

Dottorato
Asia
Africa
e Mediterraneo

Università di Napoli L'Orientale
Department of Asia, Africa, and the Mediterranean

PhD Program in Asian, African, and Mediterranean Studies
Curriculum: Archaeology
Cycle XXXVII

PHD THESIS

A reassessment of contemporary and ancient Southeast Asian
lashed lug watercraft: new evidence and perspectives

Candidate

Agni Sesaria Mochtar
DAAM/00128

Research Director

Prof. Chiara Zazzaro

Research Co-Directors

Prof. Antonia Soriente
Prof. Anna Filigenzi

Coordinator

Prof. Ignazio Tantillo

Academic year 2024/2025

Table of contents

Table of contents.....	i
List of figures	iv
List of tables	ix
Abstract.....	x
Acknowledgement	xii
1 Introduction	1
1.1 The lashed lug ship- and boatbuilding tradition in Indonesia	1
1.2 Theoretical framework	3
1.3 Questions, aims, and objectives.....	6
1.4 Methods.....	7
1.4.1 Data collection.....	7
1.4.2 Analysis	11
1.4.3 Interpretation	11
1.5 Limitation.....	12
1.6 Chapters outline.....	12
2 Literature review.....	15
2.1 Introduction	15
2.2 Lashed lug tradition: history of research and defining characteristics.....	15
2.3 Multidisciplinary approach in lashed lug studies	19
2.4 Lashed lug construction: innovation, exchange, and adaptation	22
2.4.1 Early development	22
2.4.2 Contacts with the Indian Ocean World and South China Sea	24
2.5 Conclusion	27
3 Reassessment of previous research	28
3.1 Introduction	28
3.2 Lashed lug sites in Indonesia	28
3.2.1 Lambur	29
3.2.2 Air Sugihan.....	32
3.2.3 Simpang Tiga.....	37
3.2.4 Teluk Cengal	41
3.2.5 Punjulharjo	43
3.2.6 Cirebon.....	46
3.3 Lashed lug sites in Southeast Asia.....	48
3.3.1 Pak-Klong Kluai	48
3.3.2 Khlong Thom	49
3.3.3 Ban Khlong Yuan.....	51
3.3.4 Chau Tan.....	53
3.3.5 Butuan.....	55
3.4 Current knowledge of the lashed lug tradition	57
3.4.1 Definition and terminology.....	57
3.4.2 Construction characteristics.....	58
3.5 Conclusion	59

4	Archaeology	61
4.1	Introduction	61
4.2	North Sumatra.....	61
4.2.1	Bongal	61
4.3	Riau Islands	81
4.3.1	Lagoi.....	81
4.4	Jambi	91
4.4.1	Kota Harapan	91
4.4.2	Museum Siginjei	92
4.5	South Sumatra	94
4.5.1	Sukaraja.....	94
4.5.2	Sungai Bagan	104
4.5.3	Museum Sriwijaya	106
4.5.4	Artefact storage BRIN Palembang.....	111
4.6	Bangka-Belitung Islands	112
4.6.1	Kelapa Kampit.....	112
4.7	Conclusion	116
5	Iconography	117
5.1	Introduction	117
5.2	Rock arts.....	118
5.3	Temple relief and engraving.....	123
5.3.1	Borobudur Temple	123
5.3.2	Muarajambi Temple Compound	129
5.4	Manuscripts	132
5.4.1	Serat Selarasa	132
5.4.2	Kidung Juarsa	137
5.5	Historical maps and drawings	138
5.6	Conclusion	147
6	Ethnography.....	148
6.1	Introduction	148
6.2	Lamalera, East Nusa Tenggara.....	148
6.3	Tana Beru, South Sulawesi	158
6.4	Pasuruan, East Java	163
6.5	Conclusion	169
7	Discussion	171
7.1	Introduction	171
7.2	Lashed lug vessel components	172
7.2.1	Keel plank.....	172
7.2.2	Hull plank	175
7.2.3	Bow and stern	180
7.2.4	Steering	182
7.2.5	Rigging.....	183
7.3	The lashed lug hull construction.....	186
7.3.1	General assembly of the lashed lug hull	186
7.3.2	Variations of the hull construction.....	189

7.4	Conclusion	190
8	Conclusion	192
8.1	Readdressing research questions.....	192
8.2	Significance	195
8.3	Limitation.....	196
8.4	Recommendation for future research	196
	Appendix A.....	197
	Appendix B.....	202
	References	204

Abstract

This thesis provides a detailed study of the Southeast Asian lashed lug ship- and boatbuilding tradition, focusing mainly on sites in Indonesia. This watercraft construction tradition dates back at least to the 5th century BCE and was widely practised until the 16th century CE. With Indonesia accounting for more than half of the nearly forty known lashed lug sites, this research aims to deepen existing knowledge of this enduring construction technology by examining recent and understudied sites to reassess prevailing definitions and typologies. The study highlights a complex diversity across different periods and regions within the lashed lug construction.

The methodology adopts a multidisciplinary approach that combines archaeological evidence with iconography and ethnography. Archaeological data include detailed records of both new and overlooked remains from Sumatra and nearby islands, ranging from intact shipwrecks to disarticulated timbers. The study also expands sources of iconography, encompassing images and depictions of Indonesian watercraft across different periods, locations, and media. Ethnographic fieldwork involved participatory observation in shipyards that maintain shell-first construction techniques, particularly in Lamalera (East Nusa Tenggara), where lashed lug construction is still practised, as well as in Tana Beru (South Sulawesi) and Pasuruan (East Java).

This study confirms the main features of the lashed lug construction, including the use of a keel plank, edge-joined strakes, a wing end for both the bow and stern, and the internal lugs for frame lashings. However, the key findings of this thesis highlight the variations and changes within the lashed lug construction. Variations are identified in numerous lug designs and fastening systems, while changes are observed in the overall shape of the lugs and the creation of the lashing holes. Furthermore, examination of the intact Lagoi shipwreck reveals the presence of nailed frames and long tenons passing through the lugs, which challenges the traditional view that these used solely organic materials.

For information missing in the archaeological record, iconography and ethnography strongly suggest the use of the canted rectangular sail (tanja sail). Steering was generally achieved with twin quarter rudders, as evidenced by the rudder mounting beams findings, or with steering oars on smaller boats. The bipod mast, depicted in both Borobudur reliefs and the Muarajambi engraving, remains in Lamalera's peledang, where it is not fixed and can be easily dismantled. This might explain why mast steps are absent from archaeological finds. Overall, this detailed documentation of construction

features offers a valuable dataset for future analyses—both historical and comparative—of this enduring shipbuilding tradition.

1 Introduction

1.1 The lashed lug ship- and boatbuilding tradition in Indonesia

The lashed lug is one of the ship- and boatbuilding traditions in Southeast Asia that, until recently, was thought to have been commonly practised at least between the third and sixteenth centuries C.E. (Lacsina, 2016), with the oldest boat remains found at the Pontian site in Malaysia. However, the latest research on the Andaman coast of Thailand has shown that people had built the lashed lug vessels as early as the 5th century BCE (Piromrak, 2023; Ploymukda & Piromrak, 2019). Sites with lashed lug boat remains have been found in Indonesia, Malaysia, Thailand, the Philippines, Vietnam, and even outside Southeast Asia, in Hong Kong (Manguin, 2016, 2019). Of the around forty sites found to date, over half are in Indonesia.

Remains of lashed lug ship and boat in Indonesia have been unearthed in coastal areas and a bit further inland, in silted areas, along riverbanks, and underwater. Terrestrial sites, however, by far outnumber underwater sites, with only a handful of confirmed lashed-lug sunken boats recorded to date (Flecker, 2019; Flecker & Tai, 2019; Liebner, 2014). Interestingly, all the sites are located in the western part of the archipelago (Sumatra and Java), where this tradition is no longer practised, while the ethnographic documentation mentions that people in East Nusa Tenggara, on the opposite side of the archipelago, still build their boats using a similar tradition (Barnes, 1996b; Dwyer & Akerman, 1998).

It is already established that watercraft belonging to the lashed lug tradition, both found in Indonesia and other Southeast Asian regions, shared common construction attributes ([Fig. 1.1](#)) (Lacsina, 2016; Manguin, 2021; Mochtar, 2018; Wiyana, 2015). The most prominent were the protruding lugs inside the hull planks, where the frames were lashed onto them using ropes made from vegetal fibres, usually from the *Arenga pinnata*, or sugar palm plant. The hull planks were fastened without metal nails; instead, dowels and/or rope lashings were used. The backbone of the boat was a keel plank, hewn from a single log. Another attribute was the wing ends, which consisted of superimposed, sculpted timber pieces placed at both ends of the keel plank and shaped to accommodate the hull planks forming the bow and stern of the vessel.

As more sites were discovered, scholars began to notice that, in addition to these commonalities, lashed lug vessels also exhibit variations in their components. They include the lug design, the assembly of the wing ends, the hull fastenings, and the timber species used for different construction components. The discussion of such variations, however, is still in its infancy, limited to one boat or

one site (Lacsina, 2019) or to a few sampled sites (Lacsina & Komoot, 2023; Lacsina & Mochtar, 2020). The reasons behind these commonalities and variations remain an open debate to this day, awaiting more in-depth research.



*Figure 1.1 Punjulharjo boat in Rembang, Indonesia. One example of a lashed lug vessel found intact.
Source: Photograph by A.Mochtar, 2022.*

In the last decade, the finding of lashed lug remains in Southeast Asia has been increasing, yet the number is still significantly lower to be considered a vast dataset compared to, for example, the Mediterranean (Manguin, 2021). Additionally, the fragmentary condition of most of the remains leaves many unanswered questions for scholars to address. Thus, it is essential to record every finding in detail to gain further insights, as significant information about the lashed lug tradition remains missing.

In Indonesia, reports of new findings have been coming almost exclusively from Sumatra. They are mainly on the eastern coast (Akbar, 2019; Intan, 2017; Rangkuti, 2017; Wiyana, 2015; Wiyana et al., 2017; Zazzaro et al., 2024), with direct contact to the busy route of the Malacca Strait down to the Karimata Strait. However, one site, Bongal, comes as the first lashed lug site on the opposite coast, facing the Indian Ocean (Purnawibowo & Mochtar, 2021; Purnawibowo & Restiyadi, 2020; Soedewo et al., 2021). This site, along with other sites on the southern Thailand Peninsula, provides strong evidence of lashed lug vessels' ability to sail beyond the inter-insular waters of Southeast Asia, as previously thought. In terms of condition and stage of preservation, they range from disarticulated

planks in a secondary context (Purnawibowo & Mochtar, 2021; Rangkuti, 2017; Wiyana et al., 2017, 2019), to large-sized shipwrecks still with numerous strakes intact (Akbar, 2019; Koestoro et al., 2017; Liebner, 2014; Widiatmoko et al., 1998; Zazzaro et al., 2024). Unfortunately, the trend continues: fragments and disarticulated planks remain dominant, in contrast to the two intact shipwrecks, one in Lambur, Jambi, and another in Lagoi, Riau Islands.

Previous studies on lashed lug and other shipbuilding have showcased that studying both shipwrecks and disarticulated ship timbers is equally important, although they each offer different information. It is with this exact argument that the author presents in this thesis the documentation of timbers from lashed lug watercraft, recently found across the mainland of Sumatra and the nearby small islands. The documentation includes an intact shipwreck, dismantled planks from an intact shipwreck, as well as various disarticulated components from ships and boats.

This thesis focuses on the construction attributes of the recorded timbers to examine their technological aspects, highlighting variations in lashed-lug construction and providing a deeper understanding of this shipbuilding technique. In doing so, the author also explores ship iconography and ethnography. A multidisciplinary approach is already a common practice in studying ancient shipwrecks due to the incomplete nature of the archaeological data (Sean McGrail, 2014). This study is not an exception. However, in contrast with previous studies, this thesis presents a more elaborate ship iconography, in terms of media, chronology, and provenance. Meanwhile, the ethnographic documentation presented in this thesis is of those in which the author participated. They include boats built entirely in lashed lug construction and those with some features in common with it.

1.2 Theoretical framework

Water-crossing technology might have developed quite early in Indonesia and Island Southeast Asia (ISEA). Some even argue that hominins had acquired the skills to build a simple watercraft to cross the water between small islands in Wallacea, which had never been connected to the Sunda shelf, during the Pleistocene, about 1 million years ago (Brumm et al., 2010; Morwood et al., 1998). More tangible evidence, however, came from the dispersal route from Wallacea to Sahul. Bones of various pelagic fishes from East Timor, dating back to at least 42,000 BP, indicate that humans at that time were already familiar with maritime technology. One of them might be using boats for offshore fishing (O'Connor et al., 2011; O'Connor & Ono, 2013). A computer modelling simulation of possible migration routes to Sahul around 50,000 BP also suggests that sea voyages were intentional, with sufficient knowledge of navigation and sailing for at least a few days (Bird et al., 2019).

The issue of early maritime technology remains an ongoing debate, primarily because no direct evidence has been found to date. The hypothesis that is more firmly accepted is that shipbuilding in Southeast Asia, and beyond, to Oceania, was introduced by the Austronesian-speaking communities when they migrated out of Taiwan around 7,000 BP (Bellwood, 2001; Horridge, 1995; Mahdi, 1999). The technology was later further developed into the plank-built, lashed lug construction in the archipelagos of Indonesia and the Philippines (Mahdi, 1999). This type of watercraft is, arguably, the one used by the Austronesian speakers to continue their dispersal westward through the Indian Ocean (Manguin, 2016), reaching Madagascar in the last quarter of the first millennium CE (Anderson, 2019; Cox et al., 2012; Mitchell, 2020).

Lashed lug watercraft have likely been actively involved in the trans-regional network between the Indian Ocean and the South China Sea since their emergence, connecting places and people, and exchanging goods, ideas, and cultures. The construction technology lasted for over 1.5 millennia, showing impressive durability and reliability in supporting various maritime activities. It is definitely a ship- and boatbuilding technology worth exploring in depth. As with other nautical archaeological research, documenting ship timbers is essential for interpreting the construction of ancient watercraft. For lashed lug vessels, since discoveries are limited, thorough and detailed documentation of each find is necessary.

The archaeological data in this thesis predominantly consist of disarticulated ship timbers, recorded in a secondary context (Fig. 1.2). Among the sites and storage visited by the author, Lagoi is the only site where the documentation was conducted *in situ*. One might question the examination of dismantled ship components, but various studies have succeeded in gaining valuable insight from scrutinising such findings (Creasman, 2013; Ghidoni, 2023; van Duivenvoorde et al., 2023; Ward & Zazzaro, 2010). Ghidoni (2023, p. 2) even argues that studying disarticulated ship timbers from different periods opens up “synchronic and diachronic analysis”. For the lashed lug studies, this type of finding is, indeed, the primary data (Gibson-Hill, 1952; Manguin, 1985, 1993; Nishino et al., 2018; Piromrak, 2023; Wiyana, 2015). Nevertheless, they have made significant contributions to the knowledge of shipbuilding technology.

When one works with hull planks and other dismantled ship components, the incomplete nature of archaeological remains is nowhere more evident (Sean McGrail, 2014). Here, a rigorous database can be invaluable, as comparisons with other findings may offer insight into the incomplete assemblage. Furthermore, when one has exhausted the archaeological evidence, other disciplines, such as iconography and ethnography, often help fill in the missing information.

Iconography is highly useful for its complete depiction of ships and boats, unlike archaeological remains (Grossmann, 2019). However, it must be treated with caution because the images are merely representations, rather than the actual vessel itself. They are heavily influenced by the creator's background, including their culture, skills, and education. The media used also plays a significant role in how the representation comes to be; many differences with the original could appear as the result of transferring a three-dimensional object to a two-dimensional media (Wachsmann, 2019). Other factors to consider include the audience, dissemination, and consumers of such images (Loren & Baram, 2007).



*Figure 1.2 Dismantled planks and frame from Sukaraja site in the storage of Bumiayu temple compound.
Source: Photograph by A.Mochtar, 2023*

To date, the ship depictions on the bas-reliefs of the 9th-century majestic Borobudur temple (further detailed in Chapter 5) seem to be the sole iconographic comparison for the lashed lug construction (Liebner, 2014; Mochtar, 2018). While the collection is, indeed, magnificent, Inglis (2014) has pointed out that they are not the blueprint for contemporary vessels, but an integral part of the representation of Buddhist sermons. It is deemed necessary, then, to expand the collection by including other iconography created on various media, from different periods, for different purposes, and intended for diverse audiences. Thus, one would have a more solid foundation to conduct a 'critical and informed' comparison between the images and the archaeological evidence (Loren & Baram, 2007, p. 1).

Another source to consult for a better understanding of archaeological evidence is ethnographic accounts. Within the lashed lug studies, ethnography had played an essential role in initiating the

investigation into past shipbuilding. Ethnographers provided a detailed, valuable description of Southeast Asian traditional watercraft, particularly in the Philippines and eastern Indonesia, since the 17th century (Horridge, 1982), but the peak might be during the second half of the 20th century (Barnes, 1985, 1996b; Horridge, 1978, 1982, 1985).

In modern-day maritime archaeology, it is not uncommon for scholars to actively participate in ethnographic fieldwork and experimental ship or boat reconstruction (Bigourdan, 2006; Blue et al., 1997; J. P. Cooper et al., 2021; Vosmer, 2019; Zazzaro et al., 2022). The ethnoarchaeology approach can be flawed, especially when conducted without caution and overgeneralized (Gosselain, 2016). However, it is an adequate means to train one to be more appreciative of the practical knowledge and to distance oneself from the bias of one's background when interpreting archaeological data (Cunningham & MacEachern, 2016). Involving the assistance of ethnography for maritime archaeology interpretation should mean that one employs a broader perspective, instead of a simplified direct comparison of similarities (Sean McGrail, 2014).

1.3 Questions, aims, and objectives

This thesis aims to enrich the knowledge on the Southeast Asian lashed lug ship- and boatbuilding by re-assessing the prevailing description of the watercraft construction, based on an in-depth investigation of the latest archaeological findings, new and more diverse iconography, as well as participatory ethnography. A detailed and comprehensive dataset from Indonesia is analysed in the Southeast Asian context to understand how the findings contribute to the current consensus of the description of the vessels belonging to the tradition, both to confirm and to challenge, to strengthen the ubiquities among them, but, at the same time, to celebrate the particularities of each finding. Avoiding a hasty and negligent analogy, this research expands the scope of data overlooked in the previous studies. It employs a broader perspective to construct a comparative narrative based on the archaeological data and the surviving traditional boatbuilding practices in Indonesia.

The research attempts to answer these questions:

1. How do the new findings contribute to the prevailing knowledge about the construction of lashed lug watercraft?
2. Can similarities and dissimilarities be identified from previous and new archaeological evidence of lashed-lug boats to identify regional and/or chronological variabilities?

3. Can the influencing factors of the technological changes be identified with the aid of iconographic and ethnographic data?

1.4 Methods

1.4.1 Data collection

Archaeological data

The archaeological data in this thesis include intact shipwrecks and disarticulated ship and boat timbers found throughout Sumatra, Indonesia, over the past decade. All findings that the author personally documented are presented in Chapter 4. Other findings from secondary sources are discussed in Chapter 3, along with sites in Indonesia outside Sumatra and in other Southeast Asian countries. Direct documentation was carried out through archaeological surveys and excavations, as well as visits to museums and storage facilities, during fieldwork campaigns from 2022 to 2025 ([Fig. 1.3](#)).

a. Survey and excavation

Surveys were conducted at various sites, including Bongal in Central Tapanuli, North Sumatra (2022), Lambur in East Tanjung Jabung, Jambi (2023), and Kelapa Kampit in Belitung Island (2024). None of the timbers were still in situ when the author visited these sites, but they were stored near the location where they were found. Every detail on each timber was carefully measured and documented. Wherever possible, information on the process and context of the finding was gathered from locals and/or from the team who previously worked on the site.

Meanwhile, excavation was conducted only at the Lagoi shipwreck site on Bintan Island from 2023 to 2025. Each field season lasted 4–6 weeks, between July and September. The shipwreck was an intact ship located in an intertidal zone of a beach on the northern coast of the island. The team worked during both low and high tides because the semi-diurnal tides affected the site. The excavation was conducted using a sand dredge, assisted by hand-fanning, but manual removal of sand with shovels was also employed, occasionally, particularly outside the ship during low tide (Zazzaro et al., 2024). The documentation of the ship hull was exclusively done underwater, by snorkelling or diving.

b. Museum and storage visits

The author visited two museums, Museum Siginjei in Jambi and Museum Sriwijaya in Palembang, South Sumatra, as well as the artefact storage at the Bumiayu Temple

compound in Muara Enim and the BRIN office (formerly Balai Arkeologi Sumatra Selatan) in Palembang, both located in South Sumatra. They housed timbers from various sites; unfortunately, some lacked clear provenance information. Nonetheless, all timbers were documented consistently. The museums and storage staff were also consulted for any information regarding the collection's provenance or acquisition.

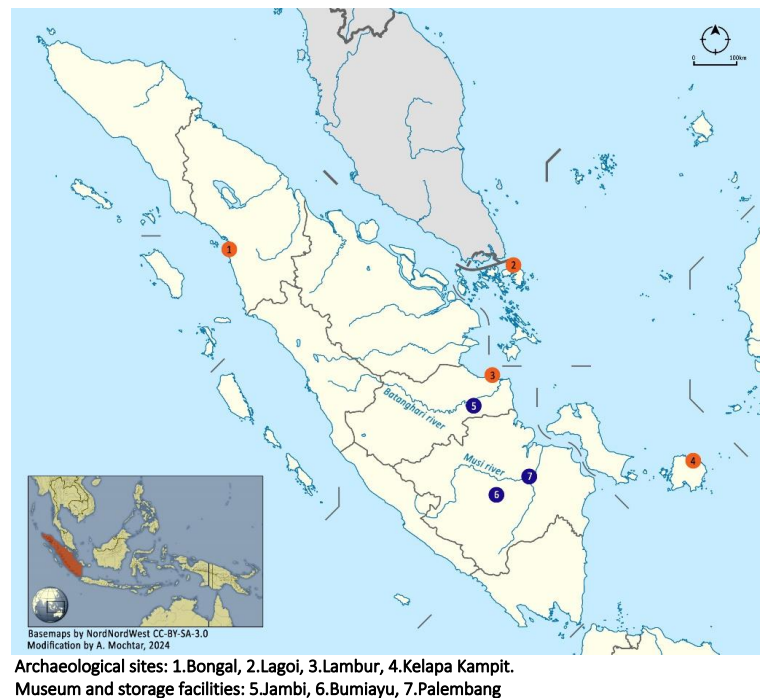


Figure 1.3 Sites, museum, and storage facility visited for archaeological data collection.
Source: A. Mochtar, 2024

c. Documentation of ship and boat timbers

Each finding was documented with rapid, close-range photogrammetry. This method is efficient for recording numerous timbers within a time constraint. The author used a Sony RX100 II pocket camera to take the photographs. The number of images per timber varied depending on its size. The software used to process the images was Agisoft Metashape. Throughout the fieldwork campaigns, the author encountered various scenarios, which, unfortunately, sometimes resulted in lower-quality photographs. However, the author found the software highly helpful because it provided different stages of image processing. When the final textured model was unsatisfactory, many details could still be observed in the mesh model version ([Fig. 1.4](#)).

While photogrammetry is a remarkable tool for documentation, the author discovered it could not capture some details necessary for this study. Examples included the depth of the dowel and the lashing holes, as well as small features like the locking peg holes, especially

on darker timbers. Therefore, the author also manually measured and recorded such details through sketches and field notes.



*Figure 1.4 A wing end from the Bongal site presented in different models in Agisoft Metashape program.
Source: A.Mochtar, 2024*

d. Secondary sources

Some sites were inaccessible due to various reasons, including weather conditions, isolated location, and permit requirements. For these sites, the author relied on the available reports, photographs, videos, and publications from previous research. Whenever the reports and publications did not provide detailed information on the ship and boat timbers, the author observed the photographs and videos to describe the construction features of the timber (see Chapter 3).

Secondary sources were also utilised to provide an overview of sites located outside of Indonesia, including the Philippines, Vietnam, and Thailand, particularly the latest findings and sites with significant information. Information from these sites and other minor sites is important for contextualising the data from Indonesia within the Southeast Asian context.

Iconography

In this thesis, iconography is explored to aid in identifying various parts of the lashed lug construction that are missing from the archaeological evidence. Iconography plays a significant role in identifying components made from perishable materials, such as sails and rigging (Thufail, 1993, p. 39). The ship depictions can also provide information on assemblies, such as rudder placement on the stern (Mochtar, 2018; Zazzaro et al., 2023). The examination of ship iconography is also expected to bridge the gap between archaeological and ethnographic data: what happened between the 15th-century San Isidro, the most recent archaeological evidence, and the 20th-century whaling vessel in Lamalera.

Therefore, this thesis chose the following depictions:

- Contemporary to the lashed lug construction being in practice: ship reliefs in the 9th-century Borobudur temple and ship engraving in the 10th-12th-century Muarajambi temple compound.
- Post 15th-century European drawings of Indonesian traditional ships and boats.
- Ship and boat illustrations in Serat Selarasa, a 19th-century Javanese manuscript.
- Ship and boat motifs in rock art. To date, they have not been dated, but whenever possible, they have been analysed in the context of the associated artefacts.

The author collected all the ship and boat iconography used in this thesis solely through secondary sources. Each image was treated as nautical archaeology data: all observable features on the ship or boat were described. To keep in line with the aim and objectives of this thesis, attention was emphasised on the construction aspects of the watercraft.

Ethnography

The ethnographic data in this thesis consist of shipbuilding in Lamalera, Lembata Island, East Nusa Tenggara; Tana Beru, Bulukumba, South Sulawesi; and the Pasuruan coast, East Java. These shipyards are located quite far from Sumatra, towards the other end of Indonesia. However, the Lamalera shipbuilders are among the very few who still build their vessels using lashed lug construction. In Tana Beru people still build traditional vessels that retain some of the lashed lug construction features, including pseudo lugs on the keel and non-metal hull fastening. Meanwhile, the builders along the Pasuruan coast, although unfamiliar with lashed lug construction, have built their vessels shell-first, and some are still exclusively dowel-fastened.

The author visited these shipyards with different teams for each location: Pasuruan in 2021, Lamalera in 2022, and Tana Beru in 2023. The length of each visit varied from a few days to a couple of weeks. Therefore, besides the field notes on observation, measurement, and interviews with the builders that the author produced, secondary sources, including reports and publications of previous accounts on these three shipyards, were also consulted.

1.4.2 Analysis

Radiocarbon dating

Wood samples were taken from various planks and sent to the laboratory for radiocarbon dating using AMS (Accelerator Mass Spectrometry). This technique is appropriate given the rarity of the data because it requires only a small sample for analysis. Among the sites the author visited, three sites were already dated:

- Bongal 7th century CE (Purnawibowo & Mochtar, 2021; Soedewo et al., 2021),
- Lagoi, 12th century CE (Zazzaro et al., 2024), and
- Lambur, 15th century CE (Akbar, 2019).

Meanwhile, the author collected samples from Sukaraja, Kelapa Kampit, and Bongal D and had them analysed at the Australian National University laboratory, funded by the Granucci Fund. The results were then calibrated using OxCAL v.4.4.4 (©Bronk Ramsey 2021), based on IntCal20 (Reimer et al., 2020) atmospheric curves.

Database formation

Following the detailed description of every archaeological finding, a robust database was established. The database presented in this thesis (see [Appendix A](#)) provides information on the sites with the fastening system and the chronology. It is developed from the list compiled by Manguin (2019, pp. 404–406), with every existing entry being re-evaluated and new entry were added, based on literature consultation for the re-assessment of previous research, discussed in [Chapter 3](#), and the results from the fieldworks for this thesis, discussed In [Chapter 4](#). This database serves as the foundation for the author to understand how the timbers are connected and to identify their shared features, as well as their variations or particularities.

1.4.3 Interpretation

The database provides a comprehensive overview of what is currently known about ship and boat remains featuring the lashed lug construction, found in Indonesia and Southeast Asia. A comparative approach to iconographic and ethnographic data was employed to examine aspects missing from the archaeological data, such as the vessels' functions and/or their components (rigging and the whole shape of the hull). Furthermore, the comparison provided information about the society or system that supported this tradition, allowing the factors that encourage the continuity or decline of certain aspects within the tradition to be identified in today's ship- and boatbuilding practices.

1.5 Limitation

This study aims to contribute to a vast, reliable database of lashed lug watercraft, fostering a more thorough understanding of the shipbuilding and boatbuilding traditions. New findings and unexamined timbers were carefully recorded whenever accessible. Photographs and reports from previous fieldwork were critically analysed to describe watercraft remains that are absent from the current regional discussion. However, understanding their spatial context was challenging because many were found in disturbed areas or were moved shortly after being found without documentation. Others were already stored in facilities with missing provenance information.

Ideally, each timber representing a vessel or site should be accurately dated, either by direct radiocarbon dating or through a strong association with other artefacts. While working on the database, the author noticed that many sites are still dated by estimation or even without any available context, even for an estimation. This study obtained new dates for only three vessels or sites, a number that is very small compared to the list of undated sites. Therefore, diachronic analysis in this thesis is far from comprehensive, and more effort is needed in the future to establish the chronology of these sites.

1.6 Chapters outline

This chapter details the rationale for a thorough examination and re-evaluation of the lashed lug ship- and boatbuilding tradition in Southeast Asia, highlighting recent archaeological discoveries mainly from Sumatra, Indonesia. It presents the aims and objectives of this research while addressing the fragmentary nature of archaeological evidence, leading to a multidisciplinary approach that includes iconography and ethnography. It also discusses the methods selected for data collection, analysis, and interpretation, appropriate to gather as much information as possible for a more comprehensive conclusion, considering constraints such as time, accessibility, and funding.

Chapter 2 provides a comprehensive review of the literature on the lashed lug ship and boatbuilding traditions in Indonesia and Southeast Asia. It briefly outlines the key construction features of these vessels, initially observed through ethnographical methods and later confirmed by archaeological evidence. The review discusses how a multidisciplinary approach has been employed and examines how the trans-Asiatic network contributes to innovation, exchange, and adaptation within this Southeast Asian tradition. This chapter also addresses gaps in the understanding of this shipbuilding tradition as a foundation for designing this current research.

Chapter 3 provides a comprehensive review of previous research on lashed-lug vessels across Indonesia and Southeast Asia. The re-assessment concentrates on Indonesian sites that have been overlooked in regional discussions, as well as a few selected sites in Indonesia and other parts of Southeast Asia, which offer important insights for the interpretation in this thesis. Additionally, this chapter examines existing definitions of ship- and boatbuilding, along with some hypotheses on the typology of lashed lug vessels proposed by different scholars.

Chapter 4 details archaeological data collected by the author from various provinces in Sumatra, Indonesia, including North Sumatra (Bongal), the Riau Islands (Lagoi), Jambi (Kota Harapan and Museum Siginjei), South Sumatra (Sukaraja, Sungai Bagan, Museum Sriwijaya, and BRIN Palembang), and the Bangka-Belitung Islands (Kelapa Kampit). Here, every ship timber is described in detail, including its dimensions, condition, and construction features. Whenever possible, contextual relationships between timbers from a single site, and even inter-site connectivity, are explored. This chapter also presents the results of new radiocarbon dating from Kelapa Kampit, Sukaraja, and Bongal.

Chapter 5 examines specific iconography that aids in better understanding the lashed lug watercraft. It highlights imagery from various sources, including rock art, temple reliefs, manuscripts, as well as historic maps and drawings. The ship and boat images originate from different locations across Indonesia and from a site in the Northern Territory, Australia. The description of each iconography stresses the construction features of the images, situating them within their temporal and spatial contexts to offer additional insights, especially for interpreting the upper structures of the vessels, which are absent from the archaeological evidence.

Chapter 6 documents the ethnographic observations in three shipyards: Lamalera (East Nusa Tenggara), Tana Beru (South Sulawesi), and Pasuruan (East Java), where the shell-first construction method is still practised, providing a possible analogy to ancient watercraft building in cases where archaeological evidence is limited. The report emphasises the building process: specifics that cannot be inferred from material remains alone, such as shaping and bending the timbers, construction sequence, and waterproofing the hull. Besides direct observation, secondary sources related to the shipyards are consulted and included in this chapter.

Chapter 7 presents the analysis and interpretation of the documented shipwreck and boat remains, complemented by iconographic and ethnographic data, to contribute to and even redefine the prevailing knowledge of the lashed lug ship- and boatbuilding tradition. The interpretation is provided by discussing the construction of the vessels, divided into key characteristics and broader aspects of

the general assembly of the watercraft. The highlight of this chapter is the discussion on variations within the tradition and what they reflect.

Chapter 8 concludes the thesis by revisiting the research questions stated in the first chapter. It explains how the entire research process achieves the aims and objectives set beforehand and addresses any remaining questions. This chapter also highlights the need for future research to fill in the remaining gaps in the lashed lug ship- and boatbuilding.



**VERBALE DELLA RIUNIONE DELLA COMMISSIONE PER L'ESAME FINALE DEL DOTTORATO DI RICERCA IN
ASIA, AFRICA E MEDITERRANEO, XXXVII CICLO**

Il giorno __3/26/2026 alle ore 9:00 presso la sala conferenza e la piattaforma Teams, si è riunita la Commissione per l'esame finale della dottoranda Agni Sesaria Mochtar, nominata con D.R. n. 131 del 25 febbraio 2026 e composta da:

Pia Brancaccio _____	Professore di I Fascia settore scientifico disciplinare: Settore ASIA-01/A c/o Università di Napoli, L'Orientale	Membri
Pierre- Yves Manguin _____	Emeritus professor Ecole française d'Extrême-Orient (EFEO, French School of Asian Studies) Southeats Asian Archaeology	
Wendy Van Duivenvoorde _____	Professor Maritime archaeology Flinders University, Australia	
Tom Vosmer _____	Consultant at Ministry of Heritage and Culture, Sultanate of Oman Adjunct Professor, Archaeology The University of Western Australia	Membro Esperto _____

La professoressa Pia Brancaccio ha assunto le funzioni di Presidente ed il professor Pierre-Yves Manguin quelle di Segretario verbalizzante della Commissione.



Area servizi alla Didattica e alla Ricerca
Ufficio Dottorato e Contratti di Ricerca

Nonostante i membri Wendy Duivenvoorde e Tom Vosmer operassero da remoto, è stata assicurata la compresenza con gli altri componenti della commissione, in modo che le valutazioni e ogni decisione fossero assunte collegialmente

I membri della Commissione hanno dichiarato che non sussistono situazioni di incompatibilità tra essi e la dottoranda, ai sensi degli articoli 51 e 52 del codice di procedura civile¹.

La Commissione ha preso visione della tesi della dottoranda Agni Sesaria Mochtar.

La Commissione ha accertato l'identità della dottoranda trascrivendo di seguito gli estremi del un documento di identità valido; la dottoranda appone di seguito la propria firma autografa.

	Cognome e nome	Tipo, numero e scadenza documento di riconoscimento	Firma
1	Agni Sesaria Mochtar	Passaporto, S414695, 17 maggio 2027	

La dottoranda Agni Sesaria Mochtar ha discusso pubblicamente la tesi di dottorato dal titolo “_A reassessment of contemporary and ancient Southeast Asian lashed lug watercraft: new evidence and perspectives” innanzi ai membri della Commissione. La discussione si è tenuta in lingua inglese ed è terminata alle ore 12.

Al termine della discussione, la Commissione ha approvato la tesi con il giudizio ottimo di seguito così motivato:

La ricerca sviluppata dal candidato offre un contributo originale e significativo all'archeologia marittima, in particolare allo studio delle imbarcazioni “lashed-lug” del Sud-est asiatico. Il lavoro è ritenuto destinato a diventare un punto di riferimento internazionale nel campo. La tesi presenta un'analisi ampia, approfondita e metodologicamente solida del corpus archeologico, presta una grande attenzione alla documentazione dei materiali, alle misurazioni e alla revisione critica dei dati precedenti. Si denota un uso efficace di dati archeologici, storici, iconografici ed etnografici. La tesi colma lacune importanti nella documentazione precedente, propone una rivalutazione critica fondamentale dei dati, costruisce tipologie e interpretazioni nuove, apre nuove direzioni di ricerca e incoraggia collaborazione tra studiosi. Le osservazioni sono generalmente marginali e migliorative,

¹ Art. 51 Astensione del giudice

Il giudice ha l'obbligo di astenersi:

1) se ha interesse nella causa o in altra vertente su identica questione di diritto;

2) se egli stesso o la moglie è parente fino al quarto grado o legato da vincoli di affiliazione, o è convivente o commensale abituale di una delle parti o di alcuno dei difensori;

3) se egli stesso o la moglie ha causa pendente o grave inimicizia o rapporti di credito o debito con una delle parti o alcuno dei suoi difensori;

4) se ha dato consiglio o prestato patrocinio nella causa, o ha deposto in essa come testimone, oppure ne ha conosciuto come magistrato in altro grado del processo o come arbitro o vi ha prestato assistenza come consulente tecnico;

5) se è tutore, curatore, amministratore di sostegno, procuratore, agente o datore di lavoro di una delle parti; se, inoltre, è amministratore o gerente di un ente, di un'associazione anche non riconosciuta, di un comitato, di una società o stabilimento che ha interesse nella causa.

In ogni altro caso in cui esistono gravi ragioni di convenienza, il giudice può richiedere al capo dell'ufficio l'autorizzazione ad astenersi; quando l'astensione riguarda il capo dell'ufficio, l'autorizzazione è chiesta al capo dell'ufficio superiore.

Art. 52 Ricusazione del giudice

Nei casi in cui è fatto obbligo al giudice di astenersi, ciascuna delle parti può proporre la ricusazione mediante ricorso contenente i motivi specifici e i mezzi di prova.



Area servizi alla Didattica e alla Ricerca

Ufficio Dottorato e Contratti di Ricerca

non strutturali: necessità di piccole correzioni e chiarimenti, come maggiore precisione terminologica (es. uso di “ligatures” invece di “ropes”), giustificazione di alcuni termini (come “lashed”), rafforzare il vocabolario nautico tradizionale (fonti linguistiche ed etnografiche) e lo studio delle fibre vegetali utilizzate nelle legature. Si suggerisce di effettuare più campioni per datazioni C14, procedere ad un’identificazione sistematica dei legni, analisi archeobotaniche delle legature e un perfezionamento delle illustrazioni tecniche. Nonostante alcune aree migliorabili, il lavoro è il risultato di una ricerca imponente e quasi esaustiva, la tesi rappresenta un contributo di altissimo livello e merita la pubblicazione come monografia

Nel colloquio la dottoranda ha dimostrato una conoscenza estremamente solida e approfondita del tema di ricerca, padroneggiando con sicurezza il corpus dei dati analizzati. Ha evidenziato una notevole capacità di discutere criticamente le fonti, di contestualizzare i risultati nel più ampio dibattito scientifico internazionale e di rispondere con precisione e chiarezza alle domande della commissione. La sua esposizione ha inoltre rivelato autonomia di giudizio, consapevolezza metodologica e una piena padronanza del lessico tecnico, confermando l’alto livello della ricerca svolta.

- La Commissione, unanime, ha proposto che alla dottoranda Agni Sesaria Mochtar sia conferito il titolo di “Dottore di Ricerca”.

In base al campo di ricerca specifico si ritiene di far afferire il titolo di dottore di ricerca al seguente SSD

Al termine delle operazioni, i membri hanno sottoscritto con firma autografa una dichiarazione con la quale sostanzialmente confermano la loro partecipazione ed esprimono la propria adesione al contenuto del presente verbale. La dichiarazione, insieme a documento di identità, è allegata al verbale, che diviene parte integrante dello stesso.

Alle ore 13:00 il Presidente toglie la seduta.

La Commissione

- Pia Brancaccio (Presidente)

- Pierre-Yves Manguin (Segretario)

- Wendy Van Duivenvoorde (Membro)

- Tom Vosmer (Membro esperto)



**UNIVERSITÀ DI NAPOLI
L'ORIENTALE**

Area servizi alla Didattica e alla Ricerca
Ufficio Dottorato e Contratti di Ricerca

T. A. Vesme