this fact, this article will retrace the religious background of the Padang Lawas biaros and observe the availability of rocks in Padang Lawas.

Introduction

In Indonesia there are around 290 Hindu or Buddhist temples all over Java, Sumatra, Kalimantan (Borneo), West Nusa Tenggara, and Bali. The temples in Java are dominated by Saivite ones, although there are also some Buddhist temples such as Borobudur, Mendut, Pawon, Kalasan, Plaosan Lor, and Sewu. Most of the temples in Sumatra are Buddhist with several Hindu ones like the Tanah Abang temple complex at Bumiayu, South Sumatra.

Padang Lawas is a temple complex in the northern part of Sumatra, which is located within a 1,500 km² area. At this site there are at least 26 temples, which are better known as biaros. The biaros are situated along the rivers of Barumun, Pane, and Sirumambe (Figure 1). At the bank of Pane River there are the sites of Gunung Tua, Si Topayan, Hayuara, Haloban, Rondaman, Bara, Pulo, Bahal I, Bahal 2, and Bahal 3. Along the Sirumambe River there are Batu Gana, Aek Korsik, Lobu Dolok, Si Soldop, Padang Bujur, Nagasaribu, and Mangaledang, while along the Barumum River there are Pageran Bira, Porlak Dolok, Si Sangkilon, Si Joreng Belangah (Tandihat 1), Tandihat 2, Longgong (Tandihat 3), and Si Pamutung. Not all the sites have building rubble, but at some sites were found artefacts such as inscriptions, statues, and stambhas (stūpa). Among those sites, some are biaros and have been restored, namely Biaro Bahal 1, Bahal 2, Bahal 3, and Biaro Si Pamutung. All of those remains have a Buddhist background, except one which religious background is Hinduism, namely Biaro Bara.

The general description of the biaros of Padang Lawas is the following: the main biaro faces the east, where a staircase leads to an empty main hall. There can be a few side-biaros where are in forms of mandhapas and individual stūpa/stambha. Schnitger (1938:87) stated that almost all the main biaros are empty.

A Buddhist candi (temple) can be identified by the presence of stūpa-shaped roofs; statues of Buddha and his emanations, and Buddhist pantheon of gods; reliefs of Buddhist tales/stories; stūpika s and...
votive tablets. The attributes found at the Padang Lawas temple complex are stūpas, stambhas, and small-sized bronze statues of Buddha.

As a place of worship, the figure being worshipped is an important matter and must have been found in a temple. Thus the figure would have been placed in the main chamber (garbhagṛha) like the ones in most temples in Indonesia. For example, in the Mendut Temple there are the statues of Sakyamuni, Lokeśwara, and Vajrapani. In the temple of Plaosan Lor are the statues of Buddha and Boddhisatva. In the Sewu temple complex there is the Manjusri statue, and statues of Dhyānibuddha and others are found in Ngawen temple. However, there are some Buddhist temples that have no chamber, such as the Borobudur Temple where the Dhyānibuddha statues are placed in open spaces. Another example is the Batujaya temple complex where stūpika s and tablets are placed outside the temple.

**Problem**

Padang Lawas is a Buddhist temple complex, where there are biaros with chambers (garbhagṛha). But there is no big stone statue of Buddha in the chambers. The biaros of Padang Lawas are mostly made of bricks but some are made of stone. And some of their components, like statues of the guardians, kala, makara, stūpa, and stambha are also made of stone.
**Religious Background**

Most of the rooftops of the biaros of Padang Lawas are in the shape of a stūpa. Sometimes there also stūpas that are built as separate buildings. These indicate that almost all of the archaeological remains in Padang Lawas are related to Buddhism. A stūpa is an element of a temple that is placed on a temple as its rooftop, and it is a characteristic of a Buddhist temple, particularly Mahayana Buddhism. In Indonesia the stūpa was introduced in 8th century CE when Mahayana Buddhism emerged to replace Hinayana Buddhism. The size of stūpas varies. The smallest ones have diameters of 4 cm to 20 cm and are made of baked clay using bronze mould. Such small stūpas are called stūpika and there were hundreds of them found at Pejeng, Tatiapi, and Seririt (Bali); Gumuk Klinting site, Banyuwangi, Borobudur temple, Candi Gentong, Trowulan, and so forth. The huge ones are found at Borobudur, with a height of 1.7 – 7 m (de Leeuw 1980:177; Susetyo 2010:163-164).

At the temple complex of Padang Lawas no intact stūpa was found, but only in the form of fragments. They are made of bricks with a diameter of around 1 m. Besides stūpas, the artefacts that were found in large numbers and are the typical finds of Padang Lawas are stambhas. The stambhas that are abundant in Padang Lawas are regarded as a “variation of stūpa shape” by Johanna Engelbertha van Lohuizen de Leeuw (1980: 277-300). Nearly intact stambhas, such as the one from Biaro Bahal 1 in Schnitger’s book (1937 pict. 28), has similar parts to stūpa (Susetyo 2010: 162). A stambha found at Biaro Tandihat 3 has reliefs of Dhyānibuddha on its top, one on each of the four sides. This is referred to by Trilok Chandra (2000: 49): on the sides of a stūpa sometimes are carved four figures of Dhyānibuddha.

We can conclude that the religious background of the Padang Lawas is Mahayana Tantric Buddhism from the Vajrayana sect. This is due to the find of a Heruka relief in the main chamber of Biaro Bahal 2, a badly broken stone statue was found in the 1950s. After being reconstructed, it is revealed to be the statue of Heruka with a height of 118 cm (see Bosch 1930: 543). The Heruka statue is the rarest type of statue that has ever found in Indonesia, both in Java and Sumatra. Heruka is the most important god in Vajrayana Buddhism and is worshipped during bhairawa rituals. The Heruka statue is depicted in dancing position. His left hand holds a human skull-shaped bowl and at his right hand is a vajra that he holds high. On the back of his head, his hair stands up like a flame of fire. A stick called khaṭvāṅga with a flag-like cloth at its tip is held in his left armpit. Heruka stands with his left leg slightly bent and his right leg is raised with its sole facing its left thigh. Bhattacharya classifies the Heruka statue of Padang Lawas into Dwibhuja Heranuka type because he holds a vajra and a khaṭvāṅga (Utomo and Nik Hassan 2008:512). What is left of the Heruka figure are a fragment of his left wrist and hand that holds a human skull-shaped bowl, a fragment of his left leg, and the flag-like cloth at the tip of the khaṭvāṅga stick. Pott (in Suleiman, 1985:29) compares this statue with the one at the Museum of Dacca, Bhairava Heruka from Kamakya Assam, a Hairatma statue from Bihar that is now a collection of the Museum of Calcutta. This figure is very famous in Tibet, where he is depicted with six arms. The worship of Heruka is specially found in Hevajra Tantra.

The Sadhanamala manuscript mentions that Heruka is depicted standing on a human corpse in ardhapayanka position (sitting with one leg folded and the other raised with the heel on the seat, the arm resting on the knee (Gupte, 1972:10); dressed in human skin, and his body is covered with dust. In his right hand is a vajra, while his left hand holding a khāṭvaṅga (a kind of a club made up of the bone of the forearm or leg. To the end of this attached a skull (Gupte, 1972:10); and a bowl filled with blood. He wears a sash decorated with a chain made of fifty human heads, his mouth is slightly opened and he has sharp canine teeth. His reddish hair stands up and on his head there are carvings of Aksobhya and five human skulls (Suleiman 1985:29).
The figure of Heruka is also mentioned in a kakawin manuscript, a poetic form, which was written during the Majapahit period (14th – 15th centuries CE). The kakawin that was known as the Sutasoma, verse 125 mentions the following:

“This is why a follower of Mahayana attempts to cleanse himself. Not because he wants to eat human flesh or satisfy his appetite. He just wants to try to cleanse his mind so that he has the power over life and death. That is the goal of his practices. At that condition he becomes one with Jinapati, the ultimate freedom. There are many ways, among others wearing dry leaves to protect himself from the sun during his practices. Bad-smelled blood runs through his head and trickles on his chest. Human intestine wrapped around his body and green flies hover around and landed on his face, entering his eyes. But his heart is completely undeterred from his main goal to unify with the god Heruka” (Bosch 1931:142)

From the two written sources, it is clear that the tantrayana rituals seem to be sadistic and are always related to human corpses and blood. Furthermore, there are also rituals that include consuming intoxicating drinks, like the ones carried out by King Krtanagara from the Singhasari Kingdom. The most important ritual in the Wajrayana sect is the Bhairawa ritual, which was performed on a ksetra (a place to put human corpses before being cremated). They meditate, dance, chanting mantras, cremate corpses, drink blood, laugh, and snort like bull’s sound. The aim is to teach the followers how to achieve richness, longevity, physical strength, invulnerability to weapons, the ability to cure sickness, and disappear, or if they repeatedly chant the name of Buddha or Boddhisattva, can overcome uneasiness or be given the miracle of being reborn with the power of the god they worship (Suleiman 1985:26).

Aside from Heruka, in Padang Lawas there is also a pedestal that was once used to place two statues of bhairawi figures. In the Archaeology of Hindoo Sumatera there is a picture of the pedestal with the bhairawi figures (Schnitger 1937:23). The pedestal is now placed at the yard of Sipamutung Temple, but the bhairawi figures mentioned by Schnitger can no longer be found (Fig. 2).
The Ritual Process

Every religion has a tool that can help people to focus better while they pray. That is also the case in Buddhism. When Buddhist followers enter a worship chamber in a temple and see the statue of Buddha, they will be inspired by the love, good character, and mercy, happiness, and serenity of the Buddha (Keene 2006:80). In the case of Tantrayana Buddhism, there are also objects that are used in its rituals, such as stone and bronze statues, as well as pictures on the wall like in the Himalayas.

During the ritual process, the ideal practice is to involve the followers to perform it in the worshiping chamber (garbhagrha). But if this is impossible, only the priests act as representations. Such notion can be found in Khmer, in which a worshipping chamber is not the place for worshippers to pray. They are even prohibited to enter the chamber. Only the knowledgeable brahmans can do it. This explains why the Khmer temples are small. Initially a Khmer temple only consists of separated buildings: a worshipping tower that can only accommodate one main god (Groslier 2002:101). The same situation can be seen in Bali, where only the high priest can enter the chamber of a temple, who then sprinkles the holy water that has been blessed by him to the devotees. This is due to the fact that the chamber is not big enough to accommodate the entire crowd. Considering the biaros of Padang Lawas, it seems like this was also the case in Padang Lawas. Only the priest who could enter the biaro chamber, while the devotees were on the yard or mandapa of the biaro.

As an illustration, the following is the Biaro Sipamutung, one of the biaros that represents the Padang Lawas biaros (Figure1). Sipamutung can be said as the most important biaro, because it is the largest one and is located at the junction of the Barumun and Pane rivers, so that it is positioned at the centre of the temple complex. It is a renovated complex, which consists of one main biaro and six side biaros. The main biaro, which is made of bricks, is facing the east. Its floor plan is square, with a measurement of 11 m x 11 m and 13 m high. Vertically it is divided into base, foot, body, and roof. Staircases are placed at the eastern porch. No statue was found in its chamber. The six side biaros consist of two single stūpas and four mandapas (Figure 3) (Susetyo 2010: 22).
Tantrism in Padang Lawas

Based on iconographic evidences, all of the statues of Padang Lawas have the face of a giant with scary expression. The relief on the wall of Biaro Bahal 1 depicts a giant performing the tandawa dance. A number of inscriptions that were engraved on gold plates and stone reveal that the religion, which flourished in Padang Lawas, was wajrayana, one of the Buddhism sects that has the characteristics of a giant (Suleiman 1985:26).

Three groups of biaros that have proven to have Tantric Buddhism characteristics are Sipamutung, Tandihat 1, and Si Sangkilon groups (Schnitger 1937:23-25). At the yard of Biaro Sipamutung there was a statue pedestal with lion decoration, which was once the pedestal of bhairawi statue, while at the yard of Biaro Tandihat 1 was found the Si Joreng Belangah inscription, which content is mantras to be chanted during the rituals of Tantric Buddhism. There are also two statues of female giants in anjalimudra position. From their mouths are two pairs of canine teeth. They have bulging eyes. In the main biaro of Si Sangkilon are found a small bronze statue and an inscription engraved on a gold plate. From the inscription we learn that Si Sangkilon was a biaro to worship Yamari statue. Yamari is one of the most demonic gods in Buddhism. He has three faces, 24 eyes, and wears a necklace made of human skulls around his neck (Schnitger 1937: 90).

Besides the Heruka figure and the inscriptions that are indications of Tantrayana Buddhism, there are also a number of artifacts that supported the assumption about the religious background of Padang Lawas. The artifacts are several bronze figurines. The bronze figurines found in Padang Lawas are identified as the statues of Buddha, Dhyānibuddha s (Amitabha and Amogasiddhi), Bhodisattvas (Padmapani/Avalokiteśwara and Manjušrī).

Metal Statues/Figurines

In the chambers of the Padang Lawas biaros no statues were found - the chambers are empty. However, among the ruins of biaros during the cleaning process, there were metal statues/figurines. They are:

A bronze statue of Buddha from Biaro Tandihat 2, which stands in abhangga position, with pegs under the feet. It is 36 cm high. In general, they show similarities to the statues of Southern India, particularly from Chola period (Sri Hardiati 1997:241);
A bronze statue of Vairocana from Biaro Bahal 2 with both hands in front of its chest in dharmacakramudra position. The figure sits in paryankasana position on an asana in the shape of Padma on a rectangular pedestal, the front side of which is a relief of two deer flanking two wheels (cakra) (Sri Hardiati 1997:241).
A bronze Amitabha statue that was found during an excavation by Schnitger near the main biaro of Si Pamutung in 1936 (Mulia 1980:12). The statue is 12.5 cm high, sitting in paryankasana position, which crossing its legs. The hands are in dhyanamudra position. It is assumed to be originated from Sri Lanka, and dates back to 10th century CE. The distinct characteristic of this statue is that the usnisa is replaced by a flame of fire (Susetyo et al. 2009: 43).

There are more bronze statues and figurines which are: a pedestal with a carving of garuda, which is the vehicle of Amogasiddhi figure (from Tandihat 1, a Padmapani (Avalokiteswara) statue that was
found in the vicinity of Biaro Tandihat 2, and a statue of Boddhisattva which holds a pustaka (manuscript), which is Boddhisattva Manjuṣrī.

The presence of the bronze statues found in the temple complex has led to the question whether or not those small statues were used as an ‘instrument to focus better’ during rituals. This suspicion is due to the presence of a hole in the main biaro of Tandihat, which could have been used to put a statue. Furthermore, the hole could also be used to place incense burner (or oil lamp) during rituals.

Some Assumptions
Why is there no statue in the main biaro when other components of the biaro like makara, pedestals of stūpas and statues, the statues of guardians, the lion statue, plinths, roof ornament (kemuncak), kala head, stamba, and some others are made of stone? Petrology analysis reveal that those building components are made of sandstone, which belongs to sedimentary rock. Sandstone is part of the rock formation in Padang Lawas area. Therefore, it can be assumed that the quarry to obtain the material used in the construction of Padang Lawas biaros are within the area of Padang Lawas. The resource can be found at Purba Sinomba and Paranginan, which are parts of the Padang Bolak District; Aek Godang area in Padangsidempuan Timur (East Padangsidempuan) District; and other areas in Padang Lawas (Susetyo and Intan 2006).

The quality of Padang Lawas sandstone is not as good as andesite rock in Java. We all know that the temple statues in Java are made of andesite rock. This fact might have been the reason why in Padang Lawas people did not make stone statues to be placed in the garbhagrha.

Meanwhile, the small bronze statues/figurines in Padang Lawas is thought to be used as instruments to focus better during ritual activities, by placing them in a “small niche” in the main biaros. In Biaro Tandihat 1 there is a small 25 x 30 cm wide and 10 cm deep niche. The use of bronze statues as ritual instruments are also found at the temples of Kalasan and Sewu in Yogyakarta. Both temples bear clues that the most important statues are made of bronze in spectacular size, which is 10 feet high. The niches in the main chambers are empty. If the statues were made of stone, there must have been there regardless of the condition. This assumption is supported by the finding of a fragment of the curly hair of the Buddha in big size, which indicates the statue must have been big, too. Unfortunate-
ly, those bronze statues, due to economic reason, were melted by irresponsible persons. Aside from in the main chamber, bronze statues were also placed in the niches of both temples, as indicated by the presence of “holes where fences had been” to protect the statues from thieves (Kempers, 1954:28). possibility as to why there are no stone statues in the chambers of the main biaros of Padang Lawas may be that the rituals were performed by worshipping the stūpas (stambhas). In Padang Lawas there are many stūpas, both as individual buildings and as the crown of a building’s roof.

**Conclusion**

There are some assumptions regarding why there are no big stone statues of Buddha in the garbhagrha of the biaros in Padang Lawas, which are: the religion in Padang Lawas was Mahayana Buddhism from the sect of Vajrayana/Tantrayana, which was focused on the characteristics of giants. It seems as though the biaros of Padang Lawas were stressed on its giant’s nature, which were represented in the form of reliefs/statues (e.g., of Heruka and bhairawi, statues of temple guardians with Central and East Java). Since the rocks are used as one of the building components like makara, kala, pedestal, and not to be made into the main statues.

Small bronze statues were used as an instrument to focus better during rituals. The rituals were led by a bhiksu, and only he may enter the garbhagrha due to the small size of the chamber. Similar architecture still be seen in Bali today.

**References**


Sri Hardiati, E (1997) *Cinandi Persembahan Alumni Jurusan Arkeologi Universitas Gadjah Mada Kepada Prof. Dr. H.R. Soekmono* [Cinandi, Tribute to Prof. Dr. H.R. Soekmono Alumni Offering Department of Archeology, Gadjah Mada University]. Yogyakarta: Fakultas Sastra Universitas Gadjah Mada.


Did the Dharma reach the ancient Philippines?: Reviewing what archaeology and artifacts tell about Buddhism

Nakarating ba ang turo ni Budha sa sinaunang Pilipinas?: Pagbalik-aral sa sinasabi ng arkiyolohiya at artifak tungkol sa Budhismo

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The Philippine islands have been a participant in the pan-regional events of Southeast Asia in the first to early second millennium CE. It is thus a paradox why studies on it have been almost silent about Buddhism. This paper reviews works and relevant artifacts to show that aspects of Buddhism were present in the archipelago, suggesting that it is most probably the Mahayana form of Buddhism emphasizing on Tantric methods that made its way into the islands. It also maintains that the survival of this belief system was being challenged by the peculiarities of complex society dynamics on the archipelago.

Introduction

In the first millennium CE state-organized societies in the whole of Asia, except kingdoms of the central Iranian Plateau and those west of it, began to adopt the doctrines of Buddhism. A proselytizing belief system of the period which then until now advocates ethical discipline, loving-kindness, reasoning, and the promise of an afterlife depending on merits gained, Buddhism has become an institution throughout Asia. The paths of Buddhist propagation have been summarily described as either by way of an overland route or through a maritime route in which to spread the Dharma, or the Buddhist teachings. These particularly refer to two general avenues by which missionizing activities were carried out: 1) the overland route, referring to the network of mountain passes and the economic “Silk Road” trails connecting the Indo-Gangetic and Yellow basins (Liu 2011); and 2) the maritime route, which is the sea passage comprised by the Bay of Bengal and the seas around Southeast Asia (Ghosh 2013). Interestingly through the maritime route of spreading Buddhism some localities in insular Southeast Asia developed into becoming hubs of Dharma practice and education, visited by monks from both East Asia and South Asia that consequently enriched spiritual practice in their own localities. The Buddhism that was involved and developed through the second route has been called “Maritime Buddhism” (Acri 2018).

With Buddhism permeating all of cosmopolitan Asia from the eastern half of the Indian Ocean to the western Pacific together with their interiors, and the Philippines being a participant in the exchanges of this enormous realm, I presume that Buddhist cultural elements reached and made attempts to take root in the Philippines in the first millennium CE to early in the succeeding millennium. I propose that this may have occurred by way of a southern route in which Philippine complex societies were part of the pan-Malay/-Javanese regional culture and that Buddhist ideology and traditions have extended into them, or by a western route through exchanges across the West Philippine Sea with Champa. The notion of a Buddhist maritime network (Acri 2018) is a helpful framework by which to
look into the involvement of the Philippines and the spread of Buddhism as it agrees with the available archaeological and epigraphic materials we have so far. With my premise that Buddhist thought and practice in the mentioned time period had set foot in the Philippines through either a southern or western entrance, the paper seeks to answer the question: What are the cultural and historical evidences for the presence of Buddhist elements in the precolonial period?

Maritime Buddhism in the first millennium was basically the propagation of a tradition which was Mahayanist in approach, and with the teachings of the Sarvastivada school as its early Buddhist foundation (Ghosh 2013). Its setting was the seas around India, Southeast Asia and China that early on stood as an international highway not only for the flow of commerce, technology, political influence, and cultural emulation, but also as avenue to connect spiritually-oriented loci in these regions which facilitated movement of missionaries, pilgrims, and scholars. Miksic and Goh (2017: 12-13) place the beginnings of Maritime Buddhism in their “Proto-Classic” (1st to 6th century CE) period of Southeast Asia when cultural elements from India were appropriated with little or no change. The development of Mahayanist-tantric forms of Buddhism in the general Southeast Asian region continued into the “Middle Classic” period (900-1200 CE) after which Theravadin thought and method started to gain significant adherence on the mainland.

On the Indian-derived religions of Southeast Asia a major debate focuses on the relationship between Buddhism and Hinduism. Miksic and Goh (2017: 151) subscribe to a situation wherein the royalties of Southeast Asian polities have maintained separate spaces for each religious system with their relationship characterized by the authors as non-violent, and as gleaned from surviving inscriptions that there was a degree of syncretism between Buddhism and Hinduism, the latter having been greatly characterized by the worship of Shiva. In this unitary belief system the royalty developed a more intimate relationship with the gods by “becoming” a particular god, explained by Vajrayana ritual practitioners as sharing in the deity’s qualities and being the deity (Lama Yeshe 1987/2001: 31-35). De Casparis and Mabbett (1992/1999: 323) proposed that royal elites were more likely to identify themselves with the deities of the Mahayana tradition because the activities of these deities very much intersects with the human realm, most especially on how deities make more inclusive their power of wisdom and charity to all.

Archaeological and Artifact Studies About Buddhist Influences on the Ancient Philippines

Scholars tend to dismiss any significant impact by Buddhism in the precolonial Philippines because of the religion’s ambiguous presence in the islands. Although his aims were not directed solely to the history of Buddhism, Scott (1984: 64-66) had meticulously reviewed precolonial documents intensively, but he echoed the disparaging statement by Rausa-Gomez (1967: 63-64) refuting the notion in the 1960s of historians who believed that the Philippines became part of the Srivijayan and Majapahit empires, and that Hindu and Buddhist influences as well were entrenched because of this. A recent study of Philippine Buddhism is a dissertation by Dy (2013) that examines the role of Buddhism in the identity of the Chinoy, or Filipinos with immediate Chinese ancestry. A part of the study was devoted to the history of the present Philippine sangha extending back to the 19th century. Dy however made no attempts in his dissertation into probing the early colonial, and much less the precolonial, periods.

Henry O. Beyer (1947: 302-307) noted the presence of artifacts in the form of anthropomorphic figurines that suggest the presence of Buddhism on the islands. He was among the first to mention the Agusan figurine made from gold which has now been popularly called the “Golden Image of Agusan” discovered accidentally at the banks of the Wawa River in Agusan del Norte in 1917. Beyer added that the Manobo chiefs of Mindanao have a practice of keeping these objects as pusuka, or sacred heirloom, passed across generations. Among these bronze images kept by the Mandayas of
the Davao area were two figurines destroyed by fire in their storage at the Ateneo Museum: one that had a height of about eight inches and was portrayed as an anthropomorphic figure with many arms which was seen by Beyer as Sivaite, while another one was seen by him as Buddhist.

A more in-depth examination of the Agusan golden image was made by Francisco (1963a) who suggested it to be associated with Buddhism, the sculpture being either a representation of a Javanese historical royal personality who was a tantric consort and consequently deified; a representation of one of the royalty’s relatives or attendants regarded in a similar manner; or a figurine depicting Bhairavi, the wrathful form of a locally-evolved deity known as a Siva-Buddha which made its appearance in the Greater Sunda islands in the 13th century. Francisco in support for his last suggestion pointed out the ornaments of small circular objects which could be tiny skulls adorning the deity in sculpture form. Iconographic wrathful deities in Vajrayana are depicted with human skull ornaments being held by one of their hands, or worn as necklace or head adornments. A recent study of the Agusan image proposes that the anthropomorphic representation is that of Vajralasya, a deity in the Buddhist pantheon that appears in a mandala as one of the goddesses surrounding the central figure of Vairocana Buddha (Orlina 2012/2013: 165-166).

A semi-oblong artifact made of fired clay with maximum dimensions of length of 2.6 inches and width of 1.9 inches was found in the Karitunan site of Calatagan, Batangas (Figure 1) in 1961 and dated associatively to the 14th to 15th centuries (Francisco 1963b: 13). The object possesses a relief which Francisco (1963b: 14-15) sees as resembling a Padmapani in tribhanga posture, thereby identifying it as Buddhist. The Padmapani is one of several forms of Avalokiteshvara, the most popular of the Bodhisattvas (or beings of the Mahayana ideal in the threshold to Buddhahood) as he embodies compassion, and has the characteristics of a red deity who is generally portrayed as standing, head with knotted hair and crown, and with the left hand holding a lotus flower and the right posed in a varada mudra (Majupuria and Majupuria 2017: 182). Because of the characteristic art form and the associated Sawankhalok tradeware, Francisco (1963: 18) speculated that can be related to forms in Thailand. Another artifact is a little-known bronze object (Carroll 1960) from the area of Cebu City where the island of Cebu is closely situated to Mactan island (Figure 1), believed by Francisco (1963a) to be a representation of Avalokiteshvara. Information about it is only found in an issue of Asia Magazine published in 1921 (Scott 1984: 31).

**Epigraphic Support for Buddhist Influence**

An inscribed rectangular-shaped copper object measuring 8 x 12 inches, the Laguna Copper Plate Inscription (LCPI) was found accidentally in Lumban, Laguna in 1989 (Tiongson 2010: 17). According to Postma (1992: 184-185; 189-190) the script seen on the LCPI was an early form of the Kawi writing system prevalent in Java and other parts of maritime Southeast Asia, while the language used was Old Malay. This artefact has been dated to the early 10th century based on an inscribed date when the events in the copperplate’s message was supposed to have happened, and the writing style of the inscriptions as evolutionarily older compared to styles of other eras. The message of the LCPI has been interpreted as an announcement of the full payment of debt of one highly regarded family to another through giving a certain amount of gold.

Aside from personalities involved in the event, the inscriptions also mention a place suggested by Postma (1992: 186-195) to be somewhere along the vicinity of the Angat River and the adjacent coasts of Manila Bay, where most place-names mentioned in the LCPI have corresponding modern-day villages and towns. This has been contested by Tiongson (2010: 22-36) who argues that the setting instead was the small alluvial plain at the southeast coast of Laguna de Bay. Although not directly pointing to the presence of Buddhist cultural elements in the locality being mentioned, parts of the message in the LCPI attest to a cosmology that is Indic and being followed at that time by the local populations. The month mentioned when the event took place was Vaisakha, second month of
the Hindu calendar that begins with the full moon of April (Santos 1996), which is also celebrated in the Buddhist calendar as Vesak that centres on the new moon of May each year. Vesak is thought to be the birth and subsequently the rebirth of the Buddha and a season when auspicious things are being made to gain merits, such as granting amnesty to debts.

Inscriptions on a thin metal plate reported to have been found non-archaeologically in a primary inhumation burial in Esperanza, Agusan del Sur at around the same time the LCPI was discovered have been called the “Agusan Gold Sheet Inscription” or AGSI (Orlina 2012/2013: 160-162). Made of 14 carat gold and measuring 1.85 x 10.05 centimetres, the AGSI features an inscription which is written in the Late Kawi script dated to the 10th-11th centuries with a message in Sanskrit interpreted as requesting a deity to protect a mentioned person. Orlina (2012/2013: 167) surmises that the message of the inscription is related to Mahapratisara, one of several deities in esoteric Buddhism that is now known to have been invoked to in insular Southeast Asia during times of need. According to Cruijsen and co-authors (2012/2013) Mahapratisara was the deity that personified, and was a sculptural representative interface of, one of the dharani or protective mantras that were chanted, written, read, and taught especially during the second half of the first millennium CE. This set of literature about Mahapratisara may have functioned for protection in a user’s present life, to increase human fertility, to have a good rebirth, or as an instrument that may quicken the path to Buddhahood. Orlina (2012/2013: 164) suggests that the AGSI was made of gold because gold can aid in visualization during tantric procedures, and the inscription may been made in particular for the need of a person named Anai, whose name can be one of the words in the AGSI that cannot be found in the Sanskrit lexicon.

Archaeological Sites with Potentials of Inferring Buddhist Influence

A big question to ask regarding an epistemic issue on the archaeology of Buddhism in the Philippines is: What archaeological sites in the archipelago could furnish information about Buddhist influence in the ancient Philippines? Admittedly large durable structures or temple complexes are hard to come by in Philippine sites, and reviewing how we look at land use and the patterns of built areas in the past could be a good starting point. Among the Buddhist polities of Southeast Asia for instance, there is a concept of sima (or sema) that demarcated land allotted for monastic activities and ritual sites, the presence of which was stated in written documents through rules regarding such land as tax-exempt, ways on how it was to be maintained and cared for, and the (often supernatural) penalties that would befall violators of the rules (Miksic and Goh 2017: 235-236; Creese 2001: 15-16). The sima was materialized in the form of stones that marked out the boundaries of sacred space such as those designated for the establishment of a monastery (Harris 2010: 220). A study of Dvaravati (6th-11th centuries CE) settlements on the Khorat Plateau of Thailand reported by Murphy (2013) made use of the presence of sima stones together with moated sites and earthen mounds to look into associations between Buddhist activity and the landscape. Moated sites were seen as nuclei for urban growth, while both earthen mounds with stupas and sima stone-demarcated areas likely functioned as pilgrimage points. In concluding the investigation, Buddhist advancement was proposed to have been affected by the landscape but was also instrumental in intensifying urbanization, agriculture, and other environmental change as it tied monastic and laymen communities together in mutual economic and spiritual dependence.

The Buddhist view of the body as impermanent consequently does not prescribe for specific burial practices, although the more common forms of disposal are through cremation which has been practiced in all of Buddhist Asia, and sky burial which has been the usual method on the Himalayan region and Tibetan Plateau until the present and was reported by written documents to have been a practice in Funan, Angkor, and even 19th century Thailand (Ward and Tayles 2016: 242-243). The site which relates to our concern here given the dates for an evidence of cremation contemporaneous with events of the first to the early second millennium CE, is a site in Pila (Figure 1) in south Luzon.
Tenazas (1968) associatively dated the archaeological layer with cremation evidence to the early centuries of the second millennium, and at this time it was a burial site with copious stoneware and porcelain ceramics acquired from long-distance trade.

Fig. 1 Location of sites mentioned in the article. Source: Illustration by J.G.L. Medrana.
It is in the Agusan area on northern Mindanao (Figure 1) that two of the metal artefacts discussed in this paper – the figurine made of gold and the gold plate with inscriptions – which point to a likely Buddhist presence have been found. The initial excavations in the area showed the trappings of indigenous settlement through primary inhumation burials, and the participation of this locality in long-distance trade is strengthened by the presence of trade wares as grave artifacts, and the discovery of sizeable water vessels capable of sailing for long distances (Burton 1977; Scott 1982). Information gathered from succeeding excavations (Dizon 1994: 9-10) in the area attests to the presence of complex societies on the Agusan basin.

Scott (1984: 66-67) believed that Butuan was the first Philippine polity to have sent a tribute mission to China, described by the Song documents as a small country to the east of Champa, farther than Ma-i, and having regular exchanges with Champa. By the beginning of the second millennium Butuan was reported as sending missions to China each year, and gradually requesting for a more equal status with Champa in the Chinese court but was denied. These points raised make the northern Mindanao area a promising research locality for the study of Indic influences on ancient Philippine culture, but I also think that other places in the Mindanao region also warrant attention.

The Sulu archipelago in particular is a region with potentials to elucidate Philippine connections to Indic religions because of its geographic proximity to the Indo-Malayan trade routes and history. Sulu is thought to have been part of the Java-based Majapahit empire as suggested by scholars showing the 14th-century document *Nagarakrtagama* mentioning a place called “Solot” as a Majapahit dependency (Mpu Prapanca 1995). The clout of Sulu, a polity that may have had its center on the small island of Jolo near Mindanao island (Figure 1), manifested as a show of force against Borneo that entailed the help of the Javanese army to defeat Sulu, according to a Chinese document dated to 1368 (Scott 1984: 75). Less than half a century later it was responding to the call for tribute missions by the newly-installed Ming rulers of China through the state visit of a royal entourage to the Chinese court in 1417 (Scott 1984: 75-78).

The Manila Bay-Laguna de Bay area (Figure 1) was a relatively developed place in terms of historico-archaeological standards of the period in consideration. It is a good candidate for a place that had advancing social complexity in the past, with the large cemeteries in Santa Ana and at Pila (Tenazas 1968) and fairly large settlements at the Pasig basin since the 10th century (Peralta and Salazar 1993) that may have been part of a big ancient communication network. A place named “Ma-li-lu” where immolation was practiced as reported by the official Wang Da Yuan in his *Dao-yi Zhi Lue* (“Summary notices of the barbarians of the isles”) in 1349, has been identified by some scholars to be the Manila area (Scott 1984: 73).

**Buddhism and Complex Societies in the First to Early Second Millennium Philippines**

Putting the Philippines in the bigger picture of maritime Southeast Asia at which time Indian-derived doctrines were taking root in the last centuries of the first millennium CE, we expect that Buddhism may have entered the Philippines as a syncretic doctrinal complex with a Mahayana form gilded with tantric features contributed by the integration of Saivite practices. Advancing social complexity especially in the vicinity of Mindanao assisted its movement into the archipelago because the polities of that region were among the most developed in the islands, shown by the fact that foreign kingdoms held them in high esteem than polities in other parts of the Philippines (Junker 2000: 102). The polities of Mindanao and Sulu may have been integrated into the pan-Malayan network of polities initiated by the wide power of Srivijaya and reinforced by succeeding regional powers in the maritime realm such as Majapahit.
While some scholars surmise that Buddhism may have been appealing to preliterate societies because it was the instrument that “filled in the void” of societies lacking universal soteriology and systems of writing, others propose that Buddhism may have been adopted more easily by agriculturists and urban dwellers than by people with pastoral and foraging economies (Ray 2006: 304-305). In the Philippine context we can modify the second clause to mean that Buddhism may have been adopted more easily by town dwellers who were often engaged in maritime long-distance trade that sustained higher levels of wealth and power, than by small-scale horticulturists and hunters-foragers. The survey of pertinent artefacts and epigraphic pieces in this paper being discovered in the areas where social complexity was advanced (e.g. Agusan basin and the Manila Bay-Laguna de Bay area) could attest to this suggestion.

Buddhism as “filling in the void” of societies with economies and ranking less in scale than long-distance traders and urban dwellers does not seem to hold water in the present state of archaeological, documentary, and anthropological studies regarding the Philippines. This may be applicable to societies which were dependencies of more powerful polities, in which case the new religious system may have been imposed on the former. But often in the Southeast Asian political landscape the relationship between high-level traders and people from tiny economies was loose because it was heterarchical. Thus acquiring cultural elements of the dominant society may have often been through emulation, wherein the parts that suit the copying society were chosen by the recipient instead of being forced to accept the whole cultural package.

This emulation of cultural elements could be seen in the acquisition of the anthropomorphic metal figurines by horticultural and foraging groups such as the Mandayas and Manobos of Mindanao that were living in the fringe of long-distance trading polities (Beyer 1947: 302, 307). In their translocation into the cultural systems of the Mindanao ethno-linguistic groups, the deities may have then assumed new roles as gods and goddesses in the local pantheon of supernatural beings, now able to inflict punishment similar to what the long-revered ancestral spirits do if they were violated as recounted by Beyer (1947: 302), and which was a total opposite to their personalities in Mahayana Buddhism as wholly benevolent beings or Bodhisattvas. In this case the integration of Indic-derived deities did not effect a significant change in the worldview of these groups.

Through the eyes of a processualist, the population of the archipelago is also a key factor as it is a function not only of how many people a polity in the Philippines may have controlled as part of its resources and the raison d’etre of its ideological performance, but also of the vitality of a sangha needed to maintain religious thought and practice. The Philippines is perceived by scholars to be sparsely populated until late precolonial times, being among the least densely population part of Southeast Asia even around 1600 CE (Junker 2000: 62-63).

If the relative dates of the LCPI and other relevant objects are valid then we can see a picture of tantric Buddhist practice in the Philippines that may have persisted to at least about the mid-fifteenth to mid-sixteenth centuries when the first conversions to the Islamic faith occurred (Junker 2000: 389-390). The extent at which Buddhism was able to spread among the numerous Philippine polities, and the depth at which it was scripturally embodied by its practitioners on the archipelago are issues still waiting for answers. What may have happened however during the coming of Islam was the wholesale conversion of court and its populace by a conscious action of effacing the previous doctrines, forbidding devotion to the Indic and indigenous deities, and changing rituals and ceremonies. This shift into Islam may have been sporadic and happened only in the core areas of social complexity; this contrasts with the conversion into Roman Catholicism which was more thorough, systematic and downright antagonistic to the old belief systems.
Acknowledgements

Many thanks to Dr. Eusebio Dizon for his valuable comments and suggestions regarding this paper; to Mr. Siegfrid Medrana for assisting in my creation of the map; and to the organizers of the 3rd SEAMEO SPAFA International Conference on Southeast Asian Archaeology for giving me the opportunity to present this work.

References


Changing Concepts of Buddhist Stupa Architecture with special reference to recent excavations in east India

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Two recent excavations conducted at Kesariya and Giryek in eastern India have revealed a paradigm shift in the concept of stupa architecture and planning. The multi-terraced brick stupa at Kesariya has a large number of cell shrines containing stucco images of Buddha meant for worship. Another stupa complex exposed at Giryek hills has revealed a separate platform-like brick structure of religious nature placed close to the stupa, both structures surrounded within a common enclosure wall. These two new excavations will induce scholars to review the development process of stupa and its layout.

Sustained archaeological exploration and excavation over the last two hundred years have brought to light many Buddhist stupas spread across the Asian continent which had almost completely come under the influence of Buddhism in the early historical period. As the land of its origin and growth, India naturally shares a large number of it. On the basis of these findings, growth of stupa architecture could be traced from the pre-Mauryan (5th century BCE) to the Pala (8th-12th century CE) period after which the religion itself, and so also its associated structures, gradually faded out over time. Beginning with a small hemispherical earthen tumulus, this most sacrosanct Buddhist structure developed into domical, cylindrical or terraced forms having a set of common pattern for each class although with many variations within that broad framework to break the monotony and to imbibe into it the local or regional art and architectural forms. Most of the new stupas unearthed by excavations are simply numerical additions to the known forms. However, some recent revelations are startling and they exhibit so much deviation from the established or known forms that they can be categorized as a distinct separate class of its own. Two recent excavations in Bihar state of eastern India- one at Kesariya and other at Giryek- have unravelled brick stupas with such new features which were hitherto not known and therefore they are bound to change the established concept of stupa architecture and its planning. Both belong to the almost same chronological bracket of 5th-6th century CE and are situated in areas which are already rich in stupas. But they qualitatively stand apart amidst other stupas and do not have any architectural parallel so far. While Kesariya stupa is located in Purbi (east) Champaran district of north west Bihar and is set against the alluvial plains at an altitude of about 70 meters, Giryek stupa is placed on the top of a hill near Rajgir at an altitude of about 280 meters in the Nalanda district of central Bihar. The contributions of both these stupas are a value addition to the concept of stupa architecture.

Kesariya stupa is believed to have been erected at the spot where Buddha, in order to persuade their return back to Vaishali, presented his alms bowl to the monks who were following him when he departed from Vaishali after announcing his approaching nirvana (Kuraishi 1931: 4). The identification of Kesariya stupa with this event is apparently correct as it falls in the route from Vaishali to Kushinagara, the place of Buddha’s mahaparinirvana. Since the stupa is affiliated to an event from the life of Buddha himself it has to be a highly revered and significant stupa and therefore finds mention in the accounts of Fa Xian and Xuan Zang, the celebrated Chinese monk travellers who visited India in 5th and 7th century CE respectively. If an alms bowl is found in the core of stupa it will conform to the class of paribhogika stupa otherwise it will turn out to be an uddeshika stupa built to commemorate a particular spot or event. But this aspect will become clear only after complete excavation of the stupa including cutting of a section to the core of stupa which has not been done so far.
The Kesariya stupa mound attracted historians since last about two centuries. As early as in 1814 a gallery was cut here by Col. Mackenzie and in 1835, a sketch of it was published by Hodgson (Hodgson 1835: 121 and plate VII). A brief account of stupa, along with its sketch, was published in 1861-62 by Alexander Cunningham (1994: 64-67). It is not known why Cunningham left the stupa mound untouched although he conducted a limited excavation at another small mound called Rani-was situated about a kilometre east to it which yielded remains of a monastery (Patil 1963: 201). In spite of its large dimensions and recognized high significance, the stupa mound was surprisingly left unexcavated till 1997-98 when Archaeological Survey of India brought it under surgical knife and the results were phenomenal. The excavation report of the site is still not available but brief account of excavation conducted during 1997-2001 has been published by Archaeological Survey of India in the annual report for corresponding years (Archaeological Survey of India 1999; 2000; 2001; 2002).

The most outstanding architectural feature introduced at Kesariya is the presence of a large number of cell shrines, as units of worship, on all the terraces forming its base with a cylindrical stupa atop the highest terrace. This feature distinguishes it singularly not only in India but even globally. Overall there are 88 cell shrines distributed over lower five of the six terraces and additionally there are few more at the ground level between the structure and its enclosure wall but the ground level cells are believed to be later additions since they are placed beyond the circular base of the main structure and are not integrated to the body of stupa. Although the stupa still remains only partially excavated, approximately up to 40%, exposure of the complete elevation on one side, the north, has made it possible to get a complete picture of the stupa through logical projection of the plan drawing of each terrace.

The stupa is a six-terraced circular brick structure of which the lower three terraces have groups of three cells placed on four cardinal directions, and also on the four intersections. Thus, there are eight groups of three cells on the lower three terraces. On the fourth and fifth terraces however, they are placed only on four cardinal directions due to the reduced perimeter on these two higher terraces. Further, on the fourth terrace, the central cell in each group is larger, almost equal to the cells on lower three terraces, while the flanking cells in each group are smaller in dimension. On the fifth terrace the flanking cells are missing altogether leaving only one cell on each of the four cardinal directions. On the sixth terrace the cylindrical stupa is the sole structure, there being no cells on it.
The cells have an average size of 2.20 x 1.80 m with an entrance of 70 to 90 cm though these openings are sometimes found secondarily reduced to about 60 cm accompanied by corresponding raising of floor inside the cell as well as on the terrace outside which is meant for circumambulation. The original floors have been constructed of bricks with a rammed layer of lime concrete over it but the secondary raising has been done only by laying additional layer of rammed lime concrete, in all probability necessitated after corrosion of original floor due to devotee’s treading and weathering action. Due to fallen roof and walls, the height of the cells is not available but it must have been low as the next higher terrace, which can reasonably be taken as the roof level of the terrace immediately below it, leaves a vertical space of 2.25 m only. Cells are provided with a low platform admeasuring about 1.80 x 1.0 x 0.25 m attached to the back wall in front of the entrance. Over the platform a stucco image of Buddha is placed but it has been damaged in most of the cells, the only cells where it is preserved and that also only below the waist, belong to the group of three cells excavated during 1997-99 on the first terrace in the north east direction. In view of their severely damaged condition, highly fragile composition and perennial exposure to the weather adversaries they have been now aptly and appropriately covered over by the excavators to provide longevity to it as they are rarely present elsewhere and hence need to be preserved for posterity and future research. The main images are made up of a core matrix of clay, lime, brick jelly, sand, husks etc. To this core a smooth layer of lime plaster has been imparted, over which there is a lime wash, white or red. At times, there is evidence of a re-coat of lime plaster on the image. Although highly damaged, the three cells of this group depict Buddha seated cross legged in padmasana over a cushion and two of them are in bhumisparsa mudra (earth touching posture). There are niches on the two sides of the rise of platform in two cells of which one is empty but the other has lion figures in the niches ascribed to Gupta period. In the third cell of this group the rise of platform is plainly plastered but there is a possibility that the removal of plaster on the rise may reveal niches beneath it as has been the case in the adjoining cells. In some cells there are other stucco images attached to the side walls but they have been damaged beyond recognition and their composition materials are inferior to that of the main images although the two are basically similar in nature. The intervening spaces between the groups of cells have aesthetic polygonal designs with varying pattern on different terraces.
The combination of cell shrines and geometric pattern in an integrated way is unprecedented for stupa architecture although separate examples of these two features can be traced at some other places. Lauriya Nadangarh stupa, situated in Pashchimi (west) Champaran district 110 kms north to Kesariya stupa is a multi-terraced structure with the lower terraces having polygonal designs resembling those at Kesariya. But the upper terraces at Lauriya Nandnagarh are plain circular and the cell shrines are not found on any terrace. It can be assumed that Lauriya Nandangarh stupa, which is earlier by about three hundred years, may have been the inspiration from where the polygonal pattern were borrowed at Kesariya. But Kesariya architecture got completely metamorphosed with the introduction of so many cell shrines integrated with these polygonal patterns. Another stupa which is also a multi-terraced structure with polygonal designs is the Choukhandi stupa at Sarnath in eastern Uttar Pradesh. This stupa is datable to the Gupta period and thus can be chronologically bracketed together with Kesariya stupa. But there are no cell shrine even in the contemporary Choukhandi stupa. The octagonal tower on the top of Choukhandi stupa is a later structure of Mughal period which might have obscured or replaced the pre-existing stupa which in all probability was a cylindrical stupa on the basis of comparisons of structure of other similar stupas belonging to the same chronological time frame.

As far as shrines are concerned, we have had examples of a single shrine centrally placed on a high-rise platform which contains a single large stucco image of Buddha. Stupa site 12, 13 and 14 at Nalanda Mahavihara datable to the contemporary Gupta period belong to such a category where there is a high solid platform of bricks accessible through a flight of steps on one side. A large shrine in the middle over this solid platform houses a huge stucco sculpture placed over a brick platform in the centre. In case of stupa site 12, additional shrines are there at the corners. The composition materials of Buddha sculptures are almost the same, but the Nalanda images are much larger in dimension compared to Kesariya. Stucco images can also be seen in stupa site 3 at Nalanda and Maniar Math at Rajigir (Misra 2008: 45-48) but they are essentially decorative in nature placed within niches on the exterior of walls unlike the Kesariya figures which are placed inside the shrine indicating that they were meant for worship. Thus, they are essentially different in function or purpose. The tradition of shrines containing stucco image in Buddhist brick stupas continued in the subsequent Pala period (8th to 12th century CE) as evidenced at Vikramshila Mahavihara, Antichak (Bhagalpur district in east Bihar) and Somapura Mahavihara, Paharpur (Bangladesh).

The Kesariya stupa is gradually changing the concept about the introduction of the mandala form of architecture in Asia. So far, the Borobudur stupa datable to 8th-9th century CE was regarded as the earliest mandala building in ancient Asia. Thus, the origin of Buddhist mandala architecture was believed to have taken place in the central Java island of Indonesia where Borobudur stupa is located. The oldest surviving architectural mandala outside Indonesia was represented at Tabo in Spiti valley of Himachal Pradesh in north India (Khanna 2008: 122) which is ascribed to 10th-11th century CE, about two hundred years after Borobudur. The excavation at Kesariya has pushed back the antiquity of Buddhist mandala architecture in India by about five centuries from 10th-11th century CE represented by Tabo in Himachal Pradesh to 5th-6th century CE represented by Kesariya in Bihar. In the process it has reversed the belief that Buddhist mandala architecture came to India from Indonesia (Borobudur 8th-9th century CE to Tabo 10th-11th century CE). Now it is clear that it spread to Indonesia from India (Kesariya, 5th-6th century CE to Borobudur, 8th-9th century CE). It is now well established that the earliest Buddhist mandala architecture in Asia was erected in India, not in Indonesia.

However, the Kesariya stupa does not represent complete mandala cosmos like Borobudur which has all the three components of Mahayanic universe (Lama 2009: 173) namely:

i. Kamadhatu represented by the base
ii. Rupadhatu represented by four square terraces
iii. Arupadhatu represented by three circular terraces and stupa on top
At Kesariya, probably only one component, the arupadhatu has been represented. This is borrowed from the fact that only Buddha’s images have been sculpted on all terraces and that also within cell shrine for worship. There is no sign of mundane activity depicted anywhere nor there is anything related to detachment from worldly passions. Since all the terraces below the stupa proper are uniform in sculptural representation it is inferred that only one component has been depicted which is the arupadhatu in view of the fact that it depicts only Buddha image representing the superior sphere of complete detachment, pure knowledge and perfection. It is to be further noted that all terraces are circular in plan, there being no differentiation of geometric pattern on different terraces and hence there is nothing like inverted combination of square and circular terraces as Swati Chemburkar has contemplated to project (Chemburkar 2018: 175) on the basis of presence of cells only on four cardinal directions on the fourth and fifth terraces. It should be noted that there also the cells are placed along the circular circumambulatory path and the top sixth terrace is also circular having cylindrical stupa on the top. It may be surmised that mandala architecture made a beginning at Kesariya in 5th -6th century CE and at this initial stage of experimentation only one Mahayanic universe was attempted to be constructed.

Giryek stupa is located on the lower of the two lofty peaks at the bank of river Panchane in the village bearing the same name. It lies close to the historically acclaimed city of Rajgir in Nalanda district of central Bihar, hardly about 20 kms away from the famed ancient centre of oriental learning known as Nalanda Mahavihara which was established in Gupta period almost contemporary to the erection of Giryek stupa. Alexander Cunningham identified the Giryek hill both as the “solitary rocky hill” mentioned by Fa Xian (Legge 1886: 80) and as the “Indra-sala-guha” or the cave of Indra’s stone mentioned by Xuan Zang (Watters 1996: vol. II 173), the reason being that both refer to the same story of Buddha responding to Indra with solutions on 42 questions raised by the latter. While Fa Xian refers to the existence of only monastery at that spot Xuan Zang records the presence of a stupa in addition to the monastery called the hamsa sangharam or “goose monastery”. This indicates that the monastery pre-dates the stupa and that the stupa was erected between 5th and 7th century CE when the place was visited by Fa Xian and Xuan Zang respectively. Thus, the period of construction of Giryek stupa is taken to be around 6th century CE, which received support from the archaeological excavation as well, on the basis of stylistic comparisons of the exposed structure related to the cylindrical stupa, the niches and the brick mouldings.

According to the celebrated Chinese monk traveller Xuan Zang, Giryek stupa was constructed over the spot where the bodhisattva in the form of benevolent goose sacrificed his life for the cause of monks who were suffering from insufficient pittance. The ruins of Giryek stupa finds mention in the work of early explorers like Buchanan Hamilton, Ravenshaw, Cunningham, Broadley, Hunter, Beglar and Bloch. Apparently the site may have been ignored for excavation as the cylindrical stupa was already visible with cavities made for treasure hunting and the debris around it formed a very small mound at the base of cylindrical structure discouraging the possibility of any major finding. Cunningham indeed conducted limited diggings complementary to the earlier cavity cut but it was also a treasure hunt in nature like the earlier activity. Close to the cylindrical structure on the west side, digging was undertaken by Cunningham though on a very small scale which yielded good number of lac seals with stupas carved on them and also the inscription denoting the Buddhist creed. Cunningham took it to be another small stupa. But when Archaeological Survey of India took up excavations in 2010-11, the true nature and morphology of the structures could be understood correctly and what emerged from it exhibited a marked change in the concept of stupa’s architectural planning.

The most outstanding contribution of the recent excavation at Giryek stupa is the discovery of another sacred structure in close vicinity of, and subdued to, the main stupa. So far stupas enjoyed the status of singular sacrosanct structure but the presence of another holy religious structure in such a
close association of stupa may require a qualitative review in the concept of architectural planning of stupas and induce the need of further probe to find more such examples. The sacred character of the other structure referred as a low platform is revealed through the following observations:

i. The platform is placed very close to the stupa, only about 1.90 meters apart.
ii. A common enclosure wall surrounds the two structures - the stupa and the platform.
iii. There is a small chamber in the centre of platform and in the south west corner of this chamber about one foot below the surface, firmly embedded in the mud mortar, was found 84 seals of lac bearing on it stupa designs and inscription representing Buddhist creed.

Fig. 3 General view of Giryek stupa. Source: Archaeological Survey of India.

Fig. 4 Plan drawing of Giryek stupa. Source: Archaeological Survey of India.
It is remarkable that the two structures, stupa and platform, are not centrally aligned with each other implying thereby that the platform was not conceptualized simultaneous with the stupa planning. At the same time, it must have been included in the plan immediately thereafter as evinced by the fact that the platform of the two structures are chronologically very close and strikingly similar in basic designs. Further, the function of both structures was also common – the stupa was meant for worship and the low platform close to it was used for performing religious rituals as testified by the discovery of large number of seals with Buddhist creeds inscribed on them. It can be said that both the structures were complementary in nature or, to be more correct, the low platform was subjugated to the main structure for completing the religious worship. Therefore the low platform was placed very close to the main stupa and was jointly encircled by a common wall. That this enclosure wall was erected at the time of constructing low platform, or immediately after it, is clear from the fact that the wall makes adjusting alignment in respect of both structures. It can be observed that on the southern side the wall runs straight as the low platform is linearly aligned to the southern face of stupa platform. But on the northern side the wall has a recess of about 1.70 m where the stupa ends, and the low platform begins. This is possibly driven by the idea of keeping the width of circumambulatory path uniform (1.90 m) all around the structures and also between the two structures. It is remarkable that the circumambulatory path is about 2 m wide almost uniform everywhere and has a rammed floor of brick jelly in lime mortar. Now, only outline of the foundation wall remains. Consequently, there is no trace of the location of entrance which is a part of superstructure. But certainly, there must have been one somewhere to allow access to the devotees for circumambulating the stupa and performing rituals or conducting offerings at the low platform, probably in affiliation to the adjoining stupa. The enclosure wall is made up of bricks laid in mud mortar, is about 75 cm thick and runs for about 23.15 m east-west, 14 m north-south on eastern side and 12.30 m north-south on western side, the difference of 1.70 m resulting from the wall negotiating to keep uniform distance from the two structures.

The low platform is similar to the platform of the stupa but it is smaller in dimension. The stupa platform is about 2.70 m high and is a two-tiered square structure measuring 11 meters at one meter high lower tier and about 8.5 m at the 1.7 m high upper tier. The low platform is only about 2 m high and is a square of about 6.70 m.

Although the cylindrical stupa at Giryek has close resemblance to the Dhamekh stupa, Sarnath in Uttar Pradesh and Kesariya stupa in Bihar, the low platform at Giryek as a separate structure in close association of stupa is a stand-alone entity exclusive at Giryek. Like the other two examples, Giryek stupa is also datable to the 6th century CE on the basis of the cylindrical shape of stupa as well as the niches and the mouldings on the exterior of plastered elevation. What prompted the planner to add a separate low platform to the stupa complex at Giryek as an exclusive example is not clear. If it was a step to restrict offerings or ritualistic activities to a limited designated place, it is indeed a great management initiative towards conserving the main stupa structure and must be admired in this light.

On the basis of observations from the two recent excavations of stupa mound in east India, at Kesariya and Giryek, many new features have emerged representing a paradigm shift in the concept of Buddhist architecture or its planning. These two excavations conducted at the turn of this century (1997 to 2011) should encourage the archaeologists to explore and unravel more such examples in future and review the overall development process of stupa architecture in the new light.

Acknowledgement
Archaeological Survey of India for photographs, drawings and information on measurements.
References
SEM-EDS Analysis and Elemental Composition Study of Stoneware Glazes from and 12th to 14th-century Kota Cina, Sumatra and the Temasek Period of Singapore, Alongside Glaze Formulae from Song, Yuan and Ming Chinese Kilns

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SEM-EDS analysis was performed on stoneware sherds from the 12th-14th century site of Kota Cina in northern Sumatra and 14th-15th deposits in Singapore, under St. Andrew’s Cathedral. Analyses of both bodies and glazes was performed, with the aim of comparing their chemical compositions with each other and with data concerning Chinese-produced high-fired ceramics in the published literature. Overall, while the fluxing agents within glaze composition of both sites is largely similar to Chinese calcium-based glazes, the presence of magnesium and lead-rich outliers, along with the suggestion that the glazes’ calcium content derives not from limestone, but plant or bone ash, suggests that Southeast Asian kilns may be contributing a larger proportion of stoneware exports at both sites than previously considered.

Introduction

High-fired ceramic vessels comprise just one aspect of the network of goods and ideas traded in Southeast Asia during three centuries (12th-15th) reflective of evolving attitudes concerning trade and exchange. Polities in the region were involved with the production, distribution and use of ceramics, metals, foodstuffs amongst other materials, with the South China Sea acting as a conduit between kilns in mainland China and other states, and their recipient markets elsewhere in the region (Heng 2009: 2-4; Miksic 2013: 93-109). The significance of the Chinese production and exchange of high-fired ceramics is highlighted by their dominance in Southeast Asian archaeological sites, to the extent that sites are largely dated using correlations with Chinese typology sequences. Ceramics are the main material used to study entanglements between Southeast Asia and China due to the taphonomic biases involved in the environments in which these traded goods would be deposited, which degrade many other types of materials (Miksic 2013: 289-290; Fahy 2014).

The two sites discussed in this paper represent two temporal ends of this period ranging from the dissolution of the empires of the past such as the Angkor and Srivijayan polities and the fragmentation of the region into individual trading posts and city-states (Miksic 2013: 103-107). Kota Cina’s occupation period highlights this earlier phase at the twilight of the earlier thassalocracies and the role of Chinese merchants in shaping settlements and patterns of trade and exchange (Miksic 2013: 121-125), while Singapore is emblematic of the latter multipolar period (Miksic 2013: 20).

Stoneware from Kota Cina, a 12th–14th century trading post formed from the coalescence of foreign merchant interest and local systems of social organisation, alongside those of Singapore, a 14th–15th century mercantile city-state which prospered from its geographical location linking the Andaman and South China Seas, has much to offer in revealing patterns of trade and contact between China and Southeast Asia during shifts in the political centralisation and fragmentation of both regions. The city-state of Singapore benefited from increased volumes of trade into and within Southeast Asia and eventually entered mythopoetic literature as a pseudo-legendary kingdom (Miksic 2013: 153-154), these trends being contemporary with shifts from Chinese re-engagement in trade with the region to the Ming Dynasty’s isolationist policies alongside the multipolar status quo giving way to the re-emergence of maritime empires in the Malay Archipelago such as Majapahit and Singapore’s successor, Melaka (Heng 2019).
**Kota Cina**  
Kota Cina (lit. “Chinese Fort”) is an archaeological site in northern Sumatra, notable for its vast array of Chinese-style ceramics. It is not mentioned within ancient sources; Marco Polo’s later account of the region states that there was little sign of settlement in northern Sumatra when he arrived there with some Chinese sojourners, necessitating the construction of one by his entourage (Miksic 2013: 121-123).

Kota Cina has been dated stylistically and via radiocarbon to the Southern Song Dynasty, which also overlaps with the post-Srivijayan fragmentation (Miksic 2013: 121-125). Chinese and Indian co-habitation was suggested by the 1969–1977 excavations of McKinnon (1984) and more recently in Perret et al. (2013). The settlement appears to have been one long episode from the 12th–14th centuries, where settlers associated with massive volumes of Chinese-style ceramics interacted with others possessing Buddhist imagery of the Chola Tamils, also evidenced through Chinese and Sri-Lankan coinage at the site confirming the 12th-century dates (McKinnon 1984).

The site’s **terminus ante quem** was determined from high-fired porcelains. McKinnon (1984) states that the lack of Ming blue-white porcelain indicates an abandonment of the site prior to its production and settles on 1380 as the latest possible date for its abandonment. Taken together, these date Kota Cina to the gap in political centralisation in the Malay Archipelago between the fall of the Srivijayan system and the rise of the Majapahit Empire (Miksic 2013: 106-111, 184-187) and may speak to trends concerning these interactions between Indian and Chinese settlers and traders in the economy of Southeast Asia.

The only scientific analysis performed on material from Kota Cina thus far has been Miksic and Yap (1992), where a combination of major and minor elements were put through principal component analysis to test hypothesis concerning their potential derivation from Java or Thailand.

**Singapore**  
Archaeological proof of Singapore’s material wealth and social complexity emerged since the late 1980s following punctuated explorations since British colonisation, and it is now the most extensively studied city of 14th-century Southeast Asia (Miksic 2013: 146-154; 440). Initial archaeological investigations followed from the British settlement of Fort Canning Hill, built over the ancient palace complex known as “Forbidden Hill”, and Thai and Yuan Dynasty ceramics were found confirming the antiquity of its occupation; later excavations of Fort Canning have expanded our knowledge of ancient Singapore (Miksic 2013: 222-240).

The vast majority of artefacts found in this 14th-15th century “Temasek layer” were ceramics. Concentrations of porcelain and gold on the Fort Canning site, alongside earthworks associated with ancient walls of Singapore, have been used to surmise that the residents of the “Forbidden Hill” enjoyed a privileged status relative to the lowland settlers, and the variety and volumes of ceramics have also been used to argue that Singapore received Chinese imports on a considerable scale, at least relative to Kota Cina. Greenware porcelains form most of the porcelain remains in Singapore, echoing the eclipsing of Guangzhou and the Guangdong kilns by Quanzhou and the Fujian kilns. However, the continued presence of whitewares indicates that the former had not been totally superseded yet, and greenwares may have been produced from multiple kilns during this period of Singaporean history (Heng 2009: 184-186; Miksic 2013: 210-222, 434-440).

With regards to the **terminus post quem** and **terminus ante quem** of the Singaporean emporium, the former may be inferred from the presence of Song Dynasty coins, with the caveat that Chinese copper coins only became widely traded as currency between Malay Archipelago polities in the 14th century, with prolonged circulations and lifespans; the latter is difficult to precisely pinpoint, but
Porcelains of the late Ming Dynasty have been found in Empress Place, another riverine settlement, indicating that Singapore received some foreign imports (albeit on a considerably reduced scale) long after the alleged catastrophic conquest recorded in the Malay Annals (Miksic 2013: 310; 330-336). The city-state prospered through entrepôt trade by capitalising upon its location; no evidence has been found for great religious or political significance for the site, unlike the capitals of its successor-states, the Melaka and Johor Sultanates, or its competitors in Trowulan (Xin 2015: 352-355).

The St. Andrew’s Cathedral site may be interpreted as a non-elite settlement within the autonomous Kingdom of Singapura, containing material typical of the realm.

Preceding my analysis of the materials, the only chemical analysis of Chinese high-fired ceramics in Singapore has been Stulemeijer (2011), where trace elements were measured in the hopes of discerning kilns producing greenwares found here, with their distinctive capability compared with those of stylistic analysis; the latter has still proven to be more useful, potentially due to the choice of elements involved.

Aims, Materials and Methodology

• To what extent can we observe variation in ceramic compositions between 12th–14th century Kota Cina and 14th–15th century Singapore on any of these levels, and infer differences in stoneware production and trade dynamics, vis-à-vis Chinese ceramic industries?
• Can we discern if “Mercury jars” contained mercury, by identifying traces of mercury on their interior surfaces?

In addition to these research questions, the lack of previous studies on stoneware at these resolutions suggests a need to develop a framework to enable further research concerning ceramic production and distribution on this overlooked body of material. This may prove useful not merely for the wealth of stoneware currently stored within the NUS-NTU Archaeological Laboratory, but for numerous other contemporary vessels and sherds which generally are only broadly classified as “trade wares”, with little further analysis.

Materials and Methods

Glazed porcelains generally are the easier of the two types of high-fired ceramics commonly found during this period to identify with source kilns due to the highly diagnostic nature of their forms and decorations; it is on these grounds that the Singaporean high-fired assemblage has been considered to be dominated by Chinese produce. Stoneware vessels, assumed to reflect utilitarian goods-transportation uses, possess fewer such diagnostic features, making stylistic identification of these difficult. Hence, it may require high-resolution analyses such as identification of elemental proportions through X-ray spectroscopy (SEM-EDS) to find means of measuring the archaeological assemblage with the products of known kilns.

The STA sherds were taken from salvage deposits; hence there was little information concerning its context besides the general area of the 14th–15th century “Temasek Layer” from which it was excavated. The KTC sherds were a relatively narrow sub-sample as they were effectively the remnants of the 1969-1977 investigations now held in the NUS-NTU Archaeological Laboratory. Groups were made first by similarity in glazes and then body fabrics, such that the glazes could all be studied together. All glazed sherds were sampled and (usually) a maximum of three sherds from unglazed fabric groups were selected.

The material for this project comprised the following:
Table 1  Types and numbers of ceramic sherds in St. Andrew’s Cathedral and Kota Cina obtained from the NUS-NTU Archaeological Laboratory in Singapore.

The resultant glazed fabric groups are as follows:

<table>
<thead>
<tr>
<th>Fabric group</th>
<th>Description</th>
<th>No.</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA-BUF-A</td>
<td>Brown glaze</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>STA-BUF-B</td>
<td>Red slip and brown glaze</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>STA-BUF-C</td>
<td>Grey slip/glaze</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>KTC-BUF-A</td>
<td>Glazed, red-pink fabric</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>KTC-BUF-B</td>
<td>Glazed exterior, grey fabric</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>KTC-BUF-C</td>
<td>Glazed on both sides, grey fabric</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>KTC-BUF-D</td>
<td>Glazed with multiple patterns</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>STA-BRI-D</td>
<td>Yellowish-green glaze exterior</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>STA-BRI-G</td>
<td>Reddish-pink fabric</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>STA-BRI-H</td>
<td>Two fabric colours glazed interior</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>KTC-BRI-F</td>
<td>Black glaze interior and exterior</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>KTC-TMP-A</td>
<td>Green glaze exterior</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>KTC-TMP-B</td>
<td>Brown-green glaze exterior; speckled interior</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>KTC-TMP-C</td>
<td>Brown glaze exterior</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>KTC-MER-A</td>
<td>Grey fabric with yellow surface colouration</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 2  Fabric groups, their descriptions and numbers of ceramic sherds present and sampled from St. Andrew’s Cathedral and Kota Cina for this project.

Sherd fragments were then ground down to ensure flatness, and then embedded into epoxy resin to permit their study within the SEM, a technique whose chief strengths are its ability to collect high-resolution data concerning the micro-texture and elemental composition of properly prepared
ceramic sherds (Tite et al. 1982). A vacuum chamber was used to extract the bubbles from the epoxy, and then the resin containing the sherds were ground and polished before being carbon-coated to avoid surfaces being charged by exposure to the electron beam and thus becoming unable to reflect a coherent signal (Reed 2005: 156-157).

Once inside the JSM-5910 SEM, the electron beam was used to generate images of the microstructure of the sherd fragments in secondary emissions mode (Reed 2005: 54-57). Looking at the generated backscatter image, I utilised the analysis software INCA 5.05, to generate target areas by drawing rectangles or polygons on its render, and hence measure the electron signal returned from the sherd surface of these areas in semi-quantification mode, following the example of Tite et al. (1982); due to the roughness of the surfaces being studied, full quantification was neither desirable or feasible (Loehman 2010: 271).

**Results**

SEM analysis of glazes generally focuses upon fluxing agents and metallic ions which comprise colourants, which reflect variations in glaze production sequences. I have chosen to focus primarily on calcium, potassium and lead due to their relative abundances within this corpus and their known uses in Chinese kilns and other production sites.

<table>
<thead>
<tr>
<th>Oxide</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MgO</td>
<td>Fluxing agent between 1170°C-1230°C; late fluidity permits strong adhesion to contours of stoneware body-fabrics</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>Fluxing agent, commonly associated with plant ash when it is burnt to produce lime; acts as an opacifier in opalescent Chinese “chun” glazes</td>
</tr>
<tr>
<td>K₂O</td>
<td>Fluxing agent, derived from feldspars and plant ash; commonly used in glazes as well as body fabrics to ensure slow and steady vitrification</td>
</tr>
<tr>
<td>CaO</td>
<td>Fluxing agent, usually derived from plant ash or limestone, desired to produce glazes that vitrify at 1100_C or higher</td>
</tr>
<tr>
<td>MnO</td>
<td>Colourant, generally producing brown, black and purple glazes; exclusively found as monoxide above 1080_C</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>Colourant, able to produce numerous colours in other oxide forms depending on oxidation number</td>
</tr>
<tr>
<td>PbO</td>
<td>Fluxing agent, relatively commonly mined and cheap to produce glazes; stable up to 1100_C as raw glaze</td>
</tr>
</tbody>
</table>

Table 3 Oxides used in this study as proxies for variability in raw materials in glaze production sequences. Oxide details from Hamer (1975) and Hamilton (1982).
Most of the STA glazes and all KTC glazes have calcium as their primary fluxing agent. This is entirely consistent with the extensive use of lime in Chinese glazes (Wood 1999: 30-33), and may be indicative of the kilns making these glazes borrowing from the same pottery traditions. The yellowish colouration on surfaces of KTC-MER-A sherd contains CaO% values very similar to the KTC
glazes, almost certainly indicating that these are the retained interfaces of degraded glazes. This aligns with the known glazing of mercury jars in earlier periods (Wong 2016: 14). KTC-BUF-C and D were noted during visual examination for the use of visually different glazes on their interiors (CI, DI) and exteriors (CE, DE), with the latter expressing multicoloured patterns. Under the SEM, only the latter groups’ glazes were discernible in backscatter mode. There is about a 7-9% difference in CaO concentrations between the surfaces of KTC-BUF-D, suggesting that there is a substantial difference in the lime content of their glazes. KTC-BUF-07 and 09 have more lime on their exteriors, whilst 10 has more on its interior. These trends open questions concerning these different compositions of glazes for the same vessel.

STA-BUF-02(B), 06(C), and 12(C), all of which are relatively matte, used potash (K₂O) instead of CaO as their chief fluxing agent. The use of potash in glazes was not unknown to Chinese potters but was not restricted to them either (Wood 1999: 215-216). STA-BRI-21(D) appears to have a concentration of MgO comparable to its CaO content. At 9.0%, this unique glaze exceeds all other MgO proportions amongst both bodies and glazes, indicating the deliberate addition of magnesia far above naturally-occurring levels. Among the entire corpus, the sole PbO-fluxed glaze was that of STA-BRI-20(G). This, combined with the sherd’s uniquely high ferrous proportions in their body fabric, suggests that it represents a unique ceramic tradition at STA, with the Singaporean material demonstrating greater variability than KTC in overall terms concerning main fluxes.

The versatility of both iron and manganese oxides as colourants was well-known to contemporary potters. Almost all glazes contained at least 2.0% Fe₂O₃ and at most 2.0% MnO, indicating that the former and not the latter was serving as the primary colourant for practically all sherds. No evidence for mercury retention was found on any of the sherds.

**Discussion**

![Scatterplot of mean STA (circles) and KTC (lozenges) K₂O% vs. CaO% values, compared to known Chinese glazes (grey squares) All values for Chinese material in this and Figure 2 are derived from Wood (1999).](image)

The glazes seen at STA and KTC exhibit K₂O and CaO proportions largely similar to those seen within the remit of contemporary Chinese pottery; even the low-calcia high-potash buff wares at STA share antecedents with some of the alkali-glazes seen in China. Thus far, the idea that the Southeast
Asian sherds are compatible with the technologies witness in Chinese kilns is vindicated; however, difficulties emerge concerning the ability to pinpoint any one kiln as being the most representative of ceramic industries supplying Singapore and Sumatra due to the broad ranges of proportions seen in their glazes, even given evidence from the body-fabric affinities.

Unlike the K₂O vs. CaO ratios, the Southeast Asian material stands in stark contrast with the surveyed Chinese ceramics due to their relatively elevated MgO and P₂O₅ content. Curiously enough, MgO and P₂O₅ both appear to exhibit statistically significant linear correlations with CaO, suggesting that plant or perhaps bone ash was being used for lime content in Southeast Asian glazes. It may be that the glazes seen in Southeast Asia represent a market with different demands from Chinese customers, or that they are not even Chinese products, but were manufactured in Southeast Asian kilns – one candidate is Sisatchanalai in Thailand, a prolific contemporary stoneware producer (Grave et al. 2000) – and the body fabrics in fact represent their products, which have successfully copied Chinese body-ceramics but not their glazes, either by choice or due to geological limitations.

Several causes for these dramatic divergences may be propounded:

- These are Chinese wares which have been glazed with formulae which have yet to be scientifically recorded.
- These are ceramics which have managed to replicate Chinese ware but use glazes of different flux formulation.
  - Plant/bone-ash flux formulae were chosen due to a lack of limestone.
  - Plant/bone-ash flux formulae were chosen due to prevailing ceramic technological traditions.

The second hypothesis, of there being a lack of suitable raw materials, may be dismissed due to the vast abundance of limestone seams and karsts in the region (Gillieson 2005: 174). Between the other two hypotheses, the first is essentially an argument from lack of evidence; conversely, it is known that wood-ash glazes have employed extensively in Southeast Asia from at least the Angkorean period, lending weight to this theory (Miksic 2009: 51).

Ideally, a broader investigation utilising element quantification aimed at Southeast Asian stoneware bodies, along with wood-ash and limestone fluxes, would be able to provide a suitable corpus to compare these technologies. This would help to establish if the “Chinese” nature of the KTC and STA bodies may be accounted for by less distant kilns in Southeast Asia, in which case more questions are opened concerning how and where trade links fuelling the economies of these two sites truly lay in these critical centuries.
Figs. 2a and 2b a) Scatterplot of mean STA (circles) and KTC (lozenges) $P\cdot O\cdot %$ vs. CaO% values, compared to known Chinese glazes (grey squares); b) Scatterplot of MgO% vs CaO% values for the same glazes.

**Conclusions**

Having demonstrated that we may have to look beyond previously surveyed Chinese kilns for the source of the glazed sherds, further questions are raised concerning the means through which they were brought from kilns to ports, and onwards dispersed to settlements. In order to make a truly instructive conclusions from just ceramic data, a whole suite of material from a variety of contexts – Chinese and Southeast Asian, terrestrial and shipwreck – will have to be sampled for body and glaze compositions; the addition of data from local kilns will make considerable progress towards overturning Sinocentric models and assumptions concerning high-fired ceramics.

In conclusion, I hope that this study does not just vindicate the choice of analytical and statistical techniques used to evaluate the material, but also opens up new avenues and possibilities concern-
ing such high-resolution scientific studies of ceramics. In this way, the field may hope to utilise the vast wealth of material culture available to its dedicated researchers to investigate this region and its history, not merely in terms of its stoneware or ceramic corpus, but to form a complete picture – or as close to one as we may realistically achieve – of life in and beyond these trading-ports as seen through their material remains.

References


Miksic, J and Yap, CT (1992) Compositional Analysis of Pottery from Kota Cina, North Sumatra: Implications for Regional Trade during the Twelfth to Fourteenth Centuries AD. Asian Perspectives 31(1), 57–76.


Comparative study of pottery manufacturing processes in North and central Vietnam
Nghiên cứu so sánh của các quy trình sản xuất gốm ở miền Bắc và miền Trung Việt Nam

Cécile de Francquen
Université Libre de Bruxelles

As they are linked to the socio-historical context in which they are implemented, technical processes are an important source of information for those who want to learn about the history and evolution of society. However, they have rarely been studied in Southeast Asia. In this paper, we present the first results of our comparative technology of pottery manufacturing processes in North and Central Vietnam. Description and comparison of technical processes have led to the identification of six technical traditions. The analysis of their spatial distribution allows us to formulate interesting hypothesis about their evolution and the history of potters’ communities.

As many works conducted mainly on the African continent have revealed, comparative study of pottery techniques can be a powerful tool to approach the history of the populations using them. However, this approach has rarely been applied in South-East Asia, where it could provide new insights on the populations’ history. In that prospect, we undertook a comparative study of the ceramic traditions of Central and North Vietnam, to find out what it reveals about the recent and earlier history of their users. While preliminary, this study confirms the potential of using this approach in the region.

Only one similar research has been conducted in Southeast Asia, by Louise Cort, Leedom Lefferts and their team. Their extensive research on pottery production processes in northeast Thailand enabled them to highlight phenomena of migration, ethnic fluidity and the influence of the socio-economic context on the history of techniques, thus demonstrating the relevance and interest of using comparative technology in this part of the world (Lefferts et al. 1999).

They extended their research through a survey across most of Mainland Southeast Asia and identified six main technical groups, three of which are present in our research area and associated with three major ethnic groups: the Kinh majority living in the lowlands, the Tai minorities in the northern highlands and the Austronesian and Austroasiatic minorities in the central highlands (Cort et al. 2010).

Cort and Lefferts’ research provides us with the general context of pottery production in Southeast Asia, allowing us to replace our own observations within a broader framework. However, such a small number of technical groups for a large-scale study necessarily conceals some variability in the practices within each group. Thus, the objective of the present study is to identify those variabilities and what they tell us about the history of potters’ communities. Cort and Lefferts’ research thus provides us with a general context of pottery production in Southeast Asia, allowing us to replace our own observations within a broader framework.
Background and Methodology
Thanks to the work of researchers such as Haudricourt, Creswell, Lemonnier, we know that techniques are social constructions in their own right, fuelled by multiple representations and transmitted through inter-individual interactions. They are learned and reproduced within a specific social network that determines both their characteristics and their potential for transformation. In our research, we sought to highlight these networks and the links between potter communities, their environment and the socio-economic context in a historical perspective.

Our data were analysed using comparative technology, a method inspired by historical linguistics, which consists in comparing manufacturing techniques and processes – here, pottery making – and assess the spatial distribution of the technical traditions identified, in order to reconstruct past connections between communities of practice (Gosselain 2018).

Technical processes documented within the studied area - North and Central Vietnam - were described, using the framework of the chaîne opératoire. The term chaîne opératoire is used to refer, both to the technical process itself and to the analytical tool used to document this process and describe it systematically. It divides the whole process into sequences of actions assembled in successive phases. The pottery chaîne opératoire has five strategic phases - which cannot be excluded: raw material extraction, clay preparation, shaping, drying and firing. The shaping phase is divided into two sub-phases: the roughing-out and the preforming (Gosselain 2018: 8).

Descriptions of the technical processes following this systematic segmentation were then compared to identify similarities and differences that would point to the existence of different technical traditions - ways of doing things shared by several groups - and could testify to historical relations between these groups.

The technical traditions thus highlighted were mapped to identify the characteristics of their spatial distribution. Since the spatial distribution is the result of relationships that have succeeded one another over time, the social, historical and geographical factors that explain these configurations must be identified (Gosselain 2017: 294). This can thus contribute to our better understanding of population movements, development and evolution of political boundaries, identity negotiations and socio-economic transformations (Gosselain 2000; Lefferts et al. 1999; Livingstone-Smith 2016).

However, it should be noted that the different steps of the chaîne opératoire involve techniques that are produced and reproduced within networks of various scales and thus inform us about different levels of potters’ social integration. In this article, we focus on direct and sustained relationships with experienced people, in which transmitted knowledge involves specific body techniques that require a long learning process. Because of the meaningfulness of the networks in which they circulate and their embodied aspect, these techniques are intrinsically linked with the identity of the potter and tend to be more stable over time, allowing us to reconstruct a “genealogy of practices” (Gosselain 2018: 7).

In the specific context of Vietnamese, where pottery is mainly produced within specialized and often isolated craft villages, we identified two phases of the chaîne opératoire corresponding to this definition:

- Shaping involves many body techniques. Although potters claim to have learned by themselves (tự học), most were born into a potters’ family and acknowledge having learned informally since they were little (tự bé) through observation and imitation. This reflects the fact that the learning of this technical knowledge takes place through direct and sustained interactions within a restricted network; that is, usually with close relatives.
Firing and firing structures. In Vietnam, pottery is fired within the household/ workshop, each having its own firing structure. Firing degree is assessed by sight (colour of the potteries or flames) and therefore has a strong sensory involvement, that is difficult to compare. On the other hand, the construction of firing structures also requires an important know-how, transmitted, at least within the village, and always through sustained relationships.

It is these two aspects of the chaîne opératoire - the shaping and the firing structures - that we discuss within this article, as they mobilise embodied knowledge learned within close networks. Therefore, the comparative study of these elements enable us to highlight direct and sustained contacts between potters and between their communities.

Sources

The original data used in this paper were acquired during interviews and direct observations in 12 villages in North Vietnam and 2 in the central Vietnam, as part of my master thesis fieldwork. These inquiries followed the guidelines defined by other researchers on African pottery manufacturing processes (Gosselain 2018, Mayor 2010, Livingstone-Smith 2007). The different steps of the chaîne opératoire were documented by film and photography. Direct observation was not always possible for every steps of the production process. Nevertheless, we made sure to at least document the shaping step. The missing steps were documented by observation of tools, spaces and interviews with the potters. In order to document the networks around the manufacturing process, those interviews also considered the identity of the potters (name, age, sex, ethnolinguistic affiliation…), their life trajectory (family, apprenticeship, travel,…), vernacular descriptions and interpretations of the manufacturing process, as well as information on the social and historical aspects of the production.

Additional data were acquired through three types of documentary sources:

- Scientific papers on the history of traditional craft villages, most of which concern Northern villages (Nguyễn and Noppe 2006; Fanchette and Stedman 2009) and therefore provide some historical data to complement the ethnographic data collected in the field.
- Vietnamese documents, in the form of video reports or articles. They enabled us to identify many production villages within and beyond the prospected area. Many provide only superficial data and could not be used in our comparison. For 9 villages, however, these documentaries provided sufficient data to be included in our analysis. For 6 others, the available data, although incomplete, was clear enough to propose an identification of the technical traditions, a posteriori. They could therefore be included in the spatial analysis.
- French colonial sources were also used, some of which describe with great precision the techniques used at the time. In areas where both were available, colonial sources provided historical depth to the current data.

Technical Traditions

By comparing each step of the chaîne opératoire from our data, we identified six technical traditions called repertoires (Table 1). Although these repertoires are mainly distinguished by their shaping technique, and more precisely their roughing out, each one has its own characteristics at each steps of the chaîne opératoire and in the organisation of production.

In each repertoires, some details may change according to the size of the pots. The following descriptions concern medium-sized recipients1, but most of these characteristics also apply to smaller and/or bigger ones.

---

1We chose to use the medium-sized pottery production techniques because, each of the six repertoires produce this types
<table>
<thead>
<tr>
<th>Village (District, Province)</th>
<th>Localisation</th>
<th>Visit./Docu.</th>
<th>Rouging out</th>
<th>Preforming (before drying)</th>
<th>Preforming Support</th>
<th>Firing</th>
<th>Repertoire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca Noon (Tây Giang, Quang Nam)</td>
<td>15°49'59.1&quot;N 107°48'54.3&quot;E</td>
<td>D</td>
<td>drawing of a lump?</td>
<td>Floor</td>
<td>Enlarg.?</td>
<td>open fire</td>
<td>1</td>
</tr>
<tr>
<td>Độc Tô Re (Kon Rẫy, Kon Tum)</td>
<td>14°23'45.1&quot;N 108°56'57.0&quot;E</td>
<td>D</td>
<td>drawing of a lump + coil</td>
<td>Floor</td>
<td>Enlarg.</td>
<td>open fire</td>
<td>1</td>
</tr>
<tr>
<td>Bảo Thập (Krông Ana, Đắk Lắk)</td>
<td>12°29'01.0&quot;N 108°01'22.2&quot;E</td>
<td>D</td>
<td>drawing of a lump + coil</td>
<td>Floor?</td>
<td>&quot;Enlarg. + Paddling&quot;</td>
<td>open fire</td>
<td>1</td>
</tr>
<tr>
<td>Yang Tao (Lệ, Đắk Lắk)</td>
<td>D</td>
<td>drawing of a lump + coil</td>
<td>Static support</td>
<td>open fire</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bảo Gor (Đa Teh, Lâm Đồng)</td>
<td>12°26'20.0&quot;N 108°13'06.0&quot;E</td>
<td>D</td>
<td>drawing of a lump + coil</td>
<td>Static support</td>
<td>&quot;Enlarg. + Paddling&quot;</td>
<td>open fire</td>
<td>1</td>
</tr>
<tr>
<td>Krăng Go (Đom Đaeng, Lâm Đồng)</td>
<td>11°31'48.7&quot;N 108°55'44.0&quot;E</td>
<td>D</td>
<td>drawing of a lump + coil</td>
<td>Static support</td>
<td>Enlarg.</td>
<td>open fire</td>
<td>1</td>
</tr>
<tr>
<td>Bình Đức (Phan Hiệp, Bình Thuận)</td>
<td>11°15'17.3&quot;N 108°50'52.4&quot;E</td>
<td>D</td>
<td>drawing of a lump + coil</td>
<td>Enlarg.?</td>
<td>Static support</td>
<td>open fire</td>
<td>1</td>
</tr>
<tr>
<td>Trà Son (Đo Lương, Nghệ An)</td>
<td>18°49'59.3&quot;N 105°26'43.2&quot;E</td>
<td>V</td>
<td>Flattened coil on slab</td>
<td>Enlarg.</td>
<td>turntable</td>
<td>Enlarg.</td>
<td>Semi-structure</td>
</tr>
<tr>
<td>Cử Đàm (Nghi Xuân, Hà Tĩnh)</td>
<td>18°36'21.0&quot;N 105°48'33.1&quot;E</td>
<td>V</td>
<td>Flattened coil on slab</td>
<td>Enlarg.</td>
<td>turntable</td>
<td>Enlarg.</td>
<td>Semi-structure</td>
</tr>
<tr>
<td>Quê An (Quê Son, Quang Nam)</td>
<td>15°39'10.0&quot;N 108°12'18.8&quot;E</td>
<td>V</td>
<td>Coil flatten on a slab</td>
<td>Enlarg.</td>
<td>turntable</td>
<td>Enlarg.</td>
<td>Semi-structure</td>
</tr>
<tr>
<td>Vĩnh An (Đức Phố, Quang Ngãi)</td>
<td>14°44'10.8&quot;N 109°01'51.7&quot;E</td>
<td>D</td>
<td>Enlarg.</td>
<td>turntable</td>
<td>Enlarg.</td>
<td>Lò bão</td>
<td>2</td>
</tr>
<tr>
<td>Quang Đức (Tay An, Phú Yên)</td>
<td>D</td>
<td>Wheel (2 persons)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trưởng Thịnh (Đồng Hóa, Phú Yên)</td>
<td>D</td>
<td>Flattened coil on slab</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hành Mai (Phú Cát, Bình Định)</td>
<td>D</td>
<td>Coil on slab?</td>
<td>Turntable?</td>
<td>Enlarg.?</td>
<td>lò ngà?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Văn Sơn (An Nhơn, Bình Định)</td>
<td>13°54'52.4&quot;N 109°04'39.0&quot;E</td>
<td>D</td>
<td>Coil on slab</td>
<td>Centrifugal force + Wooden tool</td>
<td>Wheel (2 persons)</td>
<td>?</td>
<td>lò ngà?</td>
</tr>
<tr>
<td>Huỳnh Lợi (Phú Yên, Vĩnh Phúc)</td>
<td>21°16'47.9&quot;N 105°42'33.1&quot;E</td>
<td>V</td>
<td>Flattened coil on slab?</td>
<td>Centrifugal force + Wooden tool</td>
<td>wheel (unknown type)</td>
<td>Lò bão</td>
<td>3</td>
</tr>
<tr>
<td>Gia Thuy, Nhon Quan, Ninh Bình</td>
<td>20°22'58.0&quot;N 105°46'59.2&quot;E</td>
<td>V</td>
<td>Coil on slab</td>
<td>Centrifugal force + Wooden tool</td>
<td>Wheel (2 persons)</td>
<td>na</td>
<td>Lò rồng</td>
</tr>
<tr>
<td>Châu Ô (Bình Son, Quang Ngãi)</td>
<td>15°17'52.1&quot;N 108°45'30.5&quot;E</td>
<td>D</td>
<td>Coil on slab</td>
<td>Centrifugal force + Wooden tool</td>
<td>Wheel (2 persons)</td>
<td>na</td>
<td>Lò hẹp</td>
</tr>
<tr>
<td>Phú Lạng (Quế Võ, Bắc Ninh)</td>
<td>21°09'16.1&quot;N 106°15'11.8&quot;E</td>
<td>V</td>
<td>Ring on slab</td>
<td>Centrifugal force</td>
<td>Wheel (2 persons)</td>
<td>na</td>
<td>Lò ông</td>
</tr>
<tr>
<td>Cây (Bình Giang, Hải Dương)</td>
<td>20°57'58.8&quot;N 106°13'35.0&quot;E</td>
<td>V</td>
<td>Coil on slab</td>
<td>Centrifugal force + Wooden tool</td>
<td>Wheel (2 persons)</td>
<td>na</td>
<td>Lò rồng</td>
</tr>
<tr>
<td>Hương Canh (Bình Xuyên, Vĩnh Phúc)</td>
<td>21°16'26.2&quot;N 105°38'52.8&quot;E</td>
<td>V</td>
<td>Coil on slab</td>
<td>Centrifugal force + Wooden tool</td>
<td>Wheel (2 persons)</td>
<td>na</td>
<td>Lò cổ</td>
</tr>
<tr>
<td>Kim Băng (Kim Băng, Hà Nam)</td>
<td>20°34'34.0&quot;N 105°52'19.3&quot;E</td>
<td>V</td>
<td>Coil on slab</td>
<td>Centrifugal force + Wooden tool</td>
<td>Wheel (2 persons)</td>
<td>na</td>
<td>Lò rồng</td>
</tr>
<tr>
<td>Thạnh Hà (Hội An, Quang Nam)</td>
<td>15°52'36.5&quot;N 108°15'56.7&quot;E</td>
<td>V</td>
<td>Coil on slab</td>
<td>Centrifugal force + Wooden tool</td>
<td>Wheel (2 persons)</td>
<td>na</td>
<td>Lò bão, lò ngà?</td>
</tr>
<tr>
<td>Đông Trù (Đông Trù, Quang Ninh)</td>
<td>21°04'38.8&quot;N 106°31'06.0&quot;E</td>
<td>V</td>
<td>Moulding</td>
<td>Moulded</td>
<td>Mould</td>
<td>na</td>
<td>Lò rồng</td>
</tr>
<tr>
<td>Bát Tràng (Gia Lâm, Hanoi)</td>
<td>20°58'38.9&quot;N 105°54'38.6&quot;E</td>
<td>V</td>
<td>Moulding</td>
<td>Moulded</td>
<td>mould</td>
<td>na</td>
<td>Lòغا</td>
</tr>
<tr>
<td>Ngọc Hải (Ngọc Hải, Cao Bằng)</td>
<td>22°44'19.5&quot;N 106°08'57.1&quot;E</td>
<td>V</td>
<td>?</td>
<td>Centrifugal force + ?</td>
<td>wheel (unknown type)</td>
<td>Paddling</td>
<td>Lò rồng</td>
</tr>
<tr>
<td>Hoằng Hợp (Hoằng Hòa, Thanh Hóa)</td>
<td>19°52'06.1&quot;N 105°47'14.3&quot;E</td>
<td>V</td>
<td>Hollowing of a coil</td>
<td>Centrifugal force + Wooden tool</td>
<td>Wheel (1 person)</td>
<td>&quot;Stamped Enlarg.&quot;</td>
<td>Lò cổ?</td>
</tr>
</tbody>
</table>

Table 1: List of documented sites with associated chaîne opératoire and repertoire.
In **repertoire 1**, pottery is a feminine secondary occupation. While some internal variations exist, pottery fabrication processes in those villages follow the same lines. The preform is made by drawing of a lump on a fixed stand, the potter moving around the stand to form the pot’s walls (Figure 1.a). After letting it dry for a few hours, preforming is made by scraping on the inside and the outside with a bamboo loop. The pots are fired in open fires and sprayed with a mixture of water and tree bark.

In **repertoire 2**, women make pottery during their free time. The roughing out is made by stamping a small disc of clay on a turntable that the potter spins with her toe. Then she crushes coils against her hand to make the walls (Figure 1.b). Forming is made before and after drying by expending the pot and removing clay from the inside with a bamboo loop, which is also used to form the bottom by scraping the outside. The firing structure consists of low walls with some kind of metallic wire rack that separate objects from the fire underneath. The pots are piled up to 1.5m and covered with straw. In this repertoire, potters only produce small and medium-size products although some claim that they could do bigger ones if they wanted to.

In the **repertoire 3**, in opposition with the previous ones, pottery is the main source of income and both men and women are involved in the production process. In those villages, production is or was formerly organised in cooperatives. Potters use fast-wheels spun by an assistant with her foot while preparing coils. Nowadays, the kicking-wheel is replaced by an electric wheel yet, the assistant is still needed to prepare the coils. Roughing out is made by adding coils to a slab of clay, without using centrifugal forces (Figure 1.c), then joining the coils with a wooden tool using the wheel. Another key characteristic of this repertoire is the use of closed kilns (*lô*), which are found in various shapes and sizes.

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of recipients. Which is not the case for small and big ones.
We identified five variations of this repertoire, all sharing the characteristics listed above. These variations correspond mainly to the size of the containers (one for small containers, one for medium-sized containers and three for large containers). We will not go into detail here about these variations - which would deserve a full article - as our purpose here is to make a comparison at a larger scale.

In repertoire 4, the potter uses a wheel that she sets in motion with her foot. She uses a single thick coil to form a block of clay on the wheel that she hollows during the roughing out (Figure 1.d). The shaping is carried out partly after a short period of drying by crushing the bottom and by internal and external scraping. Only small and medium sized pots are made using this repertoire.

In repertoire 5, the activity has been stopped for several years and the tools were no longer available, which made impossible for us to observe any part of the chaîne opératoire. However, based on the description made by the potter, we could easily determine that the manufacturing process had some significant characteristics: The production was a men-only occupation and the preforming was made with paddle and anvil.

Lastly, repertoire 6 is a moulding technique, using clay diluted in water, filtered and poured in a mould (Figure 1.e). After a few minutes drying, the mould is emptied of the liquid clay and only the dried clay stays on the walls of the mould.

As repertoire 4 and 5 have a single occurrence and repertoire 6 is a recently imported technique, they will not be further discussed.

Discussion
The spatial distribution of these repertoires has been analysed (Figure 2). However, so as not to overgeneralize, smaller elements of the chaîne opératoire were used to help interpret the spatial distribution of internal variations and overlaps between the repertoires. Indeed, these variations and overlaps are transmitted within - and thus inform us about - social networks of potter communities and changes in these networks over time. As such, they are evidences of how people reacted and adapted to socio-historical changes and allow us to propose a reconstruction of the evolution of those techniques and of the history of potter communities.

Spatial distribution of the first repertoire is quite clear as it is only used by Austronesian and Austroasiatic ethnic minorities inhabiting the central highlands of Vietnam. As it clearly coincides with one of Lefferts and Cort’s technical groups, we know that it is also found in Laos, Thailand and Cambodia (Lefferts et al. 2003). In Vietnam, at least, the technical boundaries of this repertoire coincide really well with natural (mountains) and ethnic boundaries. Internal variations exists in this repertoire, but as it was only documented through, often incomplete, second-hand data, we will not discuss them. However, further research on these internal variations could lead to new knowledge about the circulation networks of goods and know-hows among highlands ethnic groups.

This could also lead to a better understanding of the relations between highlands groups and coast inhabitants, as this first repertoire presents many similarities with the second repertoire - Cort and Lefferts even included them in the same technical group. Indeed, in those repertoires, the movement of the potters’ hands to raise the walls during preforming is very similar. Moreover, the pots are left to dry for a few hours before finishing the shaping by enlarging the pot and removing clay from the inside with a bamboo looped tool. Thus, not only the tool is similar, but the same sequence of operation is followed to form the pot. These similarities in the grammar of sequences and operations suggest that the two repertoires either have a common root and have subsequently evolved separate-
ly, or had had a lot of contacts in the past so that they evolved sharing common features. Either way, this implies that the concerned communities have historical links.

Yet, the roughing out method is clearly different. They not only involve different tools (a fix stand vs. a turntable), but also different corporeal techniques, as in repertoire 1, potters are standing and moving around the stand, while in repertoire 2, potters are squatting with their feet levelled with their hands. These postures and movements result from different socialisation processes, and must be linked with other cultural aspects. For example, it could be related in some ways to traditional

Fig. 2 Spatial distribution of the six repertoires. Source: Cécile de Francquen
clothes: in ethnic minorities, traditional clothes for women are long skirts, while traditional clothes for Kinh women are trousers, which allows them to squat more easily to work on a turntable.

When looking at the distribution map (Figure 2), the connection between those two repertoires is not clear, as the second repertoire is not constrained in a limited area. It was observed in villages of the Kinh ethnic majority, both in the north and centre of the country, and based on documentation, at least one more village of the central coast can be related to it. There is therefore no geographical consistency. Nevertheless, while our current data are too sparse and too heterogeneous to draw firm conclusions, they do indicate the possibility of a connection between the northern communities using this repertoire and central area of the country, in which case, the geographical relation between these two repertoires becomes clearer. This will have to be verified at a later stage of our research.

The repertoire 3 is found mainly in the north where it clearly dominates. Both historical sources and oral traditions associate it with ancient Chinese tradition. Moreover, kicking-wheels and some particular types of kiln found in the region (lò rồng) are known to have originated from China (Leonard and Noppe 2006; Lefferts and Cort 2003). Thus, it is clear that the close relation between Vietnam and China throughout the first and beginning of the second millennium impacted pottery production in the north of the country. However, this does not mean that these techniques are copy-pasted of what was done in China. It is more likely that they were incorporated into a pre-existing chaîne opératoire in the region, in ways that are still unknown. This could be revealed by conducting researches on pottery making techniques from archaeological contexts, to study more precisely the evolution of the techniques in the North region through a long period of time.

Repertoire 3 thus clearly originates from the North, but occurrences are also found along the coast. Cort and Leffert (2010) suggests that the diffusion of stoneware technique in Vietnam follows Vietnamese progression toward the South (called Nam tiến). While we do not separate stoneware from earthenware, as both are found in this repertoire, our data supports this hypothesis: Villages’ foundation dates usually coincide with the arrival of the Kinh population in the different area and the local tradition often associate the handicraft with Northern villages known for pottery production.

In those villages on the coast however, while following the chaîne opératoire of this repertoire, some odd elements appear that shows some similarities with repertoire 2.

For example, in Thanh Hà (Quảng Nam province), the only coastal village for which we have first-hand data, the chaîne opératoire presents the characteristics of repertoire 3: Potters use closed kilns, kicking-wheels, coiling preforming technique and the same kind of tools.

But a few disruptive elements occur: Just after finishing the pot and before removing it from the wheel, the potter takes a loop of bamboo or metal and scrapes slightly on the inside of the pot, making it even. She barely removes clay but when asking what she is doing, that’s her answer “taking clay out” (“lấy đất ra”). Taking clay out in order to form the pot with a looped tool is the preforming method used in repertoire 2.

Another link between the two repertoires is the firing structure: apart from using closed kiln, characteristic from repertoire 3 - which are fired once in a month - potters in Thanh Hà also use a small structure called lò nguta; a simple structure with 4 walls, open in the upper part. The fire is lit under the fired objects. The upper part is closed with wasters during the firing. Lò nguta are fired every 3-5 days, depending on the household. This structure shows many similarities with the firing structure used in repertoire 2.
These are two examples among others of the small divergences between Thanh Ha’s *chaîne opéra-toire* and the canonical *chaîne opératoire* of repertoire 3, which seem to find parallels in repertoire 2.

When analysing the literature collected on villages further south, it appears that these interferences between repertoire 2 and repertoire 3 occur more frequently, which justifies why most of these documented villages cannot be clearly linked to one or the other repertoire. For example, *lò ngữa* are found as much as regular kilns, usually in a circular form with pots piled up higher than the walls. They thus tend to resemble even more the small structure of repertoire 2 (Figure 3). At this stage of the research, our hypothesis is that repertoire 2 would originate from this central region. The relocation of craftsmen coming from the North, using repertoire 3, would have led to their insertion within local networks and gradually led to the hybridization of these two technical traditions. This hypothesis needs to be tested with in-depth analysis of the villages in the central part of the country and comparison with archaeological data.

![Fig. 3](image)

**Conclusion**

The results of this comparative analysis of pottery production techniques in North and Central Vietnam largely coincide with the results proposed by Cort and Lefferts. However, we were able to show that in-depth study of the technical variations makes it possible to bring out interesting information on past social dynamics of migration and hybridization.

Our data in some regions are still too sparse for us to fully understand which social mechanisms were at play during these transformation processes. The central region of Vietnam particularly stands out as an area of interest for the continuation of our research where different technical traditions would have co-existed and influenced each another. It is noteworthy that this region corresponds to the former Cham territory, so we hope to see this former political boundaries reflected within technical behaviours.

Moreover, this study combined with archaeological research would allow on the one hand to verify the hypotheses formulated on the basis of ethnographic and historical data and on the other hand to go further back in time, to better understand the diffusion of techniques throughout the territory.
References
This paper reviews the state of organic residue analysis in Southeast Asian archaeology, where it reveals that plant biomolecules, such as terpenoids from resinous plants, are more preserved to be recovered, detected, and identified. This contribution also highlights the preview of the results of organic residue analysis conducted on sampled pottery vessels recovered from prehistoric sites in Southern Vietnam, where they demonstrate that there are other classes of plant biomolecules preserved on the organic residues from tropical contexts. Their identification provides archaeobotanical evidence at the molecular level of utilisation of plants as food, medicine, pottery sealant, and firewood for cooking.

Evershed (2008: 895) defined the analysis of organic residues as a field that “utilizes analytical organic chemical techniques to identify the nature and origins of organic remains that cannot be characterized using traditional techniques of archaeological investigation.” The analysis of organic residues is guided by the Archaeological Biomarker Concept, which suggests that the molecular structure and isotopic compositions of key components of residues can be related to the compositions of plants and animals exploited by humans in the past (Evershed 2008). It starts from the selection of samples, such as pottery, after their recovery from archaeological site excavations. Samples are documented prior to their destructive sampling. Organic compounds, such as lipids or fats and oils, are then extracted from ground samples and converted into their chemical forms that can be acceptable into the analytical equipment prior to their analysis with chromatographic and mass spectrometric techniques (e.g., volatile forms if gas chromatographic equipment will be used for analysis). The resulting biomolecular profiles may infer the former food content of the pots, or organic materials used for the pottery production.

Along with considering the archaeological context of organic residues on artefacts (e.g., pottery) and relevant data from other materials, their analysis can address key issues regarding ancient food preparation and consumption practices, alimentary practices, introduction of particular food items, changes in subsistence practices and resource exploitation, relationships between form and function for different types of pottery vessels, how specific materials were used and functioned, vessel technology, trade and exchange, as well as mobility (Heron and Evershed 1993; Pecci 2014; Regert et al. 2003; Roffet-Salque et al. 2017). The organic residue analysis of food and non-food natural products can provide insights into the practices from their acquisition to usage by the people during the past (Regert et al. 2003). In broader spatial and temporal scales, inferring food-related practices and pottery use from organic residue analysis of a large number of samples from various sites, areas of the world, and periods can shed light on diachronic sociopolitical changes as well as social relations between different areas of the same site and different sites of the same period (Pecci 2014). The development and the interdisciplinarity of organic residue analysis are attested by much published research, summarised in a number of overview papers (e.g., Evershed 2008; Heron and Evershed 1993; Kaluzna-Czaplińska et al. 2016; Pecci 2014; Roffet-Salque et al. 2017) and edited volumes (e.g., Barnard and Eerkens 2007). The most recent review by Roffet-Salque et al. (2017) provided a comprehensive summary on the themes and research questions at different scales of analysis that organic residue addresses, as well as commodities that can be detected.
This paper then reviews how the field of organic residue analysis has fared in the tropical area of Southeast Asia (SEA), where the environment is thought to be very challenging for the preservation of organic residues. It also discusses the preview of the results of organic residue analysis conducted on sampled pottery vessels recovered from prehistoric sites in Southern Vietnam. Lastly, this review demonstrates that plant biomolecules seem to be more preserved to be recovered, detected, and identified in SEA. Hence, they provide archaeobotanical evidence at the molecular level of utilisation of plants as food, medicine, pottery sealant, and firewood for cooking.

State of Organic Residue Analysis In Tropical Southeast Asia

Most of the published and available work in the field of organic residue analysis, with good preservation and identification of organic residues, is concentrated in areas outside of the tropics or far from the equator, especially in Europe and Northern Americas (see Kaluzna-Czaplinska et al. 2016). This section surveys the available work from the tropical area of SEA according to the chemical classification of organic residues, starting with lipids, where the author’s own research is focused on, followed by phenolic compounds and alkaloids. Only the organic residues characterised by chemical or molecular methods are discussed.

Lipids

Lipids are the most common organic residues analysed from archaeological contexts, as they are moderately resistant to chemical and microbial deterioration (Brown and Brown 2011). Lipids are substances synthesised by living organisms that are soluble in or extractable with organic solvents, and insoluble in water (Bhat et al. 2009; Bianchi and Canuel 2011; Killops and Killops 2005). They are classified into two categories: those that are converted into a water-soluble matter upon saponification or alkaline hydrolysis (oils, fats, and waxes) and those that are not (resins, sterols) (Bhat et al. 2009; Brown and Brown 2011). Lipids as archaeological biomarkers permit the differentiation of major food types, such as terrestrial meat (e.g., Regert 2011), aquatic resources (e.g., Cramp and Evershed 2014), and plants (e.g., Steele et al. 2010). Based on the organic geochemistry perspective (see Bianchi and Canuel 2011; Killops and Killops 2005), lipid biomarkers are classified as isoprenoids (steroids, hopanoids, and terpenoids), long-chain waxes (plant waxes and beeswax), as well as acylglycerides and fatty acids (plant oils, animal adipose fats, and aquatic biomarkers).

In the Philippines, only one study was published on analysis of absorbed organic residues. Skibo (1992) successfully extracted fatty acids from ethnographic rice and vegetable pots as well as archaeological pots of the Kalinga, Northern Luzon with gas chromatography – mass spectrometry (GC-MS). The archaeological pots were also actually ethnographic pottery, already thrown in modern middens; however, identification of the source of fatty acids could not be done because of significant decomposition, based on the dominance of palmitic acid, indicative of adipocere (Skibo 1992, 2013). For precolonial pots, Bolunia (2005), in collaboration with a chemical laboratory, started an analysis on food residues/lipids found in earthenware pots from a 15th century burial site in Calatagan, Batangas with GC-MS. Findings from these pots indicate that they were likely used for cooking plant sources more than meat (Bolunia, pers. comm. 2010). On the other hand, Rider-Troeger (pers. comm. 2006, 2010) analysed lipids and proteins from pottery excavated at the Dimolit site, Northern Luzon. The results were not published because the dating of the pots was inconclusive. Eusebio (2010) processed and analysed a few experimental cooking pottery as modern reference materials and earthenware pottery from the 13th-14th century layer of Dizon I site, Babo Balukbok, Porac, Pampanga. The findings from fatty acid ratios and proximity of retention times of unidentified components through GC- flame ion detection analysis (GC-FID) were only preliminary, where the pots indicate that they were probably utilised for terrestrial resources (land animals like pigs, rice, and possibly woody plants) and aquatic resources from the nearby Porac River.
Hill (1988) subjected eight sherds, which were excavated from the site of MAD 1 in Malaysia, and their associated residues to wide-ranging chemical analyses. The site provides the central chronological key for the Madai-Baturong pottery assemblages as a whole since its stratigraphic layers correspond to the Atas and Idahan periods. The sherds from the bases of cooking pots contained burnt food residues on their interior surfaces. The residues have traces of wood tar or resin, high levels of lauric acid, significant amounts of myristic and palmitic acids, oleic acid, as well as waxes based on the analysis with gas liquid chromatography. The palmitic acid seemed to indicate coconut as a probable source, while myristic acid would suggest a plant of the Myristicaceae family, such as nutmeg. The lauric, palmitic, and oleic acids suggest a member of the Lauraceae family, such as cinnamon, while palmitic and oleic acids indicate some form of palm oil.

In Thailand, Hauman (2012) combined isotopic and fatty acid analyses of absorbed residues from pottery excavated from the prehistoric Khok Phanom Di, Nong Nor, Ban Non Wat, and Ban Salao sites in Thailand using GC-MS and GC – isotopic ratio mass spectrometry (GC-IRMS). Medium- to long-chain, saturated and unsaturated fatty acids, as well as alkanes were detected. The pots probably contained C\textsubscript{3} plants, fish, or mammals feeding on C\textsubscript{3} plants. Some samples came from mortuary contexts, where findings can provide insights on customs related to honouring the dead. Her work showed that lipid residues can be preserved in the subtropics, which are not conducive for the survival of organic material because of monsoons and long dry seasons (Evershed 2008). Kanthilata et al. (2014) recently identified 20 saturated and unsaturated fatty acids from residues on floor sediment samples from the prehistoric Ban Non Wat and Nong Hua Raet sites in Thailand through GC-FID and GC-MS. These fatty acids indicate that they were related to the activities associated with floor formation and possibly from ruminant animal sources (Kanthilata et al. 2014).

In Central Vietnam, the interior residue remains from four ovoid jars excavated from Go Nam, Quang Nam Province, Central Vietnam (2nd-3rd century AD) were analysed using Fourier transform infrared (FTIR) spectroscopy. The jars were identified as storage vessels for unsaturated oils, which could be a palm oil (Glover et al. 2004). In Southern Vietnam, Eusebio (2015) presented her preliminary findings on six prehistoric earthenware pottery excavated from Rạch Núi, An Sơn (Neolithic), and Gò Ô Chùa (Metal Age) sites in Long An Province, where fatty acids were detected with GC-MS.

Archaeologically, Taiwan is considered to be part of SEA. Yang and March (2012) analysed pottery and soil samples from refuse pits in the Yiou-Hsian-Fan site of southern Taiwan, dating to the Niao-Sung (NS, ca. 1800-1400 BP) and Niou-Chou-Tz (NCT, ca. 3800-3400 BP) cultures via GC/GC-MS. Medium- to long-chain, saturated and unsaturated fatty acids were from residues on pottery from both cultures, indicative of plant sources (Yang and March 2012).

The rest of the works for SEA on lipids are studies on resin residues, which mainly composed of terpenoids. Gianno (1990) analysed the resins from 15th century AD shipwrecks in Thailand and Saipan with FTIR and GC-MS. Triterpenoid resins from Dipterocarpaceae and benzoin resins from the Styrax sp. tree were identified. The latter are used as medicine and incense (Gianno 1990). In Vietnam, Edwards et al. (1997) analysed archaeological and contemporary resins with FT-Raman spectroscopy. Moreover, in Mainland SEA, Lampert et al. (2002) analysed resin residues from the Bola Merajae site in Indonesia, Han Xa site in Vietnam, and Noen U-Loke site in Thailand. The resins were from the pine and dipterocarp trees, based on the terpenoids detected with GC-MS (Lampert et al. 2002, 2003). Pyatt et al. (2005) analysed the resins used as paint in ancient rock art of Kain Hitam, Niah caves, Sarawak, Borneo with IR spectroscopy. These resins have similar signatures with those of a native leguminous tree and resin producing trees in Australia, which indicate potential cultural/technological linkages between Sarawak and Australia. Burger and colleagues (2009, 2010, 2011) recently analysed archaeological resins from shipwreck sites around SEA, along with modern dammar
resins, with GC-MS. Some of these resins are associated with ceramics and confirmed to be dammar resins due to the characteristic terpenoids. Tamburini et al. (2017) analysed the organic materials in plaster and mortar used for the construction of the temples and buildings in Mỹ Sơn (Vietnam) from the Champa Kingdom with GC-MS. Triterpenoid resins came from a tree belonging to the Dipterocarpaceae family. Lastly, Luong et al. (2018) detected terpenes, monoterpenoids, and alkanes from archaeological stone artefacts from Liang Bua (Flores, Indonesia), which were probably used for processing Camphor containing plants, via GC-MS/MS.

**Phenolic Compounds**

The common component of phenolic compounds is an aromatic hydrocarbon ring phenyl or benzyl ring (Bowsher et al. 2008). As plant pigments or copigments, they are responsible for the various colours exhibited by bark, leaves, flowers, fruits, and seeds. They also occur in roots and heartwood (Bhat et al. 2009). Tannins can combine with the protein of an animal hide, thus a tanning property (Bhat et al. 2009). The tannin derivatives from *Areca catechu* (betel nut) were detected by Oxenham et al. (2002) with the use of GC/MS from the residues in the teeth of Bronze Age Inhabitants of Nui Nap, Northern Vietnam.

**Alkaloids**

Alkaloids are basic nitrogen-containing substances found in plants, animals, microorganisms, and marine organisms. They also have a complex molecular structure and manifest significant physiological activity to those who ingest these substances (Bhat et al. 2009). Some alkaloids with cultural significance are caffeine in coffee or *Caffea arabica*, theobromine in chocolate or *Theobroma cacao*, and nicotine in tobacco or *Nicotiana* sp. (Rafferty 2007). In SEA, the work of Krais et al. (2016) had detected the alkaloid arecoline that is specific for the betel nut from the analysis of the stained tooth from an Iron Age skeleton in Gò Ô Chùa site (400–100 BC) through liquid chromatography-tandem mass spectrometry (LC-MS/MS) and LC-high-resolution mass spectrometry (LC-HR-ToF-MS). Both the works of Oxenham et al. (2002) and Krais et al. (2016) have the early evidence of the Southeast Asian tradition of betel nut chewing.

**More from Prehistoric Southern Vietnam**

Based on the works related to the analyses of archaeological residues from SEA, it appears that the terpenoids from resinous plants are the most preserved plant biomolecules. However, the preview of the results of organic residue analysis conducted on sampled pottery vessels recovered from two Neolithic sites, Rạch Núi and An Sơn, and two Metal Age sites, Lò Gạch and Gò Ô Chùa, in Long An, Southern Vietnam (see Eusebio 2016 for the details of sampling and analysis with GC-MS) demonstrate that not only terpenoids but also other classes of biomolecules from plants are preserved on the organic residues from tropical contexts.

The clay stove or *cà rang* from the Neolithic site of An Sơn (09ASH1L10B9) have both absorbed (A119 AS27) and charred interior surface residues (CSR3), which were analysed to assess if drippings from the food cooked directly via roasting, or indirectly as spillage from the cooking vessel, would be detected and identified. The absorbed organic residues are composed mainly of triterpenoids derived from the charred interior surface residues from firewood, which are α-amyrone, nor-α-amyrone, and β-amyrone (Brettell et al. 2013; Lampert et al. 2002). These triterpenoids are also known to originate from resins of plants from Burseraceae and Dipterocarpaceae families (Lampert et al. 2002). The presence of a polynuclear aromatic hydrocarbon, benz[α]anthracene, indicates the burning of wood in an open fire (Poulain et al. 2016). The presence of hexyl-cinnamaldehyde also indicates the processing of plants possibly from Asteraceae family (e.g., Formisano et al. 2011).
In the case of the pottery vessel (A122 GOC24) from the Central Mound of the Metal Age site of Gò Ô Chùa (08GOCH4L9-1), three of the diterpenoids, specifically diterpene resin acids (Keeling and Bohlmann 2006) -sandaracopimaric acid, isopimaric acid, and dehydroabietic acid- were identified (Brettell et al. 2013). These findings indicate that resins from plants of the Pinaceae family (Lampert et al. 2002) were also used as slip or sealant on pottery, probably in addition to resins from plants of the Burseraceae and Dipterocarpaceae families.

Eight pottery vessels from Neolithic site of An Sơn as well as the Metal Age sites of Lò Gạch and Gò Ô Chùa sites have series of fatty acids, alkanes, alcohols, and triterpenoids with a peculiar lipid profile. Their amount of palmitic acid (C16 fatty acid) is at least twice the amount of stearic acid (C18 fatty acid). Their dominant long-chain alcohol is n-tetracosanol (C24-OH), followed by n-hexacosanol (C26-OH). They also have tetracosanyl palmitate or C40 wax ester. Four of them have coloured viscous residue extracts. In addition, the absorbed residues of a pottery vessel (A120 GOC22) from the Northern Mound of Gò Ô Chùa (08GOCH1L10 2/4) have the most complete assemblages of fatty acids from C8 to C28 and alkanes from C15 to C33. None of the pottery samples from Rạch Núi have residues with this lipid profile. This plant source with the described lipid profile could be C3, waxy, and leafy vegetables (Correa-Ascencio et al. 2014; Roffet-Salque et al. 2017).

One of these eight pottery samples is a plain body sherd from a restricted pot with mainly fine organic temper (A5 GOC1) from the Northern Mound of Gò Ô Chùa site (08GOCH1L11-1). It has a firing cloud probably indicative of cooking by boiling, yielded a fragrant aroma during its sampling with a cutting drill, and had a viscous dark brownish green residue. The residues of this pot (A5 GOC1) has salicylic acid, which is found in medicinal plants (Raskin 1992). It is possible that this pot could have been used for decoction, where active plant ingredients were extracted from one or more plants by cooking them with boiling water (Miller 2015). One of these plants could be the C3, waxy, and leafy plant that is probably commonly found in seven other pottery vessels across the three sites. The other plant could be the one containing salicylic acid. Also, this pot has the greatest number of identified triterpenoids - α-amyrone, nor-β-amyrone, β-amyrenone, and hydroxydammarone (Brettell et al. 2013; Lampert et al. 2002), with β-amyrenone being the most prominent and common to all pots with triterpenoids. These triterpenoids are probably from resins that were used as a sealant or slip for the pots. Except for hydroxydammarone, the three triterpenoids are similar to those from the clay stove from An Sơn. Hence, the firewood and resins applied on pottery vessels as slip or sealant probably originated from resins of plants from Burseraceae and Dipterocarpaceae families, which are applied on pottery vessels as slip or sealant.

Lastly, one pottery sample (A114 RN24) from Rạch Núi (12RNH2L5-5 B1 c.2008/5) has 4-methoxy cinnamic acid, which is indicative of a plant food source probably related to cinnamon (e.g., Doll et al. 2018).

**Plant Biomolecules as Archaeobotanical Evidence**

The preview of results from the organic residue analysis of pottery from prehistoric Southern Vietnam suggests that plants that produce triterpenoids and diterpene resin acids were used as pottery slip or sealant. Triterpenoids or organic compounds with six isoprene units with 30 carbons usually originate from resins of plants belonging to the Burseraceae (e.g., *Canarium luzonicum*) and Dipterocarpaceae (commonly known as dammar resins; e.g., *Dipterocarpus alatus* Roxb.) families, which are present in SEA (Lampert et al. 2002). It is possible that dammar resins were used as slip or sealant on many pottery vessels with triterpenoids in their organic residues. Diterpenoids or organic compounds with four isoprene units with 20 carbons, specifically diterpene resins, usually originate from resins of plants belonging to Araucariaceae and Pinaceae families. However, not all terpenoids were identified with the aid of the mass spectral library, the works of Brettell et al. (2013) and Lampert et al. (2002), and the database of Amber Research Laboratory (cima.ng-london.org.uk/arl/). At least it can
be said that there were two possible main plant sources of resins that were used as slip and sealant on pottery.

As demonstrated by the clay stove from An Sơn, plants that produce resins with triterpenoids are also used as firewood. Triterpenoids also originate from mangrove trees of the Rhizophoraceae family (Basyuni et al. 2007). Mangrove trees are abundant on riverbanks near the archaeological sites included in this research, and they are utilised as a source of firewood for production of charcoal and pottery, and for construction. The remains of mangrove wood (Rhizophora sp.) were identified in Rạch Núi (Ceron 2014). Thus, firewood from mangrove trees, along with other plants having triterpenoids in their resins, is a possibility as a source.

The peculiar lipid composition of the eight pottery vessels mainly indicates that plant sources, possibly leafy C₃ plants with waxy substances, were prepared and/or served in these pots (Correa-Ascencio et al. 2014; Roffet-Salque et al. 2017). Also, not all compounds detected were identified with available references, and the plant source down to the genus and species levels cannot be identified yet. Although the plant source unknown, the detection of plant waxes (long-chain fatty acids, alkanes, alcohols, and a wax ester) in pottery from prehistoric southern Vietnam provides novel archaeobotanical evidence at the molecular level of the exploitation of C₃, waxy, and leafy plant food sources in Mekong Delta during prehistory. It is not certain if these plants were preserved in the archaeological record, since detailed archaeobotanical analyses for Rạch Núi, An Sơn, and Lò Gạch sites are ongoing. In the case of Gò Ô Chusaha site, however, the plant biomolecular markers already serve as proxy evidence for plant usage since no floral remains were recovered and analysed from its previous excavations. It also establishes the continuity of a culinary practice from Neolithic to Metal Age that involves the usage of pottery for preparing and serving a common plant food source available within the vicinities of the three inland sites of Neolithic An Sơn as well as Metal Age Lò Gách, and Gò Ô Chusaha.

Hexyl-cinnamaldehyde, salicylic acid, and 4-methoxycinnamic acid are possibly from medicinal plants. The detection and identification of all of these biomolecules that are presented in this paper provide archaeobotanical evidence at the molecular level of utilisation of plants as food, possibly medicine, pottery sealant, and firewood for cooking. What these mean for archaeobotany in SEA? If we cannot detect the plant sources through the recovery and analysis of macro- and microplant remains, biomolecular evidence can probably be their proxy evidence, especially in previously excavated archaeological sites where archaeobotanical research had not been done. The partial results from prehistoric Southern Vietnam also contribute data for the preservation and detection of mid-long-chain alcohols, wax ester, and small biomolecules to fatty acids, alkanes (e.g., Hauman 2012), and terpenoids (e.g., Burger et al. 2009, 2010, 2011; Gianno 1990; Lampert et al. 2002, 2003) in the region. They are also an additional proof that tropical SEA, with alternating wet and dry seasons, is not a bad area at all to perform archaeological residue analysis.

Acknowledgements
The research that this contribution is a part of was funded by National Science Foundation Doctoral Dissertation Improvement Grant, Wenner-Gren Foundation Doctoral Dissertation Grant, 2014 Society for Archaeological Sciences Student Research International Award, and 2014-2015 Lambda Alpha Graduate Research Grant Award, as well as Summer 2014 Graduate School Doctoral Travel Award, 2012 James C. Waggoner Jr. Grants-In-Aid, and 2013 John M. Goggin Research Award from the University of Florida. The Research Dissemination Grant from the Office of Vice Chancellor for Research and Development of University of the Philippines-Diliman provided conference travel support during the 3rd SEAMEO SPAFA International Conference on Southeast Asian Archaeology in Bangkok, Thailand.
For the sample collection, preparation, curation, and export, the author thanks the Rạch Núi 2012, An Sơn 2009, Gò Ô Chùa 2008, and Lò Gạch 2014 Excavation Teams; Nguyen Khanh Thurrence (Center for Archaeological Studies, Southern Institute of Sustainable Development, Ho Chi Minh City, Vietnam), as well as Dir. Bui Phat Diem, Vice Dir. Nguyễn Thụ Hồng, Văn Ngọc Bích, Đỗ Thị Lan, Trần Thị Kim Quy, Nguyễn Thị Sau, and Nguyễn Thị Hồng Trí (Long An Provincial Museum, Tân An City, Vietnam). She also thanks Dr. Philip J. Piper, Prof. Peter Bellwood, Dr. Hsiao-Chun Hung, Dr. Nguyễn Kim Đụ, Dr. Carmen Sarjeant, Dr. Cristina Castillo, and Dr. Andreas Reinecke for correspondences regarding on these archaeological sites. For assistance in pottery analysis, she thanks Dr. Neill Wallis and Ms. Ann Cordell of Florida Museum of Natural History for assistance. For technical assistance in laboratory preparation and analysis at University of Florida, the author thanks Dr. John Krigbaum, Ann Laffey, Lisa Duffy, (Department of Anthropology), T. Elliott Arnold, Dr. Jason Curtis, Dr. Andrew Zimmerman, Dr. Thomas Bianchi, Michael Shields, Jack Hutchings, Kyle Bostick, Xiaowen Zhang, Xingqian Cui, Gianna Browne (Department of Geological Sciences), Dr. Timothy Garrett, Dr. Eoin Quinlivan, Dr. Sergui Pali (Biomedical Mass Spectrometry Core, Clinical and Translational Science Institute/Southeastern Center for Integrated Metabolomics), and Dr. Maria Cristina Dancel (Department of Chemistry).

References
Ceron, JR (2014) Report on the Macro-Botanical Remains Recovered During the Archaeological Investigation in Rạch Núi Site, South Vietnam [Unpublished work].


Yang, F-P and March, RJ (2012) Preliminary Study of Organic Matter in Ceramics from the Yioou-Hsian-Fan Site, Southern Taiwan: Anthropic or Natural Significance, paper presented at 14th
meeting of the European Association of Southeast Asian Archaeologists, 18-21 September, Dublin, Ireland.
Salt-Making and Prehistoric Shell Middens in the Straits of Melaka
Produksi Garam dan Bukit Kerang Prasejarah di Selat Melaka

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Goto, a Japanese researcher, theorized in the 1970s that salt production might have replaced dried shellfish as an exchange item during the Late (2,500-1,250 BCE) and Final Jomon period (1,250-950/400 BCE), thus leading to the disappearance of large shell mounds (shell middens, or large shell heaps) (Kawashima (2012: 27; Habu et al. 2011: 21). Did the rise in salt-making industries similarly cause a decline in the use of shell middens in the Straits of Melaka? This paper reviews the available evidence for this model using the available archaeological, historical, and ethnographic evidence, and highlights the gaps for further research.


Introduction
Salt consumption - dietary salt referring to sodium chloride or potassium chloride - is critical to human survival (Bloch 1963). Furthermore, salt is often used for food preservation and is thus a key component in any potential surplus food production. The production of surplus was seen as a key adaptive strategy that enabled the creation of buffers; the buffers could minimize the risk of supply loss in a given community, and food storage in particular was seen as a means of coping with environmental variability factors such as drought (Morehart & De Lucia 2015: 11; Morgan 2012: 715; see also Foo 2018a). Other historical known uses of salt include animal rearing; curing, drying, and tanning leather; cleaning clothes; fixing colours for dyes; metallurgy; medicine; and cosmetics (Moinier 2011: 140; Delrue 2011: 164-165). As the availability of salt is often geographically restricted, it was an early major trade commodity, with the bulk of the extraction from plants, soil, rocks, or brine often being done in the dry season.

The early history of salt production and the spread of salt extraction technology in Southeast Asia is not as well-known. The following paper is intended to help set a baseline and facilitate further research particularly in the Straits of Melaka geographic region. As prehistoric shell middens are considered to be man-made heaps where the primary components are shell remains, which are the result of marine resource exploitation (Waselkov 1987), it is reasonable to try to trace evidence of early salt production at or near these exploitation areas. For example, a specialized type of salt extracting pottery was found in association with shell middens during the Late (2,500-1,250 BCE) and Final Jomon period (1,250-950/400 BCE) for Japan (Habu et al. 2011: 21; Kawashima 2015: 126), and as pottery was also found in the Straits of Melaka open air shell middens, it is thus relevant to determine whether the pottery found in shell middens from the Straits of Melaka were similarly used for salt production.

First, it is important to list the various methods and technologies for traditional salt production. This will allow comparison with the archaeological record; thus helping support or refute hypotheses
related to the existence and nature of salt production at or near the shell midden sites. Salt is made by certain processing methods - usually the result of concentration, crystallization, conditioning, and packaging (see Figure 1).

<table>
<thead>
<tr>
<th>Initial Raw material</th>
<th>Concentration</th>
<th>Crystallization</th>
<th>Conditioning</th>
<th>Packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt water (sea, lake, spring)</td>
<td>Salt water is boiled with either firewood or charcoal and/or undergoes solar evaporation, resulting in a brine.</td>
<td>The brine may undergo further solar evaporation, resulting in salt crystal grains.</td>
<td>The salt grains are shaped and conditioned in a mould.</td>
<td>The final product is a salt cake.</td>
</tr>
<tr>
<td>Salt soils (soil, sand, mud)</td>
<td>Water is added to the soil, and filtered usually through a sieve composed of sand and mud. It is then heated, resulting in a brine.</td>
<td>The brine is boiled until salt grains are produced.</td>
<td>The salt grains are shaped and conditioned in a mould.</td>
<td>The final product is a salt cake.</td>
</tr>
<tr>
<td>Halophyte plants (as well as Aquatic Job’s Tears)</td>
<td>The plants are burned to create ash. The ash is filtered to create a brine.</td>
<td>The brine is boiled, resulting in salt grains.</td>
<td>The salt and ash powder are mixed with brine, compressed, and packed into the moulds to become salt cakes.</td>
<td>The salt cakes are frequently packaged in leaves.</td>
</tr>
<tr>
<td>Rock salt</td>
<td>Extraction through mining techniques.</td>
<td>N/A</td>
<td>N/A</td>
<td>The final product is a salt block.</td>
</tr>
</tbody>
</table>

Throughout the Straits of Melaka, open-air shell midden sites are concentrated in the Aceh and North Sumatra provinces, Sumatra island, Indonesia and in the facing land mass of Penang province, peninsular Malaysia (Figure 2). Both sets of sites face each other with the Straits in between, and have been investigated by scholars since at least the late 19th century (Earl 1863; Huxley 1863; Evans 1929; Van Stein Callenfels 1936; Mijsberg 1940; Quaritch Wales & Quaritch Wales 1947; Jacob 1967; Van Heekeren 1972; Ahmad 1994; Bulbeck 2005; Foo 2010, 2013; Mokhtar et al. 2011; Wiradnyana 2011:20, 2017a, 2017b; Zuliskandar & Nik Hassan 2012; Gruwier 2017; Abu Bakar & Zuliskandar 2018; Mansor et al. 2018; Rosli et al. 2018; Shaiful et al. 2018; Rosli et al. 2018). Most research has concentrated on the archaeological finds at the sites, which range from simple exploitation sites to burial sites (e.g. the Guar Kepah site in Penang, Malaysia, and the Bindjai Tamiang site in Sumatra both had human remains) (see Foo 2013 for a more in-depth comparison of the finds from both sets of sites). The implications of finding the remains of these large exploitation sites, and the emergence of these sites in the larger global picture, where large middens have also emerged in other regions during the mid-Holocene are yet to be fully uncovered. Two key sites are compared for the following analysis: the Pangkalan site from Aceh Tamiang, Aceh province, Indonesia; and the Guar Kepah site from the western coast of Peninsular Malaysia. Importantly, both sites also contain pottery assemblages.

**Historical Evidence for Salt-Making**

It is important to consider the known historical and ethnographic sources for Southeast Asian salt-making and to situate them in larger Asian context as there may be timings, disruptions, and unique techniques specific to the region. Let us begin with the historical evidence for the presence of salt-making in Southeast Asia through salt tax inscriptions. Currently the earliest solid written
evidence for mainland Southeast Asia’s salt taxes have been in 7th century Khmer insessional data, where there was a decree on salt tax exemption for a certain temple (K.940) (during the Chenla period in Cambodia) (Vickery 1998: 295). To put this Southeast Asian example within the larger Asian context, China ran a monopoly on the salt trade by the Qi era (685 BCE) (Flad 2011: 35). For India, salt taxes came into effect since at least the time of the Mauryan king Chandragupta’s reign (324/321-297 BCE) (Moxham 2001: 34-35, Singh 2009/2016: 330). Further research is needed for salt tax inscriptions as they may reveal earlier dates and more insight into ancient Southeast Asian governance.

For insular Southeast Asia, the Dhimanasrama inscription from Java (thought to be a Majapahit period copy of a 10th-11th century inscription) stated that peddlers who carried their goods by shoulder-poles (pinikul bhandanya) were also exempted from taxes if the goods they carried (such as salt and salted fish) were below 5-bantal weight (60-75 kg) per person (Christie 1998a: 372-373; Christie 1998b: 154-155). As for the later Majapahit period, the Biluluk I inscription (dated to 1366 CE) from the district of Lamongan in East Java, allowed the inhabitants of Biluluk to extract salt from salt water in a yearly ritual, but those who conducted salt mercantile activity were taxed 7 kupang a month, up to 300 per year by the authorities (Yamin 1960: Parwa II, XIX-XXI; Nastiti 2003: 89; Cahyono 2017). It should be noted that salt taxes enacted by the Tang period (618-907 CE) were said to be responsible for half of the central Chinese government’s revenue (Flad 2011: 36), but whether these salt taxes play a similarly large role in ancient Southeast Asia as well remains to be seen as these decrees are only one small part of the picture.

The historical evidence for trade in salted fishery goods can also be a good indicator for the presence of the salt trade. According to Nastiti (2003: 88-89) in Java, salted fish, dried fish, and terasi (fermented shrimp paste) were coastal products, while salt itself could be produced both at inland sites and the coast. The Waharu I or Jenggolo inscription (dated to 929 CE) mentions a salted fish product named kujur, for example (Nastiti 2003: 70). Other salted fish products or dried fish products often

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Fig. 2  
Shell middens and associated radiocarbon dates in the Straits of Melaka. Source: Foo (2018b)
written in 9th century inscriptions include “ikan kembung (Somber kanagurta / Scomber neglectun), ikan duri (Arius maculatus / Arius sagor), ikan kakap (Lates calcarifer Bloch), ikan tenggiri (Scomberomorus), ikan bawal (Stromateus cinerus Bloch), ikan selar (Caranx), ikan somong / cumi-cumi (Onychotenthi angulata), ikan layar / pari (famil[y] Trigonidae / Dasyatidae), ikan gabus (Ophioccephalus striatus), keping (Scylla serrata), and udang (Crustacea)” (Nastiti 2003: 70-71; see also Simatupang 2020 in the same volume for other early Javanese inscriptions mentioning salted meat and dried fish types in the 10th century). Sumatran sources on fishery products are harder to find, but Hardenberg (1931, 1934) has described the types of fisheries exploited by the Rokan river in 1929, near Bagan Si Api Api, one of the world’s largest fisheries at the time. Barnard (2003: 29) also mentioned the economic importance of terubuk (Alosa toli) for the Bengkalis Straits in the 19th century; the fish roe was highly prized and was caught between the months of September and January.

As many local historical documents in Southeast Asia were palm leaf manuscripts (lontar), a perishable material, many did not survive to the present, and thus we must also rely on contemporary traveler and trade reports on Southeast Asia from other regions. Although the 9th-10th century Arabic Accounts of China and India (Akhbār al Ṣīnwa-l-Hind) does mention salt in its accounts of the polities in the Indian Ocean (which included parts of current Southeast Asia), it only states that the ruler of China had a salt tax monopoly as a way to support state coffers and thus we are forced to look elsewhere (Al-Sīrāfī 2017: 19).

Chinese sources did mention salt production for several sites in Southeast Asia. Zhao Ruguo’s (趙汝适) Description of Barbarian Peoples (諸蕃志 Zhu Fan Zhi dated 1225 CE) mentions that salt was produced in Tonkin as well as the north coast of Java, and bartered in Tambralinga; it also mentions that salt was traded to the eastern parts of the archipelago (Wheatley 2007: 184, 281). Other Chinese historical sources such as Wang Dayuan’s (汪大淵) A Brief Account of Island Barbarians (島夷志略 Dao Yi Zhi Lu dated 1349), Ma Huan’s The Overall Survey of the Ocean’s Shores (馬歡 瀛涯勝覽 Ying Ya Sheng Lan dated 1425-1432 CE), Feixin’s (費信) The Overall Survey of the Star Raft (星槎勝覽 Xing Cha Sheng Lan dated 1436 CE), mentioned that the following locations made salt by boiling salty water: Chan-Ch’êng (占城 zhèncéng Annam), Ji-Li (日麗 rìlì Jari?), Chên-La (真臘 zhènlià Chenla), Lo-Wei (羅衛 luówèi Ligor), Ho-Lu (羅裡 luólǐ Lopburi), P’êng K’êng (彭坑 pěngkēng Pahang), Ki-Lan-Tan (吉蘭丹 jílándān Kelantan), Hsia-Lai-Wu (遐來物 xiáláiwù ?), Tan-Ma-Ling (丹馬令 dànmǎlǐng Tambralinga), Tung-Hsi-Chu (東嬉竹 dōngxīzhú Pulo Aor), Lung-Ya-Hsi-Kio (龍牙叱ilor lángyàxīlìor Langkasuka), Lung-Ya-Ka-Mao (龍牙加貌 lángyájiāmào Langkawi?), Lung-Ya-Po-Ti (龍牙菩提 lángyàpídī ?), Pan Tsu (班卒 bānzú Pancur, Fort Canning, Singapore), San-Fo-Ch’i (三佛齊 sānfóqí Jambi, Sumatra), Ch’iu-Chiang (秀港 jiùgǎng Palembang), and Su-Mên-Ta-La (蘇門答剌 sūménshàlā Samudra, Aceh, Sumatra) (Rockhill 1915: 1, 86-157; Wang 2007: 160-163; Wheatley 2007: 185; Miksic 2013: 177-178). These Chinese accounts of salt processing by boiling salty water in Southeast Asia are also affirmed by Marsden (1966: 188), who wrote on salt production in Sumatra in the late 18th century:

“Salt is here, as in most other countries, an article of general consumption. The demand for it is mostly supplied by cargoes imported, but they also manufacture it themselves. The method is tedious. They kindle a fire close to the sea beach, and gradually pour upon it sea water. When this has been continued for a certain time, the water evaporating, and the salt being precipitated among the ashes, they gather these in baskets, or in funnels made of the bark or leaves of trees, and again pour sea water on them, till the particles of salt are well separated and pass, with the water, into a vessel placed below to receive them. This water, now strongly impregnated, is boiled till the salt adheres in a thick crust to the bottom and sides of the vessel. In burning a square fathom of firewood, a skilful person procures about five gallons of salt. What is thus made, has so considerable a mixture of the salt of the wood, that it soon dissolves, and cannot be carried far into the country. The coarsest grain is preferred.”
Tamil merchants were also known to have traded in salt and did operate in Sumatra, but inscriptions regarding their presence, such as the Lobu Tua inscription in Barus (dated to 1088 CE) and the Neu-su Aceh Tamil inscription in Banda Aceh (dated possibly to the 13th century CE) in Sumatra only mention the presence of a merchant guild called the Five Hundred of the Thousand Directions, and not any commodities explicitly (Edwards McKinnon 2009: 131; Karashima & Subbarayalu 2009: 285-286, 288-289).

There is ethnographic evidence for coastal salt being traded inland on both sides of the straits of Melaka. For Sumatra, Miksic (1985: 445) mentions that salt “has traditionally been a scarce and expensive commodity in highland Sumatra, and its procurement formed a significant stimulus of continual concern for highlands.” Furthermore, Miksic notes:

“The lowland sultans with favourable estuarine locations shared two common concerns with highland chiefs: maintaining high status, and obtaining subsistence provisions. They met these needs in a manner strikingly similar to that employed by their highland counterparts: by conducting exchanges with other maritime centers as their partners, in which prestigious and luxury items played a central role. The ivory, benzoin, and camphor which the highland regions of Sumatra produced were not meant for use by the lowland sultans, but for export. In exchange for them, the rulers of the estuarine emporia received prestigious luxuries such as green porcelain and green girdles, but also copper; from India, cloth; from Java, rice, and salt” (Miksic 1985: 446).

As an example of how important salt was, the village chiefs of the Simelungun in Northeast Sumatra sent groups of men on arduous journeys to Batu Bara, a coastal center, to obtain salt for their people, and this practice may have been commonplace (Miksic 1979: 109-110). The Orang Petalangan who lived between the Siak and Kampar rivers in a lowland forest region were known to have traded the honey and wax of the sialang tree (Koompassia excelsa (Becc.) Taub.) with the local ruler as a tribute in exchange for iron, salt, or cloth (Barnard 2003: 19; Effendy 2002: 366). As to how large the trade volumes were, the Siak ruler was recorded as having traded 3,000 kg of salt a year to the Sakai on the Mandau River even though the forest product trade volume was said to have declined the 19th century (Barnard 2003: 19).

Similarly for Peninsular Malaysia, Allen (1988: 162) mentioned that that an inland forest group the Senoi participated in direct trade with the Malays, trading “rattans, lumber, and certain fruits; the Malays provide metal tools, cloth, tobacco, salt, and sugar.” Dunn (1975: 113) also mentioned that highland Malaysian groups traded salt, metal, and cloth for forest products. According to Kathirith-amba-Wells (2005: 12), in pre-colonial Malaya, in the absence of land tax, only the elite were given access to the best hunting grounds around salt licks, which were located within secondary forests and were “earmarked as royal preserves.”

Prior to the establishment of the Minangkabau kingdom in 1340 in Sumatra, a group of at least five footpaths (Pasaman; Agam; Padang Panjang; Tanah Datar; and Solok), which had numerous road tolls and took 6-10 days to travel, were used primarily so that inland groups could travel to the coast to make or purchase salt on the western coast, and the inlanders relied on their kinship relations to the coastal groups to trade (Asnan 2002: 731). Although Asnan (2002: 731-732) mentions that only the eastern footpaths that led to the Straits of Melaka did not reach the coast and only went to places known as pangkalan, panambatan, and pamuatan, which were places where downriver traders met traders from the interior to trade, this was inaccurate. Van Vuuren (1910: 21-22) in his travels of the Dairi Pakpak region (now Kabupaten Dairi, North Sumatra province) noted the existence of pangkalan such as Beski, Sara, Belegen, Kumbi, Sulampi, Cinendang, and Pasir Punjung to the west; they were linked to the Karo plateau, which was highly valued for benzoin (Styrax benzoin dryand) and camphor (Dryobalanops camphora) (Edwards McKinnon 2009: 129-130, 132). According to
Van Vuuren (1910: 21) at a *pangkalan* there were usually one or two houses where traders could stay overnight and trade their wares. Asnan (2002: 730) follows an old argument by Alkemade, who argues that these salt roads became trading footpaths in the 14th-15th century, which expanded the scope of trade to include commodities such as “gold, *lignum aloe* wood, camphor, resins, wax, honey, and other non-timber forest goods, whereas cloth, cotton, silk, dried and salted fish, and salt” were brought from the coast. However, these salt roads were likely much older and may have allowed for longer sustained periods of inland exploration.

In the later periods, Hussin (2007: 60, 61, 99) who looked at trade in the Straits of Melaka during 1780-1830, mentioned that salt was a major trade commodity in the Straits, used as seasoning for the preparation of food, forming an ingredient in the formation of *belacan*/*terasi* (fermented shrimp paste) and dried fish, but as it was “very difficult to produce salt around the sea coast in the Straits due to its muddy sea shore”, salt had to be imported from places such as Java, India, Siam, Sumatra, and China. Hussin (2007: 61) also mentioned that the ports of Sumatra that imported salt from Melaka during the 1780-82 period were Siak, Rokan, Indragiri, Asahan, Batubara, and Pasai. Even Bagan Si Api Api, which was one of the most important fishing ports in the world from the 1860s-1930s and located at the mouth of the Rokan river in Sumatra, was reliant on salt exported from Singapore and the Gulf of Aden (Butcher 1996: 98). These accounts, then, affirm that while salt was being locally produced in the Straits of Melaka, the amounts were not enough; they needed to be supplemented through long-distance trade.

A study of the central Sumatran economy during the period 1784-1847 reveals a description of salt-making activities in coastal villages just north of Padang on the west coast of central Sumatra, near Narras and Ulakan, where the salt was made in small huts dotting the beaches (Dobbin 2017: 44). Interestingly, the salt-making was made with a lit fire; the fire was sprinkled “with sea water until ultimately the crystalized salt was retrieved from the fire’s ashes boiled in a cauldron. Most of the process was carried out by women and children, the men completing the final stage of boiling the filtered sea water in the cauldron,” though the quality of the salt was said to be of a lower quality when compared to imported salt from Java and Siam (Dobbin 2017: 44). It should be noted that during the Dutch colonial period a salt monopoly was proclaimed and disrupted salt making activities along the Sumatran coast from 1819-1827 (Dobbin 2017: 149); this disruption implies that some areas that used to produce salt in the past no longer did, and that present “traditional” salt producing areas may be different from those in the pre-colonial period.

**Archaeological Evidence for Salt-Making Timing**

In terms of archaeological evidence, some of the earliest salt production in the world has been found in Romania in Europe, dating approximately to 6000 BCE (Weller 2015). For China, coastal salt making is said to have originated in Shandong by 4000 BCE, with transitions in salt making technology detected at the inland site of Zhongba around 2500-1750 BCE (Flad 2011: 37). For the Kanto province in Japan, salt making vessels were found from 2500-1250 BCE (Kawashima 2015: 216). The site of Padri in Gujarat was thought to be an early salt manufacturing center during the Harappan period (2200-2000 BCE) (Shinde et al. 2008: 59).

In mainland Southeast Asia, the exploitation of rock salt in northeastern Thailand was under-way by at least the middle of the first millennium BCE at Bo Phan Khan in Roi-et Province (Rivett & Higham 2007: 588). The site of Nong Tung Pie Pone, also from northeast Thailand, has uncovered water tanks, filtration troughs, and furnaces for boiling the brine and bears a single radiocarbon date of 1740±185 BP (210±185 CE) (N-6308), (Rivett & Higham 2007: 588; Nitta 1997: 158). The site of Gò Ô Chùa located in the north-eastern Mekong delta of southern Vietnam, close to the Cambodian border, is radiocarbon dated to 2900-2200 cal. yrs BP, and at the site, researchers have found specialized elongated supports, likely to be briquetage for the evaporation vessels (Proske et al. 2009: 84).
In insular Southeast Asia, the suspected salt-making site of Gunung Wingko near the southern coast in central Java, has been dated from 1990±90 BP (40±90 BCE) at the earliest, and was in use until 270±60 BP (the 17th century) (Alifah 2013: 59; see also Velde 1984, 1988). At Gunung Wingko, earthenware, ceramics, metal implements, fishing ornaments, beads, bronze artifacts, and bone artifacts were found (Alifah 2013: 59). Skeletal remains both from humans and animals as well as burial and hearth features were also found at the site.

Identifying Salt-Making Sites

Salt production by the solar evaporation of sea water can be done simply on large shells (Peter Lape pers. comm. Sept. 2018) but this process is much less efficient than with other salt sources such as brine springs or rock salt, as only 2.9 per cent of seawater contains sodium chloride (Yankowski 2007: 30). In coastal areas with a longer dry season such as in Aceh in the northwest of Sumatra or the northeastern parts of Java, simple earthen embankments can be made for large-scale solar evaporation. A 2005 collation of 81 sea-level index points from the Malay-Thai peninsula suggested that relative sea levels (RSL) rose from -22.15m ± 0.55m at 9700-9250 cal. yr. BP to a maximum of 4.87m ± 0.57m at 4,850-4,450 cal. yr. BP; since then, sea levels fell from the high stand at a steady rate at about -1.1 mm/year, with no evidence of a second high stand (Horton et al. 2005, 1205-06). The rise and consequent fall in coastal sea levels in the Straits of Melaka may have impacted and erased earlier archaeological traces of coastal salt production. This is likely to be a major factor particularly for Guar Kepah, one of the sites focused in this paper, as there is indication that the site was totally submerged during the high stand event and may have affected the deposition and post-deposition of artifacts at the site (Rosli et al. 2020: 4).

In terms of identifying sites for boiling salt brine, firstly, scholars such as Gouletquer & Weller (2015) and Kawashima (2015) argue that there must be evidence for combustion – this being hearths with heat cracked rocks and/or a carbon rich soil layer. Secondly, there would likely be a large presence of salt pottery sherds which has evidence of heat being introduced to it (this may be from repeated use). Thirdly, the presence of a simple kiln structure to trap heat could be had (this would improve the fuel efficiency), and in terms of environmental impact, there may be evidence for deforestation in the immediate area during the site use (as fuel is needed to feed the site).

The vessels for boiling brine are usually deep earthenware vessels, with high amounts of temper, usually in a funnel shape (base shapes can be flat, rounded, or pointed); the external surface may be decorated / undecorated, and the rims would be flaky from salt absorption if used during repeated firing. Supports such those mentioned being found at Gò Ô Chùa may be additional evidence for salt-making. The discovery of the salt moulds themselves, where “the levels of chlorine […] are 2 to 20 times higher than in domestic contexts” may also indicate salt making sites (Weller 2015: 72). It should be noted that even though elevated chloride ions were proposed as a way to identify salt production pottery for the Japanese context, subsequent testing with sherds from two sites from China and one from North America showed that the chloride release was unlikely to be the result of salt production, and thus cannot be used to definitively distinguish salt making pottery from other types of pottery (Raad et al. 2014).

The Evidence on Possible Salt-Making at Open-Air Shell Middens in the Straits of Melaka

The open-air shell middens in the Straits of Melaka are associated with the Hoabinhian and Neolithic stone tool industry, as they date from the terminal Pleistocene (a transition from the late glacial period to much warmer and wetter conditions) to the mid-Holocene, or approximately 12000 to 3500 un-cal. yr. BP (Solheim II 2006; White et al. 2004). The shell middens in the Straits are seen as a form of
coastal adaptation (*adaptasi pesisiran pantai masyarakat Hoabinhian*) (Ahmad 2016) and researchers such as Wiradnyana (2017b) have begun to look at the coastal-inland movements based on lithic and pottery culture. The Muda River—situated very near to where the Guar Kepah site (consisting of three large shell middens) was located—was suspected to be an early trans-peninsular pathway connecting Kedah, Perak, and Southern Thailand (Nuratikah Abu Bakar & Zuliskandar 2018: 199). For Sumatra, Wiradnyana (2017b: 36) noted that the river deltas of Tamiang, Wampu, Deli, Belawan, and Percut were also pathways for coastal-inland explorations, as they had many open-air shell middens as well as cave sites associated with Hoabinhian artifacts. While Wiradnyana (2017b: 38-39) suspects that inland forays may have been quite limited, as there are many areas for exploitation closer to the coast, there is evidence of Hoabinhian lithics at Loyang Mendale (Eastern Aceh) around 8430 ± 80 BP to 5040 ± 130 BP, and this may suggest a wave of movement towards the highlands around 8000 BP and from the highlands to the coast (towards Lokop and Samer Kilang and Bintang in Central Aceh) around 5000 BP (see Figure 3).

The shell middens were likely to be resource and habitation nodes, at one end of early trans-peninsular exploration routes for both areas in Peninsular Malaysia and Sumatra, and as “salt roads” were established early, the presence of these sites could be a good indication for earlier salt making along the coast. A number of inland prehistoric sites in Peninsular Malaysia also show that several types of coastal shell were carried inland at the sites of Gunong Cheroh (*Cyrena* shells), Gua Kerbau (*Arca Cyrena, Pinna, Voluta, Nautilus*, and *Cypraeae*), Bukit Chintamani (*Arca, Cypraeae*), Gol Ba’it (*Cypraeae*), Gua Musang (*Meretrix*), and Gua Cha (*Mytilus*), suggesting a shell trade between inland sites and the coast, but only the cowries at Gua Kechil were dated, to a layer “several inches above” a radiocarbon sampling date of 4800 ± 800 BP (Dunn 1975: 125). Marine shells were also discovered at the inland sites of Bukit Chuping (Perlis), and Gua Kerbau in Perak, as well as Gua Angin in Pahang, suggesting links with the coast (Zuliskandar et al. 2014: 88).
Unlike the middens in Japan which had been abandoned and seemed to be somewhat intact, the shell middens in the Straits of Melaka were used to extract lime by local communities and foreign plantations in the early 20th century and there was a sense of urgency to investigate them prior to further developmental pressures (Edwards McKinnon 1991). When Earl (1863) discovered Guar Kepah, the mounds were reportedly 7.62m high, even after 4 years of lime quarrying at the site; when it was excavated in 1934 by the Raffles Museum staff, it had been reduced to 2m in height (Van Stein Callenfels 1936); finally, when Mokhtar Saidin and his team excavated in 2017, shell heap C was reportedly 1m in height (Mok 2017). Shell heaps B and C were further impacted by development works (Foo 2010: 47-48; Quaritch Wales & Quaritch Wales 1947: 4). The Pangkalan shell midden, which was located in Dusun Blang Mandau, Kampung Pangkalan, Kecamatan Kejuruwan Muda, Kabupaten Aceh Tamiang, Nanggrooe Aceh Darussalam province, in Sumatra, however, was also initially exploited by the surrounding local community as a way to get raw lime material in the 1970s, until the mound was reduced from approximately 4 meters to only 1.5m in height prior to excavations there (Wiradnyana 2011: 31). This may mean that the top layers of these middens which had been used for lime extraction and might have also contained any evidence for salt pottery may have already been gone even prior to the initial excavations.

According to Wiradnyana (2011: 35) the earthenware fragments found at the soil surface of the Pangkalan shell midden in Sumatra were found in limited numbers in fragile condition and were small in size. At a depth of 20 cmbs, 2 earthenware fragments were found and at 40 cmbs, 2 more fragments found as well, from layers dating from 3870±140 BP and 4460±140 BP (Wiradnyana 2011: 46, 53). The vessel surfaces are described as thin and uneven, and a vessel mouth fragment discovered at a depth of 30cmbs (dating to 4120±140 BP) that shows similarities to pottery found at Gua Kampret, Bukit Lawang, Langkat (Wiradnyana 2011: 46, 53). Charcoal remains were also found at the site but reportedly much more consistently concentrated from a depth of 80cmbs and onwards throughout the midden (dating to 6080±160 BP until 12550±290 BP) (Wiradnyana 2011: 49, 53). So far, the few earthenware fragments does not seem to indicate salt-making activities; the charcoal evidence also seems to be much earlier than the earthenware finds, making it unlikely that they were used for boiling down the salt brine.

As for the Guar Kepah site, the site (comprising shell heap mounds A, B, and C) was first excavated by staff from the Raffles Museum, led by Dr. Michael Wilmer Forbes Tweedie and Mr. H. D. Collings (Van Stein Callenfels 1936), and uncovered some earthenware along with lithic tools, which were not radiocarbon dated (see Figures 4-7). The earthenwares, which were a mixture of those found in both shell heap A and B, were water worn and suspected to be late; unfortunately, the sherds were not numerous enough to suggest that they were used for intensive salt-making. It was only in 2008 that Mokhtar Saidin’s team began to mount a rescue excavation at Mound C. Four radiocarbon dates were obtained from on an excavation phase in 2010, revealing dates between 5,680±40 BP (Beta-272743) (shell) and 5,250±40 (Beta-272744) (organic sediment) (Mokhtar Saidin, Jaffrey Abdullah, & Jalil Osman 2011). In 2017, skeletal remains dubbed “the Penang Woman” was discovered and a radiocarbon date of 5700±50 BP was given (Mok 2017; Zuliskandar 2015: 36). Although more earthenware was reported from these excavations (Shaiful Shahidan et al. 2018: 244), no in-depth study has yet been published on the pottery artifacts thus far. According to the original site excavation maps published for shell heaps A and B, hearths were found while there were none for heap C (see Figs. 8-12). There seems to be only one centrally located hearth for shell heap A while for shell heap B, several hearths were found, almost in alignment, located to the eastern edge of the mound; the arrangement of these hearths seems suggestive of some sort of firing activity, but when cross-marked with where the earthenware fragments were recovered, their locations were not at all associated with the hearths (this seems to be unlike the many wasters that one might find near a pottery kiln, for example). Thus, the evidence from Guar Kepah thus far also does not seem to indicate early
salt-making activities, and perhaps other smaller shell middens within these river deltas which were not extracted for lime-making may provide these answers.

Figs. 4 and 5  Earthenware from A0871 Guar Kepah (courtesy of the National Heritage Board Singapore). Source: Foo (2010, Appendix 1)

Figs. 6 and 7  Earthenwares A0987 from Guar Kepah (Courtesy of the National Heritage Board Singapore). Source: Foo (2010, Appendix 1)
Fig. 8  Shell Heap A top view with hearths highlighted. Source: Van Stein Callenfels (1936)

Fig. 9  Shell Heap A cross view with hearths highlighted. Source: Van Stein Callenfels (1936)
Fig. 10  Shell Heap B top view with hearths highlighted. Source: Van Stein Callenfels (1936)

Fig. 11  Shell Heap B cross view with hearths highlighted. Source: Van Stein Callenfels (1936)
Habu et al. (2011: 21) who wrote a review article on shell midden archaeology in Japan noted that rather than the large shell middens of the Late and Final Jomon shell middens, it was actually some of the smaller shell midden sites that had no pit-dwellings (established away from settlements) that were associated with a large number of evaporation pots for salt-making, suggesting that it may have been a specialized activity zone rather than an activity applied to all Late and Final period shell middens. This find then urges more research on the smaller middens as they may prove to be more interesting for further research and future preservation considerations.

**Conclusion**

Was there early salt production at the sites of Guar Kepah and Pangkalan shell middens in the Straits of Melaka? Based on the currently published number and type of pottery found at both sites during the actual excavation process, it was unlikely that the inhabitants had boiled salt in these vessels. The post-deposition disturbance at both of these sites from local lime extraction practices may have also erased whatever late pottery finds existed. Although both the Pangkalan and Guar Kepah sites did contain hearths and therefore might be suggestive, their function was not conclusive, as they might have been used for other activities (rituals, for example). So, did the rise in salt-making industries cause a decline in the use of shell middens in the Straits of Melaka? It is too early to say, unless we consider studying some of the smaller and more intact mounds that may still exist. It’s clear that salt-making became an important factor for coastal-inland movements and trade in the Straits of Melaka, but the practice of producing salt by boiling may have been a much later phenomenon in the Straits, as noted in the literary sources. It may also be a data sampling issue, where the excavated areas did not uncover items for salt production.

Other questions still remain. Was the increased exploitation of marine resources in the form of shell middens an indication of risk aversion, such as a drop in the availability of terrestrial food resources? Miksic (1990: 112-113) for example argued in Sumatra that fruit supplies in the hinterlands would

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Fig. 12  Shell Heap C top view (no hearths). Source: Van Stein Callenfels (1936)
differ from season to season and that macropods could only gather when fruits were abundant; when the fruits were low in supply, the bands would be drawn to the coastal areas, where estuarine and coastal resources could be had. As shell middens were one coastal location where we find a lot of evidence of food remains, primarily in the form of shells, archaomalacological studies on the procurement seasons of these shells may help to answer this question. According to Van Schaik (1986) and Chairul et al. (2010), who studied fruiting in Sumatra, fruiting varies between young and mature forests; under normal circumstances, June to August would be the peak fruiting season, and should there be drought weather, fruiting would occur later and in a shorter period, in August. Further phenomenological studies on fruiting, as well as computer modelling based on the past rainfall patterns could prove useful.

While this paper considers salt-making near coastal areas and the use of salt pottery as it was relevant to the open-air shell midden sites in the Straits of Melaka, it should be noted that there may have been other forms of salt making that could supplement the amounts of salt available to inland groups aside from natural sources such as rock salt, salt licks, and brine springs. The Baruya in Papua New Guinea for example were known to make and trade salt prior to colonial contact, with the distribution reaching groups that they did not visit personally; a solely male occupation, the salt bars (wrapped in bark thongs) were made inland from the ashes of Aquatic Job’s Tears (Coix aquatica Roxb., Fl. Ind. Ed. 1832,3:571(1832); formerly Coix gigantea J. Koenig ex Roxb.) which were grown on large cleared terraces irrigated by streams (Godelier 1986: 130-131; Godelier 1969: 10, Clayton et al. 2020). A kiln made of earth and stone was mixed with “salted, dried, and baked mud”; refractory clay was used for the salt moulds (Godelier 1986: 132). The Baruya made salt for ceremonial consumption and as a medium for trade, and it took approximately 5 days and 5 nights to make the salt bars, with a bar weighing approximately 2 kg; each firing produced 12-15 bars (Godelier 1986: 131, 133).

Additionally, while the ethnographic data from contemporary “traditional” salt-making in various parts of Southeast Asia are informative (Le Roux & Ivanoff 1993; Nitta 1996; Nitta 1997; Yankowski 2007; Gani 2012; Yankowski & Kerdsap 2013; Yankowski, Kersap, & Chang 2015), these data points should be treated with a degree of caution, as these modern examples may or may not have had any relevance or similarities to the actual archaeological record. Of these studies, the Bohol coastal tradition of salt making may be the most relevant dataset to look at for the Straits of Melaka. In the Bohol tradition, the earthenware pots were used up only in a single firing production cycle for salt, and doubled as up as the salt storage container for transport - this example is intriguing as it may suggest that these salt pottery containers could in fact be highly mobile, and may not have all remained in the original production areas (Yankowski 2007: 35). One future research direction for a more accurate distribution of salt pottery in the Straits of Melaka, then, may need to rely more on ethnographic studies of known salt pottery types used by inland communities, if any are to be found, and to consider whether the archaeological record has uncovered similar shapes. The Bohol method of pre-soaking coconut husks, samo (seaweed), and pagong (nipa palm (Nypa fruticans) stalks) for 2-6 months in coral-lined pits to allow them absorb more salt minerals prior to being reduced to ash and filtered into brine is certainly interesting, but this practice may be unique to that region as the historical and archaeological record has not revealed similar coral pit structures from the Straits of Melaka thus far (Yankowski 2007: 31, 32, 36).

Post-deposition research on local lime kilns, where the shell matrix from these middens were used as a source of lime would also be useful; not enough is known about whether the matrix was used for agricultural lime, mortar, building material, or for other reasons (see Carran et al. 2011 for general lime uses; see Wongadsapaiboon 2016 for a Thai case study). If agricultural lime was used in the surrounding area (to reduce the acidity of the soil for example), it may affect migration studies on
human remains found in these riverine areas, as the baseline for natural strontium isotopes are affected (Thomsen & Andreasen 2019).

Acknowledgements
ISEAS – Yusof Ishak Institute, the National Heritage Board Singapore, the Heritage Conservation Centre, Dr. Terence Chong, Emeritus Prof. John N. Miksic, Dr. E. Edwards McKinnon, Dr. D. Kyle Latinis, Andrea Yankowski, Prof. Hermann Kulke, Dr. Bhairabi Prasad Sahu, Dr. Ketut Wiradnyana, Prof. Dato’ Dr. Mokhtar Saidin, Dr. Mimi Savitri, Ms. Alifah, Ms. Thippawan Wongadspaiboon, Mr. Shyeh Sahibul Karamah bin Masnan, Ms. Geetika Gupta, Mr. Lim Chen Sian, and Ms. Jenny Sutono.

References


Foo, ST (2018a) Empire Building in Southeast Asia: The Importance of Salt. NSC Highlights, 9: 9-14.


Jacob, T (1967) *Some problems pertaining to the racial history of the Indonesian region: a study of human skeletal and dental remains from several prehistoric sites in Indonesia and Malaysia*. Utrecht: Durkkerij Neerlandia.


Van Vuuren, L (1910). *Eerste Maatregelen in Pas Geannexeerd Gebied: met beschrijving der Pak Pak landen (Daïrilanden) en schetskaart* [First Measures in Newly Annexed Area: with description of the Pak Pak lands (Dairi Lands) and sketch map], 1:250.000. Zalt-Bomel: HJ van der Garde & Co.


Wongadsapaiboon, T (2016) การศึกษาเทคโนโลยีการผลิตและอายุสมัยของแหล่งเตาเผาปูนบ้านภูเขาทอง ตำบลบ้านแม่ อ้ายบ่อสักดิ์ จังหวัดหนองคาย ด้วยวิธีการทางมนุษยวิทยาและ ชีววิทยา [The Study of Technique and Dating of Lime Kiln at Phu...


Fish Consumption in 10th Century CE Javanese Society
Konsumsi Ikan Masyarakat Jawa Kuno pada abad 10 Masehi

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In this paper the author discusses fish consumption in 10th century CE Javanese Society from epigraphical analysis of Matarām kingdom inscriptions. The subjects that will be discussed includes the fish type that is being consumed, processing method, and dishes variation in 10th century Javanese society. Data showed that Matarām kingdom retained and develop its fish consumption culture despite the kingdom’s relocation.


Introduction
This study uses the archaeological research method based on Robert J. Sharer and Wendy Ashmore (Ashmore and Sharer 2009:156). This study research stages are formulation, data gathering, analysis, and interpretation. In the formulation stage, the researcher defines the research problems and goals. In the data gathering stage, data is collected from archaeological sources that are translated inscription and ancient text, and other literature sources. Primary data on this research are archaeological remains such as inscription and relief that are declared or made by The Matarām kingdom on 10th century Java. Secondary data in this research are literary sources such as ancient text and travel logs. In the analysis stage, data collected from primary and secondary sources are analysed to reveal information regarding fish type that is being consumed, fish natural habitats, processing method, location of inscription, and variation of dishes. Analysed data are then compared and presented in a narrative form. Interpretation is done by correlating variations of selected data. The interpretation step will present conclusion regarding the consumption of fish in 10th century Java. This paper aims to describe fish consumption in 10th century Java, which included its variation of fish being consumed, gathering method, and processing method.

There has been multiple previous researches related to fish consumption in ancient Javanese inscription. Zoetmulder, through his book ‘Old Javanese-English Dictionaries’, is the first to try to interpret the species and its present vernacular name of animals of animals and vegetables that are mentioned to be eaten in ancient Javanese inscriptions (Zoetmulder 1982). Research about food and drinks in ancient Javanese Society has already been discussed by Antoinette M.B. Jones (1984), Soekardo (1986), Swandayani (1989), and Rannawati (1999). Those research uses data from 9th to 10th century Inscription that are issued by the Matarām Kingdom. Churmatin Nasiochach expand the topic ancient Javanese food consumption, by researching about the food preservation method of ancient Javanese society (Nasiochach 2009).

Similar to previous research, this paper uses data from 10th century inscriptions issued by the ancient Matarām Kingdom. The Matarām Kingdom (not to be confused with the Islamic Matarām Kingdom) was a Hindu-Buddhist Javanese kingdom that existed from 8th to 10th century CE. The ancient Matarām Kingdom is also known as The Maḍāṅ Kingdom as proposed by Poerbatjaraka (1958). In 8th to late 9th the kingdom was based on central Java and was ruled by the Śailendra dynasty (Pespoegoro and Notosusanto 2008). But in 928 CE, the kingdom moved to east Java for unspecified
reasons (Boechari 2012: 156). The kingdom continued to exist until 985 CE under the reign of raja Dharmawangsa Taguh (Boechari 2016:184). Ancient inscriptions in Indonesia usually commemorate the declaration of *silm* as a blessing from the king to a kingdom official that have render a great service or as a king’s blessing that is related to a holy building (Boechari 2012: 6). *Silm* is a plot of land or a place that is declared by the king to be self-autonomous in the matter of local affairs, especially tax related. Inscription that commemorate Sima declaration describe the ceremony by its time of the event, people who declared that place to be a sima, people who was involved and invited and type of ceremony. Although the description varied based by its historical context. In regard of fish consumption in ancient Javanese society, ten inscriptions issued by Matarām Kingdom in 10th century mentioned several fish that were served during ceremonies.

**Data Sources**

As mentioned before this study uses inscriptions that were issued by the Matarām Kingdom in the 10th century. There are about 200 inscriptions that are issued by Matarām Kingdom (Boechari 2016:184). From those inscriptions, ten inscriptions mention fish names and fish-based dishes. These inscriptions are from the reign of Dyah Balitung to Mpok Sindok and are written in ancient Javanese language and inscription.

<table>
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<th>No.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Taji</td>
<td>Dyah Balitung</td>
<td>823 Saka/ 901 CE</td>
<td>Branders 1913:23; Boechari 1985/1986: 42</td>
</tr>
<tr>
<td>3</td>
<td>Watukura I</td>
<td>Dyah Balitung</td>
<td>824 Saka /902 CE</td>
<td>Swandayani 1989:124</td>
</tr>
<tr>
<td>4</td>
<td>Mantyāsiḥ I</td>
<td>Dyah Balitung</td>
<td>829 Saka /907 CE</td>
<td>Branders 1913:27</td>
</tr>
<tr>
<td>5</td>
<td>Mantyāsiḥ III</td>
<td>Dyah Balitung</td>
<td>Not mentioned</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Sanguran</td>
<td>Dyah Wawa</td>
<td>850 Saka/928 CE</td>
<td>Branders 1913:31</td>
</tr>
<tr>
<td>8</td>
<td>Jěru-Jěru</td>
<td>Mpu Sindok</td>
<td>852 Saka /930 CE</td>
<td>Branders 1913:43</td>
</tr>
<tr>
<td>9</td>
<td>Alasantan</td>
<td>Mpu Sindok</td>
<td>861 Saka/939 CE</td>
<td>Swandayani 1989:128</td>
</tr>
<tr>
<td>10</td>
<td>Paradah II</td>
<td>Mpu Sindok</td>
<td>865 Saka /943 CE</td>
<td>Branders 1913:48</td>
</tr>
</tbody>
</table>

It should be noted that based on the data sources, this study is limited by its context and timeframe – to the early 10th century CE. Food that are mentioned in those inscriptions are also served in ceremonial context.

**Variation of Consumed Fish**

The inscriptions mentioned dishes that were served in the *silm* declaration ceremony, including fish. From those inscriptions many scholars interpreted the type of mentioned fish (characteristic, vernacular name, and scientific name). This study uses many interpretations of fish’s vernacular and scientific name (including multiple interpretations of one term).

Inscriptions mention a total of 18 fish names that were consumed, nine of which can be identified to its vernacular and scientific names, which are *Tenggiri* (*Scomberomorus commerson*), *Gabus Besar* (*Ophicepalus striatus*), *Gurami Air Tawar* (*Dangila Cuvieri*), *Duri* (*Arius Maculatus/Airus sagor*), *Rumahan* (Any fish in *Rastrelliger* Genus), *Kakap* (*Lates campechatus*), *Bawal Kadewas* (*Stromateus cinereus*), *Ikan Kembung* (*Scomber maculatus/Arius Sagor*), *Layar* (*Platax Batavianus/*any fish in *Dasyatidae* family), *Ikan Selar* (any fish of the *canax* genus), and *Ikan pedang* (*Chrocentrus dorab*).
Another eight fish names cannot yet be identified to their vernacular and scientific names (Table 1). Inscriptions also mentioned other animals or species that lived in aquatic environment, such as sea crab, squid, and turtles (Zoetmulder 1982: 654, Jones 1984: 47). But this study limits its research to focused only to fish. Fish, in this research, are defined by its physical characteristic which is aquatic craniate animals that have gills and limbs that are shaped as fins.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name mentioned in inscription (Old Javanese)</th>
<th>Meaning or Vernacular name (in Indonesian)</th>
<th>Scientific name</th>
<th>Mentioned in</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>dlag</td>
<td>Gabus Besar</td>
<td>Ophicepalus Striatus (Mardiwarsito 1981:153)</td>
<td>Rukam inscription</td>
</tr>
<tr>
<td>2</td>
<td>ikan ḍuri</td>
<td>Duri (Swandayani 1989:20)</td>
<td>Arius Maculatus/Airus sagor (Nastiti 1995:102)</td>
<td>Rukam inscription</td>
</tr>
<tr>
<td>3</td>
<td>kaḍawas</td>
<td>Unspecified saltwater fish</td>
<td>-</td>
<td>Pangumulan A inscription</td>
</tr>
<tr>
<td>4</td>
<td>kaḍiwa/kaḍiwas/kaḍiwas</td>
<td>Bawal Kadewas</td>
<td>Stromateus cinereus (Jones 1984: 57)</td>
<td>Taji inscription Pangumulan I inscription Watukura I inscription Rukam inscription Sangaran inscription Jēru-jēru inscription Alasantan inscription Paradah II inscription</td>
</tr>
<tr>
<td>5</td>
<td>kawan/kawan-kawan</td>
<td>Gurame air tawar</td>
<td>Dangila Cuvieri (Jones 1984: 57)</td>
<td>Taji inscription Rukam inscription Sangaran inscription Alasantan inscription Paradah II inscription</td>
</tr>
<tr>
<td>6</td>
<td>Kakap</td>
<td>Kakap</td>
<td>Lates calcarifer (Jones 1984:57)</td>
<td>Pangumulan I inscription Rukam inscription Alasantan inscription Paradah II inscription</td>
</tr>
<tr>
<td>9</td>
<td>praṅ</td>
<td>Ikan Pedang</td>
<td>Chrocentrus dorab (Jones 1984: 48)</td>
<td>Alasantan inscription</td>
</tr>
<tr>
<td>10</td>
<td>taṅiri</td>
<td>Tenggiri</td>
<td>Scomberomorus commerson (Jones 1984:48)</td>
<td>Watukura I inscription</td>
</tr>
<tr>
<td>11</td>
<td>wagalan/waragalan</td>
<td>Unspecified freshwater fish (Jones 1984: 58)</td>
<td>-</td>
<td>Paradah II inscription</td>
</tr>
<tr>
<td>13</td>
<td>bijañjan, Biluŋluŋ/bi-luluŋ, hala hala, iwik kandari, Prah, slar, kaḍari</td>
<td>Unspecified type of fish (Zoetmulder 1982; Jones 1984)</td>
<td>-</td>
<td>Pangumulan inscription Watukura I inscription Mantyaśih I inscription Rukam inscription Sangaran inscription Jēru-jēru inscription Alasantan inscription</td>
</tr>
</tbody>
</table>

Table 1: Fish names identified in 10th century Javanese inscriptions.
As previously mentioned, the Matarām kingdom moved from central Java to east Java. The location shifts was first indicated by an inscription on the back of a Gaṇeśa image dated 826 Saka or 904 CE (Abdullah 2012: 185; Boechari 2016:155). Despite the Matarām kingdom’s move to a new environment, the variety of fish does not change that much. For examples kaḍiwā/kadiwas/kadiwas, kawan/kawan-kawan, kakap, and rumahan were mentioned before and after the relocation. The Rukam inscription also mentioned more variety of fish that were being consumed, with new species of consumed fish (laya layar/layar layar), and fish that were only mentioned once in Rukam (dlag and ikan duri). This can prove that Matarām kingdom society still preserved its knowledge and culture of fish consumption and further develop after the relocation.

Although there are many previous interpretations of fish names, it should be noted that there are several problems on those interpretations. Many of these interpretations collides with each other, such as different interpreter giving different interpretations on the scientific name. The interpreters themselves could not be sure the exact species mentioned in the inscriptions (for example Nastiti’s interpretation of rumahan). Another contradictory interpretation is on the species of laya layar/layar layar. Jones and Nastiti’s have different interpretations, referring to different families of fish that have different characteristics.

Almost all these interpretations derive from language and ethnographic data. For example, many Zoetmulder interpretations in the ‘Ancient Javanese-English Dictionary’ are derived from present or modern Javanese language. From then, Zoetmulder picked the existing fish and referred it to its scientific names (Zoetmulder 1982). This process of thinking is present almost in every interpretation of fish name. This is a problem because fish names or terms often refers to multiple species of fish that fit general physical criteria. For example, rumahan can also refer to the genus rastelliger, not just to Arians Maculatus/Airus Sagor species as interpreted by Nastiti (Nastiti 1995:102). This is a problem in interpreting a single term in inscription to a specific scientific name that uses binominal nomenclature. Without enough additional data, it is difficult to state specified species of fish. These scientific name interpretations of fish should not be taken literally, but it can serve as a guideline to specified terms of fish names in ancient inscription.

Another problem is on defining the natural habitat of the fish. Most species of fishes can live entirely in fresh or marine waters, but many species of fishes can live in different habitat. Defining and classifying of some species fishes based on its habitat can only be done as a generalization (Nelson et al. 2016: 8). This further emphasizes the problem of defining the exact species of fish and habitat.

**Fishing in 10th century CE Java**

In the topic of fish consumption, it should be equally important to also discuss the fishing process. Previously mentioned inscriptions do not describe the process of catching fish in a fully descriptive way, and only mentions the professions and places connected to the process of fishing. Although Wulig (Bakalan) inscription (dated 857 Saka year or 935 century CE) mentioned a warning for villagers not to take fish from dams in Kahulunan, Wuatan Wulas, and Wuatan Tamya (Branders 1982: 81).

**Variation of Processed Fish**

Inscriptions mentions five types of processed fish that are served in the sīma ceremony. The processing or cooking method is interpreted from its name and meaning. There are three types of food processing or cooking that are mentioned which is salting, drying, and cooking. And one dish names are processed by salting, which are Asin-asin. Dried dishes are referred as Daiŋ or dlag in parasti, such as Daiŋ kakap and dlag Inarin. The rest Dlag inariŋ muañ and Haran haran.
### Preservation Method

Inscriptions mentioned fish to be preserved in two ways which are salting and drying. Salting is a food preservation that has been long used by fishermen or fish merchants (Sahubawa 2014: 30). Salt has a natural character to slow the growth of microorganisms that destroy and rot food. Salt decreases water content in food to decrease rotting enzymes and microorganisms. The salting process typically only takes one day to make fish meat last five to six months.

Drying is a preservation method technique that is also used to decrease the water content of food. Its principle is like the salting technique, as it is also decreases the water volume to decrease the growth of microorganisms. Drying can be done by heating or sunbathing. Besides prolonging the quality of fish for up to six months, drying also decreases fish size to ease the food transport process. However, drying also eliminates the taste of the fish and makes it bland. In modern Java, a combination of salting and drying techniques to preserve and give more taste to fish (Buckle 1987).

The terms ḍéŋ and Drying technique can have multiple benefit on processing fish. Drying and salting method can prolong fish edibility life up to six months. Drying also minimize the fish volume to make it easier to distribute and keep. There are two fish that are mentioned to be dried are Kakap and Kadiwas.

### Other Processed Fish

As stated before, there are two mentions of dishes that indicate the act of frying and cooking. The first is *dlag inariŋ muan̄*, which have many interpretations. The term *dlag* refers to *gabus* fish (*Ophicepalus Striatus*), which only mentioned once on the inscriptions. As mentioned before there are three interpretations of this dish, and a particular one refers to the act of cooking or frying. Frying is a method that heat food for the most part by conduction from a hot, oiled pan, with temperatures between 350 and 450°F/175-225°C that encourage Maillard browning and flavor development. The fat and oil that is used have several roles to play; it brings the uneven surface of the food into uniform contact with the heat surface, lubricates and (McGee 2004). However, the Rukam inscription mentions fried gabus as Daiŋ dag, which can also mean dried Gabus. Because Rukam is located relatively far from the sea, Daiŋ dlag inarin is most likely to be interpreted as dried fish with or and crab eggs (Nasiti 1995: 103).

The second one is *Haraŋ haraŋ*, which could be interpreted as fish that is cooked by charcoal. This term is most likely to refers to cooked food. Since its name is related to coal in Indonesian (*arang*)
and it is mentioned in a line with others several cooked foods (Zoetmolder 1982; Jones 1984: 47). But the terms do not indicate a specify the fish that are being cooked.

### Conclusion

Inscription from the tenth century Java that are released by Matarām Kingdom showed us an example for a society that still retains and develop its dietary culture. There is a total of nineteen different types and five processed variation of fishes. After the relocation of ancient Matarām, inscriptions still mentioned the same fish that were being consumed. As a cultural practice and an effective adaptation strategy, drying technique and the knowledge of fish selection is passed down from generation and generation. Because member of a society tends to learn from the more successful, skilled and healthier members of the previous generation, the population-level distributions of beliefs and practices will evolve based on the previous successful model (Boyd and Richerson 1988). Drying technique, that applied to *kakap* and *kadiwas*, are considered as an effective and successful model to process fish.

However, research about fish based on epigraphical data is very limited. There are many contradictory interpretations of fish type that can’t be solved with just epigraphy study. Without enough data from another field and from another data source, the discussion about ancient Javanese bioculture aspect will be very limited.

### References


Towards an Integrated Socio-Ecological History for Bagan’s Peri-Urban Settlement Zone (11th to 14th Centuries CE):
Introducing the IRAW@Bagan Archaeological Project

The IRAW@Bagan project is aimed at generating an integrated socio-ecological history for residential patterning, agricultural practices, and water management at the Classical Burmese capital of Bagan (11th to 14th centuries CE). This objective will be achieved through a settlement archaeology study within the peri-urban settlement zone immediately surrounding Bagan’s walled and moated, regal-ritual epicentre. Our program of settlement archaeology will ultimately: 1) generate a more nuanced understanding of Bagan as a dynamic capital city; 2) provide insights into the unique characteristics of early urbanism in the tropics; and, 3) contribute to considerations of resilience and vulnerability in contemporary tropical metropolises.

Introduction

With few exceptions – namely the investigations by John Miksic (2012) and his team at Trowulan, and Miriam Stark and her colleagues in the Greater Angkor region (Carter et al. 2018; Stark et al. 2015) – archaeological research designs focused on “classical” (ca. 800-1400 CE) Southeast Asian polities continue to disregard the potential of settlement pattern studies (Miksic and Goh 2017:26, 358). The lack of attention paid to settlement patterns and vernacular architecture undoubtedly reflects a long-standing partiality towards elite-focused art, architecture, epigraphy, and historical narratives. Beyond the obvious intellectual draw of the written word, and the aesthetic appeal of art and architecture, this traditional approach to knowledge creation also continues to be perpetuated because the more mundane houses and material culture inventories indicative of domestic life in the world’s tropical zones – for both elites and commoners alike – are simply considered less interesting, and they tend to be highly perishable, and thus less likely to preserve in the archaeological record (Carter et al. 2018:494-496; Cho Oo et al. 2003; Coe and Evans 2018:72, 163; Kan Hla 1977:20, 29; Koller...
Compounding this lack of archaeological visibility is the fact that vernacular architecture in Southeast Asia, both past and present, is presumed to have involved raising wooden house floors above the ground using piles or stilt supports (Carter et al. 2018:495; Coe and Evans 2018:72; also Cho Oo et al. 2003:164; Tainturier 2006). This means that, in many instances, no house floor will technically have existed at the ground level upon which archaeologists normally operate.

These conceptual, taphonomic, and structural challenges do not, however, diminish the fact that, should we truly desire to reconstruct the nature of the region’s “classical” polities – especially their socio-economic systems, demographic trajectories, political hierarchies, socio-spiritual structures, and urban footprints – it is crucial to build a detailed understanding of their support populations. In efforts to help fill this gap in our understanding, the IRAW@Bagan project was developed with the explicit goal of generating an integrated socio-ecological history for residential patterning, agricultural practices, and water management at the classical Burmese (Bama) capital of Bagan, Myanmar (11th to 14th centuries CE; Figure 1). This objective is being achieved through a settlement archaeology study within the peri-urban, or mixed urban-rural, settlement zone immediately surrounding Bagan’s regal-ritual epicentre, which is still clearly defined by remnants of its original walls and moat. A settlement archaeology study within Bagan’s peri-urban zone will: 1) generate a more nuanced understanding of Bagan as a dynamic capital city; 2) provide insights into the unique characteristics of early urbanism in the tropics; and, 3) contribute to considerations of resilience and vulnerability in contemporary tropical metropolises.

The IRAW@Bagan Approach to Settlement Archaeology
The three sub-projects at the base of the IRAW@Bagan settlement archaeology study are employing a range of tools and approaches to achieve their goals, including systematic ground reconnaissance and surface exposure assessments, remote sensing (i.e., drone imagery), geospatial and landscape analysis (GIS), horizontal and vertical excavations, collection and analysis of palaeoenvironmental ecofacts, detailed analysis of architecture, art historical imagery, and artefacts, ethnoarchaeological
observation and analogy building, ethnographic and ethnohistoric information, considerations of epigraphic materials and historical narratives, and extensive literature reviews.

**The Residential Patterning Sub-Project**

The Bagan epicenter, as is true for other historic Myanma capitals, was an “exemplary” center that was imbued with cosmological and regal-ritual significance, at the same time that it was home to royals, nobles, religious functionaries, military leaders, guards, servants, and elite craft workers (Aung-Thwin 1985:50-51, 1987:88, 94-98; Aung-Thwin and Aung-Thwin 2012:81, 100-101; Thin Kyi 1966:187; Hudson 2004:221; Kan Hla 1977:21). That said, Bagan’s epicentre clearly “represents an elite core, not an urban boundary” (Hudson 2004:221), given that a dense amalgamation of brick temple complexes, stupas, and monasteries extends out and away from the walled enclosure in all directions, thereby forming an extensive peri-urban settlement zone exhibiting a mixed urban-rural character (see also Aung-Thwin and Aung-Thwin 2012:101; Kan Hla 1977:21; Luce 1969:229). It is generally assumed that this peri-urban zone was home to a diverse support population (Thin Kyi 1966:187; Hudson et al. 2001:70; Miksic 2001:100; Nyunt Nyunt Shwe 2011; Strachan 1989:7), but we know very little about the settlement patterning associated within this city-scape. Through survey, horizontal and vertical excavations, and detailed artefact analysis, the residential patterning sub-project is examining the temporal and spatial aspects of Bagan’s peri-urban settlement zone to assess how its residents and their varied activities were distributed across the landscape, over both time and space. These investigations are building upon the initial settlement survey and collateral excavations conducted by Bob Hudson (2004:245) and his colleagues (Hudson et al. 2001), which suggested that certain concentrations of small monuments dating to the 11th to 13th centuries may be indicative of the presence of peri-urban settlement clusters (Hudson 2004:212, 245-266, 247; Hudson et al. 2001:62, Figure 9). Given that they would have been situated within a distinctly mixed urban-rural city-scape, such clusters are best conceived of as “neighbourhoods” (Smith 2010, 2011).

Considering the preliminary nature of our investigations, the immediate goals of the residential patterning sub-project are simply to find ancient living surfaces, and to ideally reveal the ancient city’s first complete house plans. As is common practice in such “exploratory” situations, our initial investigations employed non-probabilistic (purposive/judgmental) sampling methods to enhance the potential for finding buried residential features (Banning 2002:28-29; French 2015:21). This sampling strategy was informed by prior archaeological observations concerning the possible locations of settlement clusters at Bagan (Hudson 2004:208-220, 234-266; Hudson et al. 2001:53-62). Guided by this knowledge, preliminary surface reconnaissance in May 2017 resulted in the discovery of four possible residential neighbourhoods (PRN), based on the presence of comparatively high-density surface scatters (HDSS) of artifacts: 1) Shwe Creek, 2) Otein Taung, 3) South Wall, and, 4) Kiln #4 (Figure 2). In May 2019, quadrant-based surface collection of diagnostic sherds and special finds were carried out at the first two test sites – Shwe Creek and Otein Taung – in conjunction with sub-surface testing using paired 1 x 4 m excavation trenches situated 10 m apart. Excavations at both test sites exposed a series of stratified living surfaces, many of which exhibited on-floor assemblages and post-holes. The earliest floors encountered were of rammed clay construction. Floors of this type predominantly dated to the Pre-Bagan Phase (600-1044 CE). In contrast, floors dating to the Early (1044-1113 CE), Middle (1113-1174 CE), and Late Bagan (1174-1300 CE) phases were mainly made of tamped earth.

Our four test excavations sites are also being used to anchor four 200 m wide survey transects of varying length (Figure 2). These bisect Bagan’s peri-urban settlement zone. The GPS-guided pedestrian survey of these transects emphasizes the rapid and efficient identification of other locales deemed indicative of possible residential neighbourhoods (PRN). This is being accomplished through the discovery and documentation of additional high-density surface scatters (HDSS) of artifacts, defined as those that meet or exceed a minimal density criteria (MDC) of 25 artefacts per square metre,
over a contiguous area of at least 100 square meters. Each transect is divided into a series of survey lines spaced 10 m apart. These are assigned a unique, sequential designation and digitized over satellite imagery. Individual field walkers progress along their designated survey lines in increments of 50 m, completing what is referred to as a 50 x 10 m transect unit (TU). These transect units form the basic spatial unit for data recording along each of the transects. The transect survey is facilitated by scheduling our fieldwork in May, coinciding with the end of the dry season and the time when ground cover at Bagan is particularly sparse. The findings from this reconnaissance program are being used to determine the locations for future residential neighbourhood test excavations.

Agricultural Practices Sub-Project
The agricultural practices sub-project is building upon earlier assessments of Bagan's agricultural capacity carried out by Michael Aung-Thwin (1990). Given the palimpsest quality of agricultural field systems, it will be necessary to use remote sensing data, geospatial analysis, sub-surface testing and sediment analysis, historic and art historical data, and both ethnographic and ethnoarchaeological observations to build an understanding of Bagan's agrarian economy. Such assessments will be augmented by palynological analyses and ethnobotanical studies of excavated materials. ArcGIS tools will also be used to elucidate the shared orientations of field boundary walls and nearby monument complexes, with the architectural features being used to provide approximate dates for the construction and use of the agricultural plots (c.f., Bâty 2005; Hawken 2013; Pottier 2000:111-112, 2012:19-20). We will also carry out excavation of certain agricultural features, such as boundary walls, to determine construction techniques, usage patterns, and chronology (e.g., Macrae and Iannone 2011). Finally, our study of agricultural practices at Bagan will consider the impacts of the precipitation regimes associated with the Medieval Climate Anomaly (MCA, 900-1300 CE) and the subsequent Little Ice Age (LIA; 1300-1570 CE), as these would have conditioned the agricultural potential of Myanmar's Dry

**The Water Management Sub-Project**

Our water management sub-project is striving to reconstruct the relic water management system associated with Bagan's peri-urban settlement zone. Access to water was an endemic issue at Bagan (Cooler 1997; Luce 1969:7) – given its Dry Zone location – and the inscriptions and chronicles inform us that most kings attempted to augment the city's water supply through the construction of brick wells, dams, canals, and brick or stone-lined holding tanks (Kan Hla 1977:22; Luce 1969:76, 84, 256; Pe Muang Tin and Luce 1923:65, 131; Stargardt 1968:360-361). Although some of these features are still active, or at least discernible on the landscape, many are likely obscured from view as a result of having been silted up (Hudson 2004:2, 266). Be that as it may, recent examinations of Bagan's water management system, carried out by Elizabeth Moore and colleagues (Moore et al. 2016) and Win Kyaing (2016, 2018), have indicated that Bagan's peri-urban zone contains remnants of a complex and extensive, yet comparatively “small-scale” water management system comprised of seasonal ponds, streams, canals, formal tanks, deliberately positioned and planned temple complexes, and the moat surrounding the epicentre (Moore et al. 2016:285, 294-300, 302; see also Cooler 1997:22-23). Our own investigations have included preliminary visitations to many of the known water management features in the peri-urban zone in May 2017, and the mapping and excavation of water management features in the Tuyin-Thetso uplands – including Nat Yekan sacred water tank – in May 2018 (Iannone et al. 2019). This highland area seems to have served as the literal and spiritual source for the rest of Bagan's peri-urban water management system (Iannone et al. 2019; Luce 1969:76 345; Moore et al. 2016:285, 295; Ni Tut 2013; Nyan Hlaing Lynn 2017; Win Kyaing 2016, 2018).

Our ongoing modelling of Bagan's broader water management system is being carried out using a GIS-based hydrological approach, and includes analysis of the direction of flow, flow accumulation, and watershed delineation (see Macrae 2017:214-225; Macrae and Iannone 2016:374-388). These hydrological characteristics are providing information concerning the interconnectivity of naturally occurring features – such as slopes, streams, and seasonal ponds – and cultural features, including reservoirs, canals, weirs, and moats. The previously discussed transect survey program will be instrumental in collecting data for this modelling exercise, with field walkers being charged with recording information pertaining to the location, size, character, and interconnectivity of different components of the water management system. Excavation of select water management features will augment our understanding of the system's development and functionality. In considering how these various components of the water management system may have worked together to sustain Bagan's urban population, it will again be crucial to retrodict the positive impacts that the Medieval Climate Anomaly (MCA, 900-1300 CE) would have likely had on the Dry Zone's precipitation regime.

**Conclusions**

Our settlement archaeology study at Bagan is clearly in its initial stages, and we have yet to generate any substantive insights concerning the character of classical Bagan's peri-urban city-scape. That said, when trudging around Bagan's contemporary monument zone one is a constantly reminded of how expansive, varied, and dynamic this pre-industrial metropolis once was. Be that as it may, we believe we have been able to frame an effective, long-term settlement archaeology program for Bagan's peri-urban zone that will ultimately produce tangible, and useful results.

**Acknowledgements**

We express our gratitude to both the Ministry of Religious Affairs and Culture and the Department of Archaeology and the National Museum for allowing us to carry out our field work at Bagan, and for facilitating our research visas. Particularly noteworthy is the encouragement and assistance provided.
by members of the Bagan Branch of the Department of Archaeology. Our appreciation is also extended to the Department of Archaeology and Department of Historical Research for allowing various staff members to fully participate in our daily survey and excavations. We also extend our gratitude to U Nandavamsa, Abbot of Tuyin Monastery (2018), and U Nandara, Abbot of Kheminga Thein Kyaung Monastery (2019), for assisting us in so many ways, from blessing the excavation sites, providing places to stay for some of our field crew, arranging for our lunches, and supplying space to conduct lab work and to store our field equipment and artifacts. The Bagan Museum is similarly thanked for providing long-term storage space for our artifacts and equipment. U Win Thein (2018), and U Aung Htoo and his wife Hnin Hnin Hlaing (2018-2019) are commended for cooking up the best possible field lunches and “lecture dinners.” We would also like to thank our amazing van drivers – U Hla Tin and U Han Thaung (2018) and Thet Khaing (2019) – who helped us in so many ways above and beyond transporting us to and from our excavations. Landowners Aung Hlaing (Shwe Creek site) and Myint Oo (Otein Taung site) not only allowed us to do research on their properties, but also provided many useful insights while we carried out our excavations. Our days would have been much longer and hotter if it was not for Tun Tun, who built our excavation shelters and served as a general source of knowledge and assistance throughout the project. A number of experts in the archaeology of Myanmar also provided us with useful insights and inspiration over the past three field seasons, including Michael Aung Thwin, Bob Hudson, Elizabeth Moore, Janice Stargardt, Nyein Lwin, Charlotte Galloway, and Ni Tut. Finally, we extend our sincere appreciation to the National Geographic Society, who awarded us with a grant in support of our Nat Yekan investigations, and both Trent University and the Social Sciences and Humanities Research Council of Canada (SSHRC), who helped to fund our settlement archaeology study.

References


From the Mountains to the Ayeyarwady River: Water Management in Bagan, Myanmar during the 11th to 14th centuries

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Bagan is located on the plain between the Tuyin-Thetso range in the east and the Ayeyarwady River in the west. This plain slopes slightly down from the highlands in the east and southeast towards the riversides in the north and west. Water management is an essential part of urban planning in both ancient and modern settlements. Bagan is located in Myanmar’s Central Dry Zone, a semi-arid environment, and is susceptible to droughts and the occasional flash floods that affects the availability of potable water. The IRAW@Bagan research project conducted investigation of classical Bagan’s (11th to 14th centuries CE) water management components during 2017 and 2018. Among the features investigated are the water tanks of Nat Yekan and Ka Tak Kan, located atop the Tuyin-Thetso mountain range, and the water reservoirs that interconnect water management infrastructure found across the Bagan peri-urban zone. The results of our ethnographic surveys, reconnaissance, and excavations at Bagan point to an interdependence between water and socioeconomics; water and ritual; and water and climate change. This study of ancient water management will inform us as to how the ancient settlement pattern and societal challenges were reliant on the ability to manage water resources.

Water resources are an important aspect of the urban planning, especially in the settlement within Bagan’s peri-urban zone. Bagan’s natural landscape was significantly modified to support its inhabitant’s daily consumption and agricultural needs. Water management components essential for Bagan are found atop the eastern hills of the Tuyin-Thetso range, on the plains among the temples and villages, and along the east bank of the Ayeyarwady River (Figure 1). The complex system of water management infrastructure includes reservoirs, canals, artificial embankments, and a city moat. Both the Ayeyarwady River and Tuyin-Thetso Mountain range are principle source of water resources for daily consumption and agricultural production. However, beyond these traditional day-to-day water uses, there were also the ritual and spiritual usage and needs. Traces of these ritual practices and spiritual water beliefs can be found in Bagan’s peri-urban zone. It is important to take into consideration the intersection of water as a natural resource, a managed resource, and a cultural resource.
Climate Anomaly, Monsoons, and the Little Ice Age in Mainland Southeast Asia

An examination of the water management infrastructure suggests that current climatic condition might differ from those of Medieval Climate Anomaly (MCA) experienced during the Bagan era (11th to 14th centuries CE). As such, this discussion must provide a cursory review of the past and present climatic conditions. The climate and weather patterns of ancient Bagan, similar to many Southeast Asian countries, are dominated by monsoon patterns. The monsoon season for mainland Southeast Asia is primarily a product of the Indian Summer Monsoon, a southwesterly wind which first develops during the month of May and initiates the monsoon flow-terrain interaction in western Myanmar and western Thailand (Buckley et al. 2014: 14). Myanmar is affected by the Indian Summer Monsoon (ISM), East Asian Summer Monsoon (EASM), and Western North Pacific Summer Monsoon (WNPSM), all of which bring rains to the various parts of the country (Buckley et al. 2014: 2). In the summer months, moisture from the ISM is carried across the Indian subcontinent and the two adjacent seas; forming a heavy precipitation belt on the windward slopes with contrasting lower rainfall pattern experienced on the leeward slopes (Buckley et al. 2014: 2). The ancient city of Bagan is located east of these leeward slopes and is thus prone to unpredictable, and regularly low, frequencies of rain, which results in a semi-arid environment.

Fig. 1
Periods of climate anomalies can span decades and have been linked to tumultuous periods of human occupation over the past millennium (see Buckley et al. 2014: 17). Recently, Victor Lieberman and Brendan Buckley (2012a: 150; 2012b: 1050) have suggested that higher rainfall on mainland Mainland Southeast Asia occurred in three periods, notably the Medieval Climate Anomaly (MCA) circa 900/950–1250/1300 CE, and less dramatically, during the Little Ice Age (LIA), between 1470–1590, and 1710–1810; all periods of time that correlate with agricultural and population growth. The MCA was characterized by relatively gentle monsoons spread across a substantial part of the year, with limited dry season droughts, conditions that favored agricultural production. In contrast, the LIA monsoons were unstable and more concentrated in short annual periods with high magnitude deluges (Lieberman and Buckley 2012b: 1074). Bagan, Angkor, and Dai Viet were the earliest extensive indigenous polities in the region, and as ‘charter states’ they are characterized by political, territorial, and cultural florescence. All three flourished from the 10th to the 13th centuries, during the MCA. However, all three “collapsed” between 1280 and 1400 CE, during the transition into the LIA (Lieberman and Buckley, 2012b: 1056, 1057, 1059). The transition from the MCA to the LIA is hypothesized to have also contributed to 14th-century crises in Europe, China, and India between 1340 and 1380 (Lieberman and Buckley 2012b: 1078).

Tuyin-Thetso Range and Water Reservoirs (Late 11th to 14th Centuries CE)
The Tuyin-Thetso range, is located southeast of the ancient city of Bagan. On the summit of Thetso Taung there are eight reservoirs and three canals cut from the natural sandstone and modified with earthen and/or stacked stone embankments (Macrae 2019: 164; Figure 2). At the western base of this range is the classical Bagan reservoir known as the Mya Kan. Its construction is attributed to King Kyanzittha (1084-1113 CE) (Thein 1965: 47-49; Than Tun 2008: 35-36), and its first usage likely dates to before 1098 CE (Iannone et al. 2019a, 2019b). Regarding the sandstone tanks on Thetso Taung, there is only one inscription, the Paw Daw Mu Phaya (found on Thetso Taung) that refers to such a reservoir. Unfortunately, this inscription does not include an exact date for tank construction, although it has been suggested to refer to a tank dug in 1082 CE (M Aung-Than, personal communication, October 10, 2018; Iannone et al. 2019a, 2019b). The list of donations on this inscription shows one monastery; eight banyan trees; a preaching hall Dhammasa; one water tank; and two sons converted into monks (E Maung 1958: 1). This list of donations may be connected to any of the monumental reservoirs on the Tuyin-Thetso range – which one remains unclear – including the largest, Nat Yekan tank (Iannone et al. 2019; Ni Tut 2013: 162).

Net Yekan tank is located at the western slope of Thetso Mountain range at 282 m above mean sea level. With a perimeter of 89 m and a depth of 8.5 m, it has a volume of 774 m3. The maximum amount of water this tank can hold is 1,955,463 liters (Macrae 2019: 151). Inside the tank, there are four stone-cut walls of sandstone bricks in various shapes and sizes which retain the eastern and northern wall. These support walls provided structural support while protecting the reservoir against the soil erosion from the upper portion of the tank. Local people called this tank the Spirit Tank, and some believe that it may be the original Mya Kan (Ni Tut 2013: 166). In Nat Yekan Tank, animal reliefs carved on the four walls depict a crocodile (makara?), labyrinth, Muchalinda-Buddha, serpent, two hamsa birds, lizard, goose, heron, three tortoises, and two fish (Iannone et al. 2019a, 2019b).

In May 2009, hundreds of local villagers, led by the venerable monk U Nanda Vamsa, cleared the accumulated silt from Nat Yekan (Ni Tut 2013: 161-162). Found on the western wall of Nat Yekan tank, the labyrinth symbol can be considered an auspicious icon for the sacred water tank and may be connected to notions of fertility and prosperity (Iannone 2019a: 174). Other bas reliefs carved on the three walls depict animals and reptiles associated with water as well as Buddhist jataka stories that correlated these kinds of birds and aquatic life with the Buddha’s previous lives. Also significant is the Muchalinda Buddha image located on the wall in the northwest corner of the tank (Iannone
Excavations beneath the later embankment wall in this corner of the tank exposed the original reservoir outlet, from which point the symbolically purified water that had flown over the Muchalinda-Buddha image would have been discharged downslope, into the expansive Mya Kan reservoir, and then further west and north, into other components of the water management system (Iannone et al. 2019a, 2019b).

Additional archaeological survey and excavation along the Tuyin-Thetso range have broadened the understanding of the hydrological function of this upland area. Results from this survey and resultant digital elevation model (DEM) with subsequent hydrological analysis, indicate a total water catchment area within the survey zone of 11,687 m² (Macrae 2019: 146, 148). This indicates that the strategy of water management on the top of Thetso Mountain was designed for the manipulation, collection, and distribution of surface water through water catchment manipulation, canals, and the arrangement of reservoirs. The drainage system from Nat Yekan to the Mya Kan was surveyed to confirm the water management at the top of the mountain range was designed to disperse water across the Bagan plain, and the city’s peri-urban settlement zone, ultimately reaching the walled and moated epicenter (Iannone et al. 2019a, 2019b; Macrae 2019: 156).

Today, water resources at Bagan including the river, rainfall, and the water table, all of which relied on the climatic conditions and especially the monsoons effect on local weather patterns. It is important to compare the contemporary conditions of Bagan with the scientific studies of the MCA and LIA that dominated Southeast Asia in this Medieval period (see Buckley et al. 2014: 2). In modern times, Bagan experiences a dry season for about six months from December to May, during which it is often challenged by drought. During periods of drought the Ayeyarwady River is largely dry, and as a result of the exposed sandy shoals, the river is constricted at many areas along its path. As such, the Ayeyarwady River can sometimes be crossed by bullock carts or by foot. These dry conditions, amplified by sandy soils, make water a precious commodity for the Bagan region. Thus, the water collected and redistributed to the peri-urban zone from the Thetso Mountain range plays a significant role in Bagan’s urbanism and rural production. The Nat Yekan Tank could have been built not only to support the water storage for the Sangha members who lived on the top of this mountain range, but also through their religious practices of water blessing and the symbols inside the tank itself, it could have created sacred/spiritual water for distribution amongst the cultivated lands and settlement between the mountain range and the bank of Ayeyarwady River (Iannone et al. 2019a, 2019b).

Water Management in the Plain of Bagan (12th-13th century CE)

As research by IRAW@Bagan progresses, it endeavors to understand the water management practices and processes of water flow across the peri-urban zone (Figure 3). With respect to this goal, water management infrastructure found on the Bagan plain needs to be investigated. Water from Nat Yekan and its associated tanks overflows into the Mya Kan reservoir located at the base of Tuyin-Thetso range, which in turn overflows into canals and natural drainage creeks that flows northeast towards Minanthu village via the Kan U reservoir. Minanthu village is located southeast of the walled and moated Bagan epicenter. The Minanthu area is very popular during the 13th century, as is evidenced by the numerous monuments constructed in the area during this time period. According to a 13th century inscription, this place was originally known as Amana and the contemporary reservoir was known as the Amana Lake, as mentioned in line no. 6 of the Le Myat Hnar Phaya inscription (E Maung 1958: 59, Than Tun 2008: 318). This reservoir measures 80 m x 80 m x 6 m. The reservoir sits at the highest elevation in this area and is enclosed by a massive earthen embankment. A large water inlet constructed with sandstone blocks feeds this reservoir with water that originated from the previously mentioned Kan U reservoir to the east. At this inlet there is a sophisticated sandstone filtration system that cleans the water before entering the reservoir. In the present day, the Minanthu villagers still use the tank for drinking water. When this Minanthu reservoir is full, water overflows towards the western slopping area to reach the catchment area of The Beik Mauk and Sulamani tem-
Several reservoirs are similar in construction as the Minanthu reservoir. These include Tha Htay Kan and others that do not have names. The aforementioned Kan U reservoir was constructed with a 300 m earthen embankment in order retain the water that it collects from a 15-acre catchment zone. This reservoir retains the rainwater coming from the eastern Bagan plains. Reservoirs similar in construction techniques include the Nyun Lat Ta Phat and the Pho Thu Daw, which are constructed by the damming of ravines. The Ta Wet reservoir overflows into the Pho Thu Daw reservoir, similar to the way Kan U overflows into the Minanthu reservoir.
An important example of how the water management infrastructure intersects with temples across the Bagan plain is found at the Sulamani temple (see Moore et al. 2016). This pagoda (no.748) was built in 1183 CE through the dedication of King Narapatisithu, also known as Cansu Min Kri in Sulamani inscriptions (Yin Myo Thu 2013: 12-14). This temple is situated in the middle of Bagan archaeological zone and it was surrounded by the large reservoirs of Nyun Lat Ta Phat Kan, Tha Beik Mauk drainage, Sulamani drainage, Pho Thu Daw Kan, Ma Gyi Kan, and Htein Kan. According to the dedication inscription, the Sulamani temple was built by infilling a wetland depression (Moore et al. 2016: 295-296; Yin Myo Thu 2013: 12-14). As such, the placement of this temple’s foundation was designed with water management in mind. According to Pichard (1994: 293), the Sulamani drainage is estimated to be constructed between the 13th or 14th century CE, with the monastery complex built later than the temple. Pichard (1994: 293) described the monastery (no.745) as having a water tank constructed of flat bricks that was connected to a canal. However, the system has not been described in detail. A similar drainage system was also found at the Bagan palace site, which was excavated and conserved in 2003 (Phyo Ngwe Yee 2011: 21). The drainage system of the palace site is associated with the Early Bagan Phase (1044-1113 CE), suggesting that this type of drainage has been used since the 11th century CE.

The entire Sulamani compound slopes slightly from the southeast towards the northwest. Today, the water drainage system inside the compound includes six water inlets located beneath the enclosure walls designed to collect water from the adjacent catchment area (Moore 2016: 295-299). In the eastern enclosure wall, the compounds the largest water inlet is located beneath a massive brick wall, which was used to funnel water from the eastern catchment area which was also fed by the The Beik Mauk temple. The Beik Mauk is located in-between the Sulamani temple and Nyun Lat Ta Phat Kan reservoir. In front of this temple is a sandstone-floodgate connected to Nyun Lat Ta Phat Kan reservoir. The water passing over this floodgate flows through the southern enclosure wall of The Beik Mauk temple and into the eastern catchment area of Sulamani temple. The water then flows into the Sulamani temple compound through the aforementioned water inlet beneath the enclosure wall. There is also one water outlet underneath the northern enclosure wall. The water from this outlet follows the natural slope of the compound to reach the northern monastery complex and ultimately the Sulamani water tank. Finally, there are four water outlets beneath the western enclosure wall. Although the western outlets are smaller, during periods of heavy rainfall these outlets are useful for managing the runoff and preventing the risk of water erosion from directly impacting the monument.

Northwest of the Sulamani temple there is a distinctive square-shaped-water reservoir with an island in the middle. Traditionally, it had been called a water sima by Buddhist monks. This square-shaped reservoir is divided into two portions, similar to the nearby Ma Gyi Kan and Htein Kan reservoirs (Yin Myo Thu 2013). In the center of the island is a two-storied-temple named Leik Kone (Tortoise Shell). The catchment area of this reservoir collects water that overflows from the western part of Sulamani Temple. During the raining season, the watercourse flows from Nyun Lat Ta Phat Kan reservoir to this reservoir throughout the catchment area of The Beik Mauk and Sulamani temples. The Sulamani water management system is dependent on the maintenance of the Nyun Lat Ta Phat Kan reservoir and the overflow water from the Minanthu area. These also constitute the main catchment areas found between the southeastern hinterlands that connects the Tuyin-Thetso range and the western plain of Bagan through natural drainage creeks; and after passing through these temple compounds and reservoirs the overflow water will continue onwards until it reaches the southeast corner of the city moat and supplies the moat with water.

Early hypotheses suggest the Bagan city wall and moat were likely built in the 9th century CE (Duroiselle 1912: 136). However, excavations can only confirm that the 13th century King Tayokepyay renovated the wall with bricks taken from the hundreds of temples (Than Tun 1996: 192-193). The city moat was last repaired in 1698 CE (Than Tun 1985: 20). More recently, a
351-meter portion of the moat was excavated and conserved between 1989–1995 and again between 1997–1999 (Phyo Ngwe Yee 2011: 14). Excavation revealed that it is 20 m wide at the bottom of the moat and 40 m wide at the top or mouth of the moat (Phyo Ngwe Yee 2011: 14). Today, during the rainy season, only the southeast portion of moat fills with water. Initially, the moat was hypothesized to be filled from the Ayeyarwady River. However, survey data disprove this hypothesis by revealing that the moat sits approximately 17 m higher than the river level (Phyo Ngwe Yee 2011: 15; see also Win Kyaing 2016, 2018). In addition, even when the Ayeyarwady River is at full capacity during the rainy season, the water level of the river does not reach the height of the moat bed. This revelation suggests that the moat was most likely filled with water flowing across the Bagan plain, especially at the southeast corner which is supplied by the overflown water from the Sulamani temple water system.

![Fig. 3](image-url)  
Water Drainage Pattern from eastern hinterland of Tuyin-Thetso Range to the west and northwest direction. Source: Scott Macrae.
As previously described, the water management system of the Bagan plain is heavily dependent on natural drainage creeks as well as man-made reservoirs and drainage canals which direct water across the peri-urban settlement and agricultural zone, passing through temple compounds, and into the city moat which ultimately connects to the Ayeyarwady River. Supporting this argument are the northern and southern canals that flow next the Ananda and Taingchut temples into the city moat (Phyo Ngwe Yee 2011: 15-16). This massive investment in water management infrastructure may suggest that the moat was intentionally constructed to store the water, rather than simply discharging it into the Ayeyarwady River.

**Reservoirs Along the Ayeyarwady River**

There are three main water reservoirs located along the Ayeyarwady river, at Myinkaba village, Thiripyitsaya village, and Wet Kyi Inn village. The reservoirs of Thiripyitsaya and Wet Kyi Inn, in modern times, have been transformed through many modern renovations. The Myinkaba reservoir has the distinction among those that are constructed along the riverbank in that it is not affected by modern renovations other than the occasionally plowing for cultivations. Myinkaba is located on the lowest elevation of the entire Bagan plain, which makes it the natural point where water flows towards the river. Myinkaba Creek, originating in the central plain of Bagan via the catchment area of the Sulamani Temple, feeds into the Myinkaba reservoir at the confluence of the creek and river.

**Conclusions**

This discussion has presented an examination of ancient Bagan’s water management components dating to the 11th to 14th centuries. It is a brief description of how water resources were managed, starting from the collection and redistribution points on the Tuyin-Thetso Mountain range, and then spreading across the Bagan Plain, ultimately leading to the city moat and a series of riverside reservoirs, and the ultimately the Ayeyarwady River itself. This preliminary examination provided important information concerning the complex water management system from a functional perspective, but it has also briefly explored the ritual and spiritual aspects of water. The religious and spiritual means through which water collected on the Tuyin Mountain range was made both sacred fertile, after which it flowed downward, through reservoirs and associated temple complexes, towards the regal-ritual epicenter and the Ayeyarwady River, would have had a dramatic effect on how water was culturally perceived. Water would have been embodied with spiritual/ritual connotations through the passage over and through places of ritual practice religious iconography. The intersection of water as a natural resource, a managed resource, and a cultural resource provides an interesting avenue to explore the past relationship between the Bagan population and water.

**Acknowledgements**

We express our gratitude to both the Ministry of Religious Affairs and Culture and the Department of Archaeology and the National Museum for allowing us to carry out our field work at Bagan, and for facilitating our research visas. Particularly noteworthy is the encouragement and assistance provided by members of the Bagan Branch of the Department of Archaeology. Our appreciation is also extended to the Department of Archaeology and Department of Historical Research for allowing various staff members to fully participate in our daily survey and excavations. Special thanks are extended to the Bagan Branch of the Department of Archaeology GIS team for data sharing. We also extend our gratitude to U Nandavamsa, Abbot of Tuyin Monastery (2018), and U Nandara, Abbot of Kheminga Thein Kyauk Monastery (2019), for assisting us in so many ways, from blessing the excavation sites, providing places to stay for some of our field crew, arranging for our lunches, and supplying space to conduct lab work and to store our field equipment and artifacts. The Bagan Museum is similarly thanked for providing long-term storage space for our artifacts and equipment. U Win Thein (2018), and U Aung Htoo and his wife Hnin Hnin Hlaing (2018-2019) are commended for cooking up the best possible field lunches and “lecture dinners.” We would also like to thank our
amazing van drivers – U Hla Tin and U Han Thaung (2018) and Thet Khaing (2019) – who helped us in so many ways above and beyond transporting us to and from our excavations. A number of experts in the archaeology of Myanmar also provided us with useful insights and inspiration over the past three field seasons, including Michael Aung Thwin, Bob Hudson, Elizabeth Moore, Janice Stargardt, Nyein Lwin, Charlotte Galloway, and Ni Tut. Finally, we extend our sincere appreciation to the National Geographic Society, who awarded us with a grant in support of our Nat Yekan investigations, and both Trent University and the Social Sciences and Humanities Research Council of Canada (SSHRC), who helped to fund our settlement archaeology study.

References


Yin Myo Thu (2013) Religious Dedication of King Narapatisithu, Ph.D. Dissertation, University of Yangon, Yangon.
The Sustainable Hydrological Features in the Historical City of Mrauk-U

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During the Mrauk-U Period (1430-1784 CE), natural water resources were systematically exploited for the advantage of society. The construction of tanks in Mrauk-U was more cultured than the other historic sites in Myanmar. The unique water management of Mrauk-U is the shaping of natural tributaries into canals, building water gates on streams, control systems for tidal water rising up and flowing down to create hydraulic power and other innovations. That innovation of using natural water resources made Mrauk-U into a rich and grand medieval city with navigation and overseas trade and stood as the most developed cosmopolitan city among the contemporary medieval urban centres of Southeast Asia.

Introduction

The medieval city of Mrauk-U (1430-1784) was the most splendid among the Rakhine capitals and contemporary history of Myanmar, indeed within the Southeast Asian region. The glory of Mrauk-U has been described in the histories of Rakhine and records of Persian and European travellers of the time, with the monumental remains still standing. Such remains include the palace, moats, canals, city walls, fortresses, and monuments such as Shit-thaung and Dhokanthein that are important for the art and architecture. Many ruined structures and sculptures hidden in bushes are quiet, remaining to be exposed and maintained.

Mrauk-U was founded around 1430 and the last capital of the Rakhine kingdom was located strategically in western Myanmar near the Bay of Bengal in the Indian Ocean. Established because of the geographical vulnerability of the previous capital of Laung Krak which was on a plain, this new city’s location was not only beneficial for agricultural and defensive purposes but its strategic positioning between India and Southeast Asia and easy accessibility resulted in its development as a commercial and cultural trading centre, later rising to a flourishing kingdom for a period of more than three centuries. Until today the historic waterways function as the transportation network of the city areas, e.g. the creek of Alay-Zee Chaung served as the maritime trade gateway to the sea from Mrauk-U. Even though being inland, ships could reach Mrauk-U making it accessible via land and sea routes to both east and west which is unique in the Bay of Bengal.

In the Rakhine chronicles and histories there could be seen the usage of ancient water management and construction and maintenance of water pond and reservoir. One of the evidences was found in the King Ananda Chandra Stone Inscription of the 8th century CE Vesali Period, that mentions “At two locations, Dakinga Mapagtupara and Burekano Lakkalapara, the lovely and enchanted lakes
named Panneik and Soma Sangha were established” (San Thar Aung 1975: 180). Another stone inscription of King Kawliya (1118-1123 CE) in the Lemro Period (1018-1406 CE), said that the king repaired and renovated the ruined tanks as one of the royal donations. This indicates that traditional culture of irrigation and water management resources in Ancient Rakhine preceded the Mrauk-U Period.

The historic city of Mrauk-U retains with its cultural landscape features of urban setting and hydraulic engineering works. Its landscape features embrace physiographical attributes like hill city-wall system, landscape setting for royal rituals, shipyards, seasonal streams, canal, reservoirs, lake, dam, moat, pond and well. With altogether these other physical attributes of structural remains such as city-gates, fortifications, palace site, granary, kiln site and stone inscriptions are existed side by side. As the significant religious attributes, the Buddhist temples, stupas, Buddha images, Nat shrines, ordination halls and Pitakattaik or libraries are seen in different topographic locations (Republic of the Union of Myanmar 2919), and they are still venerated by the community. Similarly, the hydraulic works of larger lakes and reservoirs are partially functioning for water management, and local people continue the practice of agriculture. Some areas of paddy fields are also used the irrigated water from the remaining resource of ancient water management.

This paper focuses on the water features of Mrauk-U and its suburban areas recorded from the preliminary survey, and to understand first the nature of water evidences and environments. And the surveyed data of facts and figures are analysed how water resource exploitation for the fundamental socio-economic cultural needs of the city. By conducting systematic recording of surveyed finds on water management features, this paper also attempted initial identified components and further research on present hydrological use. For the long-term process of near future and revival water management system, moreover the paper tries to find the clear existing evidences and protecting measures for sustainability of existing ancient hydrological features.

Site and its setting
These areas belong to the coordinates of 93°04´-93°15´ East longitude and 20°30´-20°53´ North latitude and encompass 700 km². Geographically the area is in the eastern part of the Kaladan River and western part of the Lay-myo River, with among these flat plains consisting of Sin Taungtan (Sin Hill-range) and its minor spurs at different altitudes. In the Mrauk-U environs, except the northern part of the city which is a mountainous area, there are visible remains of ponds, tanks, creeks and canals on the east, south and west.

Mrauk-U lies on the southern edge-spur of Sin-taung hill-range extending from the northern Chin Hills. In the Mrauk-U area one of the spurs of Sin-taung is known as Maha-htee Hill-range, running north-south up to Baungdut and Maungswe Village. Another two on the east are Makya and Parein Hill-range located in the Lemro River Valley. On the west are wider flat plains with the networks of tributaries of Kaladan River Valley. On the north of the Kaladan River Valley is the spread of hillocks like Linmawe and Daung Hill-range (under 400 ft high) which provides an important geographical setting for the water management of Mrauk-U.

Methods
To get many data, firstly we studied cartographic sources including (i) one inch: one mile scale maps, (ii) one inch: four mile scale maps, UTM survey maps and (iii) Google Earth Satellite Maps. Although searching water resource sites on the maps was convenient for beginning our records, the UTM maps did not include all the ancient reservoirs and various sizes of tanks and ponds. But the names of localities, creeks, canals, hills and villages are available on the maps. The landscape topographic features on Google maps are readable and made identification of features that belong to the present reservoir and dam, the various sizes of tanks, and which were old and not functioning. There-
fore, the exploitation of maps could be effectively used in the fieldwork search for ancient water resources.

After desktop survey we explored around Mrauk-U and recorded evidence for water management in the ancient cities of Dhannyaawaddi, Vesali, Mrauk-U and their environs. Moreover, the valley areas of Ran-chaung (creek), Thaye-chaung (creek), the tributaries of Kaladan River, agricultural flat plain of Pan-zay-nyaung (the main water inlet and outlet canal connected with Lemro River and Mrauk-U City) and the slope areas beside Baungdut Hill-range were extensively explored.

Firstly, the team explored and recorded water features within Mrauk-U City. Then they moved to the storage tanks and reservoirs that were used up to today of Letse Kan, Ahnuma Kan, Baungdut Reservoir (Kywethe Inn) and their distribution of water to the community. After that, a reconnaissance survey was conducted of the Kassapa Moat, Sinphyu (White Elephant) Moat and other moats and drains, channels, earthen embankments such as four tiers of moats and embankment and others on the eastern part of Mrauk-U urban areas.

Furthermore, we continued surveying in the prior successive water management features especially ancient reservoirs and dams in the areas of Vesali and Dhannyaawaddi (Maha Muni Religious and Sacred land). Surrounding the ancient urban areas, the Kaladan River Valley Plain, along Sintaungtan (Sin Hill-range) on the east and its western slop-areas keep in continuous use a series of reservoirs and tanks. Running from the north to south, a series of reservoirs like Thit-ta-pon, Zi-chaung, Pazaing, Gaya-taung, Kyaukse-pyin, Makya, Kyatsin, Lakka, Vesali, Abaungdaw, Taungbyu were found. During the survey of water management evidences, the team additionally made interviews with the local people on the water current in the stream, the current condition of tank’s receiving water capacity and related history or stories.

Four quadrants were designated in the areas of the around Mrauk-U ancient city. In each quarter was observed how many ponds and calculated area of these lake. After that the team observed population density of in those area and cultivated land to know connection with lake and people in each quarter.

**Water Resources in Mrauk-U**
The major water resource for Mrauk-U is found in the western plain, a riverine hinterland. They are the important tributaries of the Kaladan River or Kissapa Nadi River (another name in the literature). In this western plain, Tha-ye-chaung (on the west), Yanwa-chaung (on the east) and Thinbaw-chaung (‘ship creek’) are useful for the agriculture and transportation. There is no tributary complex or water network on the south like the west. On the east, five miles away from the city there is the Lemro River, also known as the Inja Nadi River. To the Lemro River a manmade canal called Moe-gyo Tumyaung (north of Sinoh-chay Village) is connected and runs towards southwest, the direction of the city. Midway the canal joins with the streams of Khayu-kauk and Nget-gaung which descend from the northern water catchment area of hilly ranges. Then they join the canal named Pan-zay Myaung (Canal) and Ale-zay Myaung to finally flow into the city. Paungdut Chaung (stream) on the southeast of the city flows towards south and joins with Nayagauck Chaung (stream) that coming from the west. Nayagauck Chaung, a crucial stream on the far-south connects the two rivers of Lemro on the east and Kaladan on the west.

There is an average rainfall in Mrauk-U of 140 inches (records from 2011 to 2015). This amount of rainfall is received within the rainy season between June to October. It is also the gathering period of water in storage tanks, reservoirs, ponds, lakes and other water bodies. During the rainy season 60% of the flat plain areas in Mrauk-U is also flooded. This flood water apart from residential areas is exploitable for agricultural lands. In any season rainfall is a staple water resource for Mrauk-U.
The tributaries flowing around Mrauk-U provide crucial circulation for water resource of the city and its cultural landscape. Similarly, in the successive history of the region these tributaries have been exploited as important water ways of transportation and communication. Moreover, the tributaries are natural setting and arterials for the inlet and inlet water management as necessary for urban and suburban areas. Upon these natural phenomena, canals and channels were added. Like the natural ones functioning in the different sectors of the city’s landscape, these manmade canals, dams, and storage tanks are plentiful in Mrauk-U.

The above-mentioned tributaries and canals in Mrauk-U are also sea-tide streams. The rise and fall of the tides are important in hydraulic transportation. The hydraulic energy created by the tidal waves was exploited and managed in the water transportation of Mrauk-U Period. The evidence of old water gates to control tidal stream fluctuations was found inside and outside of the city. Therefore, the maritime water transportation of Mrauk-U with the region of Bay of Bengal was greatly aided by the regular hydraulic energy of tidal water resource to encourage the development of maritime trade.

Evidence of the usage of ground water in ancient time is also found in Mrauk-U areas. Some few years ago when Let-se-kan (storage tank) was used water distribution by pipelines to the city. The wells, stone and brick walled as the evidence of the usage of ground water in ancient time is also found in Mrauk-U areas. These have been somehow declined when Lest-se-kan (storage tank) had been used water distribution by pipelines to the city since some years ago.) Previously the wells dug for drinking water were the main resource of underground water for public use. The favourable conditions of accessing underground water in Mrauk-U seem to have (i) existed in lower altitudes like 7 m above sea level, (ii) lowlands of flat plains in the surrounding of Mrauk-U belong to the areas of flooded by Kaladan and Lemro River, and their tributaries, (iii) surviving on fresh water storage by the tanks, reservoirs on the slope areas of hill-ranges and (iv) some remaining natural forests in the hilly areas. Keeping fresh water in storage tanks and reservoirs around the city also made underground water and the wells sustainable and usable perennially.

**Distribution of Water Resources and Its Management**

Over the course of our survey of Mrauk-U water resource management and related evidence, the team tried to identify all the facts and figures of water management distributions in four areas: northeast, southeast, southwest and northwest that demarcate two north-south and east-west lines through the centre of the palace site. We observed 60.26 km² and among these area, and 359 tanks were recorded. Within this area, 9.28 km² are covered by forest and vegetation area and the rest are agricultural land and human settlement area.

**Northeastern Area**

This direction is the area from the palace to the Lemro River on the northeast, where the team studied and recorded water features and management evidence. Total area of survey in this quarter is 21.8 km² and 1.67 km² is vegetation covered and hilly area. A total of 128 ponds, lakes and storage tanks were recorded, among them nine ponds located inside the urban area of Mrauk-U and the others in the area between Mrauk-U and Lemro River. The nine ponds on the northeast side are: one tank in the Palace site between the first and second tier or row of the Palace Wall, six ponds outside of the third wall and among its quarters, with the other two in religious compounds.

One of among 19 pond and lakes, U-taw-say Kan (Royal head-wash tank) is clearly related to the Mrauk-U historic period. Historic records mention different locations for U-taw-say Kan. The Mrauk-U chronological record and the New Rakhine History say that the royalty used the tank for head washing, which is located on the north of the temporary palace site. Another history of Ancient Rakhine Literature identified the location of the same tank as a brick-tank just northwest of the temporary palace site.
Southeast Area
This area includes from the southeast of Mrauk-U Palace Site to the west bank of Lemro River and Baungdut Chaung. Total area of survey in this quarter is 29.5 km² and 5.48 km² is vegetation covered and hilly area. A total of 133 ponds and tanks were recorded. When the survey team explored in the southeast area, four parts at least were noted: (i) from the palace site to the southeast boundary of Let-se Kan, Anuma Kan and Shwe-taung, (ii) from the Shwe-taung to the Makya Hill-range, (iii) From the Makya Hill-range to the Lemro River and (iv) from the confluence of the Lemro River and the Baungdut Chaung to the west bank of the Baungdut Chaung.

Between the palace site and the foot-slope of Shwetaung there were five ponds and five storage tanks or reservoirs. The five ponds are small and occur among residential areas. The three larger storage tanks, being standardized as reservoirs were important in the Mrauk-U era for agriculture, defence, and daily water supply. The rainwater of Letse Kan is now being distributed to the community of Mrauk-U by the arrangement of the City Development Committee for multi-usage and drinking water. When rains connect the Letse Kan and Anuma Kan reservoirs with a ditch, it becomes one water body, if it overflows the surplus water spills to the Kywe-the Inn on the south. From the Kywe-the Inn the water is allotted to the lands west of Baungdaw Chaung.

There are 26 ponds between Shwetaungtan and Makya Hill-range flat-area, almost all small and with rectangular shapes found in groups across the fields. On the west of Baungdut Chaung, 33 small ponds of rectangular shape were surveyed.

In the area between Makya Hill-range and Lemro River there were 34 ponds surveyed. There are four villages located along the river, geographically advantaged by good communication, and fresh water. There are fewer ponds in the village areas being more visible outside of the villages in the agricultural lands. The ponds are small and rectangular shaped.

Most of the ponds in this area also exist outside of residential areas, among the agricultural fields, with many fewer ponds found inside the village areas. Therefore, the preliminary survey suggests that the location and dispersal of lakes and the groups of ponds in the fields may relate to suburban or satellite towns of the Mrauk-U Period. Otherwise the ponds were built when village settlements were there in the post-Mrauk-U Period.

Southwest Area
The southwest area of Mrauk U surveying works identified from the Palace Site to Baukshama Chaung, near Baungdut Village. Total area of survey in this quarter is 3.47 km² and 0.46 km² is vegetation covered and hilly area. The team recorded 38 ponds situated among the residential areas and villages, unlike the ponds located in the fields of the southeast area. The tanks are rectangular and smaller in size, although Dyekyi Kan (tank) at Dyekyi Village is the largest tank among the standardized tanks in Mrauk-U. In this southwest area there are the least number of tanks among the four demarcated and directed areas.

Northwest Area
In the northwest area of Mrauk-U includes from the Palace Site to around Htamayit Village; total area of survey in this quarter is 5.49 km² and 1.67 km² is vegetation covered and hilly area. There surveyed and recorded 60 water ponds. In that area, the quarters, suburb and two surrounding rural villages are located.

There are three ponds in Htamayit Village, five in Phaya-baw Village, nine in its vicinity and seven in the farther agricultural lands. In the habitation area, 24 water ponds are located and thirteen tanks
in the religious areas and monastic compounds. The tanks are rectangular in shape. The water management evidence surveyed in this direction, northwest of Mrauk-U, showed the second least number of ponds.

Typology of Discovered Water Management Features

Our preliminary survey of water resource and manmade features noted evidence of 15 reservoir and lakes, and over tank and ponds of various sizes in the historic lands of Mrauk-U, Vesali and Dhannyaawaddi. The large reservoirs can be mostly seen in foothills of ranges, where valley area between the hill and its sub hillock ridges were dammed and captured the water. In reservoirs, dam embankments were mostly constructed with earthen walls and seldom walled stones; they were high, wide, and long if necessary. The spillway of the reservoir was usually in natural bed rock or stone paving to resist from strong erosion, or sometimes a shallow ridge between two down slopes seem like a natural spillway. Such spillway reservoirs have long water restoring storage areas and they are found along the foothills of the ranges.

The various sizes of square, rectangular and polygonal shapes of water tanks and ponds were generally located in abundant residential and present community areas. There are rarely large rectangular tanks in areas such as ports and religious centres beyond the normal residential quarters. The surveying team went around the sites of both ancient and modern water features and searched and looked surrounding areas where the associated evidence, and enquired to local people about history, archaeological interest and traditional water management in their area. The following are summaries of some of documented water management features of reservoirs, tanks, canals, and wells.

During the surveying works we noticed that most of discovered tanks are in rectangular shape and were previously used for daily use and drinking. The baulks surrounding tanks are normally 1-2 m
Fig. 2 Dam, Reservoir and other water resources around Mrauk-U ancient city. Source: Mrauk-U GIS Team and Field School of Archaeology (Pyay).
high. The tanks among the fields usually do not have inlet drain, and they received rainwater in open air and are used as drinking water tanks. The practice of traditional drinking water tank has been gradually decaying and some are just only able to trace back memory of their use and some renovated by the community and NGOs.

Sizes of Ponds
The explored tanks in rectangular shapes are classified according to the sizes of water receiving areas. In the ponds and storage tank classification in sizes such as 128 total ponds on northeast; these ponds are subdivided into circumference sizes of areas: (i) under 1,000 m$^2$ sized 19 ponds, (ii) 1,001-2,000 m$^2$ sized 44 ponds, (iii) 2,001-3,000 m$^2$ sized 19 ponds, (iv) 3,001-4,000 m$^2$ sized 18 ponds, (v) 4,001-5,000 m$^2$ sized 12 ponds, (vi) above 5,001 m$^2$ sized 16 ponds. The study of 128 ponds on the northeast direction found that a group (ii) (1,001-2000 m$^2$ circumference) is largest number and group (v) (4,001-5000 m$^2$) has the least number of ponds.

On the southeast side of Mrauk-U, 133 water ponds and tanks in different sizes during the exploration have been found. Among them: (i) under 1,000 m$^2$ sized 38 ponds, (ii) 1,001-2,000 m$^2$ sized 37 ponds, (iii) 2,001-3,000 m$^2$ sized 22 ponds, (iv) 3,001-4,000 m$^2$ sized 16 ponds, (v) 4,001-5,000 m$^2$ sized 6 ponds, (vi) above 5,001 m$^2$ sized 14 ponds.

When observed on the southwest side, the total 38 tanks are found, and among them the tanks are categorized as: (i) under 1,000 m$^2$ sized 8 ponds, (ii) 1,001-2000 m$^2$ sized 15 ponds, (iii) 2,001-3,000 m$^2$ sized 6 ponds, (iv) 3001-4000 m$^2$ sized 4 ponds, (v) 4001-5000 m$^2$ sized 2 ponds, (vi) above 5,001 m$^2$ sized 3 ponds.

There have been found 60 water ponds in different sizes on the northwestern side and these are; (i) under 1,000 m$^2$ sized 19 ponds, (ii) 1,001-2,000 m$^2$ sized 24 ponds, (iii) 2,001-3,000 m$^2$ sized 7 ponds, (iv) 3,001-4,000 m$^2$ sized 5 ponds, (v) 4,001-5000 m$^2$ sized 5 ponds.

Therefore, the preliminary study of ponds and tanks in the respective directions and groups in the environs of Mrauk-U areas are totally 359 ponds. The largest group is the 1,001-2,000 m$^2$ size ponds in north-east, south-west and north-west. But in south-east portion, less than 1000 m$^2$ size group is the most. In all portion, 4,001-5,000 m$^2$ sized ponds is the less in all groups. The largest tank is Dyekyi Pond located in the southwestern side of Palace Site and the smallest tank is in the southeast.
Within our survey, total of 359 ponds and total area of these tanks are 0.96 km$^2$ (956,469 m$^2$) in 60.26 km$^2$ of land space. So, the area of ponds and water tanks covered 1.59% of total area of land space. In the north-east quarter of the survey area, total area of ponds and tanks is covered 1.7% of total land cover and 1.05% in south-east, 4.9% in south-west and 1.82% in north-west. So, the southwest portion around the Mrauk-U ancient area is the most dense and the south-east portion is the least dense.

**Discussion**

In the Mrauk-U cultural Heritage Region 15 reservoirs and small dams and 359 ponds have been recorded. The present condition of hydrological works shows that half amount of total evidence is being used for society; the Department of Irrigation conducts conservation on them occasionally. For ancient reservoirs that are no longer being used and maintained, has been changed for other uses they have been turned to agricultural farms along with village-settlements and the following infrastructures of road connection, schools, rural health centres, pagodas and monasteries. Such changes into village and farm of the surrounding areas of ancient reservoirs has induced salt-efflorescence and salty water penetration underground according to the local peoples’ experience. For these changing of soil-quality there should be scientific testing and laboratory analysis to assess the difference of salt inclusion of reservoir and non-reservoir area. After that, the preparation and action could be arranged on the soil quality control on the agricultural lands, maintained the ecosystem and protected the degradation of environment.

There are respective drinking water ponds and tanks in almost of villages in the region between west of Kaladan River and east of Lemro River has been already recorded on our survey. Most of them are still used. Additionally, numerous ponds are in fields, outside of villages, which are generally used for people or animal drinking in the agricultural season and watering gardens and other purposes. If we suggest why numerous ponds in the fields were dug in the past, one of the reasons is not only to use for such advantages, but for the protection of saltwater penetration from underground. Therefore, we noticed that the tradition of digging tanks in the surrounding environments of Mrauk-U, within the tide water flowing tributaries are similarly also found in other parts of Rakhine State.

The construction of ponds and tanks in Mrauk-U was more cultured than the other historic sites of Myanmar. It could be compared with what the Field School of Archaeology (Pyay) has made preliminary studies such as in Sri Ksetra, Pyu ancient city and its environs with 123 tanks and ancient water features; and with the historic city of Bagan and surrounding area with 55 ponds and tanks (Republic of the Union of Myanmar 2018). Beyond the tradition of water pond and tank construction, the unique water management of Mrauk-U is the shaping on natural tributaries into canals, water gates on streams, control system for tidal water rising up and flowing down to create hydraulic power and other systems. That innovation of the natural water resources made Mrauk-U to a rich and grand medieval city with navigation and overseas trade, more than the other ancient Rakhine cities to stand as the most developed cosmopolitan city among the contemporary medieval urban centres of Southeast Asia.

However, the old water management features of Mrauk-U have been defaced by demographic increase of the city as time goes on. The original bank and boundary of canal and stream are invaded by filling earth for building places, building walls for house complexes, growing nipa palm trees, and garbage dumping. These all should be controlled as quickly as possible.

The above-mentioned reservoirs, different sizes of tanks, canals and streams used for the present society are the inheritance of the past. Moreover the evidence of water management belonging to the old city of Mrauk-U such as fortresses, city walls, moats, lakes, city-gates, quarter and other urban
Fig. 4  Comparison of group of the area of water ponds and its percentage in each quarter.
features, exploited and transformed from the natural features of hill, spur, river, lake, forest and so forth are cultural activities of human civilization.

**Conclusion**

Mrauk-U ancient city is in one of the areas in Myanmar that receives the highest rainfall, with an annual rate of about 4192 mm, compared to the three Pyu cities: Sriksetra – (1203 mm), Beikthano (783 mm), Hanlin (883 mm) (Republic of the Union of Myanmar 2013) and Bagan World Heritage Site (629 mm). Although it has more precipitation than other World Heritage Sites in Myanmar, it has also more built-up ponds and reservoirs than others. For agricultural practice, Sriksetra and Bagan has less precipitation, so they made water ponds and reservoirs for water storage and for cultivation. But in Mrauk-U, precipitation is enough for cultivation and function of ponds are used for drinking and daily use for people and animals. The average size of 1,001-2,000 m² tanks are the most abundant group in the Mrauk-U area. Most of the villages around in Mrauk-U average around 1,000 people. It means the population around the pond is enough for this size of pond because these ponds are only for drinking and daily use and not for agricultural need. The south-west portion of study area is the densest in terms of ponds because this area is lower topographically compared with other potions and many stream are flowing in that area. All these streams are up followed tide water and the water has high salinity. Therefore, that area needs more ponds and tanks for freshwater storage. Along the stream, water gates are also built to protect tidal water flow up and another way is to smooth water transportation along the river. So, in Myauk U area the sustainable hydrological features have being used as existing of the ponds and reservoirs since Mrauk-U period to till now.

**Acknowledgements**

Firstly, thanks to U Man Thit Nyein (Field School of Archaeology), U Thein Tun Aung and U Saw Aung from Mrauk-U Branch from Department of Archaeology and National Museum for assisting with the exploration. We also thank U Than Myint (Vice Chairman), U Kyaw Thar Nyunt, U Maung Hla Thein (Secretary) of Mrauk-U Heritage Trust and local people of Mrauk-U City for their advice in our field trip. Finally, we deeply thank to U San Shwe Kyaw from Irrigation Department who share his irrigation knowledge to us and assisting with our exploration.

**References**


The Ancient Water Management Systems in Thailand and the Relationship to Mainland Southeast Asia

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Introduction

Water resources has always been the determinant of human’s way of life, which is considered to be a crucial element for a community’s activities, as well as a main resource for inhabitants of every ancient city around the world. When people started to settle in an appropriate distance to water resource, they had to employ and develop water management strategies.

Water management has no fixed method and is adapted to different natural conditions of the cities. Each city’s location, geography, geology and hydro-ecology are important conditions for human to build their surroundings appropriately. The question related to this issue include: Might water management had begun within the earliest Neolithic farming communities? Could water management have developed by hunter-gatherers?

In Thailand, the country known as the “Hydraulic Society” (Surarerks 2001: 44-46) the human ability to live with distinctive water conditions both harmoniously and sustainably has been well evidenced and demonstrated, for example by moated and mounded settlements, baray (manmade rectangle water structure), embankments, weirs, dams, reservoirs, and canals which are all physical evidences of how past-humans managed water within particular conditions.

According to archaeological studies in Thailand for over a decade, there have been numerous researches of the water management and its systems (see Liere 1980; Moore 1988; 1992; Duke et al. 2016). The earliest evidences of water management in Thailand could be traced back into prehistoric period at least in Iron Age (around 2,500 – 1,500 years ago). Most of the prehistoric sites located in parts of alluvial plains in the country showing that we have been in the hydrographic society living in ‘Rice Monopoly Culture’ for thousands of years (Surarerks 2001: 44-46).
However, this survey of ancient water management in Thailand will focus from the early prehistoric period to the present-day. Here, the chronology of ancient water management can be divided into two periods: 1) the prehistoric period to 13th century CE and 2) from 13th century CE to the present day.

The Prehistoric Period to 13th Century CE Period

Over the previous years, successive remote-sensing projects have offered crucial new insights into the archaeological landscape of Thailand. The ancient settlements are recognized from aerial photographs, visible through evidences and man-made features which are the simplest forms to be seen on aerial imagery and includes moats/ mounds, and barays, the two types of ancient settlement patterns.

1. Moat and/or Mound Settlements: the features are found in most regions of Mainland Southeast Asia, especially common in the northern, central, and northeast Thailand (Saraya 1994: 78-79). By the environment factors, the moated settlement is classified into two types, which can be described using the terms “topographically controlled” and “non-topographically controlled” (Supajanya 2001). Some sites may had been built from the prehistoric period, but most had been appeared during the early historic period (Dvaravati Period – during 6th – 10th century CE and Srivijaya period – during 7th – 12th century CE) (Suksom 2002: 67-68).

Since the past years, a plethora of theories (Moore 1988) have emerged to explain the function of moats surrounding these sites, for instance the defensive function, the agriculture function, the symbolic function, the flooding mitigation function, and the water storage function, however, the exact function and purpose of the moats is still debated.

2. Baray Structure (Manmade Rectangle Water Structure): man-made forms of artificial bodies of water which are a common element of architectural components in ancient Khmer culture during the Khmer Empire of Southeast Asia. The meaning and functions of barays have been defined and interpreted in two functions; the first definition was that barays were primarily spiritual in purpose, as symbolizing the sea of creation surrounding mountains, and another that they were made for water management of fields (Sangwan 1981).

Central Thailand was the most suitable and reasonable environment for cultivation in the country, thus, many ancient communities had been dispersed in the river basins since the prehistoric period and so far, however, archaeological evidences suggest that the number of settlements have emerged and seem to increase during the Dvaravati period. Most settlement patterns in this period were built with moats and mounds surrounding and the shapes of patterns were different according to different natural conditions in where each city’s located (Supajanya 2001: 313-315) (Figure 1).
North-eastern Thailand is the largest region of the country including two plateaus, the Khorat plateau and the Sakhon Nakhon plateau, where the evidences illustrate the feature of human settlement was, at least, possibly from the Neolithic period and have developed continuously until the early historic period during the culture from the central region (Dvaravati culture during 6th – 10th century CE) and the ancient Khmer culture (10th century CE) encountered. The moated and/or mounded settlements, most of which were located in the Khorat plateau (Kijngam et al. 1981). They often developed in three stages, starting with small settlements with moats and/or mounds without any fixed shapes and expanded in some cases. The last stage came with the ancient Khmer culture, where at least one large rectangular baray was built inside or near the settlements (Moore 1988) (Figure 2).

![Fig. 1](image1.png)  
**Fig. 1** The shapes of settlement patterns during Dvaravati Period. Source: Royal Thai Survey (1953-1954 World Wide Series)

![Fig. 2](image2.png)  
**Fig. 2** Aerial Photo of Ban Samrong, Burirum. Source: Land Development Department, Thailand (2000)
Northern Thailand is on a terrace deposit with a mountainous area. Traditionally, the natural features made several types of agriculture possible, including wet-rice farming in the valleys and shifting cultivation in the uplands. Thus, the geography characteristics generated various hydrological effect to land, especially the slope area could let water from the higher areas flow to lower areas (Praicharn-jit et al. 1996). This structure was suitable to create the water system as known as “weir water management system,” found in the early Haripunchai period (7th – 13th century). Moreover, the form of moated and/or mounded settlements, so-called “Wiang”, were also found in the northern Thailand and distributed along the river plains (Inthrawut 1993: 92).

In Southern Thailand, the earliest evidences of water management systems were indicated by the form of moated and/or mounded settlements in Srivijaya period (7th – 12th century CE). This settlement pattern was found along the east coast rather than the west (Walipodom 1982: 134-142). Most of the city was rectangular, which was probably influenced by Brahmanism. Moreover, the feature of rectangular man-made ponds, so called “Pang,” also had been found and it was another mean to control water, presumably constructed for use in rituals and daily life (Phiyakul 1999).

**From 13th Century CE to the Present-Day**

After 13th century CE, most of the independent communities united or became a part of state or kingdom, which initiated a new economic stage in the evolution of society developing a new social class of “urbanites” (Schneider 1963). However, the societies applied and tried to improve the prior technology of water management continuously until the present day. This was how great human’s adaptive ability to live with distinctive water conditions both harmoniously and sustainably has been well evidenced and demonstrated.

Sukhothai (13rd – 15th century CE) was situated on the northern part of Chao Phraya delta surrounded by several mountains. According to the terrace deposit and the natural environment of Sukhothai, the soil characteristic had no capacity to hold water and underground water resources were too deep, the city experienced drought regularly (Sihamat 2017a; 2017b).

Sukhothai as a centre of management, had to manage and store a good amount of water for agriculture and also for preventing damage caused from the annual floods. The complicated water management system in Sukhothai borrowed the idea of making a great rectangular or square city plan surrounded by ditches from ancient Khmer culture, and later this system would have influenced the building of Chiang Mai city during the Lanna period (Chaowanapreecha 1986: 1-7).

Water resources originated from the mountains in the west, which flows into the same valley, and many dams were built to store water known as “Saritpong,” and then a canal leading to the lowlands, where the city located, was built as well. At the same time, they managed to draw water into the city by storing water in the ponds for use in dry season through large channels and clay pipes for conveying water (Sihamat 2017a, 2017b and Krabuansaeng 1995).

Due to the nature of water management system, there were many reservoirs as watercourses that connected together to create complex waterways for daily use, and agriculture with religious symbolic meanings (Chaowanapreecha 1986: 48-49; Krabuansaeng 1995: 160-164). Therefore, Sukhothai was capable of being a great centre of management in this period. (Figure 3)
Water management system in the Lanna Period (13rd – 16th century CE) was developed and the foundation was derived from the previous time. In this period, water management through moated and mounded settlements were still in use along with weir water management systems as it indicated in written records (Surarerks 2001). However, after the development of Chiang Mai City, the evidences indicated that many towns were built in a rectangular form with a single moat and/or mound. It is assumed that Chiang Mai was under the influence of ancient Khmer culture which was transferred from the contemporary state, Sukhothai (Srisuwan 2014) (Figure 4).

Since the Ayutthaya Period (15th – 18th century CE), the administrative centre transferred to the floodplain areas of the lower Chao Phraya Delta, which was founded over the connecting area between the old and young delta. This area was filled with a network of rivers and canals. Due to its geography, the hydrology of Ayutthaya had difference characteristics compared to Sukhothai. The annual floods brought sediments from the northern mountains, and river kept the area productive for agriculture. The city needed to manage the water using several methods.

The water management system in this period were constantly evolving and digging canals inside the city seemed to be the top priority. Within the city, there are ditches and canals in both north-south and east-west axis (Chumsai na Ayudhaya 1982: 25). This structure could help to distribute the water thoroughly as well as to prevent floods (Songserm 2011: 71). Also, canals were used for travelling as bypass canals were dug to shorten the long journey from the crooked Chao Phraya River that could support better communication and transportation (Thai Encyclopedia for Juveniles 33).
The result was Ayutthaya became a kingdom with a complex waterway network. Not only canals, but there were also water gates connecting inner canals with outer rivers. To control water, “city walls” were applied for flood protection and protecting the city from enemies concurrently (Palakawongse na Ayudhaya 1985: 70), and reservoirs were dug for collecting water for consumption in the dry season (Ayutthaya Historical Park Project 1980-1982: 32-43). Ayutthaya was once a large island city wisely adapted to the water conditions by using it for multiple purposes (Figure 5).

In the Thonburi and Rattanakosin Period (18th century CE – Present), the centre was situated in the lower Chao Phraya basin over a young delta at the mouth of the Chao Phraya river. The cities were located about 50 km. inland from the Gulf of Thailand. According to geography, the geo-ecology of Thon Buri and Rattanakosin were far more diverse than Ayutthaya and previous centres. The Thon Buri River basin area began to be important as the capital city of Thonburi in the Thonburi Period. In this period, the main strategy was to focus on the development of infrastructure: dredging canals for use by the consumer, agriculture, transportation and strategic advantage (Ayutthaya Historical Park Project 1980-1982) (Figure 6).
Later, in the Rattanakosin Period, the capital city, Bangkok, shifted to the east bank of the Chao Phraya River in 1782 (Pattanaanek 2000: 23). As in the preceding Thonburi Period, many canals were also dredged. However, the number of dredged canals increased a lot more than before, which was probably caused by the continuously-increasing population, especially during the reign of King Rama V. After that, during the age of King Rama VI – IX, the evolution of modern technologies made the management of water to be more efficient (Surarerks 2001).

**Relationship to Mainland Southeast Asia**
The study of water management systems in various areas of Southeast Asia indicates that each country has similar water management models in some points (Lertlum et al. 2017-2019: 744-789). These water management models reflect the role of human ability to adjust themselves to nature or to control nature by learning how to use natural resources in their areas to serve their ways of life.

**Relationship of Water Management Systems and Human Behaviour**
The analysis of water management systems in various countries in Mainland Southeast Asia considered not only physical appearance models but also perspectives of water management models that were related to human behaviour patterns expressed through cultural objects (Krieger 1944). The relationship of models can be described in two characteristics as 1) water management models that support living which is the relationship between water management models and their direct functions. Namely, water management systems are created to fulfill needs of humans who require water for environmental survival and 2) water management systems that support symbolic purposes which is the relationship between water management models and hidden functions. It means that some water management characteristics were created to fulfill and develop old beliefs and holiness in religious places. Meanwhile, characteristics of water control by the ruling class reflected that water management was the symbol of political power. Furthermore, construction of large water management systems also reflected economic prosperity, wealth, and power to control population of the ruling class.

However, the study on water management models and functions found that most water management systems were not only built to fulfill a specific function but have multiple functions (Trigger 1967: 152-153; Lertlum et al. 2017-2019: 790). It can be noticeable that water management systems at the beginning of previous eras were simply built and later they were delicately built increasingly, which reflected an increasing role of their symbolic purpose.

**Similarity of Water Management System Models**
The study on water management systems in Mainland Southeast Asia indicated that water management systems in each area most likely shared the same characteristics. Such similarity begot an interesting question about the origin and background of water management technology.

Based on the review of all bodies of knowledge, the findings revealed that significant restrictions as the ages of all ancient communities were unknown and there was no clear information about the beginning of the first ancient community in each area when water management system characteristics initially appeared (Lertlum et al. 2017-2019: 790-792). Opinions from scholars and archaeological evidence support numerous concepts showing that water management systems should occur during the juncture when humans started to change from their nomadic patterns of life to permanent settlement where they could produce their own foods.

Therefore, humans learned to adapt themselves and change surrounding nature to suit their living. Due to the environment, humans need to utilize natural resources for maximum benefit (Kelly 1992) and water management technology played an important part in the development at that time. Consequently, the first water management in each area perhaps occurred in different period under dif-
ferent context of environment and social situations. However, there was no outstanding information supporting a conclusion of the question related to the origin and background of water management technology. This research was set three assumptions of probability as follows:

1. **Similar Water Management Models Have Universal Characteristics or Similar with Some Factors**

   Namely, the origin of water management systems in the first period in each area based on different times probably was the result of the development of specific culture in each area while water management technology was a tool reflecting human adaptation and behavioural change that were controlled by conditions in environment and social circumstances such as a change of seasons, natural disasters, scarcity of food, economic system, etc. (Binford 1972: 22; Steward 1979: 30-34). Such characteristics caused the origin of water management systems to have independent development without being influenced by cultures of other places.

   For example, traces of earthen dykes seem to be simple construction that was experimentally built in the first time to control the passage and flow of water before they were developed to be various water management models that are increasingly complex. Most water management models had consistent; for example, construction of reservoirs in slope areas and building levees to control the flow of water to designated directions by using the benefits of height-low of areas and these water control characteristics can be found generally in ancient communities across the world.

   Based on the mentioned characteristics, it can be viewed that water management models in similar environmental conditions probability developed in response to environmental challenge in the same direction. Therefore, adaptation to similar environments cause various cultures to share the same characteristics and reflect continuity of cultural development in each area. That is ancient communities built their own water management systems and developed independently their complexity without being influenced by other cultures.

2. **Similar Water Management Systems Result from Cultural Diffusion**

   Namely, similar water management systems reflect some cultural traits that they share. Cultural diffusion is a concept that in belief there was a specific cultural source being the major culture and the origin or role model of other cultures. That major culture was passed down and diffused its outstanding characteristics to other areas through people’s migration, exchanging, trading, and diplomatic relations including publicizing through ideas, old beliefs, religions, and political ideology. Such characteristics were important factors in making water management systems similar, caused by acceptance of cultural influence and knowledge sharing among communities.

   Traces of water management systems in Mainland Southeast Asia were found with not many different characteristics. Consideration taken into archaeological and historical evidence showed that those ancient communities had cultural relationship one way or another; for example, discovery of Khmer culture traces in the northwest region of Thailand, discovery of Mon culture traces in the north and central region of Thailand. Considering archaeological evidence from other regions, it was found that the northwest region is considerably related to Indian civilization including water management systems found in Southeast Asia is shared some similar characteristics as seen in India and Sri Lanka (Chitisankul 2013: 6-17; 146).

3. **Similar Water Management Models Have Universal Characteristics and Result from Cultural Diffusion**

   This assumption is the combination of two concepts. Water management systems of ancient communities at the beginning of previous eras in each area probably consisted of specific cultures in each area, controlled by environmental conditions and social circumstances, which led to the independent development of water management systems. Later, cultures from other areas influenced them and
were improved to suit their own environment, or perhaps ancient communities that did not have knowledge related to water management technology at the beginning of previous eras started to receive influence from major cultural sources before improving the systems to suit their own environment.

With regard to the three assumptions, it can be seen that each ancient community may have characteristics from the different assumption. Therefore, a conclusion cannot be made with only one assumption, depending on additional evidence that will be discovered in the future.

Besides, analysis and interpretation based on relationship between water management systems and humans who create technology are important. Water management technology is a tool that helped humans to adapt themselves to environment and fulfil cultural adaptation, enabling humans to survive in different environments (Lertlum et al. 2017-2019: 795). By the way, technology advancement results in the increasingly complex development of society and culture. The appearance of water management technology is considered a vital sign indicating social and cultural development immensely. Lastly, water management systems provide many interesting points to be studied for making understanding of humans in different dimensions.

**Conclusion**

Given this survey of ancient water management in Thailand, the water management system in Thailand could be dated back to prehistoric times (during the Iron Age period), however, more archaeological collections, especially the features of settlement and man-made which were recorded through remote sensing application, represented that the form of water management had appeared obviously in the early historical period (Lertlum et al. 2017-2019: 8-218, 790).

Along the presented information, Water Resource always plays a major role in the human’s way of life in every period and water management systems also showed how well human understand of the environment surrounding them and learned to adapt to environment and also tried to defeat nature. Moreover, as the archaeological research has shown, many civilizations could only flourish as a result of advanced methods of managing their water resource, no doubt in others, the beginning of society evolved from the struggle with the water element.

**Acknowledgement**

This research could not be complete without the effort and cooperation of our staff and scholars in Thailand and Mainland Southeast Asia. We also would like to acknowledge everyone who played a role in our academic accomplishments and has provided information and guidance throughout the research process and the continuous research funding support from Thailand Research Fund (TRF).

**References**


The Lashed-lug Tradition Beyond the Commonalities: A closer examination of variations in keel design within Southeast Asian shipbuilding tradition

Ang tradisyon ng pagtaling-tambuko higit sa pareparehong katangian: Ang detalyadong pagtingin sa iba’t-bang disenyo ng kilya sa loob ng isang tradisyon ng paggawa ng sasakyang pangpamalakaya ng Timog-Silangang Asya

Bukan Sekedar Kesamaan Tradisi Tambuku-terikat: Sebuah kajian lanjutan terhadap variasi lunas pada tradisi pembuatan perahu Asia Tenggara

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Lashed-lug boatbuilding is known as one of the traditional construction techniques of plank-built watercraft in Southeast Asia, dates to as early as the third century to the late twentieth century. Early archaeological studies on these vessels revealed common characteristics across several sites in Southeast Asia and even neighbouring regions. However, recent close examinations reveal many previously overlooked details in the construction technique used in different parts of the region. This paper discusses the non-commonalities within the tradition, to further the discussion of Southeast Asian maritime history by advancing the knowledge about the development of traditional ship- and boatbuilding in the region.


Pembuatan perahu tambuku-terikat dikenal sebagai salah satu teknik pembuatan perahu kayu tradisional di Asia Tenggara, yang telah digunakan setidaknya sejak abad ketiga hingga kedua puluh Masehi. Kajian arkeologi telah merumuskan karakteristik umum teknik pembuatan perahu ini melalui penelitian di berbagai situs di Asia Tenggara dan sekitarnya. Namun demikian, kajian yang lebih mendalam menunjukkan adanya bagian-bagian yang sebelumnya masih terlewatkan, yang digunakan secara berbeda di berbagai tempat di kawasan Asia Tenggara. Tulisan ini membahas tentang perbedaan yang ditemukan dalam tradisi tambuku-terikat, untuk memajukan diskusi tentang sejarah maritim Asia Tenggara dengan menambah informasi tentang perkembangan pembuatan perahu dan kapal tradisional di kawasan tersebut.
Introduction
The study of the lashed-lug tradition, one of the traditional boatbuilding techniques of Southeast Asia, had predominantly relied on historical and ethnographic data. To date, there are about twenty sites with lashed-lug vessels, many of which are only fragmentary remains, that had been found in various places in the Southeast Asian region; but detailed examination of many of them have not been conducted. Among the more closely examined lashed-lug vessels are the remains of the Butuan Boats from the Philippines and the Punjulharjo Boat from Indonesia (Lacsina 2015, 2016; Mochtar 2018).

The archaeological study of traditional boatbuilding in Southeast Asia as a line of research in maritime archaeology is still in its infancy. Only since the 1980s have scholars been documenting and investigating the traditional boats from archaeological context, as well as the boatbuilding, and seamanship of insular Southeast Asia people (Manguin 1985, 1989; Peralta 1980; Ronquillo 1987). The research then was on a mostly sporadic basis and remains so to date. Nearly four decades later, fundamental questions remain and have been debated to different degrees.

A principal reason for this is the paucity of archaeological remains of the boats themselves. What few remains have been found have been mostly incomplete—some with only a few planks preserved (Manguin 1989, 1993)—and others have been destroyed in the process of recovering the artifactual contents of the wrecks as in the case of the Cirebon wreck (Liebner 2014), or have deteriorated due to a delays in conservation being undertaken. Examination of these boat remains also has typically lacked the close attention to detail and expert treatment required to capture the all-important details of construction methods and processes involved in their construction, and to fully exploit their archaeological potential to inform. In light of this, ethnographic studies so far have been the primary sources of information used to interpret this ancient, and now practically extinct, boatbuilding tradition (Barnes 1996; Burningham 1990; Horridge 1985).

The Butuan and Punjulharjo Boats are significant archaeological resources that can help answer questions related to Southeast Asian boatbuilding technology providing information that was lacking in shipwreck finds located to date. Two different kinds of plank fastening are represented by the boats. The older Punjulharjo Boat, dated to the seventh century, was fastened by stitching and doweling. The Butuan Boats that date to between the eighth to tenth centuries, were plank-fastened using dowels. But more than that, differences in keel design have been noted in each of the examined boat remains.

Significance
Until recently, the value of studying ship and boat construction in Southeast Asia has been generally overlooked throughout history. Because of this, there is a large gap in the recording of the variety, innovations and lost practices in regional watercraft construction. Studies in Southeast Asian maritime archaeology often focus on international trade networks wherein a much greater the emphasis was placed on preserved cargo than on any other aspect of a shipwreck site. While archaeological material is available, researchers from within the region have until recently neglected the thorough and precise recording of these boats and ship remains, or otherwise have not made such documentation easily available. What is known is therefore mostly fragmentary, lacking in detail and possibly incorrect. There also appeared to be an over-reliance on historical descriptions in favour of examining the archaeological material as primary source material.

The study of ship and boat technology from Southeast Asia is obviously a topic that can benefit from more thorough study. The data here on lashed-lug boat keel planks aims to provide results that add significantly to the knowledge of Southeast Asian boatbuilding technology. It will broaden our un-
derstanding of the region’s maritime history when synthesized with other studies related to Southeast Asian boatbuilding technology and practices.

Lashed-lug Boats
Lashed-lug boats refer to a method of plank-built watercraft construction used in Southeast Asia and neighbouring regions. The vessels were built up from a keel timber with planks that were edge-fas-
tened by lacing and/or dowelling. Alongside this method of plank edge-joining, was a particular
technical practice that evidence has shown to have persisted for at least 15 centuries. This involved
the use of a series of drilled, projecting blocks, referred to as lugs, that were carved out from the
inner side of the planks to which frames were secured by tying rope or strands of rattan. The earliest
archaeological evidence of such a vessel was excavated in Malaysia and dates to approximately A.D.
260–430 (Manguin 1993: 256–257). The wooden remains of more lashed-lug boats were also locat-
ed throughout Southeast Asia: in Indonesia, the Philippines, Thailand and Vietnam (Manguin 1993;

Builders of lashed-lug boats did not use metal nails for fastenings but instead used materials such
as wooden dowels, treenails, wooden pegs, rattan strands and rope. Explanations for this type of
construction vary, the most far-fetched explaining that the region’s magnetic geological features
would cause iron nails to be pulled out of the wood (anon., in Alcina 1960 [1668]:151; Alcina 2005
[1668]:181–183). More reasonable justifications offered that iron was known to corrode easily in the
Southeast Asian tropical environment; it was a limited commodity, and not readily available locally

The seventeenth-century account by Francisco Alcina (2005 [1668]:159–213), describes how con-
temporary boatbuilders in the central and southern Philippines utilised a shell-based construction
technique in which planks were edge-joined to one another with wooden dowels. He describes how
they lashed frames to the protruding lugs on the interior surfaces of each strake. Boat remains located
in Philippine, Malaysian, Indonesian, Thai, and Vietnamese sites are consistent with the construction
technique described in Alcina’s account, and they demonstrate that this particular practice prevailed
in the region hundreds of years prior to European contact (Horridge 1995; Liebner 2014; Manguin
2012; McGrail 2001; Peralta 1980). Other first-hand accounts confirm that similar construction tech-
niques continued to be used by boatbuilders in the Indonesian and Philippine archipelagos until much
later (Barnes 1996; Dwyer and Akerman 1998; Hornell 1920; Horridge 1985; Wallace 2014 [1869]).
The construction of similar vessels outside of Southeast Asia, in places such as southern Taiwan,
the Maldives, and the Solomon Islands, have also been documented (Hornell 1936: 145; Kano and
Segawa 1956; Millar 1993). In some regions of Indonesia and the Philippines, wooden boatbuild-
ing practices, including some of the aforementioned techniques, still persist despite the presence of
modern boatbuilding technologies and the availability of modern materials. Traditional boatbuilders
in the region still apply shell-based construction methods and use dowels to edge-join strakes, though
the practice of lashing frames to lugs has almost completely disappeared. The Indonesian town of
Lamalera is the only notable example in which, at least into the late twentieth century, boatbuilders
continued to lash frames to lugs (Barnes 1996; Dwyer and Akerman 1998). In all other examples,
frames are now directly fastened to planks with wooden treenails or metal spikes (Horridge 1982:50–
To date, evidence of around 20 lashed-lug vessels or their remains have been located throughout the region (Table 1). The level of preservation of each example varies. In some cases, the remains are so fragmentary and disarticulated and it is not always clear if the timber pieces came from one or more vessels. The oldest of these, the Pontian Boat (ca. 3rd to 5th centuries CE), the Kolam Pinisi Boat (ca. 5th to 7th centuries CE), the Sambirejo Boats (ca. 7th to 8th centuries CE), and the Punjulharjo Boat (ca. 7th to 8th centuries CE), each show further evidence of lacing or stitching (Manguin 2012; McGrail 2001). The watercraft evidence that date to later periods such as the five Butuan Boats (ca. 8th to 10th centuries CE), the Chau Tan shipwreck (ca. 9th century CE), the Cirebon shipwreck (ca. 10th century CE), the Paya Pasir timbers (ca. 12th to 14th centuries CE), the Sha Tsui Boat (ca. 13th to 15th centuries CE), the Gujangan shipwreck (ca. 15th to 16th centuries CE), and the San Isidro shipwreck (ca. 16th century CE), show only evidence of dowelling and not of lacing (Lacsina 2015, 2016; Liebner 2014; Manguin 2012; McGrail 2001; Nishino et al. 2014).

As impressive as the 1500-year persistence of similarities in lashed-lug construction are, the differences and variations that the boats possess are equally striking. For many years, such differences have been downplayed and even ignored in most of the previous research conducted on lashed-lug boats.

**Methods**

In undertaking this research, archaeological and archival sources related to wooden boatbuilding within the context of pre-colonial and colonial Southeast Asia were examined. The sources include primary and secondary archaeological data, historical documents, and ethnographic studies. To supplement these, experimental wood model construction was used in order to gain insights and better understanding of lashed-lug construction. The archaeological research included the examination of previous studies, and more importantly, the examination of original archaeological objects, where available.

The primary data studied comprised of the boat remains of:

- Butuan Boats 1, 2, and 5 that had been excavated and retrieved in the 1970s and 980s, and are now on exhibit or in storage at the National Museum of the Philippines, in Manila, and the Butuan Regional Museum and the Balanghai Shrine, both in Butuan City;
• Butuan Boats 4 and 9 that were the subject of ongoing and uncompleted archaeological excavation beginning in 2012;
• Punjulharjo Boat, excavated in 2008 and dismantled for conservation purposes in the mid-2010s before being reassembled at the same site in 2017

Archaeological documents, including reports, manuscripts, and photographs were an important source of information in shaping this research. These documents outlined the activities undertaken and results produced, in relation to the excavation and retrieval of Butuan Boats 1, 2, 5, and the Punjulharjo Boat. Syntheses and summaries of previous Southeast Asian plank-built boat research from the region, some of which also contain primary data were consulted.

Results and Analysis
The re-examination of the previously recovered lashed-lug Butuan Boats 1, 2 and 5, and the Punjulharjo Boat has helped to clarify earlier inconsistencies and errors with regards to measurements, dating, and timbers used. The Butuan lashed-lug boat remains suggest an original length of more than 10 m, and less than 15 m, while the Punjulharjo Boat with its intact keel measures 15.6 in length. None were fitted with a true keel—they were instead designed with a keel plank that was left slightly thicker than the hull planking. This suggests that their use was limited to inland and coastal waters, as round or flat hulls would be inadequate for navigating open seas. Interestingly, and though most remains were found incomplete, among other Southeast Asian archaeological examples of lashed-lug craft, only the Cirebon shipwreck was described as having a true keel.

Keel plank
Regardless of their many resemblances and similarities, the results clearly demonstrate that none of the boats are entirely the same. And even within individual vessels, their builders obviously used a variety of techniques. Construction details particularly in keel plank design are evaluated here. Evidence demonstrates that boatbuilders saw the use of a single piece of timber for the keel plank as an integral part of the vessel. The same was practiced throughout the region, until evidence to the contrary began to emerge in the twentieth century.

Each of the examined lashed-lug boats show lug arrangements on keel planks to be unique to one another (Figures 1, 2 and 3). The builders of Butuan Boat 1 fashioned the lugs on the keel plank in sets of three individual and relatively narrow protrusions, except for the first two, which are single protrusions, and the third, which is a paired protrusion. The lugs have three pairs of L-shaped lashing holes, drilled from either side of the outer protrusion to the top surface. A few of the holes also extended through the thickness of the lugs, creating inverted T-shaped holes. The three sets of lashing holes on Butuan Boat 1 are unusual in the material record, where sets of two are the norm. They were also crudely fashioned in regard to their positioning; several of the hole pairings within a single lug were misaligned transversely, which would have been magnified across several planks. Or, on the lugs in which the lashing holes aligned with each other transversely, they often misaligned longitudinally. It is easier to believe that this was a result of careless or sloppy workmanship, rather than an intentional design. The middle protrusions in the lugs have no obvious function.
Fig. 1 The keel planks of Butuan Boats 1 (photo by L Lacsina), 2 (photo courtesy of the National Museum of the Philippines), 4 (photo by L Lacsina), and 5 (photo courtesy of the Western Australian Museum), and Punjulharjo Boat (photo by A Mochtar).

Fig. 2 Lug arrangements on the Butuan Boat keel planks. Illustration by L Lacsina.

Fig. 3 Diagram showing the ligature holes on a Punjulharjo keel plank lug. Illustration by A Mochtar, not to scale.
The lugs on the keel plank of Butuan Boat 2 were generally carved in paired, narrow protrusions and drilled with two pairs of L-shaped lashing holes from the outer side of the lugs and from their tops. The Butuan Boat 4 keel plank was carved with single lugs, as well as a raised ridge that runs through the centre of each of the lugs and the entire length of what remains of the keel plank. While the lugs correspond with those on the planking and leave a gap, the ridge continues through it. Two pairs of lashing holes were drilled through from either side to the top of each lug. The keel plank of Butuan Boat 5 stands out from the other keel planks quite distinctly. Instead of individual lugs, it has a continuous raised ridge, with larger dimensions than the ridge on Boat 4. The lashing holes are drilled through the ridge, from side to side, and are mostly in pairs that presumably aligned with the lashing holes on the planking lugs. Single lashing holes were also drilled through the ridge, which like Boat 4, continues over the space that corresponds to where a gap was left by the absence of planking lugs. Meanwhile, the Punjularjo Boat keel plank were carved with single-protrusion lugs with two pairs of L-shaped lashing holes.

That five different keel plank lug patterns were found on five of the lashed-lug boats examined is surprising. This is especially so in a group of watercrafts that were built in the same technical tradition, and in the case of the Butuan Boats, likely built and used in the same period. Keels and keel planks are the foundation of all plank-built watercraft, and the expectation would be that a single standard, rather than a variety of designs would be utilised. These differences may be the result of functional or aesthetic reasons. The five keel plank patterns can then be divided into two different types. The builders of the Punjulharjo Boat fashioned single-protrusion lugs, the builders of Butuan Boats 1 and 2 made use of multiple-protrusion lugs, while the builders of Butuan Boats 4 and 5 utilised a continuous raised ridge. Boat 4 can then be considered to use a variation to the continuous ridge design which is combined with individual lugs.

Another aspect relating to lashing holes is the way they were drilled or bored. If done incorrectly, the holes can easily be worn or damaged to the point of becoming useless. And unlike ligatures, a lug cannot be renewed without replacing the plank that contains it. Thus, the holes must be spaced far enough from the edges of the lug. But with the Butuan Boats, many of the lashing holes were observed to be only marginally smaller in diameter than the thickness of the lugs that contained them. Particularly with the narrow protrusions of the keel plank lugs of Boats 1 and 2, the choice to fashion L-shaped holes is puzzling, especially as many of them had been worn completely through. The same goes for the relatively large oblong-shaped lashing holes on the first six lugs of the Boat 2 keel plank. Damage coming from the constant strains caused by tensioned ligatures could have been minimised by using smaller holes, or larger lugs. Lugs on the Punjulharjo Boat are examples of how lashing holes might be better executed, leaving enough play for wearing (Figure 4).

Timbers used
The five lashed-lug boats examined each used different timbers for their hulls and keel planks; Boat 1 is the exception where several kinds of wood were utilized for the hull, including the keel plank. The builders of Boat 1 used a timber identified as a Shorea species for their keel plank. The keel plank of Boat 2 was fashioned from a Hopea species timber. A Vatica species timber was chosen for the keel planks of both Boats 4 and 9. Finally, the keel plank of Boat 5 was produced from Pistacia chinensis. Aside from Shorea, other timber species are rather not known for use in boatbuilding, although some are used in coastal construction. Punjulharjo boat timbers identification was less thorough with only representative samples collected. A plank sample was identified as Palaquium gutta from the family Sapotaceae and is assumed to be the same for used for the keel plank. The tree is commonly found in Sumatra, Peninsular Malaysia, Singapore, and Borneo (Soepadmo et al. 2002).

The variety of timbers utilised for the relatively small sample of surviving boat remains make it difficult to reach any definitive conclusions regarding their use. Extending the sample to include
identified timbers from other sites does not help as the variety of tree species is likewise broadened. Even general declarations regarding the use of preferred trees for specific boat components will have significant exceptions or qualifiers. This includes statements about the use of a single tree-type for the hull planking, including the keel plank, of individual boats. Butuan Boat 1, in particular, generally has a high ratio of the number of timber species identified to the number of samples that were analysed. This might be explained by repairs that required a replacement of planks. On the other hand, there is documented evidence in southern Taiwan where boatbuilders call for specific and different tree species for use in their planking patterns (Kano and Segawa 1956: 306, 314, 320).

**Discussion and Conclusion**

Through examining the keel planks of the five lashed-lug boats, it has been demonstrated that traditional Southeast Asian plank-built and lashed-lug watercraft are complex in their diversity. Boatbuilders from this region undoubtedly adhered to uniform concepts of lashed-lug watercraft construction that persisted for at least 1,500 years: metal fastenings were not used, planks were edge-joined and carved with lugs, and the lugs were drilled with holes to secure frames, thwarts and other components with ligatures. But the manner in which these concepts were executed and implemented by their builders, particularly in their keel planks, were so varied that it might be suggested that using such a variety is part of their tradition.

Based on the above, the written and material record confirms the existence of an enduring technical tradition in the construction of plank-built watercraft in Southeast Asia. This is evident from the easily perceived diagnostic characteristics of edge-joined and lashed-lug construction techniques. This tradition, which for brevity is referred to as the “lashed-lug” tradition, entails an extremely involved process that begins with preparing the keel piece and hull planking with a series of protrusions, or lugs. When the hull is assembled by edge-joining with dowels, and sometimes in combination with lacing, the lugs align with each other in rows that run along the breadth of the vessel. The rows of lugs are drilled with holes and used primarily to fasten frames, thwarts and other vessel components, with ligatures to lash them together. Evidence from one site, in Punjulharjo, Indonesia, confirms that in addition to this, lashed lugs also acted as a plank fastening, to supplement dowels and lacing (Manguin 2009; 2012).
The confirmation of such a boatbuilding tradition in Southeast Asia leads to certain issues raised by maritime archaeologists. These issues mainly relate to reconciling the perception of stasis that is linked with the concept of tradition, to the technological achievements and advancements that are associated with the development and construction of watercraft (Adams 2013; Muckelroy 1978). In the case of Southeast Asian lashed-lug watercraft, how do these seemingly incompatible concepts manifest in their construction? As demonstrated in this research on keel planks, substantial atypical features were identified. The most glaring example of this is the use of five different types of lug patterns found on the five examined keel planks. It is also worth mentioning the assortment of timbers used for the boats. Among just the keel planks of the five boats, five different types of timbers were used.

It is difficult to explain the wide variety of building methods seen in the lashed-lug boats, that were used (and possibly built) in the same locale and under the same tradition. Unfortunately, this cannot be answered with any certainty, especially at this point and until more detailed evidence from other regional lashed-lug boats begin to surface. Even that may only allow slightly more educated guesses than are offered here. Knowing with certainty the thoughts, motivations and intentions of a boatbuilder is of course unachievable. But it is worth repeating that a combination of material, technological, aesthetic and symbolic factors must have influenced a boatbuilder’s choices.

As is typical of any worthwhile research, the more that is learned reveals even more that remains unknown. The complexity of the construction of lashed-lug boats seems to have been taken for granted by most. As this research has shown, by looking a bit more closely at details with a critical eye, a considerable advancement in knowledge was achieved. Many more details in these and other lashed-lug boats must still be studied in the future.

Acknowledgements
The authors would like to express gratitude to Wendy van Duivenvoorde at Flinders University as our supervisor for all the helps she provided us generously throughout each writing process. We also thank Noel Hidalgo Tan and his team for putting much efforts arranging the 2019 SPAFA Conference and for allowing us to present this paper at the event. Thanks to Veronica Walker-Vadillo, our fellow co-convener of the maritime session at the conference and to all the session’s participants for the comments and inputs for this paper.

References


Wallace, AR (2014 [1869]) *The Malay Archipelago*. The University of Adelaide Library, South Australia.
The Ancient Settlements in the Semangka Fault Line of Liwa, West Lampung Indonesia
Permukiman Kuno Di Jalur Sesar Semangka Di Liwa, Lampung Barat, Indonesia

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This article discusses archaeological explorations around the inscription sites of Tanjung Raya and Hujung Langit. A geoarchaeological survey in 2018 found 14 ancient settlements along the southern part of the great Sumatra fault-line, precisely in Liwa, West Lampung. The settlements are surrounded by 20—40 meters fault-trench with common artifacts derived from surrounding tuff rocks and andesites. These sites allegedly lasted from the Hindu-Buddhist era through the Banten Sultanate until the Dutch occupation spanning from the 10th-19th centuries, supported by the presence of ceramic fragments. The study gave new additional distribution of ancient settlements in Lampung which is not only found on the coastal and its lowland as the impact of ancient trade route but also in the remote inland behind the barrier’s of Bukit Barisan Selatan (Southern Mountain Range) and in the upstream of the steep river of Way Semangka. The location of these settlements that is right on the fault zone in highly prone disaster is unpopular in Indonesia and considered unique.

Introduction
The study of settlements has long been a concern for archaeologists. The understanding of space as a place of human activity can provide a lot of information such as revealing social or political structures, adaptation strategies, and community subsistence related to economics and technological capabilities (Mundarjito 1990). In Indonesia, indications of settlement can be traced through the existence of inscriptions because they are usually placed in strategic locations and usually close to the settlement as the information media to its people.

In West Lampung there are two oldest inscription sites: Tanjung Raya and Hujung Langit. These inscriptions sites have long been suspected as the indicator of other ancient settlements in the surrounding areas. Since the early publication of the site by LCH Damais in 1995, the Bandung Center for Archaeology began researching the environment around the sites through surveys and excavations in 1995, 2012, 2013, 2014, and 2018. The overall research had found 12 new sites beside Tanjung Raya and Hujung Langit. Most of the new sites contained ceramic fragments from the 10th to the 20th centuries, hundreds of potsherds (burnt clay) which were thought as pots, jars, and urns, stone structures thought as part of an ancient building probably a kind of vihara or shrine near the Hujung Langit inscription, Islamic stone tombs, and other megalithic remains such as stone figurines, dolmens, and scrathes stones (Agus et al.1995; Rusyanti 2012; Rusyanti et al.2013; 2014 & 2018).
Besides their varied artifacts which are drawn from the megalithic tradition, Hindu—Buddhism, and several Islamic stone tombs to Dutch ceramics, these characteristics of these 14 settlements are completely unique and no known outside Lampung. This uniqueness is related to two main area: (1) the landscape of the site and (2) the changing environment and adaptation to this landscape. The two discussions addressed to this paper will lead us to more comprehend about the nature of the settlement which is always changing through space and time.

The landscape of the sites
The Liwa region lies in the southern part of the Sumatra fault zone which is a crack column extending from the bay of Semangka in the south to the Aceh valley in the north (Anwar et al. 1994). The Sumatra fault formed as a result of an oblique plate collision on the past (Sieh & Natawidjaja 2000; Aribowo 2016) and has 18 segments (Supartoyo et al. 2014). JA Katili called it The Great Sumatera Fault and according to RS Yeats, there are several opinions about the date of this active fault from 10,000, 35,000, or 150,000 years ago which then reactivated again in a later period (Katili & Yeats in Supartoyo et al. 2014). The southern part of the great Sumatra fault is called the Semangka fault which passes through the Liwa region from the Way Wurkuk and the caldera Ranau, Suoh Valley, and Antai (Bemmelen 1949: 24-25). These lateral fault line-types commonly leave geomorphological marks on the ground such as steep valleys, shutter ridges, sag ponds, and beheaded streams (Burbank 2012; Aribowo 2016) and can be clearly seen on the ground’s of Liwa.

The great river which flows on this fault area is Way Semangka River with its tributaries. One of them is Way Rubok in the north of Liwa region as the upstream, while from Suoh to Tanggamus is the downstream in the south. Way Semangka is dominated by the very steep slopes resulting higher flow speed. If there is flooding it can cause many losses such as those seen in Suoh, Way Lay, and Wonosobo districts in Tanggamus (BPDAS 2010).

While the Liwa region is passing through the active fault, the rock formation in Liwa region also generally derived from other tectonic activities. Based on geological research the volcanic material deposits that make up the hills and valleys in Liwa are dominated with a moderately loose tuff layer in the north and the weathering-soil layer that is high in plasticity and compression in the south (Anwar et al. 1994). The taken sample of tuff Ranau from Way Rubok shows the age of $0.55 \pm 0.15$ Ma (Bellier et al. 1999) while according to (Natawijadja et al. 2017) was from 33,000 years ago. The tuff layers and steep valley as well as its sag ponds are the most common features seen in Liwa regions as the impact of ancient disasters in the past (Figure 1).

![Fig. 1. The Liwa Sites (red), Ranau tuff (light blue), and the fault lines. Source: Rusyanti et al. 2018.](image-url)
The 13 sites lie in the river bank of Way Rubok, one of the Way Semangka tributary river and shaping the dendritic pattern, while the Buay Nyerupa site (or Keramat Negara) lies near to Way Wuruk (different river) (Figure 2). Most of the sites in Liwa surrounded by steep valleys that are 20—40 meters deep and as wide as the traces of the fault. Below the steep valley lies sagponds formed by opened springs caused by the earthquake. The wet valley and its sagponds have high soil fertility and are currently used for rice fields and fisheries (Figure 3) (Rusyanti et al. 2018).

The potential availability of water in this region is adequate. The wet valley surrounds the sites is like a fortress-function as well as barrier to other sites. The land in Liwa actively used for coffee plantations and vegetables since 1905. This activity has been going on for a long time and is increasingly dominated by the farmers outside Liwa. Earlier in the 15th century, the Sukau region including in Liwa was known as one of the potential pepper fields (Reid 1999) before nowadays known as one of the most productive vegetable supplying regions (Figure 3).
Hundreds of ceramics and potsherds fragment spreads all over the site’s land which is actively cultivated. The oldest ceramics of Tang dynasty (10th century) are still the oldest fragments found only in Tanjung Raya and Hujung Langit (the ancient settlement with their two inscriptions), while another 12 newly-found sites around them mostly have ceramics from 14-19th centuries. Besides ceramics, there were also flat stones and scratched stones attributed to the megalithic traditions made from andesite and stone pedestal made from the sandstone. These stone pedestals are thought as part of a simple wooden house-like structure that was once built on this land.

The 14 sites (including Tanjung Raya and Hujung Langit) are then divided into six major groups. The biggest two are Tanjung Raya (190, 346 m2) and Hujung Langit (202, 934 m2) while others average about one to two hectares. The six major groups are: (1) the sites of Buay Nyerupa, (2) the site of Tanjung Raya and another two sites; Batu Putih and Simpang Dua, (3) The site of Hujung Langit, (4) Kehidupan and Pulau Pinang, (5) the five sites of Sukarami (Batu Raja, Punjung, Puncak, Negeri Ratu, and Kurungan Aji) and (6) the Hujung (Lamban Batin and Kampung Tuha).

These are the characteristics of six major ancient settlements found in Semangka fault line of Liwa West Lampung

1) Buay Nyerupa  
At the northernmost is the Buay Nyerupa site in Sukau. Buay Nyerupa is thought as Kampung Tuha or old village. The site lies in the uphills and along Way Wurkuk river close to Ranau Lake. The geomorphology of Way Wurkuk in Buay Nyerupa is meandering river which is formed by tectonic activity. The date of this geological event in Buay Nyerupa is yet unknown (Figure 4). Ceramics fragments and potsherds are spread all over the land. The site is known as an Islamic sacred place, marked by two figurines as a stone tomb. Their faces depicted as men and woman features with head, hair, hand, and faces carved clearly.
2) Tanjung Raya
The Tanjung Raya and Hujung Langit sites are famous for their inscriptions (Figure 5). Tanjung Raya consists of two stones. Tanjung Raya 1 is a flat rock from 10th century and the Tanjung Raya 2 is the upright stone often referred to as the Batu Pahat inscription and probably dates from the 14th century (Widyastuti 2011: 8-9). Research on the Tanjung Raya inscription first appeared on Damais (1995) who wrote that the inscriptions were written in Javanese in an ancient Malay language. The site of Tanjung Raya is flanked by two other sites; Batu Putih on the west side and Simpang Dua on the north side. The site surrounded by a steep and wide valley and looks like a cape, local people called it Chakhmemung or the hanging island. Ceramic fragments, potsherds and two figurines were found at this site.

3) Hujung Langit
Hujung Langit is the largest site in Harakuning Jaya, Sukau District. The site is known as the Hanakau inscription (10th century) first reported by Dutch topography officers in 1912. According to Damais (1995) the inscription was issued by Punku Haji Yuwaraja Sri Haridewa related to the sima (tax-exempt land) in Hujung (5 km from Liwa) (Damais 1995: 27-45). The identity of this king is still being discussed by historians and archaeologists as to whether he was a Sriwijayan or Javanese king since the Lampung region was once occupied by both in around the same time. One of the assumptions said that the king’s title probably was the title for a lesser or subordinate king (Saptono 2005). In 1995, Balai Arkeologi Jawa Barat (the West Java Center for Archaeology) carried out excavations and revealed stone structures as part of probable sacred shrine near the inscriptions but by then many stones had already been lost. The variance of ceramics indicates that this settlement was from the classical period in the 10th century and continued afterwards (Rusyanti 2013). Ceramics as well as with the scratched and flat stones and also stone figurines were found on the middle and northern areas of this site.
4) Pulau Pinang and Kehidupan
Pulau Pinang and Kehidupan sites are in Sukamenanti, Balik Bukit district, 750 meters north of Liwa. Both of the sites are surrounded by the steep and wide valley that makes it looks like an island. Ceramic fragments are found dominantly in the middle and the northern side of the site. The monolith stone of Batu Ikhau believed as a stone for sacrificial worship in the past was found in Kehidupan 1 site, whilst the 10 stone pedestals were found in Kehidupan 3. The valleys both in Pulau Pinang and Kehidupan have long been cultivated for rice fields.

5) The five sites of Sukarami
The five sites of Sukarami are in Sukarami village which close one another, in line from the west to the east tracking the distance between 0.5 - 2 km. There five sites are Batu Raja, Punjung, Puncak, Negeri Ratu, and a separate northern site of Kurungan Aji. All of these sites have many spreads of ceramics and stone pedestals, especially in the Batu Raja site. The topography of these sites is bumpy (corrugated) land and near to the river of Way Robok.

6) Hujung
The last group in Liwa site is in Hujung village. There are two locations here; Kampung Tuha and Lamban Batin which believed to be the ancient villages before this recent village of Pekon Hujung. The topography of this site is mostly hills and bumpy or corrugated. Lamban Batin in the southern part of Liwa is known by its sacred building for the pilgrimage with natural pond below the site. Fragments of ceramics, potsherds, and tumulus are found in the site while in Kampung Tuha stone pedestals reveals after the slash and burns activities for plantation (Rusyanti 2014; Rusyanti et al. 2018). These stone pedestals are alike with those from the Sukarami’s site.

The inscriptions and cramics give a relative chronology to the Liwa sites but the absolute chronology still needs to be further researched with other methods due to the high disturbance of the site by agricultural activities. No charcoal samples were found on the test pits in the previous research in 2012, 2013, and 2014 for up to 70 cm depth and the increase in depth correspond with the decrease of artifact deposits (Rusyanti 2013). The soils are consistent as tuff layers up to 20-40 meters thick seen from the cliff side and no other remains were found (Rusyanti et al. 2018). The recent chronologies for these sites until now are still in the average dates from the 10-19th centuries (Rusyanti et al. 2019).

Based on historical sources it can be described that the peoples who occupy Lampung were probably peoples from the northern part of Sumatera Island such as Pagarruyung and the surroundings. Their first presences were around the foothills of Mount Pesagi and Ranau Lake near Liwa (Sudarti et al. 2006:14). Since the 10th century the Liwa regions were thought to be subordinate to the king of Punku Haji Yuwaraja Sri Haridewa as mentioned in Hujung Langit Inscription. This king probably has Javanese relations generating from the invasion of Dharmawangsa Tguh to Srivijaya in 10th century (Damais 1995) although this still needs to be researched more. Srivijaya was regarded as the ruler of Sumatera reinforced by the 7th century Palas Pasemah inscription which mentions the curse on anyone who goes against the Kingdom of Sriwijaya (Kedatuan Sriwijaya) (Utomo 2007: 10).

In the later period of the latest 16th century, the Islamic-Bantense influence gives us information of two major clans or marga who occupied the highland and the coastal lands of Lampung; the Pepaduns and Saibatins. The Pepaduns mostly occupied the inland region while the Saibatins were said to be the people who dominantly occupied the west-coast of Lampung for the first time, including the areas of Pesagi, Ranau, Liwa, Sukau, Kalianda, Batu Brak, Belalau, Krui, Suoh, Semaka, and Kota Agung in Tanggamus (Depdikbud, 1997: 59). The Saibatin people are known since the presence of
Islamic influence in Lampung around 15-16th centuries. When the Bantenese Sultanate occupied Lampung in 16th century most of the historical people inhabiting Lampung province including Liwa and surroundings were strongly related to the pepper and coffee plant trade commodities to Dutch influence in 17-19th centuries.

The changing environment and adaptation

Since geological and historical notes were recorded in 1903 the Liwa regions were prone to natural disaster (Supartoyo et al. 2014) and this situation continues today. In the last century, earthquakes were recorded in 1908 and 1933 (Aribowo 2016). The 1933’s earthquake measured 7.5 in the Richter scale and triggered a landslide in Way Rubok river valley in the foot of Mount Pesagi, Seminung, and the southern edge of Lake Ranau. Locals believe that the volcanic eruption and the flooding of Way Semangka in Suoh, destroyed the oldest village of Hantatai, Mulang Maya, Negeri Retu, and Kejadi-an in the past unknown time. This earthquake also triggered a volcanic eruption and flooding in Suoh and destroyed the oldest village of Hantatai, Mulang Maya, Negeri Ratu, and Kejadian. A survey in 2018 in the abandoned site of Negeri Ratu which is now a rice field found ceramics fragments from the Qing Dinasty (19th century) (Rusyanti et al. 2018). This artifacts might be correspond with their past disasters before records. In Liwa the 1933 disaster destroyed two villages; Bahway Unggak and Bahway Doh, 20 km north of Liwa and forced them to move (Soempono et al. 1991; Saiman, 1991; Natawijaya et al. 1993). The earthquake occurred again in Liwa in 1994 measuring 6.5 on the Richter scale and inflicted enormous damage to the region.

Liwa’s soils are not well-consolidated and are prone to landslides (Rusyanti et al. 2018). The discovery of a meandering river in Buay Nyerupa in Liwa, the findings of Qing ceramics from 19-20th centuries in the abandoned sites of Negeri Ratu in Suoh, and the vanished settlements later found in Bandar Negeri Semuong, Tanggamus (Rusyanti et al. 2019) raised the assumptions that the loss and migration of ancient settlements alongside in the watershed of Way Semangka from Liwa in the north even to the south in Suoh to Tanggamus is related to the natural disasters that happened in the past. In spite of its abundant natural resources, the watershed of Way Semangka from the upstream in Liwa to the downstream of Suoh to Tanggamus was a dreadful place to live due to its location in the southern part of the active Sumatra fault-line. Further research about past disasters are still needed.

Karl W. Butzer mentions three types of adaptation regarding the conditions of archaeological deposits: (1) adaptive adjustment, (2) adaptive transformation, and (3) adaptive modification. Adaptive adjustment interlinks with local and demographic oscillations including geophysical disasters. Adaptive transformations eventually has continental or global repercussion for subsistence settlements, and demography interlink with biological evolution, and adaptive modification eventually has regional repercussions for subsistence, settlements, and demography and may and may not result in changes in cultural or identity (Butzer 1994). The adaptive adjustment is best suited for habitation in environments like Liwa. This type of adaptation marked with the traces of ancient settlement movements that might be leads to the demographic oscillations in the past.

Conclusion

Liwa in west Lampung is one of the most interesting and unique archaeological sites. First because of their locations in the southern part of an active Sumatera fault and second because of their varied artifacts derived from long span of time from 10-19th centuries. The environmental vulnerability and the proof of 19th century ceramic deposits in abandoned old villages in Suoh and other vanished ancient settlement in Tanggamus in later research in 2019 had proven that the same environmental
disasters might be one of the factors that caused the disappearance of Liwa’s ancient settlement in the past.

Acknowledgements
This paper was drawn originally from West Java’s Center for Archaeological reports in 2018 with some updates taken from the 2019 research. The author would like to express gratitude to the fellow team from Indonesian Scholar Institute, Center for Geotechnology (Geotek LIPI) and University of Sumatera (ITERA) who has made a significant contribution and support to this research; Ananta Purwoarminta, M.T and Agel Vidian Krama, M.Si and to the colleague’s team from Bandung Center for Archaeology for their enthusiasm on making this project research from 2018-2019 well done completely.

References


Human Face Reliefs in Rock Art, Pasemah Megalithic, South Sumatera
Relief Wajah Manusia Pada Seni Cadas, Megalitik Pasemah, Sumatera Selatan

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Rock art as a relief in open spaces is found in many sites in the Pasemah Megalithic area of South Sumatera. While rock art is commonly found in caves, it is also found outside the cave areas with different forms and techniques applied. This study was conducted to find out the determinant factors for the location and form of the rock art, which may have influenced the behaviour of the builders. The methods applied in this research include descriptions, analogy, and contextual analysis. The results show that the determinant factors were myth, geographical condition, and the level of the builders’ technology.

Introduction

Rock art in Indonesia is dispersed across all parts of Indonesia, such as the karst areas of Papua, the Moluccas, Sulawesi, East Nusa Tenggara, Kalimantan, and Java (Soejono 2008a: 186-201) as well as Sumatra (Simanjuntak 2015; Permana 2015a: 43-51; Mohammad Ruly Fauzi et al. 2019: 166-174). According to R. P. Soejono, an Indonesian expert in prehistory, the rock paintings in karst areas were developed among the advanced hunter-gatherer groups, which dates vary from 3500 – 300 BCE (Soejono 2008a: 141-187). This explanation is also related to the development of artefact technology and environment of the prehistoric communities, who previously led a nomadic lifestyle and made lithic tools and began to use caves to shelter them. The explanation is in accordance with an old anthropological view about cultural ecology proposed by Julian Steward, which reveals that there are reciprocal relationships between human and the natural environment within a certain period of time (Steward 1990). In compliance to this view, Koentjaraningrat (1987), an Indonesian anthropologist, classifies adaptations among the hunter-gatherer, agricultural, and urban communities. During the adaptation processes, the communities were often influenced by their beliefs, structures of organization, knowledge, settlement patterns, arts, languages, and technology at that period (Koentjaraningrat 1987; Koentjaraningrat 1993).

Whitley (2005:3) defines rock art as images made on the surfaces of rocks using incising, painting, or stamping techniques with certain motifs. The rock surfaces can be cave walls, cliffs, big monoliths or natural rocks and not artificial media. Hence images on the surfaces of natural rocks on a landscape can be classified into rock art. The rock art objects discussed in this research are focused on those outside cave areas, which were made using incising and carving techniques.

Rock art images vary, and in Indonesia include hand stencils, human faces or anthropomorphic figures; animal figures like anoa, horses, lizards, pigs/boars, fish; and vehicles like ships, boats, and geometric designs. According to Renfrew, the resulting images are symbols, which are cultural prod-
ucts that bear ideas and expressions of creations that were communicated within each community (Renfrew 1998). As cultural products, the images have aims and functions in relation to the shapes and locations where they were placed and also in relation to the shapes of other images in a frame. Therefore it can be said that the use of symbols in the advanced level of hunting-gathering communities is a natural thing, and the symbols were only meant for each community while the culture still exists.

The problem is that apart from being found in cave landscape, these symbols can also be found in hilly and river landscapes. The techniques used also differ, for example using a tool with pointed tip that is sharp enough to make incision on rock hills or even make quite deep wavy reliefs like sculptures. The most common motifs in Pasemah are human faces with bulging eyes, thick lips, and big rounded nose like masks, or stylized human faces that are depicted in pairs facing each other, and aquatic depictions like crab legs, crocodile, shrimp, fish and eel. If the symbols in cave landscapes represent the culture of advanced hunters and gatherers, who used symbols but still lived very modest lives and were highly dependent on their natural environment, do the symbols on rocks on highlands and river also represent a certain type of culture? The assumption is that if a certain type of environment becomes the determining factor of a culture, then different types of environment will also affect different ways of life. Investigating the relationships between culture and the natural environment is a cultural ecology approach put forward by Julian Steward (1990), which attempts to understand the environment based on the cultural aspect. Based on the approach, a question comes up whether the rock art in Pasemah area was a continuation of previous rock art traditions or a more recent innovation due to the fact that it uses the same media but at different places and with different technology. In contrast to rock art which is usually depicted on cave walls or niches, in Pasemah culture rock art is carved into an open area on the surrounding rock hills which is a fertile plain area.
The aim of this research is to find out the factors that influenced these differences and to know the level of technology of the period. Furthermore, this research was also an attempt to know the forms of rock art objects outside caves, the background of their placement, and their chronology. The expected benefits are that the rock art objects on river beds and faults, which are permanently exposed to flowing water, will be documented and that by understanding the cultural remains the general public will better appreciate our cultural heritage and has greater motivation to manage and preserve them for the sake of the next generations.

Methods
The methods that are used to achieve the above goals are observation, recording, and drawing of the rock art objects in forms of symbols at the research areas. Aside from photographing them, each object was measured and drawn on paper to find out which shape was used as a symbol. Because most of the images seem to be irregular and abstract at a glance, detailed drawing is needed to know the shapes of the symbols, especially those that are located behind the waterfall at Kuy-kuy River, Tebat Gunung Village. Recording was conducted using description method, and description of other associated archaeological objects are to be used in interpretation. According to Deetz, archaeological method consists of observation, description, and interpretation (Deetz 1967: 7). Data from different locations will be treated according to their contexts. Observation and data collecting are carried out by means of surveys, after conducting bibliographical study in relation to the archaeological remains to be used as research objects. The author carried out the research surveys in 2013-2014, while the survey for the purpose of detailed drawings was carried out at the end of 2018.

Specific and contextual analysis (Clarke 1978: 32) was done on each relief image to know the shape and its association with other findings, both among the reliefs and with other findings in the surrounding area, as well as conducting analogies with similar finds from the locations not far from Pasemah and from the same period with the Pasemah Culture. For example, one of the images behind the waterfall has a similarity with the painting on a rock mound, or a megalithic statue that shows a similarity with the depiction of human faces with bulging eyes. The data were then being interpreted using cultural approach, which studies the relationships between archaeological findings and sites with the entire contents (Steward 1990).

Results and Discussion
Reliefs of Human Faces at Jarakan
The site of Jarakan is a rocky hill in a coffee plantation that belongs to Ms. Inul (74 years old) at Jarakan Village, Pendopo District, Lahat Regency. To reach the site, one has to cross the tributary of Selangis River at the shallow part, which is about 20m wide, and walks around 35 minutes into the forest before arriving on a rocky hill with many reliefs of human faces on the rock’s surface. Mount Dempo is located to the southeast of this rocky hill with reliefs, which is quite far from the site.

This rocky hill has an elevation of 371 m from sea level, with north – south orientation. The picture area is 75 – 90 cm high, 80 cm wide, about 420 cm long (Triwurjani, Rr., et.al. Untung 2014; Indrias-tuti 2011: 165-184). The human faces on this Bukit Batu (rocky hill) can be divided into three panels based on the rock curvatures. The images on first and second panels are in a row, while the one on the third panel is slightly lower to the right. On the first panel are three human faces, on the second panel are two human faces, and on the third panel is one human face. These human faces are depicted with long and wide eyes, which seem bulging; wide mouths, some are open; and tall necks. The hair is depicted as vertical lines above the forehead, and the ears are wide. These faces look like masks.

The ones on the second panel have no mouth, but only nose, forehead, and eyes. These images resemble human figures that consist of heads and necks. The average measurements of the necks are 14
cm high and 12 cm wide and 15 cm high and 14 cm wide. Such shapes are not like real human; their eyes, mouths, noses, ears, foreheads, hair, and necks are symbols.

The masks or human faces are not unusual to megalithic objects in the Indonesian Archipelago. They are commonly found on sarcophagi and stone burials in Kalimantan, warugas (stone vats) in North Sulawesi, kettledrums, and painted on stone burials. They are usually related to sacred objects. Human face is a symbol of ancestor. The scary look is because of its function to ward off evil, danger, and malevolence (Soejono 2008a: 156-157).
**Reliefs of Human Faces at Bukit Selayar**

Bukit Selayar is located at Tegurwangi Lama Village, Pagar Wangi Sub-district, Dempo Utara District, Pagar Alam. The land belongs to Mr. Ridez (68 years old) who lives along the Selangis River. Not far from this hill, to its northwest, is the stone burial complex site of Tegurwangi. The hill is actually a huge monolith with a height of about 3 m. On the foot of the hill there are various reliefs of human faces and human figures in form of sketches. They were carved on a panel 2 m long and 1 m wide.

The reliefs are located on the bottom part of Bukit Selayar, while on the middle part up there is a big relief of a human figure carrying kettledrums that are tied to his front and back body, with bulging eyes, open thick lips, and a head ornament in forms of circles. The double circles on his shoulder, elbow, wrist (?), and knees seem to show that they were moveable body parts, so that the image looks dynamic, which is the characteristic of Pasemah megalithic statues (van der Hoop 1932; Triwurjani 2018). The panel of reliefs is big, 2.5 m wide and 3.5 m high. These reliefs of human figures and faces and other shapes, which were carved below the right foot of human figure carrying kettledrums, are seldom discussed.

![Fig. 4](image1.png)


![Fig. 5](image2.png)

Several types of human face on the panel in the foothills of Selayar Source: Triwurjani 2018 and Indriastuti 2011.
At a glance the reliefs at the foot of the hill seem to have no structure due to the many vertical and diagonal lines, very different from the carving above them. The about 2 m long panel depicts sketches of human faces and human figures in a row with wide open arms. There are seven human figures of various sizes. The biggest relief of human figure has hair that stands upright on his head. The wide open arms, according to Haris Sukendar, an Indonesian megalithic expert, represent the attempt of the ancestors to get more power, while the scary or even funny looks symbolize the effort to ward off evil or danger (van Heekeren 1958; Sukendar 1990; Soejono 2008a). There is also a relief of human face with upright hair and straight lines around the head like sun rays, and a relief of round human face with bulging eyes and thick lips at the upper right. Other motifs include rows of dots, triangular lines, upright lines, and slanting/diagonal lines. The most prominent part of the reliefs is a human face with straight lines around it, which look like sun rays. Its size is also bigger than the other human faces. There is a possibility that in this panel that he is more important than the other human figures.

The reliefs at the foot of this hill are very different from the relief above them that depicts a human figure carrying kettledrums, in size, shape, and technique. The ones at the foot of the hill were made using a combination of incising and carving techniques, particularly the human faces with bulging eyes and thick lips. They are small, about 6 x 6 cm. Only the face parts are similar to the typical Pasemah type face. Their positions at the bottom show that they are not the main images on the hill and were probably made later although there has not been any evidence about the exact date. The Heger I type kettledrums carried by the big human figure above the small figures show that it was made during the Palaeometallic period, which is when metal was introduced to Pasemah in about 3500 BP ± 200 CE (Guillaud 2006: 87).

**Human face reliefs at Sungai Kukuy**

The human face reliefs and the other images are depicted in a row along the rock fault; the long rock forms the base and wall of a waterfall in the Sungai Kukuy (Kukuy River), which is the tributary of the Lematang River. It is located at the village of Tebat Gunung, Lubuk Buntak Sub-district, Dempo Selatan (South Dempo) District.

The location of the rock with reliefs can be reached using motorbikes through a coffee plantation from the Atung Bungsu Airport. Upon arrival at the Batu Gong Site, one has to turn left and walk the rest of the way because the path goes down quite steeply and goes up again across a number of hills before arriving at the swamp of the Kukuy River. The object is situated in the middle of the river, a tributary of the Lematang River. Its small and easy flow goes through a quite wide fault and the water-flow becomes more rapidly along the fault like waterfall.
During the dry season this area dries out and the water only drips along the sides. This area belongs to Ms. Asnawati (53 years old), who lives in Palembang. The Kukuy River is actually a small river, a tributary of the main river Lematang at one of the coffee plantation areas in Tebat Gunung Village. However, the water is quite plenty at all times due to the presence of forest around it, so it forms a quite heavy waterfall. The course of this waterfall can be diverted during the dry season because the river flows less profusely.

On the fault, which is ± 16.5 m long, ± 1 m high, and ± 1 m wide, there are reliefs or engravings as well as quite deep carvings. On the upper part is a carving of a round-shaped human face with a diameter of about 50 cm, which consists of big round eyes and a nose. Beside it is a depiction of an animal that looks like aquatic animal like an eel or water snake.

At front is a long relief that can be divided into several panels, each of which has one image. They are from left to right reliefs of an alligator, two human figures facing each other, fish, toad, crab’s claw. The aquatic animals are all fresh-water animals.

The black human face reliefs look eroded. The human face on the left has a body until the back part, and there are concentric circles at the joint, which show a centre of movement, like on the human figure carrying kettledrums at Bukit Selayar. It has rather wavy hair and wears a necklace. The forehead is wide and is slightly jutting forward. Its nose is round and short, and it wears an earring.

The other face is depicted from the left side, facing the left. It has a wide forehead that is slightly jutting forward, round eyes, a rather pointed nose, and slightly opened thick lips. It wears an earring from a string of beads and a necklace. The pair of human faces do not look scary; instead, they seem like ‘comedians,’ which is meant to summon magical power.
The images of human faces in the river vary: round and facing front, round and facing left or right; a single face with no ornaments (earring, necklace) and in pair with ornaments. All are depicted close to each other and close to aquatic animals, which are water snake and crocodile. Both snakes and crocodiles represent the underworld hence there is a probability that both variants of human faces have important roles. The human faces wearing ornaments reminds us to the relief of a human figure carrying kettledrums at Bukit Selayar, which has a head dress resembling a crown that curved backwards and decorated with small circles and tendrils, as well as wearing a necklace. Kettledrums are regarded sacred objects and therefore the figure carrying them must have been no ordinary figure, too. There are several depictions of human figures carrying kettledrums in the Pasemah megalithic art, such as one at Air Puar, a statue depicting a couple of men flanking an elephant in a tetralith in stone burial context at Kota Raya Lembak, and a painting on the wall of a stone burial (Vonk in van Heekeren 1958, pl.31; Kempers 1988, 476; Sukendar 1990; Sukendar 1987; Triwurjani 2018).

Other reliefs, which are of certain aquatic animals, indicate alertness to dangerous aquatic animals like crocodile and snake, while fish, shrimp, and crab show the fauna and environment of the place at that period. Probably fish, shrimps and crabs are also the source of food of the local inhabitants during the period.

Reliefs of human faces that were carved rather deeply can be found in quite large number on the rocks at the middle parts of the rivers, like the ones at Selangis River and its tributaries within the District of Dempo Utara (North Dempo). Depictions of human faces can also be found at similar kind of environment, which an area with small rivers that are the tributaries of the main rivers. For instance at the site of Burung Dinang in the hamlet of Cawang Lama, Burung Dinang sub-district, Dempo Utara district and the site of the human head statue at Selangis River in the hamlet of Cawang Baru, Rebah Tnggi sub-district, Dempo Utara district.

The human head statue at Burung Dinang site is in fact not merely a depiction of a human head but also part of its body. It can be more clearly seen when the river water shrinks or dries during the dry season. The body part, in the form of the upper torso with hands akimbo, is carved on the river fault. It wears an armlet. When the river water flows profusely, the body part is hidden by the water; only the head is visible. The human face has round eyes, wide and flat nose, closed thick lips, and wide ears.

**Relationship between the depictions of human faces in open spaces and in caves**

The above descriptions reveal the interaction between human beings and their environment. Every rock art image can represent the environment. For instance, rock art in open spaces produces images that are closely related to the environment where people lived. It is possible that the size of the rocks as the media is the reference, which determines how big the image(s) to be produced.

Contextual data indicate that the images are not individual ones but interrelated. The reliefs at Bukit Selayar can be used as a reference to see the first relations. The criterion used is that the images of human figures carrying kettledrums, which are depicted in forms of relief, statue, and painting on the wall of a stone burial, have proven that the images had an important role to the bearers of the culture. The relationship can also be seen in the similar shape and orientation, particularly on the stylized human faces and the use of ornaments/jewelleries.

Another similarity is seen in the small round human faces and those found at the rock fault of the Kuykuy River. The difference is on the carvings of animal figures that accompany them. At Kuykuy River the human faces are accompanied by a water-snake, which is also symbolizes the underworld. Probably it was meant as a warning to avoid it because it could hamper a journey. The reliefs of human faces are also found in the middle and banks of the Selangis River and its tributary with a vari-
iation of wide ear and the use of ornaments/jewelleries. The traces of human touches are also similar to the many incised stones found among the river rocks, which are presumed be where the artisan(s) sharpen the tools, which was a ritual before conducting an activity, with a hope that the activity would be smoothly done (Sukendar, Haris 2003). In their development, these rocks with carvings of human faces might have been led to the making of menhir statues, which are depicted with heads, faces and bodies but no hands and legs. The human faces with straight lines around it like sun rays also have variation, which look more like masks, at Jarakan Hill. They are carved on a rocky cliff in a fertile area, which is suitable for agriculture.

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Fig. 9 Comparison of the shapes of human face reliefs at Selayar Hill and other sites.

In relations to the source of life and fertility in hilly areas and around the rivers, the reliefs of human faces were made. They are not merely depicted on rocks in Pasemah but also on stone burials like the human face carvings with wide mouth and ear ornaments at Long Pura, Kalimantan.

Besides being carved on the stone, this human face is also found in decorative earthenware motifs, such as the Lapita pottery which is widely spread in Eastern and Pacific Indonesia as well as on Lapita pottery (Bellwood 1987: 50). It is too early to mention that there is a relationship between the two cultures, but the human face picture in almost any media in the next period can certainly indicate the possibility of a continuity relationship, and that the picture is very common and important in particular cultures.

Results of this research reveal that these rock art, which are related to burial and worship, are closely related to religious life, as stated by Sumiyati Atmosudiro that prehistoric art, aside from expressing aesthetic values, also has religious meanings (Atmosudiro 1984; Kosasih 1995; Whitley 2011: 307-326). Thus besides the environmental factor, religious system also influence the reliefs. Depiction of incomplete figures such as human faces, hand-stencils, sketches of humans, head and hair, part of certain animals refers to certain symbols. Those parts are believed to possess magical (supernatural) power.
Geographically, the depictions can be categorized into two types of landscapes, namely karst area and hilly and river valley area. The karst landscape is usually represented by hand-stencils, human figures, terrestrial animals like boar and anoa, and aquatic animals like fish. Boar and anoa are games (wild animals) to be hunted. The artefacts found in context with cave paintings are mostly arrowheads and flakes, while the human remains are commonly from Mongoloid and Australomelanesoid races (Soejono 2008a; Simanjuntak 2015; Permana 2015a). It was based on the fact that experts named the level of life of the communities in karts areas hunters and gatherers. Life during the next period, in which the social life had been more advanced and people began to live a sedentary life, is called the agricultural level (Soejono 2008b). During this period people have begun to practice ancestor worship and believe in life after death. The ancestors were believed to be able to help the people that are still alive. It was during this period that rock arts outside the karst areas began to exist, such as reliefs of human faces on rocky hills, mountain slopes and rock faults in the rivers like at Tegur Wangi, Tebat Gunung, Selangis River, and Jarakan Hill, which are parts of the Pasemah Megalithic Region in South Sumatra.

Results of this research show that depictions in rock art are influenced by several factors, both internal and external. The internal factors include geography, which is the shapes of landscapes where the images are located, and the techniques used to make them. Rock art in karst areas is influenced by the lifestyle and technology from a far older period, in which people were still in hunting and gathering phase, even as old as 40,000 years BP (Aubert et al. 2014; Pasaribu 2016: 1-27). In hilly areas and river valleys, on the other hand people have lived in agricultural phase and developed cultivation with irrigation. Rocky hill, as a media to express religious art, is not only found at Bukit Selayar but also at Jarakan. In Megalithic belief, high and strategic places like hills and mountain/hill slopes are considered sacred and are the place where ancestor spirits live. Based on the various rock art images that tend to be symbols carved on rocks in karst and non-karts areas, it can be concluded that there is a continuity between the rock arts in both areas. The continuity is closely related to the cultural backgrounds of the bearers in accordance with their natural environment and the technology that they mastered.

References


New Evidence of Iron Smelting Sites on the Montalat Watershed (Central Kalimantan, Indonesia): Comparison with the Iron Smelting Sites at Sungai Batu (Kedah, Malaysia)

Bukti Baru Situs Peleburan Bijih Besi di DAS Montalat, (Kalimantan Tengah, Indonesia): Perbandingan dengan Situs Peleburan Bijih Besi di Sungai Batu (Kedah, Malaysia)

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The Dayak Taboyan people call the location of iron smelting remains as buren. Their presence is characterized by the heaps of iron slags, tuyere, charcoal residue, smelting furnace and iron ores. During archaeological research from 2017 to 2019, thirteen buren sites were discovered along the Montalat watershed, with finds that include furnaces, which are round on the outside but rectangular in the inside. Where did this iron ore smelting technology come from? Was it introduced from another place or was it locally invented? This article uses a comparison approach with the iron smelting sites in Kedah, Malaysia.


Introduction

In Indonesia, research on the ancient iron industry has been carried out at the Lake Matano site, Luwu, South Sulawesi. Iron ores from Lake Matano, which are known as Luwu iron, were exploited from the 15th to the 19th centuries CE (Bulbeck & Prasetyo 2000; Do 2013). During this period Luwu iron was exported to Java, the Moluccas, and the southern part of Kalimantan due the fact that the nickel content is very suitable as alloy-making in the production of keris (dagger) (Marschaal 1968; Reid 2011). The Luwu iron ores contain good quality iron oxide or hematite to be extracted into iron objects (Do 2013).

Until recently, the Dayak people of Kalimantan still use various weapons made of iron, such as the mandau (typical Dayak weapon that looks like a large knife), sipet (blowpipe), and duhung (spearhead). The mandau is a family heirloom that is considered sacred. People believed that the mandau that they inherit are made of mountain rocks that contain iron, like Montalat iron. According to their oral tradition (tetek tatum), the skill to process mountain rock iron into mandau only belonged to Pangkalima Sempung and his descendants (Riwut 2003).

The Schwaner Expedition in Kalimantan in 1847 mentioned that there were about ten iron-smelting furnaces. Schwaner portrays the iron-smelting activities in his picture. The iron bars produced at Montalat were distributed all around the south eastern Borneo (Reid 2011; Schwaner 1853). Schwaner’s account is in accordance with the stories among the people of the upstream of the Barito River, who consider the iron rocks of Montalat as the raw material to make good-quality weapons that are thought to be sacred. The local inhabitants called such kind of rock batu besi (iron rock).
This article is aimed at explaining the evidences about the iron-smelting activities along the Montalat River based on results of survey and excavations. Where did the iron-smelting technology come from; was it introduced from another place or locally invented? In order to answer them, artefactual and historical approaches will be considered, along with comparison with the Sungai Batu iron-smelting site in Kedah, Malaysia.

Iron-smelting along the Montalat Watershed

In 2017 the Archaeological Office of South Kalimantan conducted research at the upstream area of the Barito River in Barito Utara Regency, Central Kalimantan, to locate traces of iron-smelting activities. Ethnographic data reveals that the local people understood the toponym *buren* as the location of iron-smelting furnaces in the past. *Buren* is characterized by the abundance of iron slag in the forest and found far from habitation places. With *buren* as our starting point, surveys were carried out along the Teweh and Montalat Rivers, which are the tributaries of the Barito River at the upstream. The research yielded data in forms of remains of iron-smelting furnace such as iron slag, fragments of baked clay air pipes (tuyere), clay furnaces, raw iron (ingots), and iron ores that have been broken. Tuyere and clay furnaces are only found at certain buren sites, unlike iron slags and fragments of iron ores that were found at every *buren* site.

The research yielded eleven *buren* sites along the Montalat River and five along the Teweh River (Figure 1). Although they were located in the forest, far from habitation places, the local people knew the locations because they often saw them on their way to and from their agriculture fields. The local inhabitants name the *buren* according to the name of the rivers where they are located or the name of the field’s owners (Hartatik and Sofian 2018). This article is focused on the Montalat area because furnaces are found at the *burens* along the Montalat River. Among the thirteen *burens* sites along the Montalat River, four sites have furnaces, which are Buren Odir (one furnace), Buren Benangin (two furnaces), Buren Temelalo (two furnaces), and Buren Jaga (two furnace).

**Buren Odir**

Buren Odir is located in the middle of the forest, surrounded by the Benangin and Tiontang Rivers, which both flow into the Montalat River. The site can only be reached by walking from Pelari Village. The furnace at Buren Odir was found during the survey, among dense trees and under a heap of dry leaves and tree branches. It was made of baked clay and was broken. It is U-shaped because one of its sides and the upper part are broken. It is 45 cm high, the length of its three sides is about 50 cm and the wide is it was 10 – 12 cm. The inner part of the furnace has corners, forming a square shape.
About 2 m from the furnace iron slag were some fragments of iron ores and grains of raw iron. The *buren* is located on a 10 x 10 cm elevated soil that is 1 m – 2 m higher than the surrounding area (Hartatik and Sofian 2018).

**Buren Benangin**

Buren Benangin is located about 1 km northeast from Buren Odir. It is on top of an elevated mound that is surrounded by the Benangin River. Survey at this area revealed a feature of burnt clay 5 – 10 centimetres high, which is thought to be the upper part of a furnace. Therefore the team decided to conduct an excavation there. The 2018 yielded two furnaces and a heap of iron ore fragments between the two furnaces (Figure 2). Both furnaces were damaged, particularly one of the sides and the upper part. The outer parts are rounded, while square inside, with flat walls. The heights from the floor are 60 cm. The outer lengths are 50 – 55 cm, while the inner lengths are 45 – 50 cm.

A broken tuyere was found not far from the furnaces (Figure 3). In and around the furnaces are iron slags, fragments of iron ores, fragments of furnace, and fragments of tuyere. Matrix in form of holes near the furnaces, with a diameter of 20 cm and depth of 90 cm. They were assumed to function as a channel to let the air flows to the furnaces. Results of radio-carbon dating analyses from three samples of charcoal (TP1, TP2, TP3) give dates of 224±66 cal BP, 420±67, 229±15 BP or 16th to 18th CE (Hartatik et al. 2018).

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Fig. 2  Buren Benangin site with finds of inside squares and heap iron ore. Source: The Archaeological Research Office South Kalimantan.
Buren Temelalo
Buren Temelalo is located near Pelari Village. Among the rubber trees were two furnaces, tuyere, and a mound of iron slag at the east wall of the furnace. The first furnace is located at the north side. It is rounded and is relatively intact, with some debris inside it. The second one is U-shaped with its mouth on the east side. Both of the furnaces have similar characteristics to the ones at Buren Benangin, which have a roundish outer shape and square inner shape. The inner part of the first furnace (A) is 47 x 42 cm and 45 cm high (minus the crumbled upper part). The second one (B) is 60 cm x 42 cm, 42 cm high, and the walls are 10 – 15 cm thick.

Traces of the use of charcoal are observed on the black soil inside the furnace, while outside the furnace, near the pile of raw material, there is blackish-red soil because of the fragments of iron ores. About 1 m from furnace A, a rectangular fossilized rock that is 28 cm long, 5 cm wide, and 3.5 cm thick was found. The local inhabitants call it batu sungkai (sungkai rock). It is assumed that it was used to flatten the inner walls of the furnace to make it rectangular in shape.

Iron slag and charcoal were found scattered outside the furnaces. The soil around the furnace tends to be black due to the large amount of charcoal. Near the black soil are fragments of iron ores, most of which were crushed, so that the colour of the soil is red because of the mixture of crushed iron ores. About two metres from the second furnace there was a tuyere, fragments of burnt clay, iron slag, and crushed and uncrushed iron ores. It is assumed that at this spot there was a furnace that had been destroyed. Around a concentration of iron ores of about 10 cm, at the depth of 30 cm were two fragments of porcelain and a hole with a diameter of 10 cm, which is thought to be a channel to draw air into the furnace. A tiny piece of ceramic (2 x 1 cm) was found about 2 m to the southwest of the hole, with iron ores and fragment of tuyere. There is a possibility that the ceramic was related to a ritual as part of the smelting activities. Dating analysis using charcoal sample from TP1 carried out at the laboratory of the Waikato University produces a date of 350 cal BP or 1600 CE (Hartatik et al. 2019).

Buren Jaga
The site of Buren Jaga is located in a tropical rainforest within the village of Kandui, about 50 m from Layung Bura River, which is a tributary of the Montalat River. A survey in 2018 yielded indication of a furnace, which was covered by a termite nest. During the 2019 excavation two furnaces
were found in two different sizes. The big one is 113 cm high and the small one is 52 cm high. Their outer shapes are rounded and the inner shapes are rectangular. Both were located 2 m apart. Besides the furnaces, there were also fragment of tuyere, iron ores, raw iron ingot, iron slag, and a rectangular whetting stone. The whetting stone is similar to the stone found at Buren Temelalo and is assumed to be a tool to shape the inner part of the furnaces into squares. Charcoal was found inside and under the furnaces.

Carbon-dating analysis from charcoal sample conducted in the Waikato University shows a date of 130 cal BP or 1820 CE, which is in accordance with the information from the land’s owner, Markus Mirun (93 years old) that the *buren* was last used by his grandfather’s father or about 150 years ago (Hartatik et al. 2019).

**Furnace, Tuyeres, Iron slags, and Iron Ores as Indications of Iron-smelting Sites**

The location of the iron-smelting sites is near rivers, due to its closeness to the material source. Laterite iron ores are situated on the banks and sandbars of the Montalat River and its tributaries, among others Benangin and Semayap rivers. Mineral analysis on the laterite iron ores from the Montalat and Semayap rivers shows high percentage of iron with a concentration of about 90% (Hartatik, et al. 2019). Results of the analysis support the travel accounts during the European colonial period that in Borneo there were abundant and high-quality laterite rocks as iron ores, which can be paralleled to Swedish ores (Blust 2005).

The process in iron industry include searching for raw material, making furnaces and tuyeres, preparing iron ores, and smelting. The presence of iron ores in fine grains shows that before being smelted, the ores were crushed to make it easier to separate the mineral elements during the smelting process (Bronson 1985). The uncrushed ores were placed beside the furnace, and the crushed ones were also placed near the furnaces. This is due to practical reasons, because after being crushed, the ores are ready to be smelted in the furnace to produce raw iron.

At Buren Temelalo, Buren Benangin, and Buren Jaga remains of raw iron were found inside the furnace, which are results from the smelting process. Laboratory analyses on the mineral content of the raw iron remains from Buren Benangin and Buren Jaga reveals high iron content, which is about 87%, while the iron content of the iron slags from Buren Jaga is 51.76% that reveals a less effective bloomery process (direct smelting) with iron extraction directly from iron ores.

Seven smelting furnaces found at the four sites have rounded outer shape and inner square shape. The inner surfaces are covered by a mixture of black soil and charcoal. The presence of charcoal inside the furnaces have supported the assumption that the fuel used in firing the furnaces and smelting the iron ores is charcoal from ironwood or *ulin* wood, and *halaban* wood. These types of wood are the strongest wood from the trees that grow well in the Kalimantan tropical rainforest.

Tuyere is a clay pipe that functions as an air channel that was mounted to a hearth to supply oxygen (O2) during the smelting process (Killick 2014). The tuyeres found at Buren Benangin and Buren Jaga are relatively intact, with a length of about 14 cm, hole’s width of 5 cm, and thickness of 2 cm. At one of the ends there is melted iron, which reveals that the tuyeres were put deep enough into the furnace (Bandama et al. 2013).

Iron slag is the waste material from the iron-smelting process. They are chunks or irregular plates of various sizes. Their surface are usually smooth because they were formed by melted iron, which was then solidified when the temperature reaches a melting point at 1538o C (Killick 2014). In the iron smelting process, the minerals that contain iron detached themselves, forming chunks and grains called raw material or ingots, while the materials that contain only small amount of iron separated
and form slags. The waste of ingots are present in all metal-smelting process, particularly in iron and gold-smelting activities (Soriano et al. 2018).

In furnaces found at Buren Temalalo, Buren Benangin, and Buren Jaga there are white chunks of what is thought to be limestone used as fluxes which are materials added to the furnace to lower the melting point temperature during the smelting process. However, laboratory tests reveals a domination of silica (Si) elements, about 70%, which was mineral in clay, while calcium (Ca) as the main element of limestone is very low (less than 1%) (Hartatik et al. 2019). There is no indication of other fluxes, hence it can be assumed that the iron-smelting technique along the Montalat River did not use fluxes, be it limestone or mollusc shells.

Based on ethnographic data, we learn that the iron-smelting along the Montalat River had been abandoned since four generations ago. If each generation was 25 years apart times three generations plus the average age of the informants (70 years), then the estimated age of the last iron-smelting activity was 145 years ago. The radiocarbon dating analysis using charcoal sample from the furnaces shows that the Buren Benangin dates back to 16th – 19th centuries, and the youngest is Buren Jaga, which dates to 130 cal BP or 1820 CE (Hartatik et al. 2018, 2019).

**Comparison with the Iron-smelting Site at Sungai Batu, Kedah, Malaysia**

Based on the radiocarbon using results of excavations at Chansen and Lopburi (Central Thailand), Santubong, Bongkisan, and Jaong (Malaysia), the iron industry in Mainland Southeast Asia existed since the first millennium BCE. At those sites were found almost similar types of artefacts, which are iron ores, furnaces, tuyeres, and iron slag. There, furnaces are not found intact. At the site of Jaong, besides traces of iron-smelting, there is also a large stone with anthropomorphic and geometric carvings that are related to the myth and ritual in iron-smelting process, particularly the making of keris (O’Connor 1977). In Dong Phlong, Buriram Province in Northeast Thailand, 17 iron smelting furnaces were found in ruined condition. Radiocarbon date of charcoal from Dong Phlong site in the 60 – 310 BC, while iron industry in Khorat Plateau in the first millennium BCE (Nitta 1997). Bronson assumed that iron smelting in Thailand was not imported from China, but originated in Thailand since 5th century BCE (Bronson 1985).

In the area of Sungai Batu, Lembah Bujang in Kedah, Malaysia, there are 17 iron-smelting sites, with finds that include iron wastes, charcoal, iron ores, and thousands of tuyere fragments. The iron industry flourished within a period of 21 centuries (535 BCE to 15th century CE). The smelting processes used the direct technique (bloomery) with melting temperature between 1150° and 1200° Celsius, with mollusc shells as fluxes. The iron from Sungai Batu was known as the black iron, which was traded up to India (Naizatul and Mokhtar 2018).

The smelting furnaces found at the sites were destroyed intentionally to take the iron at the bases of the furnaces. The shapes of furnaces at Sungai Batu are not known. From the matrix at the site can be deducted that the shape was rounded on both inner and outer parts (Figure 4). The shapes of the furnaces at Sungai Batu are analogous to those from Kampung Gading at Jeniang, about 40 km to the northeast of Sungai Batu Site. At Kampung Gading Site were found remains of an iron industry, namely tuyere and relatively intact furnaces. There are seven oval furnaces, which shapes resemble ceramic jars (Figure 5). The date of the charcoal analysis shows that the Kampung Gading Site functioned during 4th to 12th CE (Pusat Penyelidikan Arkeologi Global Universitas Sains Malaysia 2010).
Based on the current understanding, the iron-smelting industry at Lembah Bujang existed since 4th century BCE and was one of the local wisdoms of the indigenous people, not Indian influence (Zulkiskandar et al. 2014). In India, the oldest iron-smelting was performed by the Khasi ethnic group in the Meghalaya Mountains occurred at around 353 BCE up to 128 CE (Prokop and Suliga 2013). But, we think that iron melting technology does not stand alone but influence each other, especially with the nearest neighbours. Thailand recognize iron industries even older than Kedah (that is 5th century BCE) and Thailand much closer to Kedah. Therefore, we think that it is very possible that Kedah’s iron smelting technology may have been carried from Thailand.

The owner of iron smelting technology in Sungai Batu still vague, it was possible the Orang Asli, such as Negrito or Senoi whose used Austroasiatic language. The iron ores smelting in Kedah is on prehistoric times, where the prehistoric peninsula of Malaysia was closely related to Orang Asli (Adi 1989). So far, the mastery of ironworking technology by Austronesians in 200-500 BCE is still a question to be explored (Bellwood 2000). The research about language and terms of iron by Robert Blust led to the conclusion that iron smelting and iron smiting were the cultural innovations of Champa Malay, which were then borrowed by early Monic speakers who spread to the Gulf of Thailand (Blust 2005). From the Gulf of Thailand then spread south towards the Malacca peninsula to Kedah and then to Kalimantan.

Ethnographic data shows that the owner of iron ores smelting technology in the Montalat watershed is Dayak Tawoyan people. The iron ores smelting has been abandoned since four generations ago or around 150 years ago. It make sense with the results of radiocarbon dating from the charcoal samples of the Buren Benangin, Buren Jaga and Buren Temelalo sites in the 17th century until early 19th century. Besides buren, the evidence of iron smelting are iron blades (bilah besi) and traditional weapons such as the saber (mandau) which are produced from buren. It is as a legacy by Dayak Tawoyan people.

Although the shape of the inside furnace between Montalat and Kedah are different, the Montalat furnace is square and the Kedah furnace is round (Figure 4), but the outside furnace are the same, that are rounded. The similarity outside shape of the smelting furnace and the existence of the tuyeres suggest that the smelting iron ores in Montalat was related to the iron ores smelting in Kedah. The iron ores smelting technology comes from the same place or brought from the same place. Based on the age, the Sungai Batu site was older than Montalat site, so there was a possibility that the iron ores smelting technology in the Montalat watershed was influenced by the relationship from Kedah. Its
effect from the relationship between humans and the process of adaptation and negotiation. In this contact, negotiation takes place when innovation is adopted (Gosselain 2016).

Lembah Bujang as the kingdom of Kedah Tua from the beginning of Common Era until the 14th century CE was a port in the regional trade routes. The trade network uses the Merbok River and the Muda River with the royal centre along the Pangkalan Bujang River (Azlin et al. 2010). On the other hand, the Kedah Tua Kingdom was once part of the Srivijaya Kingdom so trade relations to the east (e.g., Java, Sumatra) existed. The peoples from the Southeast Asia, Indians, Chinese and Arabs traded there (Azlan et al. 2012). The trade moved from Kedah in the Malacca Strait to Sumatra, Java and Kalimantan. In Kalimantan, the spread of technological influence either by traders or immigrant groups were carried out through large rivers such as the Barito River and then entranced its tributaries, including the Teweh River and the Montalat River in the upper.

Iron smelting technology in Montalat watershed might the result of diffusion and intercultural connections. Although the basic shape of the furnace and tuyere are the same, the difference of inside furnace’s shape shows the existence of variety and creativity of the Montalat people. The experimental study shows that the square shape contains more smelting materials than round shape (Hartatik et al. 2019). The on the other hand, the smelting iron ores in Malaysia used shellfish as flux, while in Montalat no fluxes were used as there was no similar material found on. It shows that iron smelting technology in Montalat is from outside then adapted by local people in accordance with the geographical variations.

**Conclusion**

Archaeological research on the Montalat watershed found at least thirteen sites of iron smelting which is characterized by iron slag, tuyeres, charcoal combustion, smelting furnaces, and iron ores. The seven furnaces with approximately the same shape and size were found in four sites. The bottom of the furnaces measure 45 x 45 cm with a height of about 1 m, and wall thickness of about 10-15 cm. The furnaces were found in incomplete condition; especially the upper part and one side of the walls are destroyed. Tuyere has a length of about 14 cm, diameter is 3-5 cm, and a thickness of about 2-3 cm. *Buren* sites with iron smelting furnaces in Montalat watershed is the first complete discovery in Indonesia. The radiocarbon dating analysis known that the iron smelting in Buren Benangin and Buren Temelalao took place in the 16th and 18th centuries.

Based on its comparison and chronology, the iron ores smelting site in Kedah is older than in the Montalat watershed, so it can be concluded that the iron ore smelting technology in Montalat is an innovation of the iron ore smelting in Kedah. The technology is adapted to local geographical conditions and creativity of the local people. The inside of the furnace is not round shape but square which contain more smelting materials than round shape. Likewise, there is an absence of sea shells used as a flux in the smelting of iron ore in the Montalat watershed because it is located in a tropical forest which far from the sea.

**Acknowledgments**

We would like thank to our colleagues on the Montalat research team: Sunarningsih, Nugroho Nur Susanto, Eko Herwanto, Gauri Vidya Daneswara, Restu Budi Sulistyo, and Ismail, who have contributed to the research of metal at the Montalat watershed.

**References**


de Schwaner, CALM (1853) Borneo Beschaving van Het Stroomgebied van Den Barito [Borneo Civilization of the Barito River Basin]. Amsterdam: P. N. van Kampen.


Patterns in Dental Health and Disease in the Philippine Pre-Spanish Colonial Period

Mga Pattern ng Sakit at Pangkalusugang Dental Noong Si-naunang Panahon sa Pilipinas

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Patterns in dental pathologies and lesions can be used to investigate the general health status of past populations, since teeth are remarkably effective as an aid for interpreting diet, living conditions and habits between ages, and the change (gradual or abrupt) of cultural traditions. This preliminary research macroscopically evaluates the biological indicators of dental health (occlusal wear, caries, periodontal disease, and antemortem tooth loss, AMTL), including dental defects (linear enamel hypoplasia, LEH), in human skeletal remains to determine the overall health status of two human skeletal assemblages from two coastal archaeological sites. Samples derive from two sites in the Philippines, dating to two periods – c. 500 BCE to 500 CE (Metal Age), and 12th to 16th century, respectively. There are significant differences between the sites in frequencies of dental health indicators. On the other hand, occurrence of LEH show no significant differences between the sites. Variations and similarities in dental disease and childhood stress (LEH) frequencies between the assemblages may be due to local disparity in cultural, microenvironment, and/or temporal differences, the age structure of the samples, as well as the diet and food preparation.

Introduction

The condition of an individual’s teeth can reflect the food consumed, and thus gives valuable information for deducing past lifestyles, including diets and behaviour, which further suggest their living environments, cultural practices, and type of economy (Eshed et al. 2006). Inferences can be made because different diseases affect teeth in distinguishable ways, and thus can be examined to provide association for health disparities. Variability in dental health indices within or between populations is generally induced by environmental, cultural and technological constraints, which include food resources limitations and food preparation practices, as well as insights into possible gender inequality, social class or status, ethnic affiliation, and religious beliefs (Bonsall 2014). Examination of these indices have multifaceted aetiologies that can be reconstructed only by examining all the factors together (Gagnon and Wiesen 2013). Moreover, dental diseases and anomalies are the most common disease observed in early human populations (Eshed et al. 2006; Lukacs 1992; Roberts and Manchester 2010). Generally, high incidence of dental pathologies within population suggest poor oral health (Alt and Pichler 1998; Hillson 2001). Dental pathologies have different aetiologies, yet there is comorbidity or multimorbidity between these diseases (van Schaik et al. 2014).
As a preliminary study, this paper aims to macroscopically assess the overall health status of pre-Spanish human skeletal assemblage from two coastal archaeological sites by investigating the indicators of dental health, which includes caries, antemortem tooth loss (AMTL), periodontal disease, calculus and occlusal wear. From this evaluation, possible diet and subsistence can be inferred.

Previous archaeological investigations of health status from pre-Spanish colonial Philippines
There is minimal information on the health status of the past peoples in the Philippines before the onset of the Spanish colonisation. Most written literature on health and diseases are during the Spanish and American colonial periods, which are based on historical documents (e.g. Anderson 2006; de Bevoise 1995; Newson 2009; Raudzens 2003). However, bioarchaeological researches that focus on the pre-colonial health status in the country have gradually increased. There are currently three studies as of this writing: Medrana (2005) examined the human skeletal assemblage from Guyangan Cave in Baton Island, Romblon, while Gutierrez (2015) investigated the prehistoric human skeletal remains from Ille Cave, Palawan, and lastly, Labidon (2012) compared the health status of pre-colonial and colonial period individuals from four different archaeological sites (Ille Cave and Sibaltan in Palawan, Bongabong in Mindoro, and Catanauan in Quezon Province). All three studies found low incidences of oral pathologies, especially caries and AMTL during pre-colonial times. The low occurrence of carious lesions was attributed to consumption of mainly marine proteins and other low cariogenic foods. However, Gutierrez (2015) found high frequency of periodontal disease and calculus deposits in the Ille assemblage, which was associated to betel quid chewing. These aforementioned studies suggest that past populations in the Philippines suffered minimal oral pathologies compared to the population during the colonial period. Yet, the environment, climate, population structure and density, food resources and diet, and occurrence of infectious diseases should be considered (Medrana 2005), since any or combination of these variables can influence the health of a population.

Materials and Methods
The teeth examined in this paper come from two coastal archaeological sites, excavated by the Archaeological Studies Program of the University of the Philippines and the National Museum of the Philippines between 2011 and 2012. The two sites are: (1) Sapilang Site in Sinait, Ilocos Sur, and (2) San Juan Nepomuceno Parish Church Compound, San Remigio, Cebu. Chronology was established through relative dating for the Sapilang Site, based on the Chinese coins, trade ware ceramics and glass beads recovered, giving the site a range from 12th to 16th century. On the other hand, the San Juan Nepomuceno Parish Church was dated to 1500 BP (Acabado, pers. comm. 2019), falling within the Philippine Metal Age (500 BCE to 500 CE) established by Fox (Garong and Bersales 2011).

Only individuals with preserved teeth or partially intact dentitions (at least one surviving tooth with corresponding socket) regardless of age and sex were examined for the biological indicators of dental health using a hand lens with 10x magnifying power and a Nikon SMZ745T stereomicroscope with a maximum of 10x zoom. Caries was recorded, with consideration of its location on the tooth surface, using a modified version of the coding system presented by Hillson (2001). The periodontal disease was evaluated using the screening system introduced by Ogden (2008), wherein the buccal contour of the alveolar margins of the teeth were scored based on its morphology. Occlusal wear and calculus was scored using the guidelines set by Buikstra and Ubelaker (1994: 52-53, 56, respectively), while AMTL was documented using Hillson’s (2001) system, wherein the missing tooth and the degree of alveolar remodelling were logged. Linear enamel hypoplasia (LEH), an indicator of childhood stress (Crowder et al. 2019; Halcrow and Tayles 2008; Lukacs et al. 2001), was recorded as either present or absent.
Results

Sapilang, Sinait, Ilocos Sur

The Sapilang archaeological site is located at Barangay Calanutian in the Municipality of Sinait, Province of Ilocos Sur in northwestern Philippines. It is approximately 700 meters from West Philippine Sea, with an elevation of 11 meters above sea level (Canilao 2015, 2012, 2011). At least 16 human skeletal remains were unearthed during excavation seasons 2011 and 2012, however not all have its dentition intact. The majority of the human inhumation were commingled and disturbed, possibly due to the re-use of the burial space (Canilao 2015; Lara 2012), and ploughing of the area in recent times (Canilao 2011). For this paper, seven individuals (n=7) were evaluated for dental health analysis.

Only two individuals exhibited caries – C122 and C407 individuals, both found on the molars. C122 has two carious lesions on its left maxillary second molar (LM2) at its mesial and distal interproximal surfaces, and another on its left maxillary third molar (LM3) at its mesial interproximal surface; while the caries on C407 is on its left mandibular second molar (LM2), at its distal interproximal surface.

Six individuals displayed periodontal disease, in which the overall range extends from moderate to severe. Individuals C423, C259 and C207-2 showed mild periodontitis, wherein the alveolar margins were blunt and flat-topped with slightly raised rim. Individual C207-1 demonstrated mild periodontitis on its left mandible and at its right 3rd molar alveolar margin, and a moderate periodontitis on right mandible, which is illustrated by its rounded and porous alveolar margins. On the other hand, individual C407 exhibited moderate periodontitis on its maxilla and a severe periodontitis on its mandible, where the alveolar margin is ragged and porous, with an irregular funnel of about less than 5mm depth between the tooth and alveolus. Individual C122 indicated mild periodontitis on its left mandible, and a moderate and severe periodontitis on its right maxilla. The last individual, C1205-1 did not show periodontitis, likely due to its incomplete dentition.

As for its other biological indicators, the occlusal wear of the individuals ranged from moderate to severe, and the incidence of calculus deposits was consistently moderate to severe across the assemblage, and the AMTL was high in two individuals (C122 and C407). Lastly, four individuals – C423, C407, C259, and C207-1, exhibited linear enamel hypoplasia (LEH).

San Juan Nepomuceno Parish Church, San Remigio, Cebu

San Remigio is located in the northwestern part of the island of Cebu, bounded on the west by the Tañon Strait. The San Juan Nepomuceno Parish Church is only a few meters away from the sea. At least ten human burials were unearthed, both extended and in jar burials, during its excavation seasons in 2011 and 2012. Only four individuals (n=4), all primary, extended burials, from the 2011 excavation were included for this paper.

No caries were found amongst the four individuals, and indications of periodontal disease were only found in two individuals – SR1-B3 (mild periodontitis) and SR1-B2 (severe periodontitis). Occlusal wear was found to range from low to moderate, while the frequency of calculus deposits was low across the individuals. Only individual SR1-B2 displayed AMTL, with three molars (LM2, LM3, and RM2) absent and its alveolar sockets displayed bone remodelling. SR1-B2 also exhibited LEH on its maxillary teeth.

Discussion

Examination of the correlations among caries, calculus, AMTL, periodontal disease, and condition of occlusal wear may provide insight on co-occurrence or comorbidity of disease expression, since one
or two of these can influence the presence or absence, and low or high incidence of the other. Additionally, one pathological condition may have increased or decreased the risk or susceptibility of the other condition (van Schaik et al. 2014). For instance, caries and calculus are inversely proportional to one another. Although both caries and calculus are expressions related to plaque accumulation, wherein the plaque pile-up may eventually lead to tooth decay, caries demineralises the enamel while the calculus creates a mineralised form on the tooth surface (Duyar and Erdal 2003; Hillson 2001; Limbo 2013; Marin et al. 2005). This inversely proportional relationship of caries and calculus is evident within the assemblages.

The low frequency of caries observed suggests that the individuals possibly consumed foods low in carbohydrates. Carbohydrates are generally linked to high incidence of caries in the past, since the development of an agricultural-based economy resulted in a diet with high amount of carbohydrate staple foods (e.g. maize, wheat, tubers such as taro and yams) (Tayles et al. 2009). However, not all carbohydrates have the same cariogenicity (Tayles et al. 2000), such as sugar versus starch (Hillson 2001; Limbo 2013; Marin et al. 2005). Sugar (sucrose), by comparison, is a mono- or disaccharide that is highly cariogenic (e.g. banana). Fresh fruits and vegetables, on the other hand, have low cariogenicity as the carbohydrates in it are broken down rapidly because their texture requires chewing, and chewing increases the salivary flow rate and the clearance rate (Lukacs et al. 2001; Oxenham and Tayles, 2006; Tayles et al. 2000).

Rice, being the centre of most Southeast Asian diets, is a carbohydrate-rich food, yet it contains low cariogenicity (Lingstrom et al. 2000; Tayles et al. 2009, 2000). Spanish documents describe coastal Ilocanos as farmers, and the land as very fertile, suitable for raising rice, wheat, sugar cane, and cotton; numerous streams also supplied water for the well-elaborated irrigation systems of the Ilocanos (Kessing 1982; McLennan 1980; Newson 2009). Therefore, wet-rice cultivation was possibly practiced in the lowlands, in a small scale due to seasonal rainfall (Newson 2009). Ethnohistoric accounts also show that the Ilocos coastal inhabitants exchanged rice from the upland peoples, and then traded with foreigners (e.g. Chinese traders) since the Ilocos coast was a centre of maritime trade during at least 14th to 16th century (Agapin et al. 2011; Canilao 2015; McLennan 1980; Newson 2009; Scott 1984). Another possibility for the low incidence of caries recorded in the assemblage is the consumption of vegetables and root crops (McLennan 1980). Although vegetables are known to have low cariogenicity, the cariogenicity of available root crops in the area are unknown. Additionally, high consumption of marine foods and meat products may have led to the low carious lesions, as these are less cariogenic (Okazaki et al. 2013; Oxenham et al. 2006).

Similarly, the island of Cebu was a port for Chinese, Southeast Asian neighbours, and other islands in the Philippines before the arrival of the Spaniards (Churchill 1977, Newson 2009; Scott 1984). Ethnographic accounts on the island in the 16th century CE have mentioned that the staple foods were rice, millet, taro, yams, and bananas (Newson 2009; Scott 1994). The carbon and nitrogen isotopes study of the human skeletal assemblage from Boljoon archaeological site (Garong 2013), southeast area in Cebu, found that the individuals were dependent on terrestrial C4 plants, such as millet (locally known as dawa). Newson (2009) surmised that millet was consumed as the main crop rather than rice or maize during pre- or early colonial period, since drier conditions favoured its cultivation; and maize was only introduced when the Spaniards have established a settlement in the island (Blair and Robertson 1903). Millet, however, is a cariogenic cultigen (Okazaki et al. 2013; Turner 1979), yet the incidence of caries in the assemblage is low. Reasons for this can be attributed to (1) the small sample size, (2) how millet was processed or prepared, which may have reduced its cariogenicity (Lingstrom et al. 2000; Okazaki et al. 2013), or (3) the consumption and quantity rate. The moderate to severe score of dental occlusal wear possibly also aided with the low prevalence of caries, since continuous and rigorous activity-induced use of teeth can mechanically eradicate food debris from dental surfaces (Chazel et al. 2005). Furthermore, consuming coarse foodstuffs increases the rate of wear, yet also accelerates salivary flow that quickly clears the starchy material from the
mouth. This action indirectly affects caries development, since it removes the sites of plaque and bacteria accumulation from pits and fissures (Tayles et al. 2000: 77-78). For the Sapilang assemblage, the dental wear is unlikely the cause of low carious lesions due to the frequency of calculus observed in the dentition.

The question of how diet affects calculus formation is complicated. Nonanthropological and non-archaeological literature is abundant, however diet and its effect on calculus accumulation have been inadequately investigated. Without direct analysis of the calculus and information on the environment, subsistence patterns and the like, the best that could be done is to link the possible implications of dietary factors on the etiology of dental calculus. It is generally accepted that calculus formation flourish in an alkaline environment (Pietrusewsky and Douglas 2012). It is also recognized that diets high in protein result in increased calculus formation. Though not directly, protein intake does affect the oral pH. Dawes (1970) explained that protein causes an increase in blood urea levels, and since mineral levels in blood are directly associated with those of other body fluids, it also leads to increased oral fluid urea levels. When the oral bacteria metabolize the urea, the process produces ammonia which in turn result in increased alkalinity. Thus, it follows that, incidentally, diets high in protein can facilitate calculus accretion.

Both Sapilang and San Remigio are coastal localities. Spanish accounts described Ilocos as forested area with numerous streams and abundant in pigs, goats, búfanos, deer and several types of water birds; while Cebu also has domesticated animals such as pigs, goats and chickens, as these were frequently offered to Miguel Lopez de Legazpi (Newson 2009). Archaeozoological remains were found in both sites, yet not enough as evidence for food consumed, in the case of the Sapilang site. Net sinkers, however, were also recovered, which indicates the likelihood of fishing as one of the Sapilang past inhabitants’ subsistence. According to the isotopic study by Garong (2013), there is more reliance on marine resources than terrestrial resources for protein intake for the Boljoon human skeletal assemblage. It is then possible that the past inhabitants of San Remigio were also reliant on marine resources for their protein intake.

Carbohydrate-rich diets have also proven to advance calculus formation. The soft, sticky quality of many carbohydrate rich foods, and its lack of abrasivity assist in bacterial colonization and plaque development (Douglas 2006; Lieverse, 1999; Lillie 1996; Lillie and Richards 2000; Mickleburgh 2012; Oxenham et al. 2006), but may not always increase mineralization of the plaque, which is a process that requires an oral alkaline environment that is not provided by carbohydrate diets (Douglas 2006).

The teeth of the Sapilang assemblage exhibits dark-reddish brown staining from the incisors to the premolars, with some molars having a lighter expression of the staining. This suggest the probability that these individuals practiced betel quid chewing. The same staining pattern have been documented in previous dental analysis in the Philippines (e.g. Medrana 2002; Gutierrez 2015). The areca nut (Areca catechu L.) contains an alkaloid, arecoline, that when mixed with the saliva and other microelements create an alkaline environment in the oral cavity (Oxenham et al. 2006), and the act of chewing itself increases the salivary flow rate (Tayles et al. 2009). This practice, therefore, likely enhanced the calculus formation in the individuals of the Sapilang assemblage. Additionally, areca nut is also a known cariostatic, which tends to inhibit the formation of caries (Douglas 2006; Howden 1984; Oxenham et al. 2006; Pietrusewky and Douglas 2012; Schamschula et al. 1977). Then, it follows that the calculus deposits in the Sapilang assemblage is high, and caries have low incidence. High calculus deposits and betel quid chewing can be cytotoxic to periodontal fibroblasts and can exacerbate pre-existing periodontal disease (Trivedy et al. 2002). Chatrchaiwitatana (2006) have studied the relationship between caries, periodontal disease and betel quid chewing, wherein it revealed that betel quid chewing is directly associated with periodontitis.
As for the San Remigio assemblage, the probable cause for the presence of periodontal disease can be attributed to poor oral hygiene. Although the frequency of calculus deposits only ranges from mild to moderate, and there is occurrence of gingival inflammation (based on the changes on the alveolar margins), the individuals were not affected by progressive chronic periodontitis that is severely enough to result in periodontal morbidity and tooth loss (Raitapuro-Murray et al. 2014). Raitapuro-Murray et al. (2014) suggest that other major factors that could result to moderate-to-severe chronic periodontitis include genetic factors and systemic factors (e.g. diabetes mellitus).

Antemortem tooth loss (AMTL) is not an isolated occurrence, but a consequence of periodontal disease, severe caries and wear, or deliberate removal of the tooth (trauma) as either part of a cultural practice or dental surgery (Bonsall 2014). Only two individuals (C407 and C122) from the Sapilang assemblage, and one individual (SR1-B2) from San Remigio assemblage showed AMTL, which were located at the posterior of their mouth. Changes in the alveolar margins were also observed on some of the alveoli with the teeth still present (or lost postmortem). For the Sapilang assemblage, the likely cause of AMTL is periodontal disease; while for the San Remigio assemblage, it remains inconclusive.

Linear enamel hypoplasia (LEH) is a dental defect that indicates stress experienced early in life and provides a ‘memory’ of earlier metabolic events (Goodman et al. 1980). LEH has the greatest potential to reveal about the duration of enamel growth disturbances (King et al. 2002, 2005). Aside from growth disturbances, other in information that can be gleaned from examining LEH include: differential treatment of the sexes, differences between the health status of elite children versus non-elite childfree, and the patterns and implications of early weaning (Maclellan 2005). Enamel defects reflect stress in the body of a child up until seven years of age. The crowns of teeth develop in an overlapping sequence that begins just after birth for the first permanent molar and ends around the sixth to seventh year of life for the second molar. The third molar is then still forming, and could as well be used, but the growth of the third molar crown is unpredictable, thus it is often not used in analyses of timing the defects (Hillson 2003). Three suspected causes of formation of hypoplasia during childhood are genetic abnormalities, trauma, or metabolic stress. Cases of LEH caused by genetic abnormalities and trauma are rare in the archaeological realm, since those individuals have a significantly low chance of survival, which would not give the defect sufficient time to appear on the enamel surface. Because of the low chance of survival, the majority of LEH cases in archaeology are assumed to be caused by metabolic stress (Goodman and Rose 1990).

When there is a period of stress or trauma is experienced, such as high fever, malnutrition, or hormonal changes, by an individual, these insults cause disruptions with the ameloblasts production of the enamel matrix, which then manifests as dental enamel hypoplasia (DEH) in the individual (Hillson 1996). Its severity corresponds with the length of the stress or trauma that the individual experienced (Goodman and Rose 1990). For example, if an individual had a severe illness, the hypoplasia might appear in a wave-like pattern which relates to the severe periods of illness. Because the disruptions that cause LEHs affect only a portion of the crown that is in the process of forming, determining their locations allows researchers to reconstruct chronologies of stressful events (Ritzman et al. 2008).

LEH is present in both human skeletal assemblages, thus the individuals with this defect experienced early stress in life. However, it is difficult to determine what could have caused this stress. It could have been due to malnutrition, shift of diet, diseases, or climatic or environmental changes. According to the historical accounts on Ilocos, it was observed that the locals barely produced enough food to feed themselves, and for part of the year had to live off root crops (Newson 2009). Additionally, there were threats of flood and droughts due to the highly seasonal climate, and infestations of rats and locusts. Spanish records have also consistently described the coastal area of Ilocos and Cebu
as densely populated (Doeppers and Xenos 1998; Keesing 1922; Newson 2009; McLennan 1980),
perhaps because it was a maritime trade centre at that time, which may have contributed to the spread of
diseases.

Continuous and prolonged activation of the stress response system can cause functional disorders in
the immune system. Thus, the individuals from both assemblages may have survived the initial att-
tack of stressors early in life and have grown into puberty or adulthood. But with their compromised
immune system, it likely gave them a low chance of survival when another onset of stressors, such as
diseases, struck.

**Conclusion and Recommendations**

This paper provides a preliminary analysis on the health status of past populations from Philippine
pre-Spanish Period through the evaluation of its dentition. The dental health may have shown that the
individuals from Sapilang and San Remigio consumed low cariogenic foodstuffs, and likely subsi-
dised through fishing, foraging and semi-agriculture. The individuals are fairly healthy, but had poor
oral hygiene, which can increase cardiovascular and metabolic diseases, since bacteria that infect the
gums also travel to blood vessels elsewhere in the body, where it can cause blood vessel inflamma-
tion and damage; or rather than bacteria causing the problem, it is the body’s immune response that
sets off a cascade of vascular damage throughout the body, including the heart and brain (Najafipour
et al. 2013; Sanchez et al. 2017). The presence of LEH suggests the individuals have experienced
insults or illnesses at a young age. These insults likely compromised their immune system, and insti-
gated a lifelong frailty, which could have led to further vulnerability, which led to enhanced chances
of early death when they acquired illness later in life.

This preliminary research can be further substantiated with the utilisation of high-resolution ana-
lytical techniques, such as stable isotope analysis, analyses of dental microwear and microfossils of
plant remains from calculus deposits. Analysis of other pathological conditions, or more in-depth
analysis such as the timing of LEH can add insights regarding the health of these individuals. And
lastly but not in the least, compare features of the population with those of others, archaeological or
otherwise, in the Philippines and Southeast Asia.

**Acknowledgements**

I would like to thank Dr. Michael Armand P. Canilao, and to the ones who made ISAP possible: Pro-
vincial Government of Ilocos Sur (PGIS) headed by Luis “Chavit” Singson (governor) and Deogra-
cias Victor “DV” Savellano (vice governor); the municipal mayors Marlon Ines (Sinait), Germlina
Singson-Goulart (Caoayan), Edgardo Cobangbang, Jr. (Cabugao), Bernard Sarmiento (San Juan),
Clifford Patil-ao (Quirino), Ruel Sumabat (Allilem), Fernando Quitton (Sugpon); and Barangay
captains Reynaldo Ocampo (Patiacan), Matthew Cayat (Danac), Philip Bringas (Nagsingcaoan),
Rolando Ramoss (Refaro); PGIS Heritage Consultant Eliza Agapin and PGIS Research Consultant
Maria Lourdes “Malot” Ingel; Ms. Fe Yanoria-Calixterio and Mr. Yagin, owners of the land where
the archaeological site is located; and members of the ISAP team.

To Dr. Ame P. Garong, Dr. Jose Eleazar R. Bersales, Dr. Stephen Acabado, and the National Museum
of the Philippines.

**References**

Agapin, E, Canilao, MAP and Faylona, PG (2011) The old biray in Pandan, Caoayan: An underwater
cultural heritage assessment. In: MAP Canilao (ed.) Calanutian: archaeology of a pre-Spanish


Ethnoarchaeological Study of Megalithic Monuments in Nias: Comparative Study of Megaliths in Bӧrӧnadu and Orahili Fau

Kajian Etnoarkeologi pada Monumen Megalitik di Nias: Studi Perbandingan Megalitik di Bӧrӧnadu dan Orahili Fau

Elyada Wigati Pramaresti
Ullen Sentalu Museum

Megaliths of each area in Nias, Indonesia show difference in shape and function. It is also noted that nowadays the ritual practice of building megaliths is not consistently carried out by every local community in Nias Island. This research focuses on megalithic monuments located in two villages, Bӧrӧnadu of Central Nias and Orahili Fau of South Nias. Although there are many stone monuments distributed within the area of Bӧrӧnadu village, the activities which include megaliths construction and usage are no longer exist, whereas in Orahili Fau, stone monuments are still being constructed, even to this day.

Introduction

One of the phenomena that emerged during the prehistoric period of Indonesia was the megalithic culture. The word megalith is derived from the Ancient Greek, mega means “great” and lithos means stone (Whitehouse 1983: 313). These words literally refer to the notion of megalithic as a culture that uses large stones. Another description expressed by Wagner has caused the definition of megalith to widen because the concept is not limited to the object’s material, but is applied to all archaeological remains which are related to the worship of ancestors (Wagner 1962: 25-28).

Wagner’s explanation has given a different understanding because the usage of other materials like wood can also be categorized as megalithic as long as the objects have the function to praise the ancestral spirits. The statement raises the assumption that all megalithic monuments were always related to religious occasions (Sudarmadi 1999: 73-74). The shift of megalithic concept from man-made boulders into a component of religious activities has created disorientations in various studies. Many scholars indirectly use the common sense analogy, the assumption held by individuals or groups today based on general principles (Tanudirjo 2009:8) in which the existence of the ancestors becomes the main reason of the erection of these great stones. In fact, megalithic monuments that vary in size and shapes are not always related to the reverence of certain spirits.

Some areas in Indonesia which possess megalithic culture show that the making of stone monuments is not associated with a religious purpose on every occasion, but it is linked to other aspects. This can be seen through the use of megalithic monuments in Nias Island. The small island is about 85 miles long and is located in the western part of Indonesia (Feldman 2011:36). Administratively, Nias is divided into five regencies, the North Nias, Municipality of Gunungsitoli, Nias Regency, West Nias, and South Nias. In terms of culture, Nias has three areas, namely the North, Central, and South with distinct customary procedures, language, and material culture (Feldman 1984: 21 and 2011: 36-37;
Two of three cultural areas, Central and South Nias have a large number of megalithic monuments.

The existence of megalithic monuments are important for the native inhabitants of Nias because these large stones complement traditional ceremonies. A series of feasts were held and megalithic monuments were used in the process (Beatty 1992:217-218). Nowadays, not all local communities in Nias villages carry out activities related to megalithic use. In this case, two Nias villages will be examined, namely Sifalagö Gomo Börönadu or simply known as Börönadu in the Central and Orahili Fau in the South. Sifalagö Gomo Börönadu, which recently became part of Börönadu District 1, is believed as the oldest settlement in Nias and has many stone monuments within the village area. However, rituals related to the establishment or the use of megaliths are no longer practiced by the villagers. On the other hand, in Orahili Fau, megalithic monuments are still constructed, even until this day. The village is also known to have the most well-preserved megaliths among traditional settlements in southern region that makes it interesting to observe. This research seeks to answer the functions of megaliths in the two villages of Nias and the existence of activities related to megalithic buildings.

Nias with its unique cultures have been described by Feldman as “the objects of a great deal of literatures” (Feldman 1977 in Scarduelli 1990:448). These include Modigliani (1890) and Schröder (1917) that focus on ethnography. Some texts about architecture of Nias are written by de Boer (1920), Feldman (1984, 1988, 2011), Hämerle (1990) and Viaro (2006). Several books written by Indonesian scholars like Duha (2012), Sonjaya (2008 and 2010), andWiradjnyana (2010) are also narrate the material cultures found in the island. Although there are a huge number of old texts about Nias cultures published by various scholars, the descriptions often depict the island’s culture as a “single unified system”. Most ethnographic, linguistic, and archaeological records are gained from Gunung Sitoli, North Nias which is the centre of administration in the island (Scarduelli 1990:448). Only a few publications that describe the central and southern area specifically, such as Feldman (1984 1988), Hämerle (1982 and 1995) Sonjaya (2008 and 2010) and Hidayati (2014). Due to the limited sources about these two areas, information is collected through interviews with the village elders both in Gomo and Fanayama District and some scholars who have done their researches about Nias cultures. Literature study is also used to support the field data. The main purpose of this paper is to outline the similarities and distinctions of megalithic functions in two cultural areas of Nias Island, represented by the archaeological sites of Börönadu and Orahili Fau.

**Megaliths and Society in Nias Island**

Megalithic culture in Nias begins in Gomo District of the Centre (now administratively part of South Nias Regency). This can be traced through the archaeological remains found in the region as well as the oral traditions which present the origins of Nias people. According to several village elders, all stories about ancestors refer to a progenitor known as Hia Walani Adu. The individual was considered as the central figure in Nias because he was the one who created the social law, the establishment of stone monuments, and narrative genealogy (Duha 2012: 6-17; Pramaresti 2018: 20). He founded the first village near the banks of the Gomo River which is later known as Sifalagö Gomo Börönadu. The village name, Börönadu comes from the word börö which means beginning and adu which means image but can also be interpreted as ancestors. The overall meaning of the name is the beginning of ancestors (Hämmerle 1982 in Feldman 1988: 34). Megalithic culture, architecture, and oral history spread from Börönadu to the southern and northern part of the island.

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1 A new district in South Nias. Previously, Sifalagö Gomo was one of several villages which administratively located in Gomo District.
Although the native legends mentioned Hia as the earliest human, however, there were already other inhabitants who settled in Nias before Hia’s arrival based on the findings of stone tools in the cave of Tögi Ndrawa, Gunungsitoli. Nata’alui Duha, the director of the Nias Heritage Museum, stated that Hia is glorified as the “first man” because he was the person who already practiced customs which until now are still held by Nias people (pers. comm 9 January 2018). The term “human” in ancient Nias culture was identical to the generations that performed the laws and customs Hia created. His predecessors who had not known the megaliths establishment were not included in genealogical stories. Consequently, their existence as early humans were not recognized. Therefore, the history of Nias, according to the local myths, always begins with Hia and his descendants (Pramaresti 2018: 21).

As Börönadu was founded, Hia organized an aristocratic chiefdom society in which every member was associated with the notion of elevation (Feldman 1988:34, Beatty 1992:215). Throughout Nias the community live in villages led by the chiefs. They are called *salawa* in Central Nias which means high, while in South Nias they are called *si’ulu* which means up (Feldman 1988: 37). The nobles are equipped with several privileges that the commoners or *sato* cannot gain, such as large houses, clothes, and jewels. Between the chief and the commoners, there are a group of advisors called *si’ila* which means “he who knows”. This stratum is not always hereditary and may be achieved by the commoners through the virtue of personal qualities. All village residents, including the nobles distribute their wealth in enormous feasts. The feasts are often accompanied by the establishment of megaliths which create new titles and are the primary way for the noblemen and some commoners to exalt their status (Feldman 1988:37). These stone monuments can be found in many regions of Nias Island, especially in the Central and the South. Furthermore there are distinction of megalithic culture from the two areas.

**Börönadu**

Börönadu is one of traditional settlements whose residents still preserve the customs strictly and is known for its megalithic remains. The settlement is rectangle in shape following the line of Gomo River from the northwest to the southeast. Houses are arranged in two rows facing each other and are separated by a single stone paved street. In the centre of the village there is a rectangle-shaped stone structure with a new pyramid-like monument built by the North Sumatera Governor, Roos Telambanua. It is put on the place believed by local people where Hia firstly established the customary laws. The structure was once the foundation of a small building known as *omo nadu* or the house of idols which was the ritual centre (Figure 1). Inside *omo nadu*, a pair of idols believed as the embodiment of Nias deities were placed (Hämmerle 1995:60-66). Only the shaman or *ere* was allowed to enter the *omo nadu* and therefore, people worshiped the idols through the rites led by *ere*. 
Behind *omo nadu*, nine vertical stones or *behu* are put neatly in a row. They have the form of plain short boulders, approximately one metre in height. The stones were revered as the sacred monuments of nine forefathers including Hia (Figure 2). Based on the myth, the creator god in Upper World sent his sons to inhabit the earth (Nias). Hia was the first who descent to earth, followed by his siblings.

Other main features of the village are the noble stone seats. The People of Central Nias call them *osa-osa*. The seats are clustered in a large plaza and serve as the seats for noblemen during the ceremonies. Their shape can vary with the simplest form of plain horizontal stones like those found in Börönadu. They were arranged not far from *omo nadu* and in the past were used by the village elders as the gathering place for customary deliberations. Despite its unadorned shape, *osa-osa* is actually the representation of a mythical beast. It is believed to protect and carry the nobles or other village residents whose high honour are renowned.
There are also stone tables or *awina* which are consecrated in front of some houses. They were used as tables to put the offerings for the spirit of nature. A handful of them, however, were utilized as graves. Skulls of the deceased villagers, usually who had noble lineage, were put beneath the *awina*. During the burial, slaves were decapitated on the *awina*, allowing their blood to cover the stone table where the nobleman’s head was placed. The slaves’ heads were kept together with their master’s in belief that their spirits could serve the noble in afterlife. Accordingly, *awina* have the function as tombs coupled with vertical stones that are dedicated to the late aristocrats. However, a few upright stones are erected as mere landmarks. This reveals that not every megalith in Bӧrӧnadu is associated with a spiritual function.

**Orahili Fau**

The oral history of Nias recounted that some of Hia descendants migrated to the southern part of the island. Until now, people of South Nias claim their ancestry from Sifalagö Gomo Bӧrӧnadu. Interestingly, genealogies found in the clans of South Nias have shown a relative consistency and could be traced to as far back as 25 generations ago. The estimated average span for a ruler was thirty years, and therefore the migration from Central to the South took place approximately 750 years ago (see generation count in Faqih (2010)). This indicated that the southern area was settled around the mid-thirteenth century.

The villagers of the South have brought some customs and art forms from their homeland in Gomo. The establishment of megaliths is the example of the ideas the southern inhabitants have brought with. Over time, the culture of South Nias became distinct from that of Central Nias (Feldman 1988: 42). Although folk of the South retained the megalithic tradition of their Central counterparts, the terms *behu* and *osa-osa* are not found in the southern region. Southern people call the horizontal stone *darodaro*, whereas the vertical one is known as *naitaro*.

These stone monuments can be seen in traditional villages of South Nias. In Orahili Fau, the megaliths are still constructed to this day. Located in Fanayama District, the village has a compelling history. Dutch documents mentioned that the great war between the villagers of Orahili Fau against Dutch army occurred in 1863 (Duha 2012:50; Pramaresti, 2018:26) and implied that the village was found before that date. After Orahili was burnt down by the Dutch, its residents moved to the upper hill and built a new village named Hilifanayama (which later changed into Bawӧmataluo). However, due to the internal conflicts among the nobles, some of the villagers returned to Orahili and rebuilt their old settlement.

The village’s megaliths show a different style from the older prototypes found in Gomo. Stone monuments are elaborately carved in finer and more detailed forms. Furthermore, the complexity of megaliths in the South, including those from Orahili was attained as the area grew wealthier. The enormous growth of wealth in southern villages was because the region was facing one of the largest trading ports in Sumatera, the city of Padang. Its strategic location had allowed people of the South to conduct transactions with traders from mainland Sumatera more easily. More villagers, especially the rulers, were undeniably opulent through the large-scale commerce.

Like the older Central Nias custom, they held a series of feast as qualifications to win the prestige and upraise their status. The distribution of wealth in the form of expensive feasts produced megalithic monuments. Usually, the bigger feast would qualify for a more elaborate stone memorial which gave a higher prestige to the host. Unlike in Bӧrӧnadu, there are no sacred monuments in Orahili. The production of megaliths are linked to other functions, often as a commemoration for individual who has carried out the massive feast. Stone sculptures are resplendent with various carvings that depict nature, wealth, and power. The example of these themes can be seen on the village entrance. A large stone monument is put up on the left side of the entrance, adorned with two ornaments. First
is a comb or ni’osokhu which symbolizes a well-dressed rich noblewoman. The other one is a circle with many segments named ni’ogolilimo that means “the inside of a fruit”. Its outer skin holds the pieces altogether, representing the unity in a village (Figure 3).

Forty-three naitaro and seventeen darodaro are consecrated in the village plaza. Within the traditional context, vertical stones signify enormous banquets that have been held by the community. Some upright stones are proof of a rank advancement, while a handful of them are used solely as memorial of the death. Burial ceremony in South Nias is also conducted with feast, followed by the establishment of stone monument. In this case, naitaro which is placed in cemetery does not give a new title or social status elevation for the deceased villager. Much the same in function with naitaro of the village square is the stone seat. Throughout formal occasion, dignitaries would sit on the darodaro therefore their rank could be clearly recognized.²

Another prominent trait of Orahili is the presence of a vertical stone structure used for stone jumping or hombo batu. This cultural practice exists only in South Nias. Initially, stone jumping was part of a rite for the young men to be accepted as adults and warriors. The ceremony necessitated several juveniles to jump over 2-metre-high stone. Based on the oral history, the skill of stone jumping was developed in southern area as a fighting technique ³. Such ability was required due to the fact that village expansions by war and conquer were common in South Nias. During a siege, warriors could jump over the defensive wall of the enemy village. The stone jumping tradition is still preserved as an attraction for visitors (Figure 4).

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2 Martinus Mo’arota Fau, an elder who takes responsibility in maintaining cultural activities and the close agnate of the late balö si’ulu (main noble). Interviewed on 21 January 2018 in Fanayama.

3 Sadarman Hondró, a lecturer, village elder, and the close agnate of the current balö si’ulu (main noble). He has a wide knowledge about history of ancient villages, oral traditions, and customs in Fanayama District. Interviewed on 3 February 2018.
Megalithic Monuments in Present Day Nias

Nowadays, the ritual practice of building megaliths is discontinued in some parts of Nias Island, including Börönadu. Although this ancient settlement has many megaliths in its area, the activities which involve megalith construction and usage no longer exist. Megalithic production started to decrease after the arrival of Christianity, when it was brought by a German missionary Edward Ludwig Denninger in 1865 (Hummel and Telaumbanua 2007:97). The preaching of the Gospel in Nias initially did not run smoothly. Although many natives of North Nias chose to embrace Christianity, the communities from central and southern areas still displayed intolerance toward missionaries.

The preachers affirmed they did not want to change the customs of the local inhabitants. In fact, they used the elements which would help them introduce Christianity and abandon things seemed unsuitable (Hummel and Telaumbanua 2007:104). Even with the increasing quantity of local Christians in 1815, missionaries assessed that Christianity had not been properly implemented as many Niasans converted to Christianity were still consulting the shaman and worshiping adu zatua (images of ancestor). However, after 1916, Christianity was fully accepted and enacted by the native inhabitants. They destroyed the idols and monuments which previously had a significant role in their religious rites. Those left became dead monuments as the artefacts were not used accordingly to their original functions. Nonetheless, pig sacrifice and feasts did not infringe the guidelines in Christianity. Therefore, villagers of Börönadu still celebrate the feast as their tradition without the erection of a stone monument.4

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4 Pankraius La’ia, a clergyman and the nephew of the previous chief. Interviewed on 10 January 2016 in Gomo. It was said that after the entry of Christianity in Gomo, villagers were forbidden to construct megaliths because some of them correlated with religious rites for certain spirits.
The constraint of megalithic construction is exacerbated by the geographic condition. Börönadu is situated on the valley between steep hills, far from the trade centre which is mostly located in the coastal area. Even though it is not impossible for Börönadu residents to reach the seaside, the access is quite strenuous. Villagers often find it hard to carry out transaction and obtain goods needed for a grand banquet. No wonder that large feasts becomes rarer recently.

Megalithic establishment is also considered very burdensome because in Börönadu, customary laws related to certain rites tend to be implemented rigorously, causing extremely large expenditure in the process. Moving a boulder from the hill to the center of the village requires a lot of people who are paid with dozens of pigs. As the stone arrives in the village, before it is cut and shaped, a feast that serves more pigs is held. Each stage of stone working will increase the number of pigs that must be delivered to the workers. Obviously, preparing a meritorious feast can be a difficult task. Pig raising takes a considerable amount of time due to its slow maturity (six months) and each household is mostly only able to manage a few pigs. For this reason, the organizer of the feast often draws multiple loans from other villagers. If he could not pay his debts, it causes humiliation and has a wider effect of losing his influence.

On the contrary, in Orahili Fau megalithic monuments are still produced. While in Börönadu many megalithic monuments are functioned as mediums of ancestral reverence, megaliths in Orahili serve as mere markers of social status in which the existence of these stones is not viewed as something that poses a defiance towards Christian teachings. Ancestral glorification in South Nias was carried out by using the wooden *adu zatua*. Even after the community adheres to Christianity and religious rituals utilizing *adu zatua* is abandoned, stone monuments are deemed acceptable for showing off high achievement in the society.

The village location also gave a great impact for improvement both economically and technologically. Compared to Börönadu, Orahili Fau has a more advantageous condition because the settlement is established near the port of Teluk Dalam (which replaced the ancient port of Lagundri Bay), the trade centre in southern region. Since the eighteenth century, the coastal area in the south has been a busy port. A Dutch officer, Engelbertus E.W.G. Schröder had written that rice, coconuts, pigs, chickens, betel nuts, and even slaves were exported from the South (Hämmerle 2013:25-19). Guns, irons, tobacco, and ceramics were gained from foreign merchants. In the present-day, people of the South fulfil their daily needs by buying goods in Teluk Dalam. The trade does not only support the Niasan to obtain various materials acquired for quotidian activities, but also transfers knowledge and technology. Additionally, technological advance also influences the duration of megalithic contrivance. The shorter the process of making a monument, the fewer pigs that must be given as a payment for the sculptor.

One fascinating thing is, though properties are extravagantly presented, villagers of Orahili seem to be open toward new ideas and cultural changes. As time goes by, the total of pigs for feast requirement is reduced following the present circumstances to lessen heavy debts. Combined with its strategic location, people in Orahili can support themselves to maintain the great feast and megalithic construction.

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5 For religion in Nias Island before Dutch colonization, see Hämmerle (1995).
Conclusion
Based on this explanation, it can be concluded that megalithic monuments in Nias cannot be recounted as a single unified cultural product. Stone monuments of Bӧrӧnadu and Orahili Fau have shown some distinctions. There are differences in the pronunciation, shape, and existence of activities related to megaliths construction. Though these enormous stones are utilized differently at certain limits, megaliths found in two villages still present the similar function to show status achievement. The arrival of Christianity, village location, and the residents’ adaptiveness to cultural changes affect the continuity of megaliths production.

Acknowledgments
This study is based on researches in Nias during 2016 and 2018. I gladly give my gratitude to Dr. Anggraeni, M.A, Head of Archaeology Department of Universitas Gadjah Mada. I also give my thankfulness to Nias informants, Pankraius La’ia from Gomo District, Sadarman Hondrӧ, and Martinus Mo’arota Fau from Fanayama District. My gratefulness is also given to Johannes Hämmerle, Nata’alui Duha, and Jajang Sonjaya for providing assistance. I also appreciate my colleagues, Filemon Hulu, Franky Sihura, and Katarina Laoli for their support in collecting the field data.

References
Hämmerle, Johannes (1990) Omo Sebua [Chief House]. Gunungsitoli: no publisher


Development of Image Analysis Software for Archaeological Applications

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A large quantity of still and video images are generated in archaeological sites and research labs for record keeping, dimensional analysis, colour analysis, conservation, environmental evaluation etc. The lack of a universal software assisted, image-based dimensional analysis capability, makes quantitative colour analysis and statistical analysis very difficult. Due to the difficulties in image analysis and the labour-intensive nature of the task, only a very small fraction of image data is ever utilized. For these reasons, we have developed a user friendly, unified image processing software for archaeological applications. A few examples of image analysis using the newly developed software are introduced.

Introduction

An extremely large quantity of various types of still and video images are generated daily in archaeological sites and research labs worldwide for record keeping, dimensional analysis, colour analysis, conservation environmental evaluation etc. A variety of image capturing devices are used in the archaeological fields and labs. Besides conventional still cameras and camcorders, many different types of images and video images using different sources (different wavelength ranges) such as infrared (IR), ultraviolet (UV), X-ray, Terahertz (THz), ultrasound (US) are used in practice. For metal detection, changes of inductance across the scan area is mapped and saved as image files. Every image capturing device provides its own software for image saving and very primitive analysis functions. Still images and video images are saved in many different sizes and formats. Thus, most images are still analysed manually using a number of different image editing software. The outcome is largely dependent on the image editing software and individual skill sets. The level and efficiency of image data usage in archaeology is still very primitive and must be improved.

Many types of reports are generated on a regular basis. All reports include photographic images, sketches, illustrations, drawings and graphs. It usually takes considerable time to select the best suited photographic images and get sketches, illustrations, drawings and graphs from the images. If image analysis and information extraction from the images were available in appropriate forms, it would give archaeologists, anthropologists and conservation scientists more time for considerations in their specialty fields. Balancing between project deadlines and in-depth study is very challenging, even for an experienced staff. This is the very reason why we have to improve the image analysis and information extraction processes by using user-friendly and standardized image processing software.

The lack of universal software for image-based dimensional analysis, quantitative colour analysis and statistical analysis prevents efficient utilization of image data in archaeological studies. Due to the difficulties in image analysis and the labour-intensive nature of the task, only a very small fraction of image data is ever utilized. It is important to develop user friendly image processing software to promote efficient utilization of image data. For these reasons, it would be beneficial to develop equipment-independent and user friendly, unified image processing software which can support various digital image formats (such as BMP, JPG, PNG, GIF, TIF, DM3, MOV, MP4, AVI, WMV etc.).

In this paper, such software (PicMan from WaferMasters, Inc.) is introduced, along with a few digital image examples from archaeological studies.
Scope of Image Analysis Software Development

In developing a new image analysis software, there are hundreds of features on a wish list from archaeologists, anthropologists and conservation scientists. We had to set reasonable scope and guidelines of image analysis software development.

- **Software file size:** We wanted to limit the size of software files far below 20MB with all functions to allow as many potential users, even laptop computers with limited computing power and memory size.
- **Software file format:** The software must run from an execution file without an installation process to the user’s computer.
- **Supporting image file formats and size:** The software must handle various formats of digital images such as BMP, JPG, PNG, GIF, TIF, DM3, MOV, MP4, AVI, WMV etc. up to reasonable size (perhaps 5,000 x 5,000 pixels).
- **Brightness and colour information display:** It should read and export brightness values of RGB (red, green and blue) channel pixels at any point on the image.
- **Conversion of RGB values into HSV and L*a*b* values:** The software must be able to convert pixels with RGB values into HSV and L*a*b* values for colour analysis.
- **Threshold switching:** It has to have a threshold switching function to freely select pixels with RGB or HSV values above or below threshold value.
- **Dimensional analysis:** It must have length and angle measurement capability.
- **Line, angle, shape drawing:** Lines, angles and shapes can be drawn on top of image files without modifying original image file.
- **Free line and free shape drawing/tracing:** Free line and shape can be drawn or traced on screen.
- **Line graph generation:** Colour and brightness in RGB channels on the pixels on a selected line must be displayed for reference and judgement.
- **Edge detection:** Edge detection function at a given threshold value is necessary for finding boundaries of shape, based on RGB value combinations.
- **Area measurement:** Area of selected region must be calculated and key characteristics such as coordinates, width, height, perimeter, equivalent diameter (assuming a perfect circle), circularity must be quantified and exported.
- **Data export and save:** All measurement data and modified images can be saved for record keeping and further analysis.

In addition to the above list, more than one hundred functions and features were added as we developed the image analysis software (PicMan). A few applications in the conservation science area have been reported in various conferences and journals since 2017 (Kim (2019), Yoo (2017) and Yoo (2019)).

Application Examples in Archaeology

As an image analysis example using PicMan, a logo image file of SEAMEO SPAFA (the Southeast Ministers of Education Organization Regional Centre for Archaeology and Fine Arts) was analysed. Figure 1 shows the logo image file opened and extracted design using PicMan.
Figure 2 shows the line graph of a vertical centre line crossing the SEAMEO SPFA logo. It consists of RGB colours in 8-bit brightness information. The brightness value is in the range of 0 to 255 ($2^8 = 256$ levels). Red line, green line, blue line and greyline represent the 8-bit brightness levels of RGB channels and average of RGB channels (greyscale). Purple and dark red colour portion of logo show different combinations of RGB brightness.

Figure 3 shows the SEAMEO SPFA logo in colour and extracted design in black and white using PicMan’s threshold switching and automatic isolated area detection function. All isolated areas of extracted design were calculated and their key characteristics (such as coordinates, width, height, perimeter, equivalent diameter, assuming a perfect circle, circularity and centroids) can be exported as a CSV (comma separated value) file. All exported values can be viewed using any spreadsheet application software for statistical and quantitative analysis.

Figure 4 shows separation of the SEAMEO SPFA logo by different brightness and colour components. They are halftone grey, dark red, purple and black in a clockwise direction from the top left.
Fig. 2  Colour analysis graph (left) on a vertical centre line crossing the SEAMEO SPAFA logo. Red line, green line, blue line and greyline represent the brightness levels of RGB channels and their average. Source: Author.

Fig. 3  SEAMEO SPAFA logo in colour and extracted design in black and white. Design was extracted by the threshold switching and automatic isolated area detection function. Source: Author.
Fig. 4  Separation of SEAMEO SPAFA logo components by brightness and colour. Source: Author.
Figure 5 shows a colour inverted SEAMEO SPAFA logo in a complementary colour with virtual relief effect image for 3D-like expression.

![Image of SEAMEO SPAFA logo](image1)

**Fig. 5**  Complementary coloured (colour inverted) SEAMEO SPAFA logo with virtual relief effect for 3D-like expression. Source: Author.

Figure 6 shows a Korean Buddhist painting in colour. It mainly used four families of colours. They are red, yellow, green and black colours. Figure 7 shows red, yellow, green components of colours used in the painting and extracted design outline image of the painting in greyscale.

![Image of Korean Buddhist painting](image2)

**Fig. 6.**  Korean Buddhist Painting in colour. Source: Asadal 2005.
There is no need to trace all shapes on the image. Most of the designed shapes can be easily extracted by using combinations of image analysis and control functions provided by PicMan.

Figure 8 shows the bottom of a ceramic cup with manufacturer’s seal (blue) and the extracted design of the seal (red) using PicMan’s threshold switching and isolated shape extraction function. The extracted seal image can be stored as separate image files and can be referenced for comparing the similar seal for manufacturer verification.
Figure 9 shows the red seal on an old paper document before and after image processing by PicMan. Due to the black printings, the design of the red seal cannot easily be visualized. By selecting the specific family of colours of a partial image, the red seal image became much clearer and black printings do not make it as hard to recognize the total shape of red seal. We can also make 3D-like effects using the virtual relief generation function.

Fig. 8  Bottom of ceramic cup with manufacturer’s seal (blue) colour and extracted design of seal (red) using PicMan’s threshold switching and isolate shape extraction function. Source: Author

Fig. 9  (This page and next) Red seal on old paper document before and after image processing by PicMan. Source: Kim H and Author.
**Perspectives**
Image analysis software for archaeological applications were developed and tested using relevant digital image files for its capability and effectiveness. The newly developed image processing software, PicMan, has been tested in the field for the last three years. Newer functions are constantly developed and added for ease of use in the field without lengthy training. During the software development and customization, collaboration between the software development team and end users among archaeologists, anthropologists and conservation scientists were very productive. We strongly believe that further collaboration will make software even more user friendly and mutually beneficial. We would like to get more inputs and feedback from researchers in the related fields of study.

**Acknowledgment**
The authors would like to thank Ms. Hayoung Kim, Archival Digitization Specialist of Jangseogak Archives of The Academy of Korean Studies for providing valuable old document images and guidance for this study. The authors also would like to express special thanks to Mr. James Schram of WaferMasters, Inc. for his constructive suggestions, guidance, encouragement during this software development project.

**References**
Asadal (2005) 한국어: 닥수궁 불교 복화, Wikicommons Media. Available at: https://commons.wikimedia.org/wiki/File:%EB%B6%88%EA%B5%90_%ED%83%B1%ED%99%94.jpg (accessed 16 July 2020)
Kim, H유시필지(儒書必知). Available at: http://jsg.aks.ac.kr/viewer/viewIMok?dataId=K3-680%7C001#node?depth=2&upPath=001&dataId=001 (accessed 16 July 2020)