FLYING FISH

WRECK

NORTHERN SONG (960-1127)

北宋飞鱼沉船录

中英版本

MICHAEL FLECKER & TAI YEW SENG

Preface

Dr Michael Flecker

Maritime Archaeologist

When an old friend and ceramics collector first informed me of a new shipwreck discovery off Kota Kinabalu, Sabah, I was thrilled by the prospects but not particularly surprised. Some years earlier we had carried out the rescue excavation of the late 13th century Jade Dragon Wreck in conjunction with the Sabah Museum. It was a Southeast Asian ship with a cargo of Chinese Longquan ceramics, lost off the northern-most tip of Borneo. Prior to that the Museum documented the remnants of a 12th century Chinese junk that wrecked less than a kilometre away. A series of Song dynasty shipwrecks have been found off Palawan in the Philippines, just to the north of Sabah.

From terrestrial excavations, the intended destination of all these ships becomes apparent. Vast quantities of contemporaneous Chinese ceramics have been unearthed in Brunei and around Santubong in Sarawak. The early trade route from China to Boni, the ancient toponym for shifting trade centres in north-west Borneo, is well established.

Despite clear evidence of looting on the new wreck site, a pre-disturbance survey revealed that much of the cargo and some of the ship's structure remained intact. A full archaeological excavation was definitely warranted.

As with most archaeological institutions in Southeast Asia, the Sabah Museum's budget did not cover maritime projects, where the cost of vessels, diving equipment, qualified divers, and logistics far exceeds the cost of terrestrial excavation. Fortunately, the Museum was amenable to collaboration with the private sector. It was the timely funding provided by a responsible corporate entity that saved the site from total plunder.

The wreck derives its name from the distinctive decoration on one of the first finds, a gliding flying fish freely painted in the centre of a stoneware basin. The *Flying Fish Wreck* is a Southeast Asian lashed-lug vessel, following a shipbuilding tradition that lasted for over a thousand years. She has been dated to the first quarter of the 12th century, corresponding to the late Northern Song dynasty, when the Chinese export trade was flourishing. Most of the ceramics cargo was manufactured in Fujian province, suggesting that Quanzhou was the port of embarkation. The ship followed the eastern route down the South China Sea bound for northwest Borneo. If not for the tragic loss just short of her destination, the Flying Fish ship would have supplied months, if not years, worth of ceramics, iron and other important foreign products to a key port-city, together with its littoral and riparian hinterland. With the low frequency of shipping likely in this era, the economic impact must have been substantial.

The *Flying Fish Wreck* findings are significant enough on their own, but when integrated with the results of other shipwreck excavations along the ancient eastern trade route, new light is shed on regional shipping and trade. This in turn provides further insight into 12th century life in both Borneo and China. Furthermore, this archaeologically excavated site helps explain the provenance and context of other wreck sites in Southeast Asia where nothing has been recorded in-situ, a scenario which arises all too often.

It has been a great pleasure working with the enlightened people of the Sabah Museum and Five Dynasty Antique Sdn. Bhd., their private partner. And it is a great pleasure to be able to document the *Flying Fish Wreck* and disseminate the findings in this book. I personally believe that this course of action is currently the most effective way to save shipwreck sites in Southeast Asia, where looting, trawling, and licensed but unregulated salvage remain an extreme threat to underwater cultural heritage.

Biography

Michael started working life in 1985 as a civil engineer in a Singapore-based company. Two years later he changed course, joining Pacific Sea Resources for the two-year excavation of the Manila Galleon, Nuestra Senora de la Concepcion, in Saipan. Since then he has directed some of the most important shipwreck excavations in Asia, either directly through his company, Maritime Explorations, with other licenced companies, or for government institutions. They include the 9th century *Belitung (Tang) Wreck*, the 10th century *Intan Wreck, th*e 13th century Java Sea Wreck, the 15th century *Bakau Wreck*, the c.1608 *Binh Thuan Wreck*, and the c.1690 *Vung Tau Wreck*. Michael's specialty is ancient Asian ship construction and trade. He earned his PhD from the National University of Singapore, based on his excavation of the *Intan Wreck*. This thesis was published as a book by the British Archaeological Report Series (2002). Other works include the book, Porcelain from the *Vung Tau Wreck* (2001), chapters in Southeast Asian Ceramics: New Light on Old Pottery (2009), Shipwrecked: Tang Treasures and Monsoon Winds (2010) and numerous other books, along with a wide range of articles in international journals. Apart from archaeological work, he has written extensively on ethics, politics, legislation and pragmatism in the troubled realm of underwater cultural heritage in Southeast Asia.

Dr Tai Yew Seng

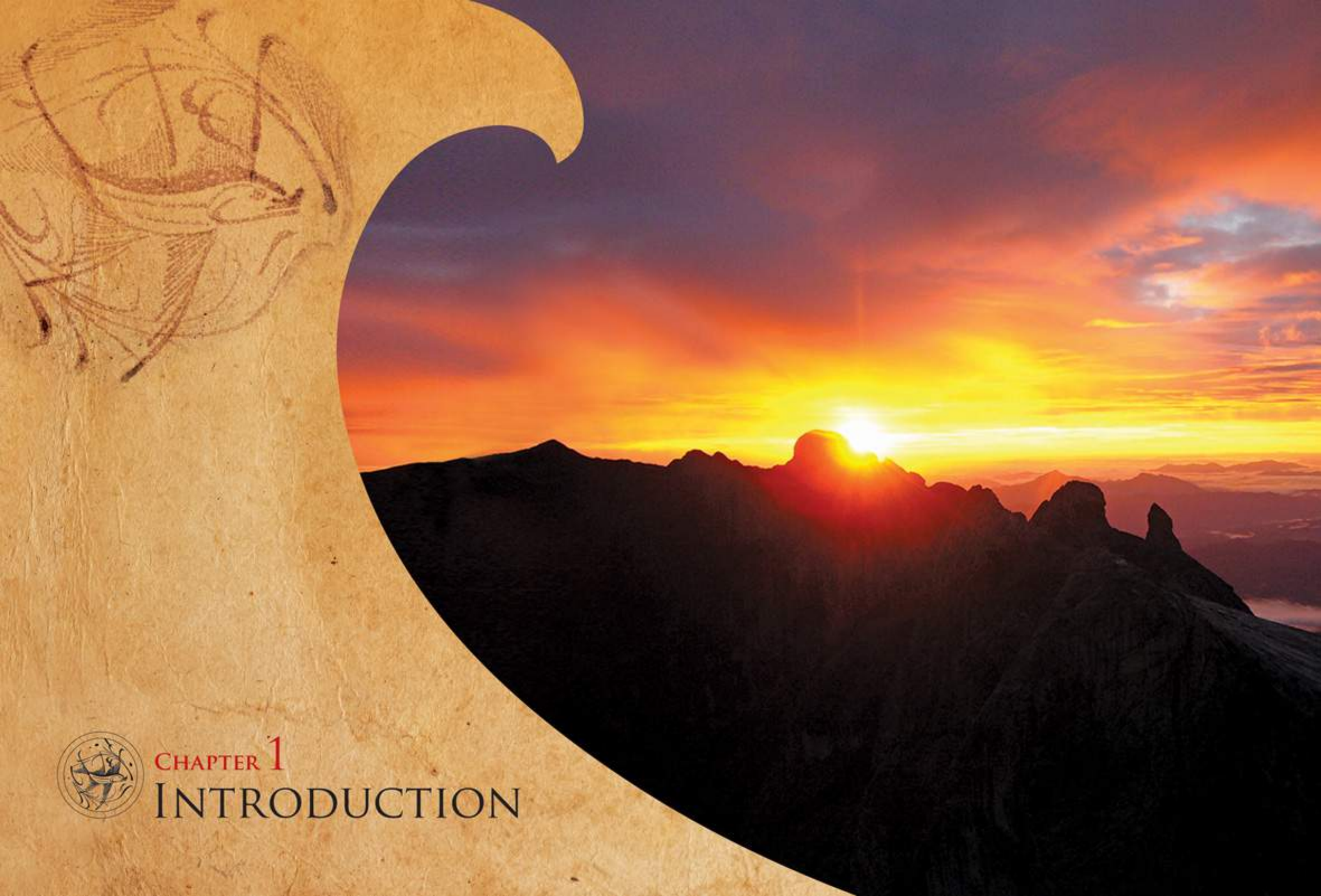
Ceramic & Maritime Specialist

The Flying Fish Wreck is the earliest shipwreck found along the eastern sea route of South China Sea. In 1082, the Bo-ni (Borneo or Brunei) mission to China requested to make the destination port to be Quanzhou instead of Guangzhou. This is the starting date of the eastern sea route of the South China Sea, and Quanzhou becomes the largest sea port according to Marco Polo in late 13th century and prospers for nearly 300 years until the second half of 14th century.

The Flying Fish Wreck sunk when Quanzhou was developing at high speed. Its cargo is critical to our understanding of how Quanzhou developed into a great port. It is also the earliest shipwreck to prove that this part of the world is connected to the maritime trade network.

Biography

Dr Tai Yew Seng is an archaeologist specializing in Chinese ceramic and maritime trade between China and Southeast Asia. He is a Visiting Fellow at the Nalanda-Sriwijaya Centre, ISEAS-Yusof Ishak Institute, and currently is working on Chinese navigation charts and texts. He was a Research Fellow at the Earth Observatory of Singapore, Nanyang Technological University (NTU), involved in the Aceh Geohazard Project analysing ancient ceramics from the archaeological survey. He has been involved in the excavations of Ding (2009), Longquan (2010) and Xing (2011) kiln sites, and Kenya ancient sites (2010, 2013). He has taught courses on Chinese culture at the Chinese Department at Nanyang Technological University and the National University of Singapore, and authored a number of papers and book chapters on ceramic archaeology and maritime trade in English and Chinese.



Chapter 1
Introduction

Cizao basins with a flying fish decoration.

CHAPTER 1

INTRODUCTION

In November 2016 fisherman approached a collector in Kota Kinabalu, Sabah, offering an array of brown ewers, off-white bowls and other assorted shapes. The pieces were typical of Chinese ceramics made during the Song dynasty (960 to 1279 CE). Several were encrusted in coral. Another ancient shipwreck had been found.

A stoneware basin emerged from its newspaper wrapping to reveal a painted iron-brown central decoration, a beautifully rendered flying fish. Such wares are known from the Cizao kilns of Fujian Province, China, but none had ever been found on a shipwreck before. This unique nautical-themed artefact embodies the new discovery, and therefore attributes the name, the *Flying Fish Wreck*.

Some six years earlier dealers in Kudat, a town nestled in a bay near the northern tip of Sabah, had been offered high quality Longquan celadon by local fishermen. The looted bounty originated from the Jade Dragon Wreck[1], a Southeast Asian ship that sunk in 19 m of water off Tanjung Simpang Mengayau around the late 13th century. The Sabah Museum conducted a formal survey of the site three months after the dealers were first approached, but it was too late. The wreck had been completely looted.

In 2003 the first ancient shipwreck came to light in Sabah, less than half a nautical mile (900 m) to the northeast of the Jade Dragon Wreck and in only 12 m of water. The so-called Tanjung Simpang Mengayau Wreck was also largely destroyed by looters. A short licensed salvage effort in 2003[2], and an even shorter official survey in 2008[3] revealed that the wreck was a Chinese junk with a primary cargo of ceramics, iron and bronze gongs. The ceramics suggested a 12th century date.

The Jade Dragon Wreck lay partially exposed on bedrock and partially buried under sand. The sand afforded some protection to the wooden hull and the ceramics cargo, although the covering layer was not deep enough to hinder looters equipped with a rudimentary air-lift. The *Flying Fish Wreck* came very close to suffering the same fate. The periphery of the wreck lies only 7 m from the base of a gently sloping reef, and yet the sediments covering the wreck are deep. Despite some looting, much of the cargo remained beyond reach. It seems that salvage was conducted purely by hand in this instance.

The collector had long been hoping for a scenario such as this. Ever the optimist, he introduced one of the lead fishermen to Mr Dickson Lee, a businessman with a special interest in ancient Chinese history and ceramics. With rival groups depleting the accessible cargo, the fisherman, a Haji[4], was eventually persuaded to reveal the location for a reward.

With the location in hand, the collector and Mr Lee approached the Sabah Museum to apply for a Pre-Disturbance Survey Permit. Having satisfied the specified preconditions, the Permit was issued to Lee's company, Five Dynasty Antique Sdn. Bhd. (FDA). The author participated as project maritime archaeologist, working closely with Sabah Museum personnel and FDA on site and in the museum.

This book is the outcome of the field work and follow-up research. Specialists in many areas have been called upon to analyse the finds, most notably Dr Tai Yew Seng, who focuses on ancient Chinese ceramics. It is his intimate and constantly updated knowledge of early trade ceramic production in China that forms the core of this book, a comprehensive catalogue style appraisal of every ceramic type excavated from the wreck. As a background to the ceramics study, the wreck is dated, the ship type is identified, and the likely original port of embarkation, route, and intended destination are determined. Ceramics were not the only cargo on board the Flying Fish ship. Other cargo items such as wrought and cast iron, lead ingots and rings, and copper alloy bracelets are discussed, along with ship's equipment, personal belongings, and indeed one of the original voyagers whose bones survived deep inside the wreckage.

The Flying Fish Wreck is yet another important discovery that, through proper documentation and research, demonstrates the vast scale and dynamism of maritime trade throughout Asia during the early second millennium.

1 Flecker, 2012.
2 Sjostrand et al, 2006.
3 Basley et al, 2009.
4 Haji is an honorific bestowed upon a Malay Muslim who has completed the pilgrimage to Mecca. A Haji may be addressed by this honorific alone, as was the case with this particular fisherman.

Dive support vessel on the wreck site, waiting for divers to surface.

The Legend of Mount Kinabalu

Legend has it that there was once a Chinese prince who was undertaking a sea voyage when his ship ran into a storm and was wrecked in the South China Sea. He was cast adrift and rescued by fishermen who took him back to their fishing village, where he met and fell in love with a local girl.

The two married and were very happy for many years. He lived his life in the same way as his neighbours and they saw him as one of their own. Even though he had been born a prince, he felt at home with them and they with him. However, over the years a deep feeling of longing crept upon the prince. He began to feel homesick and wanted to see his homeland but most of all he wanted to see his parents who were none other than the Emperor and Empress of China. Therefore, after much thought and agonizing he asked for permission from his new family to visit his parents. After promising that he would soon return to Borneo to take his wife and family back to China they reluctantly gave permission.

The prince returned to China and was given a hero's welcome by his family and the people. The Emperor and Empress of China although happy to see their son, were not happy that he had married a poor village girl from Borneo and forbade him from bringing her to China. They told him they had arranged for him to be married to a princess from a neighbouring country to cement an alliance between the two nations. The prince had no choice but to respect the wishes of his parents even though it broke his heart.

Back in the village in Borneo his young wife waited, at first patiently, trusting her husband to return. As time passed and he did not come she became more and more anxious. The family lived some way from the village which was situated on the coast and she could not travel there every day as she would have liked. Instead she decided that to get a better view of the ships that sailed into the harbour she would climb to the top of a nearby mountain. Every morning at sunrise she would climb to the summit and gaze out over the sea, seeking her husband's returning ship. As the sun went down she would descend the mountain to tend to her children.

The mountain was high and the climb to the top was hard. Eventually the continued effort began to sap her strength. One day after a hard climb she fell ill as she stood on the top looking out over the sea. Sadly, as the sun set and the cold night closed in around her she passed away.

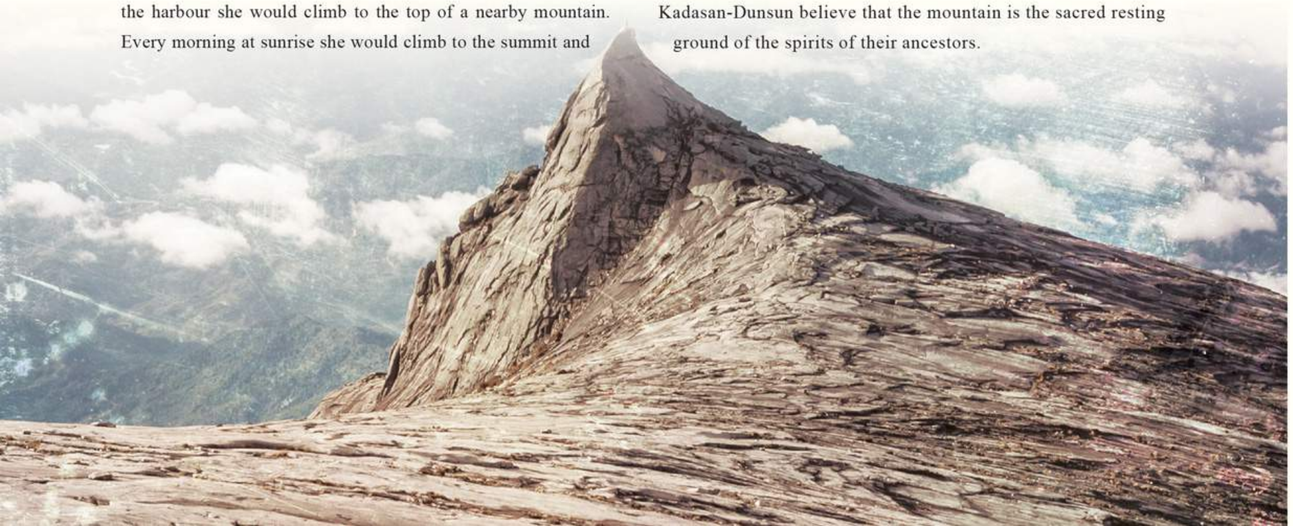
The Mountain Spirit

The spirit of the mountain had grown to know her, and respected her dedication, faith and loyalty to her husband. He was touched by her death. As a long lasting tribute he turned her into stone so that her face looked out forever over the South China Sea, seeking the return of her husband. When the people of her village discovered she was dead and saw her face looking out over the ocean they named the mountain "Cina Balu" in tribute to her example of faith, love and loyalty.

"Cina Balu" means "Chinese Widow". Due to the linguistic influence of the Kadazan-Dusun people of Sabah, the pronunciation of the word "Cina" (chee-na) changed to "Kina" (kee-na) over time. And that is the origin of the great mountain's name, Kinabalu.

The Summit of Borneo

Towering at 4,095 metres, Mount Kinabalu exerts a magical quality that is both indescribable and unbelievable. The granite peaks are almost constantly veiled in wisps of clouds which sometimes resemble a graceful woman peeping coyly from behind the veil. At times during a clear day, the summit reveals distinct pinnacles rising from the smooth granite dome, exuding tranquillity and peacefulness. Sabah's largest ethnic group, the Kadasan-Dunsun believe that the mountain is the sacred resting ground of the spirits of their ancestors.



Tajau

Nearly one hundred intact stoneware storage jars were recovered from the Flying Fish Wreck. These may have held water or salted pork for the crew, or a wide variety of liquid and organic trade goods such as wine, preserved fruits, ginger, or even smaller ceramic items. Some may have been destined for a return voyage to China as containers for the ship's stores. But the majority would have had considerable commercial value as stand-alone vessels after their contents had been sold. Indeed, the finest jars may never have been compromised as containers at all.

The indigenous communities of Borneo have given storage jars an elevated stature, well beyond that of a mere water-tight container. They collectively call these jars Tajau, or in some cases Tempayan. Western scholars have used the term Pusaka, which means heirloom, drawing on the hereditary value of the jars. Another generic term was Martaban, reflecting the trade in jars at the ancient Burmese port of that name, but this has now fallen from use.

Stoneware storage jars appear in the earliest archaeological deposits in Borneo. They date from the 10th century CE, although from some rare pieces in collections it is possible that Chinese 'Dusun' jars first appeared during the late Tang dynasty. During the Five Dynasties period trade with ports in the region of Santubong and Brunei became established, while during the Northern and Southern Song it thrived. Storage jars are found across the spectrum. They are mostly Chinese from Guangdong and Fujian provinces, but there are also fine jars from Burma, Vietnam and Thailand. While some would have been purchased by the cosmopolitan coastal communities, most of the jars made their way up the rivers to the interior where they we prized above all other trade goods.

Of course, many of the jars were simply utilitarian, being used to store rice or to ferment rice wine in the long-houses of Dayak farming communities. Others, usually of greater aesthetic appeal, were purchased as status symbols or for their sacred value. Tajau could be offered as settlement for tribal disputes, or as a marriage dowry. Some took on mystical or spiritual properties, being a tool for oracles or for curing the sick. Some were said to have a 'soul' and could 'speak'. They were even used by some groups to inter the dead.

Tajau continue to be a symbol of wealth and high status for the indigenous communities of Borneo. They are heirloom vessels passing from one generation to the next. Today the State museums of Sabah, Sarawak and Brunei house remarkable collections of jars dating from the ancient Tang to the recent Qing dynasty. The wide range of glistening brown dragon jars is complemented by green-ware, blue-and-white and poly-chrome jars of all shapes and sizes. These sacred Tajau are well worth seeing.

Chapter 2

Site Investigation and Excavation

Chart showing Flying Fish Wreck location (derived from Admiralty Chart No. 2111).

CHAPTER 2

SITE INVESTIGATION AND EXCAVATION

The Pre-Disturbance Survey commenced in July 2017. Haji initially directed the survey boat by lining up distant landmarks, but after the first confirmation dive proved unsuccessful he resorted to GPS[1].

The depth sounder indicated 25 m. To the north a steel post marked a treacherous reef. Waves generated by the southwest monsoon could be seen breaking over the shallows at high tide. At low tide jagged rocks made an appearance. On Admiralty Chart 2111 this reef is named "Deluar Shoal". "Di luar" is Malay for "outside", referring to the reef's location, the outermost danger in a string of reefs and shoals extending 9 miles northwards from the island of Pulau Tiga[2]. This island lies off Kimanis Bay, a large coastal indentation halfway between Kota Kinabalu and the off-lying Federal Territory of Labuan.

The wreck site is more than 13 nautical miles from the nearest point on the mainland. The ancient sailors must have thought they were being prudent in keeping such a distance from shore on their south-westerly coasting course. They probably stuck at night. During the day the shoals stand out as large pale green patches surrounded by deep blue, so they could easily be seen whether waves were breaking over the shallows or not. Having impacted the reef the ship drove straight over the top, or perhaps the sailors used anchors to heave themselves off. As the cargo holds were filled to capacity there was no internal access to the damaged planks[3]. The captain changed course towards the shore in a desperate bid to ground his ship in sheltered waters. It was not to be. He barely made it a mile before the ingress of the sea overwhelmed the bailers, and his ship slipped below the surface.

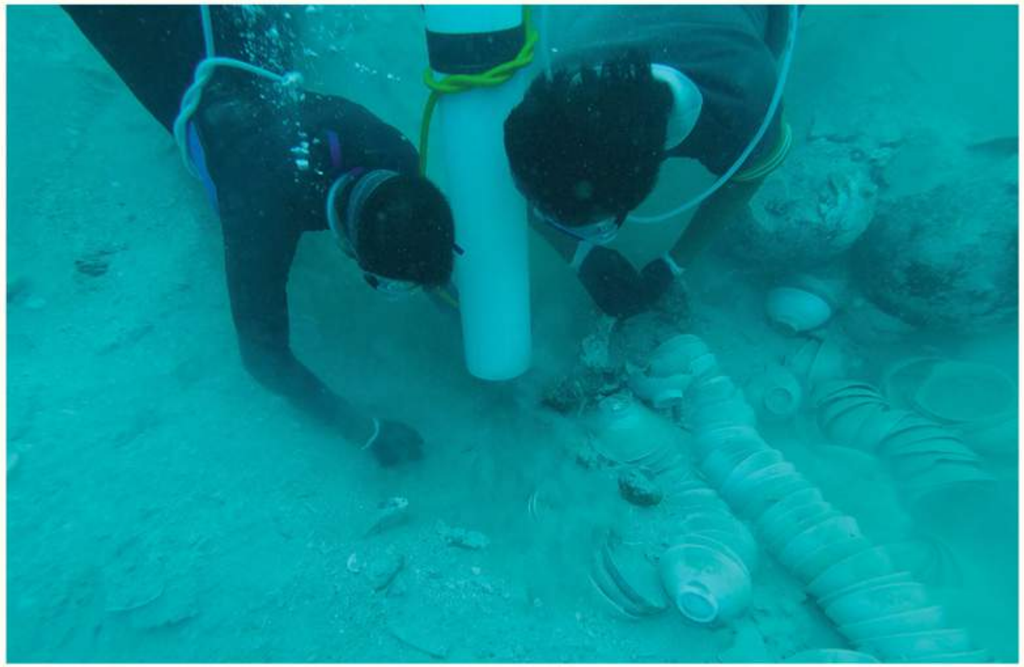
Commencing the excavation with a water-dredge. Note the piles of debris around the central depression.

The first official inspection dive was undertaken in relatively poor visibility. Upon reaching the seabed there was nothing but sand in sight. Half way through a circle search the tell-tale signs of a wreck, piles of broken ceramics, finally emerged from the gloom. The author tied in a 50m tape, took a compass bearing, and commenced a swim to measure the length of the tumulus. The mound was barely 4 m long by 2m wide. Another mound was detected several metres away, this one even smaller. In all there were eight distinct piles of broken ceramics. Having taken distances and bearings, these were plotted on the surface to reveal a rough circle some 13 m in diameter. The enclosed area was slightly depressed but bereft of ceramics.

1 It is unfortunate that traditional fishermen (indeed all seamen) seem to be losing their navigation skills due to the insidious use of GPS. Until recently a couple of landmarks were enough to relocate a wreck. Only two decades ago the author witnessed the relocation of a wreck without a landmark in sight. The fishermen used a compass bearing and his watch (time being equivalent to distance at a known speed), together with a lifetime of experience on his boat.

2 "Pulau Tiga" means "Three (or Third) Island". When approaching from the north, Pulau Tiga first appears to be three distinct islands, before they are eventually discerned to be three hills on the one island.

3 Hirth and Rockhill (1911:32) cite a 13th century Chinese description of Southeast Asian ships, "If the ship suddenly springs a leak they cannot mend it from the inside, but they order their foreign slaves to take knives and oakum and mend it from the outside, for the foreign slaves are expert swimmers, and do not close their eyes under water".



Local divers using an airlift to expose a long stack of bowls.

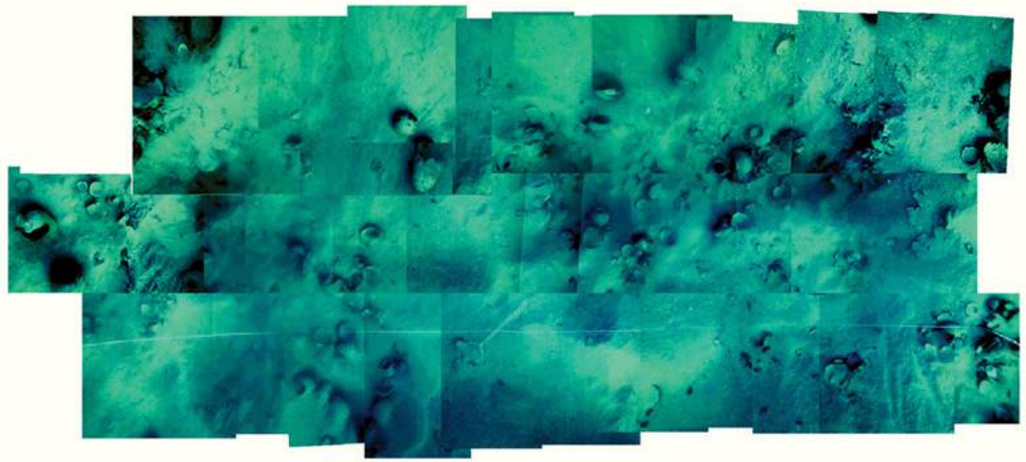
With nine months of accumulated knowledge the fishermen-divers were best placed to commence productive excavation. After a lesson on how to cautiously use a 150mm diameter water-dredge and airlift, the first pair suited up for their dive. Braided PVC hoses were wrapped around their waists, with the open ends clamped between their teeth. Fins of fibreglass sheet with bicycle inner-tube straps were slipped on. The 5 horse-power petrol-driven paint compressor was started up and in they went, trailing the water-dredge to the bottom. The divers had politely declined the offer of second-stage regulators which are usually used in a hookah diving system. They preferred their traditional techniques.

Excavation started near the middle of the central depression. The extremely unusual site layout was quickly explained. One diver operated the dredge while his buddy collected freshly exposed shards and partially broken ceramics for disposal on the surrounding ceramic mounds. The mounds were not the result of some bizarre wrecking process, but peripheral spoil piles. The Pre-Disturbance Survey was not exactly pre-disturbance.

The water-dredge allowed the divers to dig deeper than they had previously managed by hand alone. As much as two metres of sand had to be removed to gain access to the remaining cargo. When intact ceramics and large iron concretions began to appear, excavation could proceed in a more systematic manner.

Initially, a base-line was installed in a north-south orientation. As shall be discussed shortly, a few hull planks were uncovered early enough in the excavation to reorient the base-line to follow the ship's alignment of 30°/210°, without having to adjust much data. Significant finds were recorded as perpendicular offsets to the baseline.

The visibility improved after the so called Pre Disturbance Survey, allowing for basic photomosaic work. A GoPro camera was used in both still and video mode to shoot parallel lines at a fixed height above the wreck. The images were later cropped, realigned and merged to form a mosaic of the entire site. This process was repeated towards the end of the excavation when more of the iron concretions had been revealed, although some of the earlier excavation had been deliberately reburied to protect the ship's timbers.



Photomosaic of the wreck site a week after commencing the excavation.

Many loose planks were uncovered during the excavation, having been displaced by the looters. They must have come from the outer edge of the hull where they were not buried deep beneath the sand and were not pinned down by iron concretions. While details of these planks were recorded, such as lug, lashing and dowel configuration, it was impossible to determine their original position within the hull.

A diver recovers two nested teabowls, or temmoku, from the sediment beneath a storage jar.

CHAPTER 3

HULL REMAINS

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HULL REMAINS

While Haji had mentioned wooden hull remains, none could be seen when excavation commenced. Small seabed depressions contained wafting wood fragments, but initial excavation stopped short at amorphous iron concretions with entrapped ceramics[1]. In many cases stacks of bowls adhered to the iron. However, in some instances loose bowls could be gently prised from the stacks. Indeed, entire stacks lay free in places. It was the lowest bowl in such a stack that concealed the first evidence of vessel structure. Upon removal of the bowl a plank fragment appeared. The centre had been well preserved by the over-lying bowl while the fringe had suffered the ravages of teredo navalis[2]. The preserved section encompassed a carved lug, and a hole through that lug still contained vegetal fibre. Two wooden dowels remained embedded within the teredo-riddled plank edge.

1 As will be discussed shortly, many shipwrecks with cargoes of Chinese ceramics also carried iron from as early as the 9th century.

2 Teredo navalis is commonly referred to as teredo worm, or simply shipworm. It is actually a tropical bivalve mollusk. The body resembles a worm but it is the rough surface of the anterior shells that rasp their way through wood.

Wood from under bowl showing edge-joined dowels.

Wood from under bowl showing adze marks.

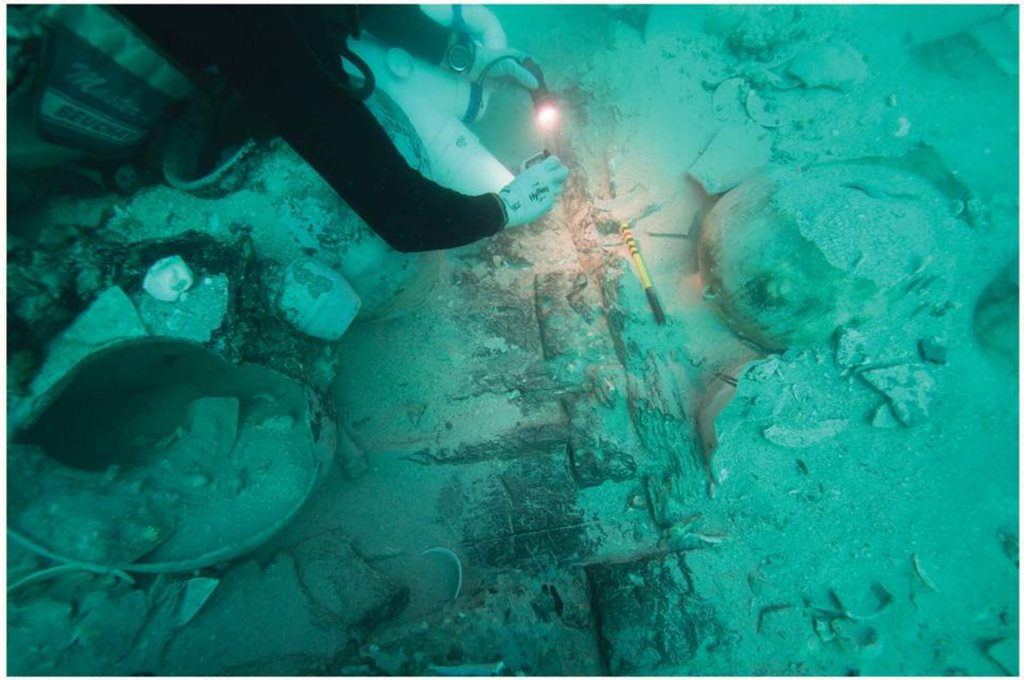
This 25 cm long chunk of degraded wood was all that was needed to establish that the Flying Fish Wreck was a Southeast Asian lashed-lug ship. Adze marks on the edge of the lug portrayed how the plank had been hewn from a log. The black vegetal fibres originally lashed a branch-like frame in place. They had the appearance of ijok (sugar palm fibre), which was typically used for lashing. The dowels were used to edge-join hull planks, traditionally with a layer of Melaleuca (paperbark) as luting. The darker wood of the dowels was relatively unaffected by teredo suggesting that it might be the oft-used belian (Borneo iron wood).

Ongoing excavation soon revealed more evidence, a small section of in-situ hull planking between iron concretions. The visible structure was barely half a metre by half a metre in extent but incorporated a plank with a rectangular lug which displayed four pairs of holes for lashing. From the longitudinal alignment of the plank edge, the ship's orientation was determined to be 30° / 210°.

Just two metres to the south a larger gap in the iron cargo exposed four in-situ hull planks and a frame. All planks incorporated rectangular lugs, however every second plank had the lugs joined longitudinally by means of a narrow-raised strip. The planks varied in width from 30 to 36 cm, the lugs from 19 to 24 cm, and the raised joining strip was typically 6cm across. The lugs and connecting strips varied from 3 to 5 cm in height.

Plan view of hull planks and frame.

The most interesting feature of the larger piece of exposed structure was an in-situ frame composed of several parts. As is typical of lashed-lug vessels, the frames are in essence sections of a branch that have been squared off to a minor extent where they rest on the lugs. Otherwise the frame is roughly circular in section, with diameter varying from 8 to 12 cm in this instance. Without being able to determine the centreline of the ship, a floor frame could not be positively identified. However, one section was short and scarfed at each end, which is suggestive of a floor. At one end the simple scarf incorporated a vertical wooden peg, while at the other there were remnants of what seemed to be rattan lashing. The fastening did not appear beneath the frame, so it may have been for lashing the frame to lugs rather than for binding a scarf. It occurs between lugs, so it seems that both a rattan-like material and ijok were used for lashing on the *Flying Fish Wreck*. A longitudinal pole, or stringer, of 5 cm diameter lay on the frame between two lugs, with another light thwart-ships pole above that.



Side view of hull planks and frame.

Towards the end of the excavation another four articulated planks were exposed just to the east of the site centre-line. Interestingly, the surviving planking incorporated two lugs lengthways although only fragments of the frames remained. Only one plank had the lugs joined by a raised strip. However, the strip was not continuous from lug to lug along the plank. It only joined two adjacent lugs. Perhaps the joining strips were only used in areas of higher stress, such as near a mast-step. Furthermore, only the inboard plank had the joining strip while the three planks outboard of that did not.

Frame lashed to lugs.

Detail of frame, lashing, and thwartships and longitudinal poles.

Rounded lug with connecting raised strip.

While most lugs were neatly carved flat rectangles, closer to squares in some cases, there were a few that were quite rounded in section. These included some lugs that were joined by raised strips showing the same degree of rounding.

A loose piece of planking was recovered from beneath a storage jar that was entrapped in iron, and brought to the surface for examination. The rectangular lug was pierced by 1.5 cm diameter holes for the lashings, some of which remained in place and resembled ijok. Edge-joining dowel holes were 1.4 cm in diameter, 9 cm deep, and spaced at intervals of approximately 13 cm centre-to-centre. The plank was only 4.5 cm thick, while the section incorporating the lug was 9.5 cm thick. One end of the lug seemed to be encrusted in a thin layer of a lime-based compound. A frame sample was also recovered. It incorporated a pinned scarf and remnants of rattan-like lashings.

Sample of a plank with a lug, showing four lashing holes, some containing ijok-like fibre.

Pinned scarf joint in a frame timber.

Timber Identification

Three timber samples were sent to Dr Nili Liphschitz of the Institute of Archaeology – Botanical Laboratories, Tel Aviv University, for species identification. They covered the three key structural elements of lashed-lug design - a hull plank, a frame, and a dowel. Longitudinal, tangential and radial sections were examining under a microscope for comparison with reference sections of known species.

The hull plank is of the Shorea genus. Comparison of the three dimensional structure intimated the species, Shorea robusta, commonly known as sal. This wood is heavier than oak and well known for strength and durability, even under tropical conditions. Burkill[3], in his epic early 20th century 'Dictionary of the Economic Products of the Malay Peninsula', notes that sal is only found in India, where it is the second most important commercial timber after teak, and at lower elevations in Nepal. Of course, a timber endemic to India is hardly likely to have been used for hull planking in a Southeast Asian ship when Southeast Asia is blessed with an abundance of suitable hardwoods. Burkill[4] points out that while sal is a robust species, it is not as durable as some Shorea species in the region of Malaysia.

Dr Liphschitz remarks that it is almost impossible to distinguish Shorea species from their three-dimensional structure alone. The hull plank timber could therefore be of the sub-genus, Rubroshorea, which occurs throughout most of Southeast Asia where it is commonly called red meranti. According to Suzuki[5], Rubroshorea is not found in Java, but has a disproportionately large incidence in Borneo and Peninsula Malaysia. This sub-genus is singled out here as the hull timbers of the late 13th century lashed-lug Jade Dragon Wreck were carved from red meranti[6]. She was found in northern Sabah. Of course, there are many other contenders amongst the Shorea species.

The frame identification is definitive, being one of the most prized shipbuilding timbers, Tectona grandis, or teak. Teak occurs from India to the Philippines, with ancient forests known in Myanmar and Thailand. According to Bramwell[7], another tropical timber specialist, teak is the foremost shipbuilding timber due to its strength, stability and durability. South China Sea Tradition ships, built in the region of Thailand from the mid-14th until the mid-16th centuries, had hulls made entirely of teak. India shipped teak to the Middle-East for shipbuilding from the early first millennium. The 9th century Belitung Wreck, a Middle-Eastern dhow, had thwart beams of teak[8]. Not only is teak highly workable, it is resistant to teredo attack, although this useful property would not be much utilised by frames, unless the ship was particularly leaky. While teak is found throughout Southeast Asia, it is interesting that Burkill[9] comments on its relatively unsuccessful introduction to Peninsula Malaysia from Java, Myanmar and Thailand during the 1800's.

The dowel, unsurprisingly, is of Eusideroxylon zwargeru. This species is commonly known as belian or Borneo ironwood. Indeed, Bramwell[10] notes that it is the heaviest, hardest and most valuable timber in Borneo. The tree can live for up to a thousand years, and its timber can resist decay for hundreds of years in the worst conditions, pilings in salt water being one example. Burkill[11] goes further by describing belian as one of the strongest known woods, showing little checking or warping even when placed in the most extreme conditions. While this timber is endemic to Borneo, Burkill[12] notes that it could also be found sparingly in Banka, Sumatra and the southern Philippines.

Samples of the rattan-like lashing material were analysed by Dr Hanna Szczepanowska, Senior Conservator at the Singapore Heritage Conservation Centre, and rattan specialist[13]. The analytical examination included imaging the surface features of the samples using optical stereo-microscope, surface morphology using scanning electron microscopy, and chemical mapping of elements using energy-dispersive X-ray spectroscopy. None of these techniques revealed the typical features of rattan: biogenic silica present on the surface, phytoliths (silica inclusions in the cells), nor the typical pattern of sieve-like vascular vessels visible in cross-sections.

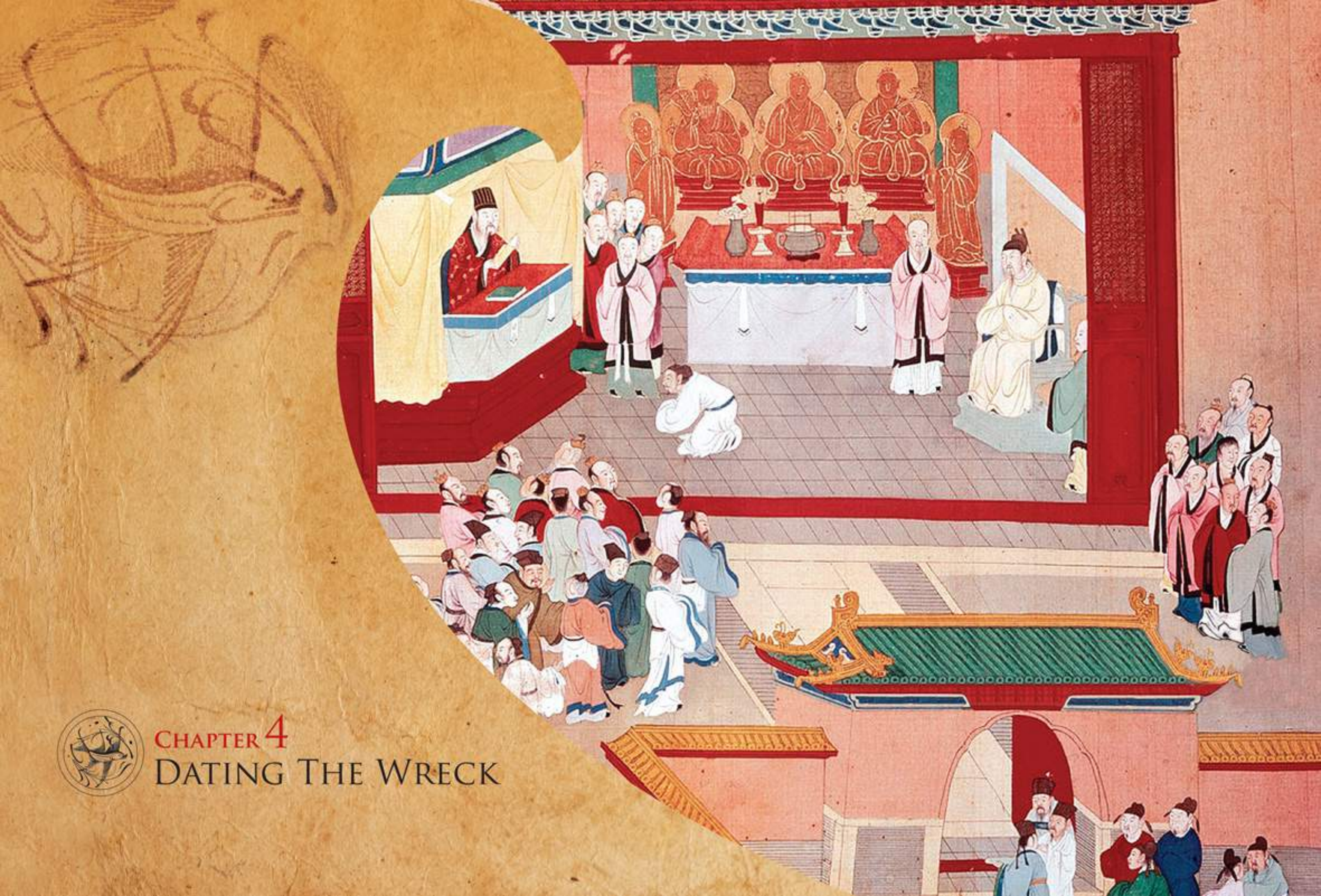
Rattan-type lashing on frame timber.

It was also noted that the width of the strands was greater than typically found with plaited rattan. Furthermore, rattan responds to water by dimensional expansion and increased flexibility, which would adversely affect the tightness of lashings. And yet rattan is specifically mentioned as a lashing material by Horridge in his ground-breaking study of ancient Indonesian craft, although he does use the term 'special rattan'.

So while it seems that this particular lashing material is not rattan, no macroscopically similar alternative has been identified or suggested as yet.

Rattan-type lashing through a hole in a lug.

3 Burkill, 1966:2037.
4 Burkill, 1966:2040.
5 Suzuki et al, 2006:10.
6 Flecker, 2012:17.
7 Bramwell, 1982.
8 Flecker, 2008:385.
9 Burkill, 1966:2165.
10 Bramwell, 1982.
11 Burkill, 1966:1002.
12 Burkill, 1966:1002.
13 In house report by Dr Hanna Szczepanowska, HCC-NHB, Analysis of Shipwreck Samples: Plant Material that was Used for Lashing Frames on the Hull Planks of a Shipwreck, December 2017.
14 Horridge, 1985: 51.



Chapter 4
Dating The Wreck

The two wood samples collected for radiocarbon dating.

CHAPTER 4

DATING THE WRECK

The initial consensus of the ceramic collectors in Kota Kinabalu was that the ceramics cargo as a whole dated to the Southern Song period (1127 to 1279 CE). However, there were a few unique pieces that appeared to be Northern Song (960 to 1127 CE). There were no Chinese copper coins found on the *Flying Fish Wreck*, so this handy tool for determining an earliest date could not be utilised. Radiocarbon dating was therefore enlisted to provide an additional dating perspective.

Two wood samples were collected from the seabed specifically for radiocarbon dating: the outer growth rings of a structural frame; and a small branch, which may have been used for firewood or for dunnage. The aim was to collect samples that would have been closest in date to the loss of the ship. The samples were analysed by Dr Irka Hajdas of AMS Radiocarbon Dating, at the Laboratory of Ion Beam Physics in the Swiss Federal Institute of Technology.

The calibrated date probabilities for both samples resulted in multi-peaked curves which signify two separate periods within the standard 2-sigma range (95.4% probability):

Frame :	1021 to 1059 CE	1065 to 1155 CE
Branch:	1018 to 1052 CE	1081 to 1152 CE

Firstly, the date ranges for the frame and the branch are very close, reinforcing the validity and significance of the radiocarbon analysis. Secondly, when assessed in conjunction with other dating evidence, it is possible, and common practice, to eliminate one of the peaks. In this case the stylistic analysis of the ceramic cargo suggests Southern Song, or post 1127 CE. A few unique pieces indicate a late Northern Song date. However, early to mid-Northern Song is highly unlikely, thereby eliminating the first peak for both samples. The 2-sigma date range is therefore 1065 to 1155 CE, which statistically indicates a higher likelihood of Northern Song (62 years from 1065 to 1127) than Southern Song (28 years from 1127 to 1155).

A green-ware bowl, probably from the Yaozhou kilns in Shaanxi province.

Now we can turn to the unique ceramics. Green-ware bowls with a carved floral decoration on the exterior, a ribbed pattern on the interior, and a high foot-rim are very similar to wares from the Yaozhou kilns in Shaanxi Provence, which are famed for their production during the Northern Song (a comparison is illustrated in Chapter 11).

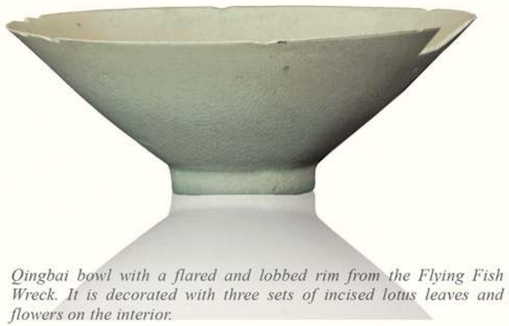
The array of very fine qingbai bowls with an incised cross-hatched design and an unglazed rim, are clearly from the Jingdezhen kilns. They are sometimes referred to as 'Haji cap' bowls due to their close resemblance to the dome-shaped headgear worn by pilgrims to Mecca. An example of this type was found at a Chinese tomb that has been accurately dated to 1127 CE[1]. The tomb, belonging to Madam Zhang, was located in Wuyuan county in Jiangxi province, adjacent to the Jingdezhen production centre. Five more 'Haji cap' bowls were recovered from the Pulau Buaya Wreck[2], apparently inside a storage jar. The primary cargo of Guangdong ceramics on the Pulau Buaya Wreck is very similar to the ceramics cargo on the nearby Lingga Wreck[3], which has been quite concisely dated to the period 1111 to 1127 CE.

Chapter 4 header illustration
Emperor Huizong holding court. He reigned from 1100 to 1126 CE, the period corresponding to the loss of the Flying Fish Wreck.

1 Peng, 1998: 57.
2 Ridho and McKinnon, 1989:11.
3 Flecker, forthcoming.

Qingbai 'Haji cap' bowl from the Flying Fish Wreck.

Qingbai 'Haji cap' bowl excavated from a tomb dated to 1127 (Peng, 1998:57)



Qingbai bowl with a flared and lobbed rim from the Flying Fish Wreck. It is decorated with three sets of incised lotus leaves and flowers on the interior.

Qingbai bowl from the tomb of Madam Zhang. It is decorated with a combed and chrysanthemum pattern on the interior (Peng, 1998:56.)

Madam Zhang's tomb contained one more bowl that bears a very close resemblance to a bowl from the *Flying Fish Wreck*[4]. It is a conical qingbai bowl with a flared rim and fine interior decoration. Both are of identical shape, however the rim of the Flying Fish bowl is delicately lobed.

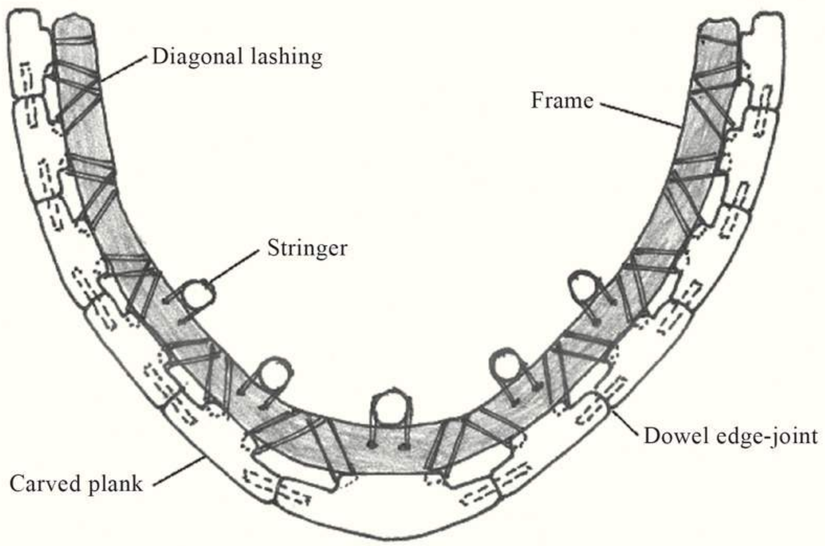
Dr Tai Yew Seng, of Singapore's ISEAS Yusof Ishak Institute, is of the opinion that a qingbai bowl on the *Flying Fish Wreck*, with a delicately lobed rim and a high foot ring, was a product of a Jingdezhen kiln that only made this type of ware during the reign of Emperor Huizong (1100 to 1126 CE).

It may therefore be concluded from the combined evidence that the *Flying Fish Wreck* is dated to the very late Northern Song period, say the first quarter of the 12th century. It may well have wrecked just before hostilities broke out, leading to the transition from Northern to Southern Song.

4 Peng. 1998: 56.

A qingbai bowl thought to have been produced at Jingdezhen during the reign of Huizong (1100 to 1126 CE).

Chapter 5
Ship Origin and Evolution



Cross-section of a typical small lashed-lug vessel.

CHAPTER 5

SHIP ORIGIN AND EVOLUTION

As has been confirmed, the *Flying Fish* ship is of Southeast Asian lashed-lug design. However, it is difficult to determine specifically where she was built as almost identical vessels have been unearthed in Malaysia, Indonesia, the Philippines, and Vietnam. Timber identification provides contradictory clues, with hull planks of a shorea genus, frames of teak, and dowels of belian. Belian is primarily found in Borneo, where red meranti, a species of shorea known to have been used in lashed-lug ships, is also abundant. However, teak is not endemic to Borneo. Belian, being such an important timber for construction elements like dowels, which only require small quantities, could easily be exported to ship-building centres throughout Southeast Asia. Java is a contender. Red meranti is not endemic there, however this identification is only tentative. Many other suitable shorea species are endemic to Java, as is teak. Teak does not seem to be endemic to Sumatra, and it certainly is not to Peninsula Malaysia. While the conclusion must remain tentative, Java is a likely origin of the *Flying Fish* ship.

Indeed, one of the best preserved lashed-lug hulls has been excavated on land in Java. Before taking a close look at the Punjulharjo ship, it is worth a chronological examination of all of the archaeological evidence covering a multitude of other lashed-lug vessels throughout Southeast Asia. But before that, a collation of all that is known of the lashed-lug shipbuilding tradition.

An Overview of Lashed-Lug Design

A pioneer of the study of lashed-lug design, Pierre-Yves Manguin[1], notes that all pre-14th century Southeast Asia ships found in archaeological contexts belong to a single technical tradition. They are built by raising planks on each side of a keel piece that shows clear signs of having evolved from a dug-out base. The-planks are edge-joined with wooden dowels, which in earlier examples are interspersed with internal stitching. The planks are carved, rather than bent to shape, and incorporate protruding cleats or lugs (locally termed tambuku). Holes are carved or drilled out of the lugs so that they may be lashed to more or less flexible frames and/or thwart beams. Horridge[2], another pioneer focusing on ethnographic evidence, coined the term "lashed-lug" to designate this tradition.

Apart from maintaining the cross-sectional shape of the vessel, the frames provide shear and bending strength to reinforce the wooden dowels within the planks. Lashings between lugs and over the frames serve to hold the frames in place and to pull the planks together. Tiers of thwart-beams, lodged below and above the lugs, help provide the compressive forces that hold the planks tightly together despite the flexing of the hull. They also help to provide lateral support, preventing the hull from opening up or bending inwards.

On first impression a lashed-lug boat appears to be flimsy, suitable perhaps for fishing and coastal transport. But from archaeological evidence ships of up to 35 m were constructed by this technique, and Chinese historical sources indicate that some may have been as large as 45 m^3. The secret to their success may lie in their flexibility. The vegetal bindings, both the plank stitching and the lug and thwart ties, are to some degree elastic. As the vessel flexes with the waves the bindings stretch but always maintain their tensile properties, thereby keeping the planks in compression and the boat watertight. Vessels constructed with nails and bolts, on the other hand, must be rigid and therefore utilise more and bigger timbers. Once such a vessel starts flexing the fastenings tend to loosen as the holes are enlarged, and the compressive forces holding the ship together decrease, resulting in a loss of watertight integrity.

Traditionally the bark of paperbark trees (Melaleuca sp.) has been used as luting between the seams of hull and deck planks on vessels with dowel edge joining in Indonesia[4]. It is quite likely that the same material was used on the ancient lashed-lug boats. Strips of bark are laid along the seams, pierced by the dowels, and are cut flush with the hull after the planks have been hammered together.

These early Southeast Asian craft were steered by two quarter rudders, a system that survives to this day on many sailing vessels still plying the waters of Indonesia, the pinisi in particular. They had up to four tripod masts and a bowsprit, and probably used canted square-rig or lug sails.

Overall, the lashed-lug construction technique can be viewed as a magnificent piece of engineering. Great compressive forces were achieved in a light structure, utilising cheap and readily available materials, by rolling with the waves rather than trying to fight them.

1 Manguin, 1996:184.
2 Horridge, 1978 and 1982.
3 Manguin, 1996:188, and forthcoming.
4 Burningham and Mellefont, 1997:40. Also observed by the author in Sulawesi.

Replica of the Candi Borobudur ship, thought to have been of lashed-lug construction (© Danielle Eubank) .

Iconographic Evidence

The iconographic evidence for Southeast Asian ships of the first and early second millennium is lacking, with the 8th century Candi Borobudur reliefs standing out as the prime example. While some of the ships depicted on Borobudur appear to be of moderate size, they are generally not thought to represent the large cargo carrying vessels of the time. These vessels, having outriggers and resembling the later Indonesian kora kora, seem to be more like fighting ships[5]. However, the stories depicted on the reliefs are concerned with travel between different countries, rather than with fighting. In one case the ship appears in the context of a minister going into exile, while another involves the shipwreck of a commercial vessel[6]. While no supporting archaeological evidence has yet been found, there may have been ancient Indonesian craft equipped with outriggers that were used for trade. If so, they probably had a limited cargo capacity and range, as outriggers tend to be a hindrance for larger vessels in tempestuous seas. Chinese records indicate that large Indonesian ships without outriggers carried on trade with the ports of southern China from the 8th to the 15th centuries[7]. In all probability such voyages began much earlier.

Internal construction details are obviously lacking on the temple reliefs, but the complex system of thwarts and longitudinal poles depicted on many is consistent with lashed-lug vessels utilising outriggers. Other important indigenous features depicted on the reliefs include quarter rudders, one or two tripod masts with canted square sails, and a spritsail.

Historical Evidence

The very early appearance of Southeast Asian ships is reflected in the 1st century CE Chinese manuscript, Han shu (History of the Han Dynasty):

> *"The barbarian trading ships transfer them to where they are going [and those on the ships] also benefit from this trade, and sometimes rob and kill people. The traders also suffer from the winds and waves and sometimes drown. Those who survive will be several years on their return[8]."*

Manguin[9] cites two more Chinese texts of the first millennium. They are descriptions left by Chinese pilgrims who sailed to Sumatra and then on to India on Southeast Asian ships which they called kunlun p'o. The first text, dated to the 3rd century states:

> *"The large ones are more than 50 metres in length and stand out of the water 4 to 5 metres... They carry from 600 to 700 persons, with 10,000 bushels of cargo [according to various interpretations, from 250 to 1,000 tons]... according to the size of their ships, [they] sometimes rig four sails, which they carry in a row from bow to stern. The four sails do not face directly forwards, but are set obliquely and so arranged that they can all be fixed in the same direction, to receive the wind and to spill it... This oblique [rig], which permits the sails to receive from one another the breath of the wind, obviates the anxiety attendant upon having high masts. Thus [these ships] sail without avoiding strong winds and dashing waves, by the aid of which they make great speed."*

The second text was written by a Chinese monk in the 8th century:

> *"The p'o are sea-going ships. They lie 6 or 7 feet deep in the water. They are fast and can transport more than 1,000 men, apart from cargo... With the fibrous bark of the coconut tree, they make cords which bind the parts of the ship together... Nails and clamps are not used, for fear that the heating of the iron would give rise to fires. [The ships] are constructed by assembling [several] thicknesses of side-planks, for the boards are thin and they fear they would break. Their length is over 60 metres... Sails are hoisted to make use of the winds, and [these ships] cannot be propelled by the strength of men [alone]."*

Manguin[10] summarises information contained in these two Chinese texts, interpreting the descriptions with the benefit of archaeological data now at hand:

- They were up to 45 m in length and some 600 tonnes burden.
- No iron was ever used in fastening their components together. The texts clearly refer to fastening with palm fibres.
- Some craft had several layers of planks.
- They were rigged with multiple masts and sails.
- They probably had no outriggers, as no mention was made of such an unfamiliar attachment.

5 Manguin, 1996:190.
6 Miksic, 1999, personal communication.
7 Horridge, 1985:1.
8 Wade, 2013:2.
9 Manguin, 1980:275. The lengths mentioned in both of these texts are thought to be exaggerated based on the archaeological evidence.
10 Manguin, 1996:189.

This information is certainly limited, with the only real evidence of lashed-lug construction being the reference to palm fibre fastening, which could equally apply to Indian or Arab vessels. The multiple layers of planking are a fundamental feature of the later South China Sea tradition, so it is interesting that there is such early mention of this. However, it seems impossible to have multiple layers of planking on a lashed-lug vessel unless treenails (as opposed to dowels) were used to attach them. There is no evidence of this from archaeological finds. The additional layers on vessels of the South China Sea tradition were fastened to the inner layer with iron nails.

Horridge[11] cites a Portuguese description of a paddled war canoe with outriggers, the kora kora, written around 1544:

"They are neither nailed nor caulked. The keel, the ribs, and the fore and aft timbers having been adjusted, they firmly fasten all of them with cords of gamuto [black sugar palm fibre] through holes made in certain places. They leave some handles or grips on the inside of the boards. Through these they tie them together so that nothing can be seen from the outside. In order to join the planks, they make pegs at the end of some of them; and in others at regular intervals they bore holes into which the pegs fit. And before joining the planks together, they put baru [type of paper-bark] between them so that no water may enter; and once joined together, they fit so well that they look like one piece."

The fast, manoeuvrable kora kora is a far cry from a sailing cargo ship, but the construction technique is consistent with the archaeological remains of the latter.

The account of the Spaniard, Francisco Alcina (1668), is also cited by Horridge[12]. Alcina describes the construction of lashed-lug vessels in the Philippines. Interesting details include the method of making planks, whereby a tree trunk is split lengthways with only one plank made from each half. The planks are carved with projecting lugs on the inner surface. They are edge-joined with dowels. As a curing process the vessel is fully assembled, with transverse thwarts being lashed to the lugs to hold the shape, and logs with rattan lashing pressing the planks together. After some time it is taken apart and the planks reshaped. When the planks are reassembled they are held together by ribs that are pliant, durable and light, bound to the lugs with 'special rattan'. Splinters of hardwood are driven through the ends of the dowels after holes are drilled for the purpose, effectively clamping the planks together.

Ethnographic Evidence

To this day there are examples of lashed-lug craft plying the waters of the eastern Indonesian archipelago. They are but tiny counterparts of the cargo carriers and war galleys of a thousand years ago, but the construction techniques have changed little. Horridge[13] notes the perahu belang of Aru, a small open fishing boat with individually carved planks incorporating lugs. The lugs are lashed to light, flexible ribs with rattan. Longitudinal poles lashed to the ribs serve as deck supports, the deck being removable split bamboo sheets.

11 Horridge, 1978:9.
12 Horridge, 1982:5-14.
13 Horridge, 1985:51.
14 Gibson-Hill, 1952, citing Evans, 1927.
15 Manguin, 1996:185.
16 Manguin, 1996:185.
17 Manguin, 1996:185.
18 Manguin, 1996:189.
19 Manguin, 1989:203-205 and 1996:188.
20 Burkill, 1966.
21 Clarke et al, 1993:143.
22 Lacsina, 2015.

Terrestrial Finds

Most of the earliest Southeast Asian lashed-lug ship finds are terrestrial. They are not shipwrecks at all, but abandoned hulls that have gradually been covered with sediment in rivers or estuaries over centuries of geological change. As such, they were generally not carrying any cargo or personal belongings, so it is difficult to draw conclusions on the original function of these vessels.

The oldest known example was found in 1926 on a river bank at Pontian on the Malay Peninsula[14]. The remains consisted of four strakes, seven ribs, and the stern post, all crudely cut and finished timbers. The wood was identified as being of a Hopia species, and surviving stitching was identified as ijok fibre (Arenga pinnata). Associated ceramic shards are comparable to finds at Oc-Eo in southern Vietnam, which gives them a broad 1st to 6th century date. Radiocarbon analysis of timbers carried out long after the ship was first exposed yielded a date between the 3rd and 5th century, consistent with the ceramics date[15].

Some badly damaged pieces of timber kept in the Wat Khlong Museum in southern Thailand bear close similarities to the Pontian timbers. This, and their apparent association with the bead production site of Khuan Lukpad, which dates from approximately the first half of the first millennium AD, indicates a broad date comparable to the Pontian boat[16].

Two dozen badly damaged planks, including a small section of keel piece, were discovered and excavated at Kolam Pinisi, near Palembang in south Sumatra. They belonged to a large sturdy hull that had its planks stitched together and fastened to frames by way of lashed-lugs. A radiocarbon date of the 5th to 7th century was obtained from the planks[17].

At tin mining sites in Jenderam Hilir, south of Kuala Lumpur, Malaysia, damaged planks with dowel holes and protruding lugs were recovered. A radiocarbon date ranging from the 5th to the 7th century has been obtained[18].

Eleven planks and a quarter rudder were recorded at a disturbed site in what appears to be an ancient river bed some 2 km from the Musi River, near Sambirejo, south Sumatra. Eight of the planks belong to a single vessel of stitched plank and lashed-lug construction. It is estimated that the original vessel was 20 to 22 m in length overall, and appears to have been a swift, narrow boat rather than a bulky trader. The other planks are of the same design, but appear to be from two other boats. One plank has been radiocarbon dated to between 610 and 775 CE. This is not a conclusive date for the main vessel as a small number of shards in the vicinity are Yue-type ware of the Five Dynasties period (907-960 CE)[19].

Nine ancient wooden boats have been discovered west of Butuan in Mindanao, the Philippines. Five of them have been excavated, and they are all of lashed-lug construction with dowel edge-joining. The planks of one vessel have been identified as Heretiera littorals, a species of mangrove which Burkill[20] describes as possibly the toughest of Malayan timbers and valued for boat building. Ijok fibres were used for lashing. Three boats were initially radiocarbon dated to 320, 1215, and 1250 CE[21], which was confounding. Recently timbers from all five boats have been reanalysed, providing a more coherent radiocarbon date of late 8th to late 10th century[22]. The boats are 14 to 17 m in length and narrow, and therefore were perhaps not intended for bulk cargo transport. They may have been used for small scale inter-island trade, or they may have been war craft. It is difficult to speculate without associated artefacts.

Sand quarrying at Paya Pasir, near the city of Medan, north Sumatra, has revealed thirty badly damaged timbers, some paddles, and part of a wooden anchor. The timbers belong to a variety of vessels of different sizes, all belonging to the lashed-lug tradition[23]. One timber is the broken extremity of a large keel piece, which is also bored for dowels. There are floors as well as side-frames, all with bevelled joints at their extremities where they would have been fastened with a treenail through a single hole[24]. By comparing the greatest plank thickness with later vessels Manguin[25] estimates that the overall length of the larger ship was 30 to 32 m, which is comparable to the largest lashed-lug vessel so far discovered, the Ceribon Wreck. The site has been shown to be the harbour of the nearby settlement of Kota Cina which was active from the 12th to the 14th century[26]. Ceramics recovered from the ship graveyard confirm this date.

Chau Tan Wreck

After a typhoon passed over the coast in 2011, a wooden shipwreck was exposed in very shallow water near the town of Chau Tan in Binh Son District, Quang Ngai province, Vietnam. The wreck was immediately plundered, to the extent that locals pulled up the hull remains to use for firewood. Fortunately, a local collector managed to acquire a large selection of ceramics and a few non-ceramic artefacts, along with many of the disarticulated ships' timbers. A Japanese archaeological team undertook the task of studying these remnants, a daunting exercise considering that all context has been lost[27]. The surviving keel is 22 m long. Hull planks are edge-joined with wooden dowels, and stitched internally with coir[28]. The strakes incorporate pierced lugs, with coir lashings still evident. The Chau Tan ship is clearly of Southeast Asian lashed-lug construction, and the first example to be found in Vietnam. And yet an anchor found on the wreck bears a striking resemblance to the Arab-style anchor from the 9th century Belitung Wreck[29].

Some 400 sacks of ceramics now belonging to the collector have been found to contain Yue greenwares, Changsha-ware, Ding and Xing whiteware, and a few three-colour-ware figurines. There are also a number of turquoise-glazed Middle-Eastern amphora shards. Three types of Chinese copper coins have been noted from the Tang dynasty, including those from Qianyuan Zhongbao (758 to 760 CE). Ink inscriptions on some of the ceramics are in Chinese, Arabic and Indic script. It can be tentatively concluded that the Chau Tan vessel had loaded at a Chinese port, most likely Guangzhou, during the early 9th century. She stopped off near Chau Tan in Vietnam, perhaps the first landfall after the crossing between Hainan and the Paracels, to trade, revictual and/or shelter. From her shallow gravesite it would seem that a storm drove her ashore and filled her with sand, preventing the contemporary salvage of some of her cargo.

Intan Wreck

While the surviving hull remains of the Intan Wreck were minimal, dowel edge-joints and timber analyses conclusively identify it as another lashed-lug ship[30]. Apart from 46 small pieces of degraded wood, nothing at all was left of a once substantial vessel. A sample from an apparent plank has been positively identified as a timber of the Bombacaceae family, and is most likely to be a Durio species (durian). A dowel or treenail, with a length of 11.5 cm and a diameter of 2.3 cm, corresponding to the diameter of dowel holes in some of the wood fragments, has been conclusively identified as Eusideroxylon zwageri (belian or Borneo ironwood). Dowels were spaced at 9.8 cm, and plank thickness was approximately 6cm.

Wood fragment incorporating a dowel, from the Intan Wreck.

From the cargo distribution, particularly that of less mobile tin ingots, an overall length of 25 to 30 m was initially estimated. Assuming that plank thickness correlates to vessel length, the Intan ship should be shorter than the Paya Pasir Wreck which has been roughly estimated to be up to 30 m long, as discussed above. However, when comparing the relatively small volume of the Intan cargo to that of her big sister, the 30 to 35 m long Ceribon Wreck (see below), she may have been closer to 25 m than 30.

Stylistic analysis of ceramics, Chinese coins, and C14 analysis provided an early to mid-10th century date for the Intan Wreck. Nearly half of the ceramics cargo consisted of small brownware pots, some with handles and some without. These pots, along with storage jars and basins probably came from kilns in the Chinese provinces of Guangdong and Fujian. A small number of white-glazed jarlets, dishes and vases came from the Ding or Xing kilns of Hebei Province. Greenware bowls and covered boxes with finely incised decorations, and lobed ewers originated from the famous Yue kilns of Zhejiang Province. But not all of the ceramics were from China. Hundreds of fine-paste-ware bottles and kendis were probably crafted in southern Thailand. Large jar shards with a thick turquoise glaze were of Middle - Eastern provenance.

The Intan Wreck also carried a wide array of bronze objects cast in Sumatra, yet showing the strong Buddhist and Hindu influences of India. There were bronze mirrors and silver ingots from China, tin from the Malay Peninsula, and glass from the Middle-East. The wreck's location south of Bangka Strait, the fact that none of the bulk cargo items originated from Java, and the presence of several artefacts that are known to have originated in Sumatra, indicate that the ship was sailing from Sumatra to Java. Although Chinese ceramics and other Chinese commodities formed a large part of the cargo, the ship did not go anywhere near China. Tonnes of tin from the mines of Kedah were stowed beneath the Chinese ceramics. The Chinese cargo must have been transhipped at an entrepot port in Sumatra, probably at or near Palembang, the seat of the Srivijaya Empire. She was probably bound for the Javanese state of Mataram.

23 Manguin, 1996:188.
24 Manguin, 1989:208.
25 Manguin, 1996:188.
26 Manguin, 1996:189.
27 Nishino et al, 2014.
28 It is not clear in the report whether the identification of coir is from scientific analysis or simply from macroscopic examination. Usually the binding is of ijok (sugar palm fibre) which looks similar.
29 Flecker, 2000:209.
30 Flecker, 2002.

In-situ hull planking of the Cirebon Wreck (Courtesy PANNAS BMKT / Cosmix BV).

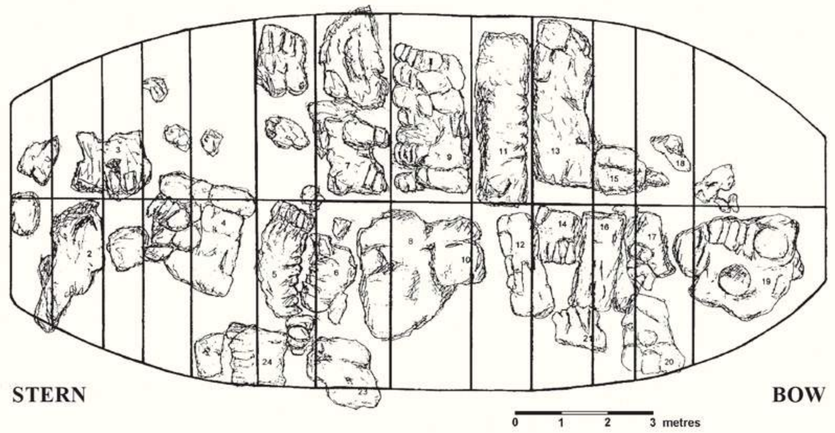
Cirebon Wreck

The 10th century Cirebon Wreck has a cargo almost identical to that of the Intan Wreck, but in much higher quantity. She was discovered in over 50 m of water well north of Cirebon in western Java. Over 150,000 artefacts were recovered, with ceramics making up the vast majority. Unlike the Intan Wreck, much of the hull survived under the cargo and sediments in this deep-water site. A cyclic date inscribed on the base of a Yue-ware bowl provides an earliest date of 968 CE[31], making the Cirebon Wreck a decade or two later. She was involved in the same entrepot trade. Neither ship was voyaging from China when it sunk, although the large Cirebon vessel was certainly capable of passage making throughout the South China Sea and beyond.

While the great depth and poor visibility made recording of the site problematic, Liebner[32] has managed to digitally reconstruct the ship based on measurements taken by the divers. The overall length is estimated to have been as much as 35 m. The hull remains displayed three different lug configurations. At midships, the first nine strakes did not really have lugs at all. Instead approximately 80 per cent of the width of each plank was effectively doubled along its entire length, with pairs of holes being carved out at each frame location. The next two strakes had defined lugs but they were linked to each other, in the same manner as the lugs on the observed Flying Fish Wreck planks. The next three strakes (the extent of the surviving hull) had separated square lugs. These adaptations of the basic lashed-lug design greatly enhance the strength of the ship, as would be necessary when scaling up to this extent. Plank thickness was 9 cm, not including the lugs.

Apart from some extremely complex dowel edge-joining (in some cases three dowel holes overlap each other), suggesting repairs or mistakes in the original construction, there is evidence of 'stringers'. Liebner has included these in the digital reconstructions. They appear to be similar to the longitudinal poles that were observed on the *Flying Fish Wreck*.

31 Liebner, undated:35.
32 Liebner, 2014.



Configuration of the Java Sea Wreck as determined from the layout of iron concretions (Pacific Sea Resources).

Java Sea Wreck

The Java Sea Wreck has been dated to the 13th century based on the stylistic analysis of the ceramic cargo[33]. This is consistent with the radiocarbon date range of 1265 to 1310 CE for a resin sample recovered from the wreck. The base of a covered box inscribed with the manufacturing location, Jianning Fu, indicates that the ship sunk before this city was renamed in 1278[34]. She went down in the western Java Sea, 40 nautical miles from the coast and roughly halfway between Jakarta and Bangka. While almost nothing remained of the hull, dowel edge-joining and Southeast Asian timber species are sufficient to conclude that she was a lashed-lug vessel.

The timber that seems to have originally been from hull planks, displaying evidence of dowel holes, was identified as Parastemon urophyllum (mandailas). It is found in west Irian Jaya, Papua New Guinea, the Soloman Islands, Myanmar, Indonesia and the Malay Peninsula.

The iron cargo of the Java Sea Wreck has to a large degree preserved the configuration of the vessel. Iron bars and cauldrons stowed throughout the ship concreted together before the structure disintegrated. The concretion blocks lie in a distinct pattern and seem to have moved little from their original position. They are divided longitudinally into two rows by a long, narrow gap. Transversely they are similarly separated at regular intervals, indicating that the ship was divided into at least thirteen compartments. The longitudinal division could possibly have been caused by a non-structural partition. The transverse divisions were created by tiers of thwart-beams.

The iron cargo has been estimated to weigh approximately 190 tonnes. The ceramics cargo was originally 25 to 30 tonnes. Factoring in the weight of the ship, rig and other cargo items the displacement would have been in the order of 300 tonnes. From the remaining iron cargo, the beam is likely to have been 8 to 9 m. The length overall has been estimated to be in the order of 28 m, by comparing the aspect ratio of contemporary ships of known dimensions[35].

33 Mathers and Flecker, 1997 and Flecker, 2003.
34 Chicago Field Museum.
35 Flecker, 2003.

It has been estimated that the ceramic cargo originally comprised at least 100,000 pieces. The majority were utilitarian wares from kilns at Anxi, Nanan, and Putian in Fujian Province. Several hundred qingbai covered boxes and small vases were from kilns at Dehua and Anxi. Smaller numbers of high quality wares with a qingbai glaze, are thought to have been produced at the kilns of Jingdezhen. A small number of black-glazed temmoku teabowls may have been produced at or near the Jian kilns of Fujian Province, or perhaps the Jizhou kilns of Jiangxi Province. A wide range of shapes characterized by floral decorations painted in dark-brown or black pigment and originally covered in bright green lead glaze may have been produced at the Chayang kilns in Nanping County, Fujian Province, or less likely from kilns in Yongchun County[36]. Large heavily potted bowls and dishes with a dark olive-green glaze are from the Tong'an kilns in Fujian Province. Brown-glazed jars may have been produced at kilns near Guangzhou.

There is no doubt that the Java Sea ship loaded in China, either at the port of Guangzhou or Quanzhou. Finely potted fine-paste-ware kendis and bottles from kilns in the southern Thai region of Patani indicate that she may have traded there during the return voyage. Ivory and aromatic resin, products of Sumatra, suggest a stop at a port along those shores. There is, of course, a chance that the non-Chinese commodities were transhipped at a single entrepot port. In all likelihood, the Java Sea ship was heading for a port in Java, perhaps Tuban. Part of her cargo may have been intended for transhipment to the vast island network to the east, the islands that supplied the all-important spices.

Hull planks with lugs from the Jade Dragon Wreck.

Jade Dragon Wreck

Yet another lashed-lug ship was discovered off the northern-most tip of Borneo, within shouting distance of the 12th century Tanjung Simpang Mengayau junk[37]. Despite the site being heavily looted, some hull planks were found in-situ. They incorporated lugs and were edge joined with dowels. A large stone was once the stock of a Southeast Asian style anchor. Iron concretions contained wrought iron bars and blades. Ceramics recovered from the wreck site, and others on display in local antique shops, confirmed an almost exclusive cargo from the Longquan kilns, dating from around the late 13th century. Most were in the form of bowls and dishes, but there were also covered boxes and jars. Glazes ranged from translucent pale green to unctuous dark green, emulating the various hues of polished jade. The dealers prized a few large chargers decorated with an appliqué dragon, and therefore coined the name, Jade Dragon, for the wreck.

The only plank found in-situ was 35 cm wide, 180 cm long and 3.8 cm thick. It incorporated two long lugs 132 cm apart, centre-to-centre. With so much of the hull missing it was impossible to provide any sort of definitive length, but a rough estimate based on the ceramic distribution indicated approximately 20 m length overall. The carved lugs were semi-circular in section, with three holes bored through each for lashing to the frames. Several of the less degraded lugs also had a rectangular slot carved into each end. These would have taken the thwart-beams, one on each side of each frame.

The hull plank timber has been identified as being sub-genus Rubroshorea (red meranti), which occurs throughout Sumatra, Borneo and the Philippines. The dowel identification is not as specific, being any one of many species in the Lauraceae family. Medang was suggested. It covers an equally wide swathe of South East Asia. Belian is another member of the Lauraceae family. It makes an ideal timber for dowels and has been identified on several other lashed-lug ships.

With the exception of the utilitarian brown-ware jars which are found on all wrecks of the period, and some kendis from Cizao, the only non-Longquan ceramics on the Jade Dragon Wreck were from Cizhou, way to the north. This lack of diversity suggests that the Jade Dragon ship departed from the port that served the Longquan kilns exclusively, Wenzhou. From terrestrial finds, it is most likely that she was heading for well-established settlements in Santubong or Brunei.

The Punjulharjo boat during excavation (P-Y Manguin).

Detail of frame-lug lashing on the Punjulharjo boat (P-Y Manguin).

Punjulharjo Ship

A remarkably intact lashed-lug ship was discovered on an ancient beach ridge near the town of Punjulharjo in northern-central Java, half way between Semarang and Surabaya. It was excavated in 2009 by archaeologists from Balai Arkeologi Yogyakarta with the participation of Pierre-Yves Manguin. Radiocarbon analysis of the ijok rope used to tie her strakes together yielded a 660 to 780 CE date[38]. As this is a terrestrial site, dated to the 7th or 8th century, it is out of sequence in this discussion. However, it is both the best preserved of all lashed-lug ships, and it would seem, the closest in design and size to the *Flying Fish Wreck*. It has therefore been left until last for a more detailed and direct comparative analysis.

36 Ho, in Flecker 2003.
37 Flecker, 2012.
38 Novida Abbas, 2010.

The original hull length has been determined to be about 17 m overall[39]. The keel plank was carved out of a single timber, with six strakes on each side. A dozen frames remained in place out of the original fifteen. There were also complex stern and stem winged pieces, a quarter rudder mounting, stringers, thwarts, stanchions, and many intact ijok stitches and lashings. While the timbers are not specifically identified, the stringers appear to be bakau (Rhisophora sp.). The long straight aerial roots of this mangrove tree are still commonly used as pilings and scaffolding. They may have added to the longitudinal stiffness of the design, but their main purpose seems to have been to support bamboo lath flooring which may have served to keep the cargo clear of the vulnerable stitching.

The mode of lashing is of particular interest, in part because it replicates that of the *Flying Fish Wreck*, and in part because it differs from the generally assumed lashing technique. The author and others have illustrated lashings passing through holes in a lug and over the frame directly above that lug. Surviving lashings on the Punjulharjo ship and the *Flying Fish Wreck* pass over the frame between two lugs, crossing at the centre. This not only holds the frame to the hull planks, but pulls the hull planks together. On the Punjulharjo ship the planks are also stitched together, but this feature seems to have been phased out over time, as will be discussed shortly. On the same vessel, relatively light lashings pass through holes in the frames and over the stringers to hold them in place. The stanchions have bifurcated ends, natural branches, that seat over the stingers where they are lashed to frames. They probably supported tiers of thwart-beams.

Manguin[40] speculates that the Punjulharjo ship was probably abandoned after a long and busy life, attested by numerous repairs in the planking. She could have been a medium-sized coaster or a large fishing boat.

Evolution of the Lashed-Lug Tradition

The enduring, indeed, the defining feature of the lashed-lug tradition is the system of lashing frames to lugs (tambuku) that have been carved as an integral part of the hull planks. Archaeological evidence confirms a thousand-year continuum, from the 3rd to the 13th century. Portuguese descriptions of the 16th century and Spanish accounts of the 17th demonstrate that the tradition continued, in parallel with the all-dowel joined Southeast Asian jong. A handful of small craft that still exist in eastern Indonesia provide vivid proof that the lashed-lug tradition, at least in a scaled down version, is closer to two thousand years old.

Manguin[41] has painstakingly compiled a chronological list of all archaeological lashed-lug finds along with their specific characteristics, with a view to observing evolutionary patterns. A separate illustration of varying lug configurations shows that lugs on the earliest vessels seemed quite rudimentary. The 3rd to 5th century Pontian lugs were rounded with only two holes. The 5th to 7th century Kuan Lukpad lugs were rounded and triangular in section, again with only two holes. Thereafter, lugs are all flat and rectangular. However, this apparent lug evolution is dashed by the late 13th century Jade Dragon Wreck, where the lugs are again small and rounded, with three holes.

The variation in lug configuration is not a function of vessel size either. The largest archaeological find, the Cirebon Wreck, has rectangular lugs joined by raised strips, as does one of the smaller finds, the *Flying Fish Wreck*. The Cirebon Wreck also demonstrates that several lug configurations can be utilised in the one ship.

One evolutionary trait that does seem to hold true is the phasing out of plank stitching. In earlier craft, additional strength and water-tightness was achieved by stitching the planks together. Holes were drilled near the edges of the planks for stitches of vegetal fibre, usually ijok. They were drilled in pairs within the seam, not being visible from outside the hull. Manguin[42] notes that there were relatively few dowels in the early ships, but as dowel numbers increased the degree of internal plank stitching correspondingly decreased until the stitches were phased out altogether. The 7th to 8th century Punjulharjo ship displays stitches, while the 8th to 10th century Butuan boats are without. Stitches do not occur in any of the early second millennium wrecks, so this structural transition seems to be confirmed towards the end of the first millennium.

Manguin[43] points out that the friction on wooden dowels and frame lashings would not be sufficient to prevent the strakes from riding apart. He observed that locking or counter pins, driven through some dowels from the inside of the hull, were utilised on the Butuan, Paya Pasir and Cirebon vessels. Perhaps these ships employed a lashing system whereby frames were fastened to single lugs. Archaeological evidence from the Punjulharjo and *Flying Fish* sites demonstrates that frame lashing could also link adjacent hull planks, providing a great deal of compressive force to hold the planks together, and alleviating the need for any other clamping mechanism.

A Summary

Lashed-lug vessels plied the waters of Asia throughout the first millennium and well into the second. They were built along similar lines in the islands of Indonesia and the Philippines, and on the Malay peninsula. This suggests a great degree of interaction amongst the populated islands of the vast archipelagos and the main. Lashed-lug vessels ranged in size and function from small fishing craft, to sleek fighting ships, to bulk cargo carriers of several hundred tonnes burthen. They played a pivotal role in maritime trade throughout the South China Sea, the Java Sea, and indeed the Indian Ocean.

The *Flying Fish Wreck* is a relatively small example of a long-distance trader. She dates to the early 12th century, but would have been of similar size and configuration to the nearby late 13th century Jade Dragon Wreck, and is astonishingly similar in size and design to the 7th to 8th century Punjulharjo ship. While there were minor tweaks to lashed-lug design over the centuries, the key elements remained remarkably unchanged.

A model of the lashed-lug Java Sea Wreck in the Field Museum,Chicago.The Flying Fish Wreck is thought to be a smaller version of this ship, perhaps with two lug sails (© Field Museum).

39 Manguin, forthcoming.
40 Manguin, forthcoming.
41 Manguin, forthcoming.
42 Manguin, forthcoming.
43 Manguin, forthcoming.

Chapter 6
Song Dynasty China -Port of Embarkation

CHAPTER 6

SONG DYNASTY CHINA - PORT OF EMBARKATION

With a cargo made up exclusively of Chinese manufactured products, most notably ceramics and ironware, there can be no doubt that the Flying Fish ship originally departed from a Chinese port. But during the last decade of the 11th century the Song government had become remarkably and uncharacteristically liberal, opening up many ports to unrestricted international trade. Consequently, Guangzhou, Quanzhou, Zhangzhou, Hangzhou, Mingzhou, Dinghai, Huating, and Wenzhou were all thriving ports by the early 12th century.

During the pre-Song era, Guangzhou was the most important port in southern China. In the Yiqiejing yingyi of 815, Hui Lin notes that kunlun bo (Southeast Asian ships) were arriving regularly at the Gulf of Tonkin and along the south-eastern Chinese coast.[1] A source from 841 states, "Guangzhou enjoyed the profits of the barbarian ships where all the valuable goods were gathered… Of all those who served at Guangzhou, not one returned without being fully laden[2] ".

In 971, when the local kingdom of Southern Han was finally subdued, the newly installed Northern Song government established the Office of Superintendent of Maritime Trade at Guangzhou[3]. This Office was intended to coordinate overseas trade and impose and collect taxes[4]. Superintendents were appointed to Hangzhou in 989 and to Mingzhou (Ningbo) in 999 in order to maximise the collection of taxes from trade with northern polities such as Japan and Korea.

As the largest port in southern China, Guangzhou remained the main gateway to the Nanhai trade. Ceramics from the widespread Guangdong kilns were exported largely to the south, where Srivijaya was the main consumer. Indeed, Srivijaya was the leading trade partner with Guangzhou throughout the 11th and into the 12th century. A Srivijanan was even designated headman of the port[5]. This Southeast Asian entrepot was a key supplier of aromatics such as camphor, sandalwood incense and frankincense[6]. Interestingly, the camphor originated from Borneo and was transported on Southeast Asian ships, while the frankincense came from the Middle-East on Arab dhows. Chinese sea-going junks were late on the scene.

1 Heng, 2012:28.
2 Wang, 1958:83.
3 Tan, 2005:231.
4 Wade, 2009:224.
5 Heng, 2012:93.
6 Heng, 2012:93.
7 Heng, 2012:42.
8 Heng, 2012:48.
9 Guy, 1990:19.

It was only in 989 that the Song court began to permit Chinese private vessels to sail abroad for the purpose of trade[7]. However, regulations were imposed requiring all Chinese traders to first register with a Maritime Superintendent. Chinese vessels had to return to the ports where they registered for customs inspection, which must have put a damper on the early growth of Chinese shipping[8]. Southeast Asian, Arab and Indian ships continued to be the chief importers to China, although Chinese shipping continued to gradually increased during the course of the 11th century.

The P'ing-chou-k'o-t'an (Discourse on the Floating Islands), written from direct observations at Guangzhou from 1086 to 1094, famously notes that on ships trading out of Guangzhou, "the greater part of the cargo consists of pottery, the small pieces packed in the larger, till there is not a crevice left". This trade was conducted by small merchants, with each "man getting several feet [of space for storing his goods] and at night he sleeps on top of them[9]".This is the earliest reference emphasising the important role that ceramics played in Chinese overseas trade. It also points to the Guangdong kilns as a key source from at least as early as the Northern Song period.

Map of 12th century China.

Despite the ongoing significance of Guangzhou, the second half of the 11th century saw a major shift in the region's maritime trade to the Fujian port of Quanzhou. This may have been partly precipitated by the Nong attacks on Guangzhou in 1052[10].

According to Dr Tai Yew Seng, in 1082 Boni (a port-city in Borneo) asked the Song government to designate Quanzhou as their principal trading port in China. Prior to this date it was Guangzhou. This change may have initiated the shift to the eastern route in the South China Sea. From Guangzhou ships may have been more likely to follow the western route past Vietnam before crossing to Borneo. The eastern route allowed the Boni traders to avoid Champa, which had been intercepting passing ships. It was also a shorter distance from Quanzhou to Borneo via the Philippines. The *Flying Fish Wreck* is of course located along the eastern route.

In recognition of the growing economic impact, an Office of Superintendent of Maritime Trade was finally established at Quanzhou in 1087. Prior to this, Chinese ships that sailed out of this port had to pass through Mingzhou for inspection if bound for Japan or Korea, or through Guangzhou if bound for the various polities in the South China Sea. Upon their return they had to call at Mingzhou or Guangzhou again for payment of import duties. While smuggling was no doubt widespread, these restrictive measures must have seriously hindered trade. With the lifting of such restrictions in Quanzhou, export ceramic production soared in surrounding Fujian kilns[11]. While merchants laboured to transport ceramics from the widespread kilns in Guangdong province for export through the port of Guangzhou, the relatively tight cluster of kilns around Quanzhou, linked by an extensive river network, made internal transport easier and cheaper. If the ensuing cost benefit was transferred to foreign buyers, it may account for a certain preference for Fujian wares.

In 1090, just three years after Quanzhou's elevation, the Song court decreed that instead of having to register at one of the designated ports of departure, Chinese ships would be permitted to depart from any prefecture, as long as their departure was officially registered[12]. Overall China trade figures show a short-term two-fold jump as a result of this measure[13]. As there was no change in the conditions for foreign traders, much of the benefit may be attributed to an increase in Chinese shipping.

The maritime trade situation in Quanzhou in about 1100 is described in a funerary inscription of the period:

> *"Maritime merchants visited this port twice a year. Each voyage comprised twenty ships. Exotic goods and government monopoly items were so abundant as to be piled up like hills. Those officials who privately traded with them were able to pay but one-tenth or one-fifth of the regular price. Who could possibly refuse such a fortune! Officials of the entire prefecture rushed to trade with these merchants[14]."*

This effusive text speaks for itself. By 1120, the governor of Quanzhou claimed to have half a million residents in his city and its immediate hinterland[15].

As it happened, the *Flying Fish Wreck* was lost during the reign of the most cultivated Song emperor. Huizong (1100 to 1126 CE) was a talented painter and calligrapher, with a deep interest in the Daoist religion. In the popular imagination, it was because Huizong was so absorbed in aesthetic and religious matters that not only did he lose the throne, but the dynasty lost northern China[16].

Dr Tai Yew Seng counters this version of events. He notes that in 1103, Huizong aggressively promoted foreign trade (personal communication). As a result, the Maritime Superintendent in Quanzhou sent emissary, Liu Zhu, to Lopburi (central Thailand) and Champa (central Vietnam) to encourage trade with these kingdoms. They later sent missions to Quanzhou in 1115.

When Huizong reinstated the Maritime Superintendents in Guangdong, Fujian and Zhejiang in 1107, after they had been briefly abolished by the previous emperor, Quanzhou established the Laiyuan Station to receive foreign traders. This Station performed like a hotel, providing all the necessities to the foreigners for the duration of their stay. The Maritime Superintendents in Guangzhou, Quanzhou and Mingzhou received and sent off the foreigners with a banquet.

The central government needed capital to buy imported goods. Dr Tai notes that in 1125, Huizong issued 1,300 'ordination certificates' (度牒) for Buddhist monks and Taoist priests without filling in the name of the recipient. Guangzhou and Quanzhou were issued with 500 copies each, and the Zhejiang ports (Hangzhou and Mingzhou) 300 copies combined[17]. These certificates conferred exemptions from tax liabilities, so unsurprisingly they were highly sought after by wealthy merchants as well as monks and priests. Each certificate is known to have cost 220,000 wens (Chinese coins) in 1101. Therefore, if all of the certificates were purchased at the same price in 1125, the capital raised was 2.86 million wens. No doubt some of the certificates went to the holders of religious office, as was originally intended. However, from the number of ordination certificates issued to each port it is possible to estimate relative trade volumes. The trade volume of Hangzhou and Mingzhou combined was about thirty percent of Guangzhou and Quanzhou combined. The trade volume of Quanzhou was equivalent to that of Guangdong near the end of Northern Song.

After the Song government was forced to retreat to their new capital of Hangzhou, south of the Yangtze River, more conservative trade policies were pursued by the court. In 1127, the first year of the new Southern Song administration, the export of copper coins was banned, and quotas were instituted for goods imported from the Nanhai. Foreign traders who came to the Song polity were still paid in copper cash, but they were now expected to convert their cash into other Chinese products before leaving[18].

Despite the shift in the centre of power, it appears that the economic prosperity which was reflected in the establishment of the Maritime Superintendent in Quanzhou towards the end of the 11th century continued through to the end of the 12th century. The increased external trade in the 12th century seems to have been associated with the commercialisation of agriculture and the growth of local industries involving not only ceramics but textiles, wine, sugar, minerals and salt[19]. The large profits that the Maritime Superintendent garnered for the state are well attested. The Southern Song government continued to develop new ports along the coast in the 12th century, including one at Tongzhou near the mouth of the Yangtze and another in Hainan at Shajin[20].

10 Wade, 2009:234.
11 Tan, 2005:231.
12 Heng, 2012:47.
13 Heng, 2012:49.
14 Wade, 2009:229.
15 Ebrey, 1996:144.
16 Ebrey, 1996:149.
17 Xu Song, 1936, Office Holders 44:11. (宋会要辑稿》职官四四之十一).
18 Wade, 2009:225.
19 Wade, 2009:229.
20 Wade, 2009:224.

Painting of Emperor Huizong.

Visiting Quanzhou in 1292, Marco Polo wrote a vivid description of its trading activities:

> *"Zaiton [Quanzhou] ... the port for all the ships that arrive from India laden with the costly wares and precious stones... It is also the port for the merchants... of all the surrounding territory. And I assure you that one spice ship that goes to Alexandria to pick up pepper for export to Christendom, Zaiton is visited by a hundred*[21]*...".*

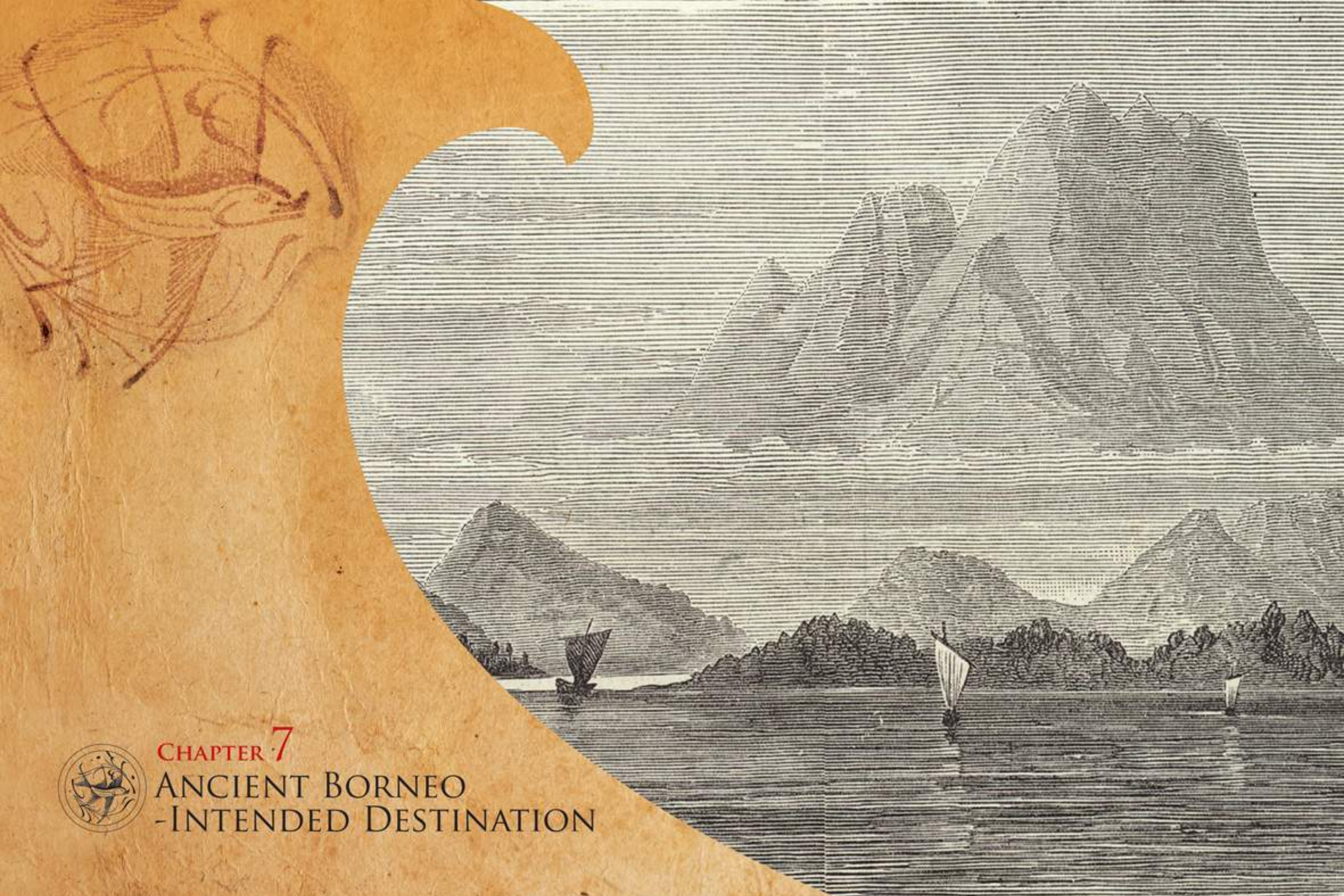
Notwithstanding these glowing reports, the reversal of maritime trade encouragement, caused in part by the monetisation of the trading system and the imposition of quotas, was to bite hard over the following century with the result that Song China's once-thriving maritime trade with Japan, Korea, Southeast Asia and the Indian Ocean withered in the 13th century[22].

Quanzhou's role as the major trading centre finally came to an end in 1366 following a ten-year war that began when Muslim traders launched the Ipsah Rebellion[23]. They lost and were massacred. Shortly after, the first Ming emperor, Hongwu (1368 to 1398 CE), imposed restrictions on Chinese foreign trade which led to a major reduction in the quantity of ceramics exported to Southeast Asia.

Leaping back to the first quarter of the 12th century, when the *Flying Fish* ship set out on her last voyage, the port of Quanzhou was flourishing. Chinese ships could finally voyage freely throughout the Nanhai and as a result were steadily increasing in numbers. Foreign ships continued to trade unabated. Imported products "piled up like hills" on docks and in warehouses. Industries in the hinterland fought to meet increasing regional demand by ramping up production of textiles, salt, wine, minerals, and most notably, ceramics. With her ceramics cargo consisting mostly of Fujian wares, there can be little doubt that Quanzhou was the port of embarkation for the *Flying Fish Wreck*.

21 Guy, 1990:18.
22 Wade, 2009:226.
23 Druce, 2016:34.

Painting of Along the River During the Qingming Festival.



Chapter 7

Ancient Borneo -Intended Destination

CHAPTER 7

ANCIENT BORNEO - INTENDED DESTINATION

Textual Evidence

The earliest textual reference to Borneo, or at least a polity or significant trading port within Borneo, comes from a 10th century Chinese manuscript. The location is referred to as Boni.

The earliest conclusive account, when Boni first comes to the attention of the Chinese court, occurs in 977. It is found in the Taiping huanyuji (Universal Geography of the Taiping Era) by Yue Shi[1], where a brief description of the country was recounted by three Boni envoys. Their king had been convinced of the benefits of paying tribute to China by the foreign trader, Puluxie, who was perhaps an Arab, Persian or Indian. They brought Borneo camphor, turtle shell, sandalwood and elephant tusks[2]. While the envoys explained how to reach neighbouring countries from Boni, there was no clear description of the whereabouts of Boni itself.

It would seem that the Taiping huanyuji is the original source for all other books dealing with Boni in Song times[3]. The Zhufan zhi (Record of All Barbarian Countries), a geographical work describing overseas countries and trade goods, was written around 1225 by Zhao Rugua. Zhao, who had been Supervisor of Maritime Trade in Quanzhou, based his work partly on personal observations, partly on information provided by foreign merchants, and partly on earlier works such as the Taiping huanyuji and Lingwai daida of 1178 by Zhou Qufei[4]. He notes that Boni had over a hundred ships to protect its trade. While this is probably an exaggeration, and the type and size of ship is not specified, the implication of a thriving port remains valid. There was a population of 10,000 within the port, which was surrounded by timber walls. The king wore Chinese silks on special occasions, while he and the elite wore gold-threaded Javanese textiles on a regular basis[5].

Chapter 7 header photo
Mount Kinabalu, Kini Balu or The Chinese Widow.

1 Kurz, 2014:3.
2 Wong, G., 1979
3 Kurz, 2014:4.
4 Kurz, 2014:6.
5 Hall, 2008:185..

The Song huiyao (Institutions of the Song) records the composition and arrival dates of tribute missions but little about Boni itself. There were two missions from Boni: on the twentieth day of the ninth month of the second year of the Taiping xingguo era (4 November 977); and on the twenty-fourth day of the second month of the fifth year of the Yuanfeng era (26 March 1082).

An encyclopaedia entitled Yuhai was compiled in the 13th century by Wang Yinglin, and refers to the two official missions from Boni, in 977 and 1082. It provides new information only in the form of the presents that were given to the envoys, among them horses and saddles. The name of the ruler, Xiangda, is consistent with earlier reports, but again the exact location of Boni remains a mystery[7].

The Wenxian tongkao (General History of Institutions and Critical Examination of Documents and Studies) of 1308 by Ma Duanlin adds the contents of a letter from the Boni king to the emperor of China. Apparently, the king in 977 had heard of China, but did not know how to get there. Xilimanuo is named as the king of Boni in 1082[8].

The Songshi (Official Dynastic History of the Song) of 1345 provides more detail of the 977 tribute gifts, and specifies some navigation details for various trade partners. It was 45 days sailing from Java, 40 days from the realm of Srivijaya in the Malacca Straits, and 30 days from Champa[9].

6 Kurz, 2014:7.
7 Kurz, 2014:9.
8 Kurz, 2014:9.
9 Hall, 2008:185.

A European chart of Borneo dated 1650.

In 1350 Wang Dayuan, in his work entitled Daoyi zhilue (Brief Record of the Island Barbarians), notes that the people in Boni were Buddhist and practiced agriculture. He also mentions the Longshan, or Dragon Mountain. The temptation is to associate this with Mount Kinabalu, a phenomenal landmark and the first mountain to be observed when arriving from the north, but there are many other contenders further south.

There are more references to Boni in Ming and Qing texts, increasingly suggestive of Brunei, but they are beyond the time frame of this investigation. Kurz[10] concludes that on account of the very scarce sources, Boni at any given time during the Northern Song, Southern Song, Yuan, Ming and even the early Qing, referred to a general region rather than a very specific country, kingdom, or urban mercantile centre with a continuous history. He suggests that even though Boni provided some luxury items, they were not sufficiently rare and exotic to create long term interest in China as these items could be obtained through other trade centres[11].

Hall[12] agrees that the Boni polity identified from 11th to mid-14th century Song and Yuan records periodically shifted. But by also drawing from the archaeological record he goes further, stating that during the Song era Sarawak coastal port-polities were dominant, and Brunei river mouths, most notably at and around Kota Batu, were the Boni base during the Yuan era and later. The archaeological evidence that follows might in fact suggest otherwise.

The boom in trade[13], which can be seen from Brunei and all along the coast of Sarawak to Santubong, was linked to sweeping commercial growth in China during the Northern and Southern Song periods. Progressive foreign trade policies and liberalised shipping regulations saw a major expansion of Song maritime trade. Particularly important in trade with Southeast Asia was the port-city of Quanzhou, which rose to prominence in late 11th century. It was a cosmopolitan and religiously diverse city where the most prosperous traders were Muslims of both Chinese and non-Chinese ethnicity. Relations between these traders and those of Southeast Asia blossomed. Given the importance of Quanzhou during the 12th century, a direct trade relationship with the northwest coastal areas of Borneo is undoubtedly apparent[14].

Archaeological Evidence Sarawak

The Santubong delta, just north of modern day Kuching, is strategically located for both external and internal trade. At only 800 m, the isolated Mount Santubong barely qualifies as a mountain, but nonetheless provides an unmistakable landmark for the knowledgeable sailor. The associated network of rivers extends well into the interior, providing vital access to a wide range of sought-after forest products.

Santubong's archaeological complex consists of six sites, including evidence of an iron smelting industry. Huge quantities of ceramic shards have been excavated. Many are hard-to-date locally manufactured earthenware. However, tens of thousands of Chinese ceramic shards clearly date from the 10th to the early 14th century.

Archaeologist Cheng Te-K'un[15] summarises specific finds at the various sites. Sungai Jaong is best known for strange carved stones depicting spread-eagle human figures. Amongst them is a plenitude of Chinese ceramics, coarse earthenware, glass beads, bangles 'of various origins', and a few small gold objects.

At Bongkissam there were over a hundred thousand ceramic shards, slightly less than half of Chinese origin. Just below the surface a so-called Tantric shrine, in the form of a stone platform, housed a ritual silver deposit box containing approximately 140 gold objects, semi-precious stones and beads. Earthenware crucibles cited by Cheng[16] are in fact the nozzles of rudimentary bellows that were used in the iron smelting process[17]. Similarly, huge quantities of iron slag recorded by Harrisson[18] are actually naturally occurring concretions associated with iron-rich lateritic soil [19]. The iron content of nearly 50% confirms that these concretions were in fact the raw material for the local smelting industry.

10 Kurz, 2014:3.
11 Kurz, 2014:23.
12 Hall, 2008:185.
13 Wade, 2009.
14 Druce, 2016:34
15 Cheng, 1969.
16 Cheng, 1969.
17 Wisseman Christie, 1985:84. Harrisson (1969:169) notes in his illustrations that these earthenware artefacts could either be crucibles or tuyere (nozzles of bellows).
18 Harrisson and O'Connor, 1969.
19 Wisseman Christie, 1985:83.

Archaeological sites in Sarawak and Brunei (adapted from Druce, 2016:22).

At the adjacent Bukit Maras site there was a huge quantity of earthenware but very few Chinese shards. Over 500 glass beads were unearthed, along with a damaged stone Buddha statue of the Gupta tradition, a stupa finial, and a sandstone tile depicting an elephant and lotus. Together with the shrine, these finds are strongly suggestive of Buddhist influence.

The Sungai Buah site contained thousands of ceramic shards, earthenware nozzles, grooved stone hammers, beads, and glass bangles. Tanjong Kubor is thought to be a burial ground, with paddle decorated earthenware found in far greater quantities than Chinese ceramic shards. There were also glass beads, glass bangles, 46 pieces of iron, 7 bronze bangles, 2 gold objects, and a Chinese coin. Tanjong Tegok may also be a burial ground, but here the Chinese ceramic shards significantly outnumber local earthenware shards.

But Sabtubong is not the only significant archaeological complex in Sarawak. Gedong lies approximately 65 km to the east of the Santubong delta. This large habitation site seems to have first developed about a hundred years after the earliest Santubong occupation, although it may perhaps be considered an outlying part of the Santubong complex. Gedong is well inland but easily accessed by the Sadong River. As with Santubong, this site seems to have been abandoned by the mid-14th century.

There are several other small habitation sites with Song ceramics near river mouths further north in Sarawak. Some may in fact be burial sites where Chinese ceramics have been interred with the dead, such as in the Rejang River delta[21].

Druce, an historian working in Brunei, neatly summarises these archaeological findings:

"In Santubong's development as a polity, the earliest site appears to be at Sungai Jaong in the 10th century and its nearby burial ground at Tanjong Kubor. During the following centuries the complex expanded to Bongkissam and Sungai Buah. It was perhaps in the 12th century that the Tantric shrine on Bukit Maras was used, and another burial ground was established at its foot, presumably a response to population growth. Harrisson concludes that the complex reached its peak in the late 12th to early 13th century. By the second half of the 14th century the sites had been abandoned[20]."

The meandering Santubong River.

20 Druce, 2016:30.
21 Zaine and Harrisson, 1967.
22 Druce, 2016:31.
23 Franke and Ch'en, 1973.
24 Matussin and Shariffudin, 1978:61.
25 Matussin, 1981:105.
26 Druce, 2016:32.
27 Matussin and Shariffudin, 1978:61.

Thatched houses on a Sarawak river bank.

Brunei

The Kota Batu site, near the mouth of the Brunei River where it discharges into Brunei Bay, is as well-known as the Santubong sites. It had been occupied since the 10th century but the ceramic finds of this early period are very limited. The main growth period begins as late as the Ming dynasty, in the second half of the 14th century, and the zenith is not reached until the 15th and 16th centuries[22].

A grave of a Song dynasty official surnamed Pu, thought to be from Quanzhou, has also been found in Brunei. Dated to the equivalent of 1264 CE, it is the earliest Chinese-script gravestone in Southeast Asia, and one of the earliest Muslim gravestones[23].

Far more importantly in terms of this study, Terusan Kupang, just 4 km upriver, and Jai-Jai on the adjacent Limbang River, were clearly occupied from the 10th century. Some of the Yue-ware excavated there is typical of the Five Dynasties period (907 to 960 CE). There is an abundance of Song material, but few finds from the Ming. An intact temmoku was recovered from the Terusan Kupang site, along with several temmoku shards[24]. There were also a number of Chinese coins[25].

Sungai Limau Manis is 30 km further upstream, off a tributary of the Brunei River. It was a large and important urban centre with a thriving trade. 50,000 shards of imported ceramics from the 10th to the 14th centuries were excavated in 2002 after the site was discovered during river widening work. Several hundred ceramics were found intact or nearly so, suggesting an unplanned exodus. There were over a thousand Chinese coins, boat timbers, house posts, glass beads and bracelets, and some gold jewellery. Given that Terusan Kupang and Sungai Limau Manis appear to have declined at about the same time, coinciding with the expansion of Kota Batu in the 14th century, it is possible that their populations were forcibly relocated to this port-city nearer the mouth of the Brunei River[26].

Large quantities of Song ceramics were also excavated at Bintudoh, some 50km southwest of Kota Batu and well inland[27]. Most of the shards were from bowls or kendis.

Potential Destination

In determining a potential destination for the *Flying Fish Wreck*, the options are limited to the northwest coast of Borneo. Interestingly there do not appear to be any candidates further south in Kalimantan[28] nor indeed in Sabah, where the wreck was located. Sabah does not have the extensive riverine system that characterises the wide coastal plains of Sarawak. A mountain range extending the full length of Sabah's west coast prevented ready access to the hinterland with its wide range of jungle products.

While Santubong did not reach its zenith until the late 12th or early 13th century, it was already well established during the earlier Northern Song. Many of the Fujian ceramic types found on the *Flying Fish Wreck* have also been unearthed in Santubong. Unearthed at Bongkissam, an intact qingbai ewer with a cross-hatched decoration is now in the Sarawak Museum collection, along with others said to be found in the Sarawak River delta[29]. They are identical to ewers on the *Flying Fish Wreck*. Harrisson[30] illustrates two lead rings from the Sungai Buah site, similar in size to those from the *Flying Fish Wreck*. While the Sungai Buah rings are discontinuous, one has the same asymmetry as the *Flying Fish* rings.

Apart from ceramics, the main cargo on the *Flying Fish Wreck* was iron. Paradoxically, Santubong was also an iron production centre, but on a small scale. The iron smelters at Santubong were particularly basic. Wisseman Christie[31] describes how pits were dug out of the ground and lined with rudimentary bellows. Layers of charcoal and iron ore were placed into the pits before igniting. The resultant lump of impure and porous iron, called a bloom, would have been reheated and beaten to remove slag inclusions, thereby forming wrought iron. Depending on the quality of the ore, the end product may have been superior to Chinese wrought iron. Nickeliferous lateritic iron ore from the Luwu area of Sulawesi, for example, was smelted into high quality iron that was used in the forging of highly sought after kris blades[32].

The manufacture of Chinese wrought iron has been discussed in Chapter 10. It was mass produced and generally not of particularly high quality. It is therefore likely to have been cheaper than the locally produced equivalent, and was available in much larger quantities. The two producers probably did not complete head to head. If they did, it is unlikely that there would have been a production centre in Santubong at all. Even if the *Flying Fish Wreck* was destined elsewhere, from extensive archaeological evidence, most ships carrying Chinese ceramics, whether Chinese or Southeast Asian, also carried a cargo of iron. As there is no lack of Chinese ceramics in Santubong, there cannot have been any lack of wrought iron. Of course, Chinese cast iron was also carried on these ships. It remained a unique and highly sought-after commodity.

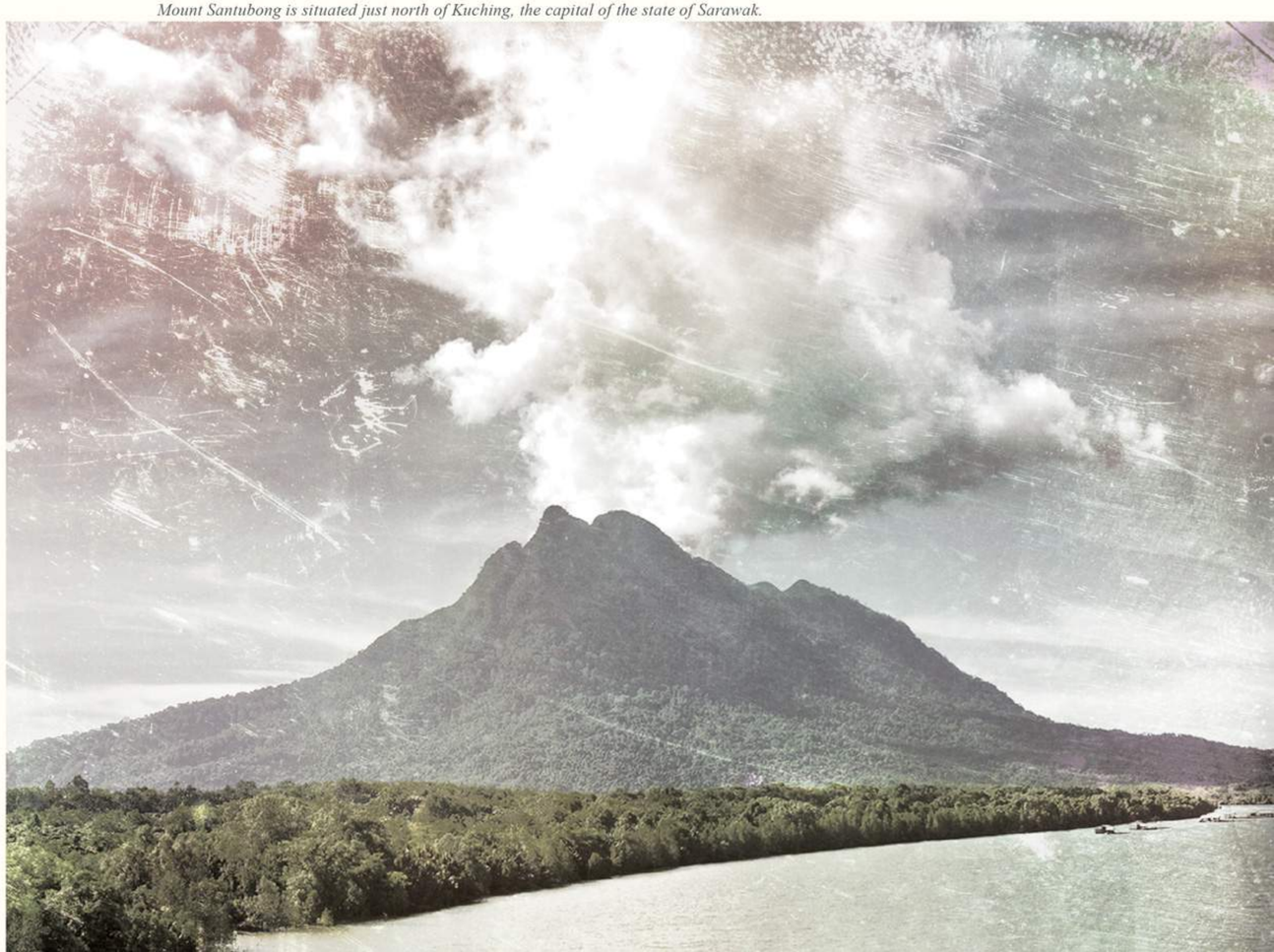
Nearby Gedong is just as likely to have been the final destination for the *Flying Fish* cargo. Indeed, the quantity of ceramics and iron arriving on one ship could well exceed the demand created by any single urban centre. The *Flying Fish* cargo may have been destined for distribution to Gedong and Santubong, as well as the multitude of smaller settlements along the coast and upriver, via secondary trade.

Further north, in what is now Brunei, the important port-city of Kota Batu developed too late to host the *Flying Fish* ship. Terusan Kupang and Sungai Limau Manis, on the other hand, were thriving. An excellent report edited by Karim Bin Osman[33] illustrates many of the finds from Sungai Limau Manis. Direct parallels with the *Flying Fish Wreck* include the ubiquitous off-white bowls with a high footring, Cizao bowls with a brown painted decoration, Qingbai wares with a cross-hatched decoration such as the 'Haji cap' bowls, ewers and small vases, greenware Tong'an bowls, temmoku, brownware jarlets and kendis, and tall and squat jars with brown glazed shoulders. Furthermore, there were bronze anklets identical to those on the *Flying Fish Wreck*, and even a few hull planks from a lashed-lug boat.

There were probably more similar parallels at Santubong, Gedong, and Terusan Kupang, but as these excavations took place from the 1950's to the 1970's the findings have not been as well illustrated or as widely disseminated. All four habitation sites could have been the intended final destination for the cargo of the *Flying Fish Wreck*.

28 Artefacts indicate that there was maritime trade along the western Kalimantan coast around 400 CE, however it was short-lived.
29 Chin, 1988:29,37.
30 Harrisson, 1969:299.
31 Christie, 1985:84.
32 Misol, 2013.
33 Karim, 2004.

Mount Santubong is situated just north of Kuching, the capital of the state of Sarawak.



Chapter 8
The Probable Route

CHAPTER 08

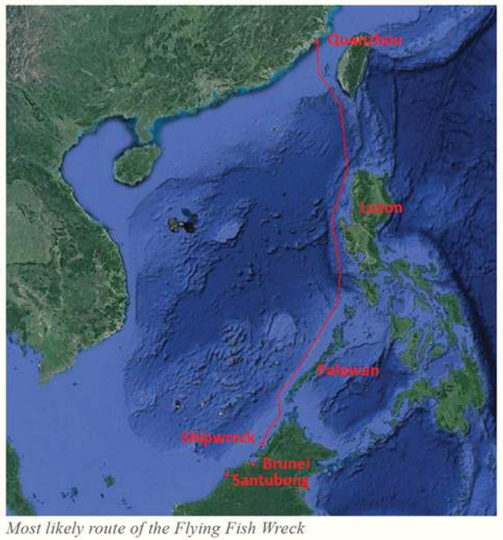
THE PROBABLE ROUTE

The fact that the cargo of the Flying Fish Wreck, a lashed-lug Southeast Asian ship, is entirely Chinese in origin is not at all unusual. The Chinese did not freight their own products into Southeast Asian waters in significant quantities until well into the 12th century. Instead Southeast Asian, Indian and Arab ships made their way to China to trade their home products and others they had picked up along the way for ceramics, ironware and silk.

With a surviving cargo made up mostly of iron and Fujian ceramics there is no doubt that the Flying Fish ship's last voyage originated in China, and from lengthy analysis in the previous chapters, the port of embarkation was almost certainly Quanzhou.

The Flying Fish Wreck lies approximately 1,200 nautical miles south of Quanzhou. There is nothing on board the ship to suggest that she stopped off anywhere along the way to trade, although she could have called in at one of the islands in the Philippines to revictual. The shortest route, and one supported by archaeological evidence, is to head southwest from Quanzhou to the Penghu Islands, off the west coast of Taiwan. There are casualties amongst these islands and reefs suggesting that several ships came a little too close over the years. Continuing south, from the southern tip of Taiwan there was a 250-mile leg to the north-western tip of Luzon. The west coast of Luzon is relatively free of navigational hazards although typhoons would have been a serious threat. From southern Luzon the course would swing southwest along the west coast of Palawan. There is evidence that ships voyaged some distance off the coast, with contemporaneous wrecks on off-lying Breaker Shoal and Royal Captain Shoal. From Balabac Island, immediately south of Palawan, to Tanjung Simpang Mengayau, the northern-most tip of Borneo, it is only 60miles. The 12th century Tanjung Simpang Mengayau Wreck[1] and the late 13th century Jade Dragon Wreck[2] attest to the significance of this landfall. These wrecks lie within a kilometre of each other and not far from shore. Perhaps their anchors dragged while they sought refuge from a squall.

From Tanjung Simpang Mengayau ships would have followed a coasting route, with the changing aspect of Mount Kinabalu clearly in view to port. As long as they remained more than two nautical miles from the shore, as it seems they did, there are few off-lying dangers until reaching Deluar Shoals, which, of course, claimed the *Flying Fish* ship.



Most likely route of the Flying Fish Wreck


The 17th century Selden Map, a Chinese depiction of the South China Sea showing key maritime routes (Bodleian Library, University of Oxford).

The famed early 17th century Selden map, a Chinese depiction of the South China Sea, portrays the various ancient trade routes. There is a line plotted from the vicinity of Quanzhou which follows the route described above, the so-called eastern route. There is another line, the western route, that leads from Quanzhou south of Hainan to the coast of Vietnam. From southern Vietnam, one branch continues south-westwards to the Melaka Strait and Java, while another heads south across the South China Sea to the western most point on Borneo before continuing on to Java. This cross route is mentioned in Song and Yuan texts, linking Champa to Cape Dato.[3] For ships bound from Quanzhou to Santubong, the distance is roughly the same along either route. For those heading to Brunei, the eastern route is shorter, but there is not much in it.

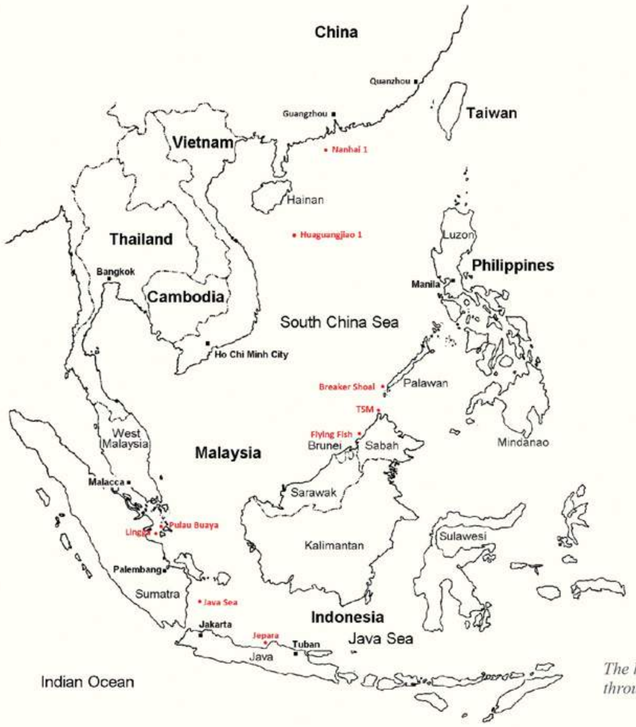
The deep open waters of the western route are largely inaccessible to the maritime archaeologist. The archaeological evidence that we do have strongly suggests that the eastern route was well utilised, at least until the 14th century. The Tanjung Simpang Mengayau, Jade Dragon and Flying Fish ships were all heading southwards along the eastern route, bound for habitation centres in the vicinity of Brunei or Santubong.

1 Flecker, 2015.
2 Flecker, 2012.
3 Ptak, 2004:403.

Chapter 9

Shipping Trends

Comparison with Other Song Dynasty Wrecks



The locations of known Song dynasty shipwrecks throughout the South China Sea.

CHAPTER 09

SHIPPING TRENDS - COMPARISON WITH OTHER SONG DYNASTY WRECKS

The Flying Fish Wreck was lost between the years 1100 and 1127 CE, towards the end of the Northern Song dynasty. She adds to a growing corpus of documented ceramic cargoes that fall within the Song period. Several contain close parallels to the *Flying Fish Wreck*. Unfortunately, some of the cargoes come from heavily looted shipwrecks, where most, if not all context has been lost. Even the ship's origin may be unknown. The well documented *Flying Fish Wreck* can, in some instances, expand our knowledge of these poorly documented sites. Viewed in combination, these wrecks demonstrate interesting trends in cargo selection, routes taken, and vessel ownership.

Contemporaneous documented wrecks include Lingga, Pulau Buaya, Jepara, and Java Sea in Indonesia, Tanjung Simpang Mengayau in Sabah, Nanhai I and Huaguangjiao I in China[1], and Breaker Shoal in the Philippines.

1 The Huaguangjiao I Wreck was found in the Paracel Islands, which are occupied by China but also claimed by Vietnam.

Bowl from the Lingga Wreck with Chinese characters depicting a date of 1054, while coins place the earliest date of the wreck at 1111 CE (Courtesy of Tai Yew Seng).

Lingga Wreck

The Lingga Wreck[2] is particularly relevant. While the cargo was not archaeologically excavated, it has been documented in a warehouse, and the ship has been confirmed to be of the Southeast Asian lashed-lug tradition. She went down some 8 nautical miles southwest of Pulau Tuka, one of the Lingga Group of islands in the Riau Archipelago, Indonesia. While a Xicun bowl is painted with Chinese characters depicting a cyclical date of 1054 CE, coins confirm an earliest date of 1111 CE. Ceramic styles strongly suggest Northern Song, giving a tight date range for 1111 to 1127 CE for the Lingga Wreck. Some scholars interpret the date as "first year of the Zhi He reign" which is 1054 CE, however Chinese coins provide an earliest possible date of 1086 CE.

The vast majority of the ceramics recovered from the Lingga Wreck were made at kilns in Guangdong province, so she almost certainly sailed from Guangzhou. Most of the ceramics on the *Flying Fish Wreck* are from Fujian province. Only one ceramic type was found on both wrecks: medium-sized storage jars with a wavy line around the shoulder. They are probably from the Xicun kilns, or perhaps the Nanhai Qishi kilns, in Guangdong. Jars of this nature were used for liquid storage or as packing containers, so they could potentially make several voyages from different ports. Copper-alloy anklets, and bronze gongs were also found on both wrecks. And they both contained large cargoes of Chinese cast and wrought iron.

Pulau Buaya Wreck

The Pulau Buaya Wreck[3] was found close to the Lingga Wreck. From the very similar ceramics cargo, it also sailed from Guangzhou during the early 12th century. It too had the cargo documented in a warehouse, but nothing whatsoever is known of the ship. If she was a lashed-lug vessel, as is likely, she is truly a sister-ship to the Lingga Wreck, and therefore to the *Flying Fish Wreck*. Indeed, there are bronze gongs, copper-alloy anklets, medium-sized storage jars, and Chinese cast and wrought iron on all three wrecks.

The Pulau Buaya Wreck also has some fine qingbai-ware from Jingdezhen, including several thin-walled cross-hatched 'Haji cap' bowls with an unglazed rim just like those on the *Flying Fish Wreck*. So small quantities of better quality ceramics were loaded onto ships in both Quanzhou and Guangzhou.

2 Flecker, forthcoming.
3 Ridho and McKinnon, 1989.

Ewer from the Tanjung Simpang Mengayau Wreck, very similar to ewers on the Flying Fish Wreck (©Sabah Museum).

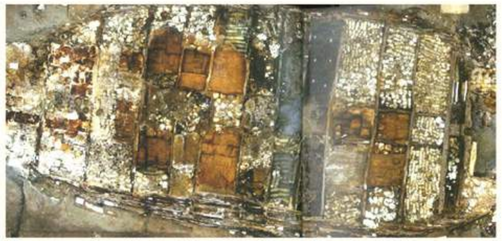
The qingbai and brown-ware ewers are very similar to the *Flying Fish* pieces, however, from a perceived later date for some of the other wares, it would seem that the Tanjung Simpang Mengayau Wreck dates to the early part of the Southern Song dynasty, around the mid-12th century.

Huaguangjiao I Wreck

The Huaguangjiao I Wreck was found in the Paracel Island group to the southeast of Hainan. Chinese archaeologists excavated a considerable quantity of ceramics that came from the Cizao, Nanan and Dehua kilns of Fujian province, indicating that the ship most likely sailed from Quanzhou. It has been loosely dated to the Southern Song period. A large section of the wooden hull survived beneath the ceramics cargo, despite the shallow nature of the site. The iron-fastened planks are typical of a Chinese junk.

Tanjong Simpang Mengayau Wreck

The Tanjung Simpang Mengayau Wreck[4] was heavily looted, and later subject to limited archaeological investigation. She lies off the northern-most tip of Sabah, having had her voyage along the eastern route cut short. Iron fastenings in softwood planks confirm that she is a Chinese junk, perhaps the earliest so far discovered in the Nanyang. As with the *Flying Fish Wreck*, much of the ceramics cargo originated in Fujian province. There are Tong'an-type green ware bowls with incised decorations, and ewers, mercury jars and squat jars from the Cizao kilns. Qingbai covered boxes may be from Dehua or Anxi in Fujian, or perhaps from Jingdezhen in Jiangxi province. Qingbai ewers with a cross-hatched decoration are perhaps Fujian copies of Jingdezhen-ware. Storage jars with impressed flowers around the shoulder are from the Xicun or Nanhai Qishi kilns in Guangdong.



Plan view of the Nanhai No.1 Wreck in the Yangjiang Museum.

Nanhai I Wreck

The 12th century Nanhai I Wreck was raised intact and now resides in a purpose-built museum in Yangjiang, Guangdong province. The hull is 30 m long with a beam of approximately 10 m, and is divided into fourteen compartments by a series of bulkheads. Of the thousands of coins that have been recovered, the most recent is dated to the Shaoxing reign (1131 to 1162 CE), while ceramic analysis suggests a latest date of around 1200.

The ship contains a large cargo of ceramics on top of a massive cargo of wrought and cast iron. She came to grief off the coast of Guangdong while bound for Southeast Asia along the western route. However, from the predominant Fujian origin of the ceramics, she loaded her cargo in Quanzhou. Other ceramic types include high quality wares from Jingdezhen and Longquan. The various Dehua covered boxes and ewers are clearly more recent than the Flying Fish pieces. Cizao brown-glazed jars are the same, which is not surprising as there was little variation in this ware over the centuries

Chinese stone anchor stock reportedly recovered from the Jepara Wreck.

Jepara Wreck

A significant cargo of Fujian ceramics was looted from a wreck some 24 nautical miles west of Jepara in central Java[5]. They are very similar to the Nanhai I finds, although the most recent Jepara coin date is 1118 CE. While Chinese coins are known to have been circulated for centuries, the absence of later coins may indicate that the Jepara Wreck is closer to a mid-12th century date.

A 2.6 m long Chinese-style stone anchor stock, weighing approximately 400 kg, was purportedly recovered from the site. It is most unfortunate that there is no direct evidence of hull construction, for this ship could have been a contender for the oldest Chinese junk so far discovered in Southeast Asia. Without this evidence, it may always be speculated that a Southeast Asian ship replaced lost anchors with Chinese anchors in Quanzhou.

Tens of thousands of bowls are probably from a range of Fujian kilns including those at Nanan, Tong'an, Anxi, and Putian. Some finer quality Longquan bowls are also present. Dehau white-wares include bowls, covered boxes, kendis and vases. Qingbai ewers with a cross-hatched decoration, very similar to those on the *Flying Fish Wreck*, may be from the Minqing kilns in Fujian, as they are not as fine as typical Jingdezhen pieces. Brown-glazed kendis are from the Cizao kilns. Bronze gongs up to 80 cm in diameter and iron-ware were also recovered from the wreck.

4 Flecker, 2015.
5 Djuana and McKinnon, 2005.

Java Sea Wreck

The Java Sea Wreck[6] is a Southeast Asian lashed-lug ship that wrecked between Bangka Island and modern Jakarta, while following the western route from Quanzhou to Java. Her cargo originally consisted of approximately 100,000 ceramic objects stowed above nearly 200 tonnes of iron. While almost all the ceramics are Chinese, and the majority of those from Fujian province, an array of fine-paste-ware kendis and kundika suggest that the ship also traded at the Isthmus of Kra.

The 2-sigma radiocarbon date range for the Java Sea Wreck is 1215 to 1405 CE. A covered box base inscribed with the manufacturing location, Jianning Fu, indicates that the wreck occurred before 1278, when this city was renamed. So the wreck dates from the early to mid-13th century, at least a century after the *Flying Fish Wreck*. And yet an olive-green bowl on the Java Sea Wreck with an impressed character, ji (auspicious), in the centre, is nearly identical to a piece from the Tanjung Simpang Mengayau Wreck which was lost just after the *Flying Fish Wreck*. Clearly some styles persisted.

Breaker Shoal Wreck

The Breaker Shoal Wreck[7] was lost on a reef of that name just off the southwestern tip of Palawan. While nothing of the hull has been reported, there was a stone anchor stock in the Chinese style: square in section and tapering towards the extremities. Again, this does not prove that the ship was a junk as a Southeast Asian ship could have replaced lost anchors with Chinese anchors when loading. The wide range of ceramic types on board mirror the Java Sea Wreck finds to a remarkable extent, including rare lead-glazed painted ware and Thai fine-paste-ware. It would seem that the quantity was considerably smaller. With such a similarity in cargo, the date of loss is likely to have been within a decade or two of the Java Sea Wreck.

Conclusions

While there may be a minor component of higher quality ceramics from Zhejiang and Jiangxi provinces, and of multi-use storage jars from Guangdong, ships voyaging to the Nanyang during the Song dynasty either carried bulk cargoes of Guangdong ceramics or Fujian ceramics, but not both. Those with Guangdong ceramics loaded in Guangzhou, while those with Fujian ceramics loaded in Quanzhou.

The Lingga ship sailed from Guangzhou with Guangdong ceramics, followed the western route, and was bound for Jambi or a neighbouring port. The *Flying Fish* ship sailed from Quanzhou with Fujian ceramics, followed the eastern route, and was bound for Brunei or Santubong. And yet they are both Southeast Asian ships that wrecked within a decade of each other in the early 12th century. They are sister-ships, but had minimal ceramic cargo overlap. Fujian ceramics have been found in quantity in Jambi, and Guangdong ceramics have been found in northwest Borneo. There may have been some entrepot trade at both Guangzhou and Quanzhou, although from the shipwreck evidence it would seem to have been minimal. The ceramic cargoes were dominated by products from kilns in the ports' hinterland.

Fujian ceramics seem to be the preference. Only the two oldest wrecks on the western route from China to Indonesia, the early 12th century Lingga and Pulau Buaya Wrecks, carried a primary cargo of Guangdong ceramics. So far only Fujian ceramic cargoes have been identified on Song era ships following the eastern route to north-western Borneo: the *Flying Fish*, Tanjung Simpang Mengayau, and Breaker Shoal Wrecks. The distance from Guangzhou to Borneo is similar to that from Quanzhou, so it would seem that Fujian wares were preferred in their own right. While they are arguably of higher quality, the potential price premium may have been offset by cheaper transport costs from kiln to port. The early Yuan dynasty Jade Dragon Wreck[8] was bound for Borneo with an exclusive Longquan ceramics cargo, implying that there was indeed a market for higher quality wares in Brunei or Santubong. Presumably the Longquan wares came at a considerably higher price.

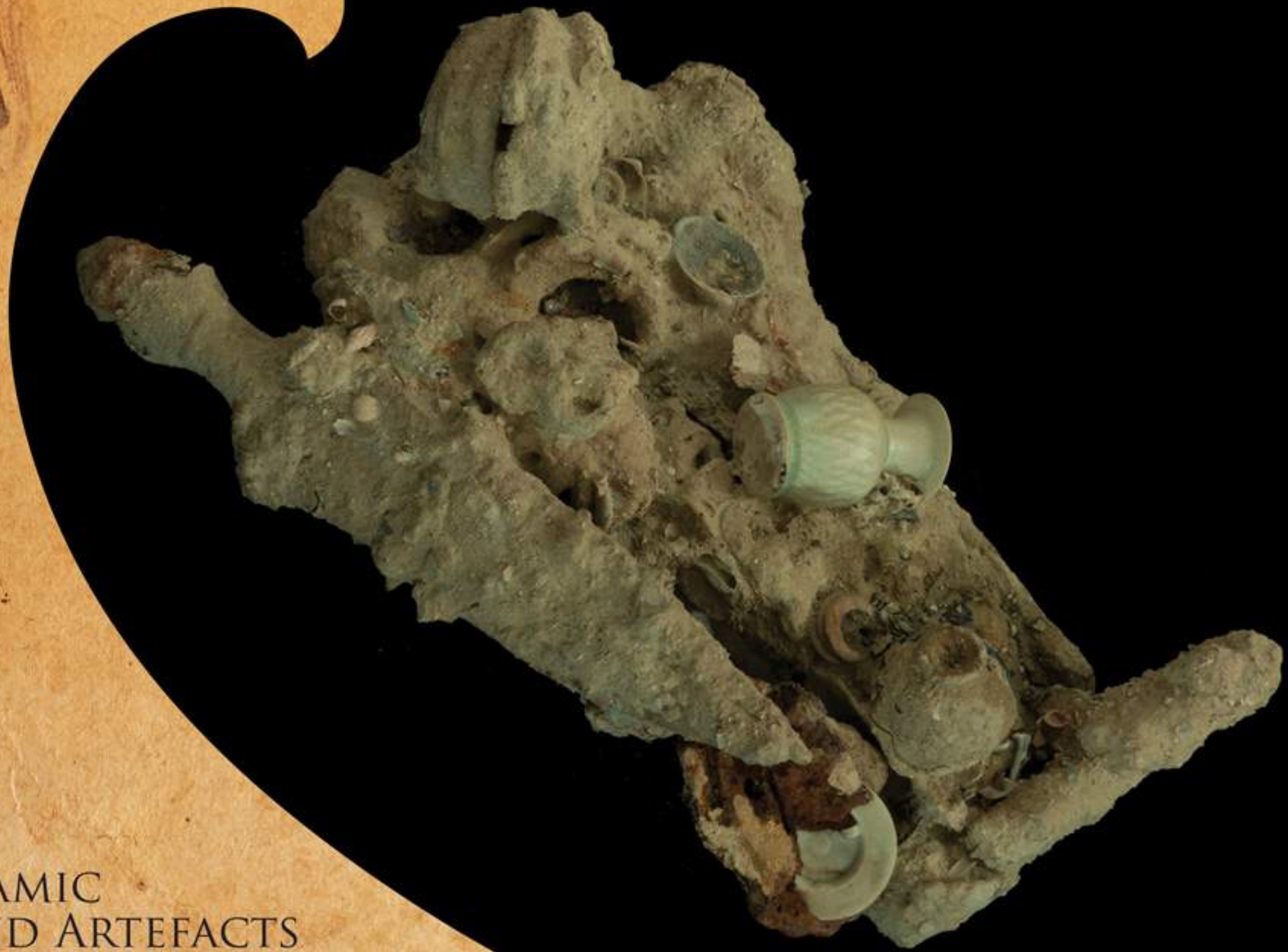
Longquan ceramics recovered from the Jade Dragon Wreck.

The large cargoes found on the Java Sea and Nanhai I Wrecks could be expected on the route to populous Sumatra or Java, while smaller vessels carrying commensurately smaller cargoes made the journey to northwest Borneo.

Ceramic finds from the Java Sea and Breaker Shoal Wrecks demonstrate that very similar cargoes were sometimes shipped to both Java and Borneo. The quantity varied, but so too did the shipper. The Breaker Shoal Wreck may be a Chinese junk while the Java Sea Wreck is a Southeast Asian ship. In north-western Borneo, ceramic imports cater to funerary practice as well as ceremonial and utilitarian. In Java the use is only ceremonial and utilitarian. The question has been asked: if the end use of the ceramics was different, and the cultural context of the two markets certainly was, was it the Chinese ceramic merchants who selected the ceramic types to be shipped to various centres in Southeast Asia[9]? It is hard to fathom how a Chinese ship-owner exporting to Borneo could select the same cross-section of ceramics as a Javanese importer.

As usual, there are more questions than answers. With luck, a few more documented shipwrecks may narrow the gap.

6 Mathers and Flecker, 1997.
7 Dupoizat, 1995.
8 Flecker, M., 2012, etc.
9 Flecker, 2003



Chapter 10
Non-Ceramic Cargo and Artefacts

CHAPTER 10

NON-CERAMIC CARGO AND ARTEFACTS

Wheatley, in his monumental work on Chinese trade, notes that raw and finished iron was commonly exported from China to Southeast Asia during the Song dynasty[1]. Maritime archaeology bears this out. Most shipwrecks found with a cargo of Chinese ceramics also contained a cargo of Chinese iron. The *Flying Fish Wreck* is no exception. Large quantities of cast iron cauldrons and wrought iron blades and bars were stowed beneath the ceramics. The cauldrons were in stacks, while the tapered bars were packed in a conical manner, a common practice in shipwrecks of this era. Unfortunately, when the iron corroded it formed a powerful adhesive matrix with sand and coral that entrapped all the ceramics in close proximity. Large storage jars and entire stacks of bowls could not be removed from the iron concretions without breakage. Furthermore, the large amorphous blocks of iron prevented observation of the underlying hull, leaving only a few small areas for documentation.

Apart from the bulk iron cargo, several individual iron artefacts were found. These are double-edged symmetrical blades with a tang, some 32 cm long, suggesting that they were either daggers (as illustrated on the previous page) or spear-heads.

China held an extended monopoly on the production of cast iron, being the only country to master the technology until the Europeans finally caught on in the 14th century. Iron ore and charcoal were heated in a blast furnace to a temperature high enough to liquefy the iron (~1350° C). The molten metal was then poured into moulds to produce thin-walled cooking vessels, such as cauldrons and woks. Cast iron is an ideal material for this application due to its high thermal conductivity and strength. It was also used to make cheap ploughs and tools, however being brittle, cast iron is far less suitable than wrought iron for applications involving impact.

Iron concretion formed by conical bundles of wrought iron bars. The ceramics have been encased in the concretion.

Concretion formed by an iron dagger or spear-head.

Cross-section of blade.

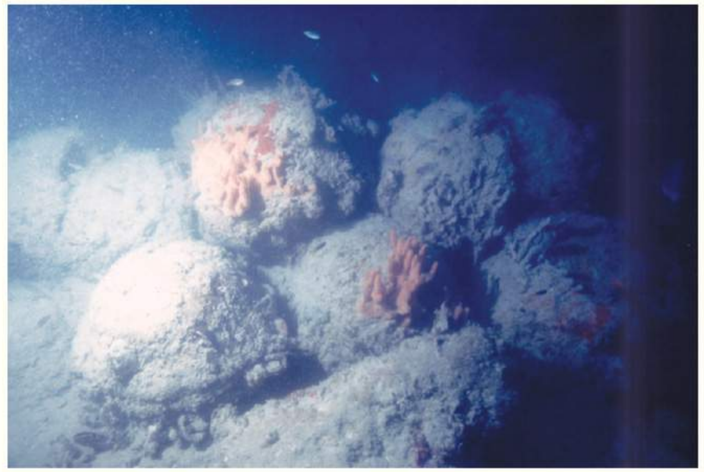
Wrought iron was manufactured throughout Southeast Asia, and indeed was often of higher quality than Chinese wrought iron. The sulphur inclusions in the Chinese product tended to make the metal more susceptible to shattering under the blacksmith's hammer. However, China produced vast quantities, so through economies of scale it seems that they could readily compete with Southeast Asian producers. The high production was achieved through advanced technology rather than access to high grade ore deposits.

China produced wrought iron in a two-stage process whereby ore and charcoal were initially heated in a blast furnace to produce molten iron. Continuous production could be achieved by tapping the molten metal from the furnace, thereby saving fuel and increasing output. It cooled quickly into a brittle cast iron with a high carbon content and significant inclusions of phosphorous, sulphur, and silicon. The cast iron was then placed into a second furnace known as a finery, where it was again melted and exposed to oxygen for long enough to burn out the carbon, making it far more malleable. Finally, it was formed into bars for export or local use. The second stage of the process used additional fuel, but the higher production rate made the two-stage process more economical than the direct process used by Southeast Asian smelters.

In the direct process a mixture of ore and charcoal was heated at a relatively low temperature (1200 to 1250° C) in a furnace. Impurities were drained off in a liquid slag until a solid lump or 'bloom' of iron formed at the bottom of the furnace. After the furnace cooled the bloom could be extracted and then hammered to squeeze out remaining slag. The resultant product was a low carbon iron of high chemical purity, ready for immediate use by a blacksmith.

The great Sinologist, Joseph Needham[2], maps the Chinese iron production centres in the late Northern Song period. The largest centres by far were in Xingzhou and Zizhou in Hebei province in the far north of China. The five medium sized centres were all in the surrounding northern provinces of Henan, Shangxi, Shandong and Jiangsu. There was relatively little production in the south of China. Smaller centres could be found in Yuanzhou in Jiangxi province, and in Yingzhou in Guangdong province. There were ten more southern production centres in Guangdong, Fujian and Guangxi provinces, but their output was not high enough to feature on official receipts of the period.

1 Wheatley, 1959:117.
2 Needham, 2008:299.

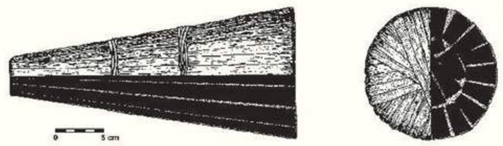


Cast iron cauldrons on the Java Sea Wreck (Pacific Sea Resources).

Iron has been mass produced in China since the Han dynasty (206 BCE to 219 CE). With advances in metallurgy during the Song, iron production grew to well over 100,000 tonnes for the year 1078, according to tallied receipts, a six-fold increase over the figure for the year 800[3]. Initially charcoal was used in the production process, leading to deforestation of parts of northern China. By the end of the 11th century, however, bituminous coke had largely taken the place of charcoal in the north. In the south charcoal continued to be used.

It is hard to say whether iron production in southern China, near key ports such as Guangzhou and Quanzhou, was sufficient to meet domestic and overseas demand, or whether supply had to be supplemented by shipments from the north. With the massive iron cargoes that were being shipped to the Nanyang, it is quite possible that northern production did have to be tapped. This would have added to the cost for the Southeast Asian consumer, and therefore made Chinese wrought iron less competitive. But from the sheer scale of the trade, it would seem that demand far outstripped indigenous supply, suggesting that pricing may have been of secondary concern.

Large deposits of high grade iron are found in Luzon, the Malay peninsula and along a belt running from northern Thailand through Laos, to northern Vietnam and China. India was a major exporter of iron to the Middle East through to the 13th century, and may also have supplied Java[4]. Small, low grade deposits occur throughout Southeast Asia and were suitable for a competent smelter to make sufficient iron for use in the immediate vicinity. While the quality of iron from these smelters was on a par with that produced by larger smelters in rich ore areas, the iron was more expensive, requiring more fuel and labour to produce a unit of finished metal[5]. There were also specialist smelters. Small mines in the Luwu region of Sulawesi produced a nickel-rich iron ore that was used for forging highly prized kris blades.



Wrought iron bars stacked in a cone shape, wrapped in leaves and bound by rattan (Pacific Sea Resources).

An estimated 190 tonnes of iron were stowed on board the 13th century Southeast Asian Java Sea Wreck, in the form of wrought iron bars and cast iron cauldrons[6]. Elemental analysis of the wrought iron showed a high sulphur content, indicative of Chinese production. Trapezoidal bars were bundled in a conical shape, wrapped in coarsely woven fabric or strips of cane, and bound with strips of rattan-like material, in the same manner as those on the *Flying Fish Wreck*. Rectangular bars were stacked in bundles of four or five and were similarly packaged. The conical bundles were stacked end-for-end in the cargo compartments. Iron cauldrons were stacked inside each other, both thwartships and longitudinally within the hull. All of this iron fused together in massive discrete concretions that delineated the original ship layout. All of the timbers had rotted or were consumed by teredo navalis.

The Southern Song Nanhai I junk, found off Guangdong in China, has an even larger iron cargo, although numbers have not been published as yet. Countless stacks of cast iron cauldrons and bundles of wrought iron bars fill the lower holds from stem to stern. The bundled bars are tied with rattan-like bindings.

Cast iron cooking vessels and bundles of wrought iron blades or bars were also found on the mid-10th century Southeast Asian Intan Wreck[7], the early 12th century Southeast Asian Lingga Wreck[8], the 12th century Pulau Buaya Wreck[9], and the late 13th century Jade Dragon Wreck[10]. They were found on several of the 14th to 16th century South China Sea tradition wrecks in the Gulf of Thailand, a 14th century wreck near Belitung in Indonesia, and on the Vung Tau junk[11] which was bound from China to Batavia around 1690. Dutch East India Company records confirm that large quantities of cast iron were shipped from China to Java well into the 17th century. For example, in the decade from 1673 to 1682, 9 junks from southern Fujian province brought 55,214 iron pans, 22 hampers of pans, 92 iron shovels, and 6 iron cannons to Batavia[12].

Massive iron concretions in the bow of the Nanhai I Shipwreck.

While the base metal often turns to a foul smelling black mush, the shape of the original iron objects is preserved by the calcareous concretion formation on shipwreck sites. Cast iron tends to remain solid within the concretions, although in a graphitised state. Iron objects in terrestrial sites tend to rust away until nothing remains but dust. So shipwreck cargoes are particularly important in determining the great significance of iron as a Chinese export commodity. The iron trade may have rivalled the far better documented ceramic trade.

3 Needham, 2008:280.
4 Wisseman Christie, 1998:245.
5 Bronson, in Mathers and Flecker, 1997:95.
6 Flecker, 2003.
7 Flecker, 2002:86.
8 Flecker, forthcoming.
9 Ridho and Edwards McKinnon, 1997:84.
10 Flecker, 2012.
11 Flecker, 1992:234.
12 Bronson, in Mathers and Flecker, 1997: 96.

Lead 'ox-hide' shaped ingots, one with an incised marking.

Character stamped into lead ingot.

Lead

Lead in the form of small 'ox-hide' ingots was shipped on the *Flying Fish Wreck* as a raw material. The ingots typically measure 9 cm across at the widest point and 14 cm long, with the thickness varying from 5 to 10 mm. A few ingots were incised with Chinese characters while some others were stamped. A sample was analysed by Dr Richard Webster and Dr Tan Howe Siang of the Department of Chemistry at Nanyang Technological University (NTU) in Singapore, and found to be almost pure lead (99.96% Pb).

So too were unusual asymmetric metal rings (99.97% Pb) found in abundance on the wreck site, with some still stowed inside small storage jars. These are of varying section and diameter (22 to 41 mm). All are wider and thicker on one side, uniformly tapering to the other. The inner surface is flat or concave, while the outer cross-section can be rounded or sharply angular. Some of the angular rings are roughly octagonal on their outer face. Some are either cracked, or more likely have been cut at one point. Stacks of rings, up to fifteen to a stack, were found isolated on the seabed or embedded within iron concretions. Some rings have one or two internal protrusions pierced by very fine holes, which all line up exactly when found in a stack. The purpose of these holes remains a mystery. So too does the function of the rings themselves. While some of the angular rings may fit on a finger, the majority are either too small or way too big. There is a distinct possibility that they were intended to be used as a form of currency. Small shaped tin-lead alloy objects have been used as currency in the region of Indonesia and Malaysia since at least as early as the 10th century[13].

Interestingly, several earthenware ring moulds were also recovered from the *Flying Fish Wreck*, so more could have been made at the final destination using the raw lead on board. The moulds would have required a matching mandrel, however none were found. The interior surface of the rounded rings is smooth, whereas the same surface of the angular rings is gouged, suggesting that the latter were filed after casting.

Two lead ring shapes.

Stacks of lead rings: in-situ; showing aligned holes; and cracked.

One other type of lead artefact is similar in appearance to the lead weights attached to fine fish nets, such as those used in cast or drift netting today. They are also very similar to tin-lead alloy 'canoe' currency found on the 10th century Intan Wreck[14], so they may also have been a form of currency. Wheatley[15] notes that during the Song period lead was used for sinkers on nets, and was bartered in the Philippines, Brunei, and in Cambodia, where one tael of lead could be exchanged for two bushels of rice.

Lead usually occurs naturally in conjunction with zinc, and there are many deposits spread throughout Asia. Myanmar is particularly rich in lead and Sumatra has numerous small deposits. Only Cambodia and southern Vietnam are lead deficient[16]. The smelting of lead from lead ore was well known in ancient times, however deposits in which the lead and zinc were intimately bound could not be readily smelted.

Lead was often used as a minor ingredient in the production of bronze. It enhanced the bonding of the main constituents, copper and tin, and also reduced the viscosity of the molten metal making it more suitable for casting in complex moulds. On European wooden ships, lead was used for sealing joints and for pipes, although no evidence has been found for its use on early Southeast Asian ships.

13 Flecker 2002:63.
14 Flecker, 2002:63.
15 Wheatley, 1959:114.
16 Bronson, 1992:78.

An earthenware mould for casting lead rings.

Lead net weights.

Lead rings stowed inside stoneware jar.

Eight-lobed lead dishes. The one on the left came loose from the stack on the right.

Lead Dishes

A fascinating stack of five small metal dishes was recovered from the centre of the site. Each dish has eight lobes, surrounded by a flat rim which is folded at the outer edge. At first glance they were assumed to be modern pressed aluminium dishes, perhaps lost over the side of one of the looter's boats. Analysis at NTU revealed that the dishes are in fact 98% lead, with a few trace elements. It would not have been particularly healthy to eat from these over the long term.

In her sumptuous book on Song ceramics, Rose Kerr illustrates a six-lobed silver dish as an example of a metal object that was replicated in the production of ceramics during the Song dynasty[17]. Apart from the number of lobes, it is very similar in appearance to the *Flying Fish* dish. Indeed, an eight-lobed dish is also illustrated, however in this case it has been carved from a fine-grained stone[18] . The metal counterpart would have been identical in form to the *Flying Fish* dishes.

17 Kerr, 2009:76.
18 Kerr, 2009:78.
19 Flecker, forthcoming.
20 Druce, 2016:32.

Copper Alloy

Copper alloy anklets were found in abundance on the *Flying Fish Wreck*, with some still packed in small stoneware jars. They are too large for bracelets, but a gap in the circle allows for them to be pried open for fitting around an ankle, or perhaps the upper arm. This unadorned artefact type shows up all over the ancient world and no doubt has many sources. In this instance they were clearly from China, where the export of copper and copper alloy was later banned as there was insufficient available for domestic use. Very similar anklets were found on the early 12th century Lingga Wreck, and at the 10th to 14th century settlement of Sungai Limau Manis[20] in Brunei.

From analysis at NTU, the anklets are approximately 80% copper and 20% lead. Bronze is a copper-tin alloy and brass is a copper-zinc alloy, so it is clearly neither of these. Lead may be added to bronze and brass in small quantities to aid in machining, as the lead, which is insoluble in copper, acts as a lubricant. There is a modern alloy termed 'high-leaded tin bronze' which can have as much as 25% lead, although it also contains 5% tin. There does not seem to be a modern alloy consisting only of copper and lead.

Several small copper alloy gongs were recovered. They are 26 cm in diameter and the rim is 5cm in width. Two adjacent holes in the rim provide for a string suspension arrangement. There is no central boss, a feature of gongs dated to the 13th century and beyond. Similar gongs were recovered from the early 12th century Lingga Wreck[21], while many larger gongs were found on the 12th century Tanjong Simpang Mengayau junk[22].

During the Southern Song dynasty gongs were the only permitted copper alloy export item, apparently because they were needed for signalling and warning. Interestingly, in Chau Ju-kua's early 13th century description of Boni (a polity in Borneo) he notes, "When the inhabitants give a feast, they make merry by beating drums, blowing flutes, striking gongs , and by singing and dancing[23] ".

Copper-alloy anklets.

A copper-ally gong, with two holes for hanging.

A single copper alloy disc, which is cracked in half, is 12 cm in diameter and 3 mm in thickness. Both surfaces are flat and unadorned, so it is not a conventional Chinese mirror, although perhaps it served that purpose. The metal composition has not been determined.

Two artefacts are a copper alloy-iron composite. One is 9 cm long with a cylindrical copper alloy section of 3 cm diameter making up nearly half that length. A square section hole through the object suggests that it was once pierced by an iron nail or tang. A pattern within the surrounding concretion indicates that wood may have been a third element in this composite artefact. The second object is 14.6 cm long, with the copper alloy element being 8.5 cm long and 3 cm in diameter. The copper alloy is decorated with flanges in the manner of a candlestick, however it is pierced by an iron tang. The projecting iron concretion is roughly circular in section, so it was not a blade. It may be concluded that the copper alloy section of both artefacts was a handle for an iron implement, although the function of these implements is not known.

21 Flecker, forthcoming.
22 Sjostrand et al, 2006.
23 Hirth and Rockhill, 1911:156.

Two composite copper-alloy artefacts, probably parts of handles.

Stone

Small stone artefacts come in the form of sharpening stones and a touch stone. Both types appear to have been well used as can be seen from wear marks on the former, and hints of gold on the latter. The sharpening stones could well have been for ship-board use, whereas the touch stone is likely to have been the personal possession of a travelling merchant.

A larger stone artefact takes the form of a section of an octagonal column, some 32 cm long and 15 cm across. It appears to be a coarse sandstone. The edges have been worn down making it difficult to discern the original section.

A larger stone from the *Flying Fish Wreck* is likely to have been a stone anchor stock. Two stones of similar shape and assumed purpose were also found on the early 13th century Java Sea Wreck[24], another Southeast Asian lashed-lug vessel. A depiction of a South East Asian style anchor can be seen on a 12th century Angkor Thom bas relief in Cambodia. Paradoxically, the axial rudder and matted square sails of the ship indicate that it is an early sea-going Chinese junk. In the bas relief, the stone is lashed to the crown of a double-fluked wooden anchor and acts as a stock in the manner of a modern northill-type anchor. Chinese wooden anchors had a stone stock that was attached to the shank in the manner of an Admiralty anchor. The Chinese stock was more carefully crafted, with the stone tapering from the centre to the extremities and having a square section. The South East Asians seem to have pressed any rock of suitable dimensions into service with minimal, but discernible, alteration.

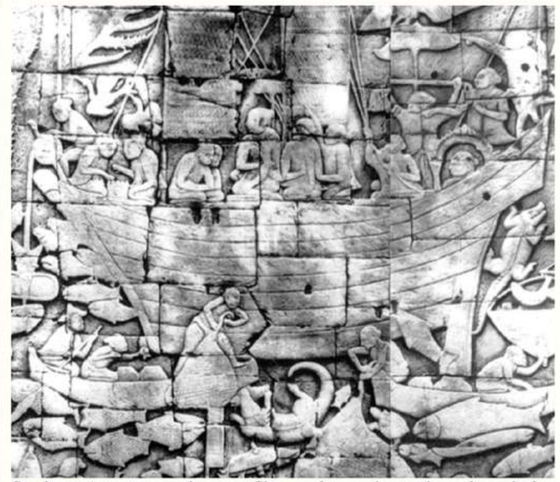
24 Mathers and Flecker, 1997:73.

Sharpening stone.

Remnants of gold rubbings on a touch stone.

Rough octangular stone column section.

Stone anchor stock of Southeast Asian style.



Southeast Asian type anchor on a Chinese ship, as depicted on a bas relief on the Bayon at Angkor Thom (Joseph Needham, 1971).

Non-Cargo Ceramics

Three examples of fine paste-ware were recovered from the wreck: two rim shards; and one neck shard. The rim shards show a slip decoration in the form of narrow bands, while the neck is unadorned. The latter seems to be from a vase, rather than the typical kendi or kundika, being straight sided with a flared rim. The exposed edge of the body shows a typical 'weathering' with a light-coloured centre darkening towards the surface.

Fine-paste-ware is a common find on shipwrecks of this era, with many on the 10th century Intan Wreck[25], the early 13th century Java Sea Wreck[26] and the Breaker Shoal Wreck[27], which had a cargo nearly identical to that of the Java Sea Wreck. Smaller numbers have been found on the early 12th century Pulau Buaya Wreck[28]. They originated from kilns on the Isthmus of Kra, perhaps at Pa-O, which makes this cargo type a common anomaly amidst predominantly Chinese ceramic cargoes. The very small quantity on the *Flying Fish Wreck* suggests that the few vessels they represent were for ship-board use.

Shards of a heavily potted earthenware wok were recovered. They incorporate a lug handle as would be expected on their metal counterpart, but much larger in section. The clay has an almost black finish.

25 Flecker, 2002:117.
26 Mathers and Flecker, 1997:172.
27 Dupoizat, 1995.
28 Ridho and McKinnon, 1989.

A fine-paste-ware kundika from the Java Sea Wreck.

Fine-paste-ware shards: a neck; rim; and rim cross-section.


Earthenware wok handle.


Earthenware stove base, underside view.

Wood

A number of fragments of wood show fine workmanship. They are remnants of small, carved wooden boxes or stands. A large wooden spoon some 44 cm in length was recovered. The long slender handle has survived intact, however only a small part of the bowl remains.

Several wooded artefacts are conical in form and appear to be turned rather than carved. They are approximately 11 cm long. Most have a flat top and would have made fine bungs. Indeed, there are round impressed marks that suggest they have been forced into holes of varying size. Interestingly two marks on one of these bungs occur very near the tip, showing that the holes were small, perhaps spouts on ceramic jars. One of these conical objects has a tiered top and is 8cm long. There is a single line around it, however this has been finely incised rather than impressed through use as a bung.

A piece of a branch has been partly burnt through at one end. The *Flying Fish* ship was lost because it struck a rock rather than succumbing to fire, as sometimes happens at sea. So, this single burnt timber was probably firewood. It may well have been alight and warming a beverage for the night watch when the ship went down.


Fragments of worked wood.


A long wooden spoon, with most of the bowl missing (length 44 cm).


Wooden bung with wear marks near tip.


Turned wooden object with etched line.

Organic Materials

Several shell ornaments or gaming pieces have been carved from the flat end of cone shells. They have a diameter of 27 mm. The umbilicus of the shell forms a short central knob with a hole through the middle. The naturally occurring hole seems to have been drilled out as well. This knob is usually circular in section, although one has been facetted giving it an octangular cross-section.

The flat end of cone shells, with their attractive spiral configuration, are used to this day by indigenous groups in northern Borneo as pendants or as decorations on elaborately beaded baby carriers. The difference is that these shell disks are pierced through the centre but do not have protruding knobs. Even so, it would seem evident that the shell artefacts on the *Flying Fish wreck* are likely to have belonged to the Southeast Asian crew members. They were not an import from China.

Several pieces of resin, were recovered. Aromatic resin was used for religious and medicinal purposes, or for ship caulking and repair. Small quantities have been found on many shipwrecks, with Sumatra being a common assumed origin. A sample was sent to Dr Pierre Adam, of the Biogéochimie Moléculaire Institut Le Bel in France, for analysis. The distributions comprise mainly sesquiterpenoids and triterpenoids, demonstrating unambiguously that the resins originate from angiosperms and not from conifers. The triterpenoids are typical for Dipterocapaceae, and more precisely are from the dammarane or ursane series that may be associated with the Shorea genus.

A resin sample from the Lingga Wreck[29] was analysed simultaneously. The distributions of the terpenoids in the two samples are very similar, and the predominant constituents are identical, suggesting that the two wrecks contained the same resin. However, the *Flying Fish* sample also contains small amounts of triterpenoids which could not be detected in the sample from the Lingga Wreck, perhaps indicating that the two resins originated from trees of the same genus (possibly Shorea) but not from the same species. The extra compounds might be related to the presence of a small quantity of another Dipterocarpaceae resin in the *Flying Fish* sample. Investigation continues, but as with the shell ornaments, the resin was for ship board use and not an import from China.

A single artefact appears to be made from ivory. It has a flat rectangular base of 36 by 26 mm, rising as a low pyramid. The centre is pierced by a square hole, 6 by 6 mm, which seems most suited to mounting with a nail.

There is one tooth of unknown origin. It may be from a fish and therefore not related to the wreck.

29 Flecker, forthcoming.


Ivory artefact.


Shell ornament or gaming piece, back and front (top and bottom).

A baby-carrier crafted by the Murut ethnic group, using cone-shell decorations.

A lump of resin with a weathered outer layer.

Skeleton

Readily identifiable bones found concentrated in one location on the wreck site include a skull, femurs, tibia, humerus, pelvis, vertebrae and ribs. Dr Eric Yap, of the Singapore National University Hospital, has concluded that they are compatible with a single human skeleton. These bones were removed from their resting place in the absence of the author, so unfortunately the context is not known. Due to superstition amongst the divers they were reluctant to bring the remains to the surface. Instead, they placed the bones inside a nearly intact storage jar, covered the mouth of the jar with a bowl, and left the assemblage on the seabed. This is a fascinating reflection on funerary ritual as practiced by various indigenous groups over past millennia, only waning in recent generations. In the past a corpse was placed inside an imported Chinese jar, or a wooden coffin, and left above ground to decompose. When decomposition was complete, the bones were washed and then returned to the jar, which was then placed in a dedicated repository[30].

The author removed the bones from the jar in order to take still and video images on the seabed, before carefully replacing them. It is sometimes possible to extract ancient DNA from a section of the skull just behind the ear, so if this option arises in the future, perhaps a suitable ceremony could be performed to allow for recovery.

30 Winzeler, 2004:40.

Human bones laid out for recording on the seabed.

Indeed, the issue of respect for the dead crosses several cultural spheres. Licence holder, Dickson Lee, consulted his Feng Shui master. From a boat bobbing over the wreck-site the master declared that no less than three of the ancient voyagers perished with the *Flying Fish* ship, largely because they were drunk. As has been recorded in many instances on wrecked European ships, the crew may have raided the wine stores in desperation or resignation. Two of the three may have drifted free of the wreckage. But the one who remained with the ship for the last nine hundred years apparently shared the Chinese surname, Lee.

Entering one more cultural sphere, that of the maritime archaeologist, it is difficult to envisage a scenario whereby a person could be trapped deep inside a ship where their remains were buried early enough in the wrecking process to preserve the entire skeleton. Unless perhaps that person was a slave who had been tied up below decks. Slaves were indeed traded in the opposite direction, with a mission from Borneo delivering 'little black slaves' to the Chinese court in 1371[31].

31 Hirth and Rockhill, 1911:45. Furthermore, in the same era "The people of Annam buy male and female slaves, and their ships carry human beings as cargo" (Hirth and Rockhill, 1911:50).

Human skull resting on the seabed for photogrammetric recording.

Chapter 11
The Ceramics Cargo

CHAPTER 11

THE CERAMICS CARGO BY DR TAI YEW SENG

Typology

There is one type of painted ware and four varieties of coloured glaze represented on the *Flying Fish Wreck*. These define the primary ceramics typology: brown painted ware, qingbai-ware, black-ware, green-ware and brown-ware. The provenance of each type is noted where such provenance can be conclusively determined through comparative analysis.

1. Brown Painted Ware

The brown painted ware comes in two shapes. The first is a basin and the second a bowl, both in a variety of sizes.

1.1 Brown Painted Basin

Type A

Brown Painted Basin with a Flared and Wavy Rim

The brown painted basin has a flared and wavy rim with an everted edge, slightly rounded shoulder and tapered sides on a flat base. It is painted in iron-brown on the interior well with a vivid flying fish, displaying pectoral and pelvic fins spread out like wings, among seagrass scrolls. This motif is so striking that the shipwreck takes its name from it. A glassy glaze with a yellowish tinge covers the interior and exterior rim. It is a product of Cizao in Fujian province.

Type A brown painted basin decorated with a flying fish, interior. Rim diameter 33.5 cm.

Waster from the Cizao kilns with the same distinctive flying fish decoration (Fujian Jinjiang Cizao Kiln Sites Archaeological Survey and Excavation Report, plate 126)

Type A brown painted basin, exterior.

Type B

Brown Painted Basin with an Outward Rolled Rim

This basin has an outward rolled rim, slightly rounded shoulder and tapered sides on a flat base. It is painted in iron-brown on the interior well with a *flying fish* among seagrass scrolls. A glassy glaze with a yellowish tinge covers the interior and rim. It is a product of Cizao, Fujian province.

Type B brown painted basin, interior. Diameter (shoulder) 38 cm, height 10.8 cm.

Type B brown painted basin, exterior.

Brown painted bowl, interior.

Brown painted bowl, exterior.

1.2 Brown Painted Bowl

The brown painted bowl has a slightly everted rim and flared sides on a ring foot. It is painted in iron-brown on the interior well with freely scrolling leaves. There is a biscuit ring within a central indentation, which demonstrates that the bowl was stack-fired. A glaze with a yellowish tinge is applied, stopping short at the lower exterior. It is a product of Cizao, Fujian province.

2. Qingbai-Ware

Qingbai-ware encompasses the greatest variety of ceramics on the *Flying Fish Wreck*. Bowls, ewers, covered boxes, dishes and vases are typically for domestic use, although some are of very high quality.

2.1 Qingbai Bowl

Type A:

Qingbai Bowl with an Everted and Lobed Rim

This bowl has a six-lobed everted rim, with the body similarly lobed on a high ring foot. A qingbai glaze covers all but the base. The fabric is thin and white. The unglazed base well has a burn mark, demonstrating that the bowl was fired on a clay pad. It is a product of Jingdezhen, Jiangxi province.

Type A qingbai bowl, side profile.

Type A qingbai bowl, base.

Type B

Qingbai Bowl with a Flared and Lobed Rim

This bowl has a six-lobed flared rim, with a conical body on a small and thin ring foot. The fabric is very thin and white. The interior is decorated with three sets of incised lotus leaves and flowers. A qingbai glaze covers all but the base. The unglazed base well has a burn mark, demonstrating that the bowl was fired on a clay pad. It is a product of Jingdezhen, Jiangxi province. For comparison see Zhan Yongxuan and Zhan Xiangsheng, "Porcelains and Wares Unearthed from Tombs of Song Dynasty in Wu Yuan," in China Ceramic, vol. 66, 1982, no. 7, p. 104 and fig. 9, and Peng Shifan (ed.), Dated Qingbai Wares of the Song and Yuan Dynasties, p. 56, fig. 37. [comparison illustrated in Chapter 4: Dating]

Type B qingbai bowl, interior.

Type B qingbai bowl, side profile.

Type C qingbai bowl, side profile.

Type C qingbai bowl, base.

Type C

Qingbai Bowl with a Straight Rim

The qingbai bowl with a straight rim has cavetto sides and a small flat base. It is decorated with a carved diaper pattern and applied with qingbai glaze on all but the rim. Remnants of a black corrosion product suggest that the rim was metal-mounted after firing, probably with silver. It comes in several sizes, and is sometimes refered to as a 'Haji-cap' bowl due to its close resemblance. As there is no burn mark on the base, it was fired upside-down on the biscuit rim, probably with smaller vessels nested inside larger ones. It is a product of Jingdezhen, Jiangxi. For comparison see Zhan Yongxuan and Zhan Xiangsheng, "Porcelains and Wares Unearthed from Tombs of Song Dynasty in Wu Yuan," in China Ceramic, vol. 66, 1982, no. 7, p. 104 and fig. 5, and Peng Shifan (ed.), Dated Qingbai Wares of the Song and Yuan Dynasties, p. 57, fig. 40. [comparison illustrated in Chapter 4: Dating]

Type D qingbai bowl, interior.

Type D qingbai bowl, base.

Type D

Qingbai Bowl with a Constricted Rim

This bowl has a constricted rim, with flared sides on a ring foot. It is decorated on the interior with six raised radial lines around an indented centre. The qingbai glaze stops short at the lower exterior.

Type D qingbai bowl, side profile.

Type E qingbai bowl, side profile.

Type E qingbai bowl,base.

Type E

Qingbai Bowl with an Everted Rim.

This bowl has an everted rim and a small ring foot. It is decorated with a fine combed pattern on the interior well. A qingbai glaze has been applied to all but the base well.

Type E qingbai bowl showing combed decoration, interior.

Type F qingbai bowl, side profile.

Type F qingbai bowl, interior.

Type F qingbai bowl, base.

Type F

Qingbai Bowl with a Slightly Everted Rim

This bowl has a slightly everted rim, with a deep body on a high ring foot. It is decorated with a combed pattern on the interior cavetto, between two concentric lines. A qingbai glaze has been applied to all but the base well.

Type A qingbai dish, interior.

Type A qingbai dish, base.

2.2 Qingbai Dish

There are four types of qingbai dish, all with varying rims.

Type A

Qingbai Dish with a Twelve-Lobed Rim

This dish has a twelve-lobed rim, with everted sides on a recessed base. It is decorated with twelve raised radial lines on the interior. A qingbai glaze has been applied to all but the lower exterior. There is a biscuit ring in the indented centre, and a clay pad firing mark in the base well. The biscuit ring and pad mark demonstrate that both stack-firing and support-firing were used. The vessel at the top of the stack would not have the biscuit ring in the centre, while the bottom vessel would have both the ring and the base mark.

Type A qingbai dish, side profile.

Type B qingbai dish, side profile.

Type B qingbai dish, interior.

Type B qingbai dish, base. The ink inscription reads, Guo (郭), a surname, but the given name is illegible.

Type B

Qingbai Dish with a Five-Lobed Rim

This dish has a five-lobed rim, with everted sides on a recessed base. It is decorated with five raised radial lines on the interior. A qingbai glaze has been applied to all but the lower exterior. There is a clay pad burn mark on the base.

Type C qingbai dish, side profile.

Type C qingbai dish, interior.

Type C qingbai dish, base.

Type C

Qingbai Dish with an Everted Rim

This dish has a slightly everted rim, with flared sides on a ring foot. It is decorated with two concentric rings, one on the rim and one in the well. A qingbai glaze has been applied to all but the lower exterior, with drips of glaze on the exterior rim. It has been fired on the foot.

Type D

Qingbai Dish with a Flared Rim

This fine quality dish has a flared rim, with a shallow body on a ring foot. It is decorated with a combed and carved pattern on the interior and a carved diaper pattern on the exterior. A qingbai glaze has been applied to all but the base well. All examples have an ink inscription with the Chinese character Chen (陳) on the base. This is a very common Chinese surname, pronounced as Tan in Hokkian and Chan in Cantonese. Product of Jingdezhen.

Type D qingbai dish, interior.

Type D qingbai dish, base.

Type A qingbai ewer. It is decorated around the shoulder.

Type A qingbai ewer. It is without decoration on the shoulder, but has an applied decoration on each side of the neck.

Type B qingbai ewer.

Very similar ewer excavated from the Pulau Buaya Wreck (Ridho-and McKinnon, 1989: 45)

2.3 Qingbai Ewer

There are two types of qingbai ewer, one with a straight rim and the other with a trumpet rim.

Type A

Qingbai Ewer with a Straight Rim

This ewer has a straight rim on a long neck, with a sloped shoulder and deep body on a ring foot. A long strap handle is attached to the neck at the top, and the outer edge of the shoulder at the bottom. A long curved spout is attached to the shoulder directly opposite. A lid with an indented centre has a small lug for a string attachment. The body is decorated with a carved diaper pattern, while the shoulder may or may not have a carved radial pattern. Some examples have a small applied decoration on each side of the neck. A qingbai glaze has been applied to all but the base. Product of Jingdezhen. Very similar examples were recovered from the Tanjong Simpang Mengayau Wreck[1] (comparison illustrated in Chapter 9).

Type B

Qingbai Ewer with a Trumpet Rim

This ewer has a trumpet shaped rim on a long neck, with an eight-lobed shoulder and body on a flat base. A long strap handle is attached to the upper neck at the top and the shoulder at the bottom. A long curved spout is attached to the opposite side of the shoulder. The body is decorated with double grooves below the shoulder. A qingbai glaze has been applied to all but the base. An identical ewer was recovered from the Pulau Buaya Wreck[2]. Product of Jingdezhen.

1 Sjostrand, 2006: 108.
2 Ridho and McKinnon, 1989:45).

2.4 Qingbai Vase

There are two types of qingbai vase. The first has a trumpet rim, while the second has a flattened and raised rim. Both have sub-types with a round or lobed body.

Type A

Qingbai Vase with a Trumpet Rim

This vase has a trumpet rim on a long neck. There are two sub-types. The round body subtype has two incised rings around the neck and a diaper pattern on the body. The lobed body sub-type has eight lobes and no decoration on the neck or body. Both sub-types have a spread ring foot and a burn mark on the foot rim. A qingbai glaze has been applied to all but the foot rim. Product of Jingdezhen.

Type A qingbai vase with a round body.

Type A qingbai vase with a lobed body.

Type B qingbai vase with a round body.

Type B qingbai vase with a lobed body.

Type B

Qingbai Vase with a Flattened and Raised Rim

This vase has a flattened and raised rim on a long neck which is decorated with incised rings.There are two sub-types, one with a round boby and one with an eight-lobed body. Both sub-types have a spread ring foot. A qingbai glaze has been applied to all but the foot rim. Product of Jingdezhen.

Type A qingbai covered box, interior.

Type A qingbai covered box. Moulded Chinese characters: Ye Jia He Zi Ji (Covered box of the Ye family workshop), base.

2.5 Qingbai Covered Box

There are two types of covered box, one with a lobed body and the other with a round body.

Type A

Qingbai Covered Box with a Lobed Body

This covered box has a round undercut rim, with a six-lobed body on a six-lobed foot. A qingbai glaze has been applied down to the lower exterior on a white body. One example has moulded Chinese characters on the base: "Ye Jia He Zi Ji" (葉家合子記) meaning "covered box of the Ye family workshop". Very similar covered boxes with moulded characters on the base were recovered from the Pulau Buaya Wreck[3] .

3 Ridho and McKinnon, 1989: 61.

Type B

Qingbai Covered Box with a Round Body

This large covered box has a lid with a conical top, sloped shoulder and a straight, wide rim. The body has an undercut and straight rim, and is cylindrical on a tapered and recessed base. A qingbai glaze has been applied to all but the rim and base.

Type B qingbai covered box, side profile.

Type B qingbai covered box, side upright.

Type B qingbai covered box, side upside-down.

Type A black glazed bowl, side profile.

Type A black glazed bowl. Hare-fur decoration, interior.

Type A black glazed bowl, base.

3. Black Ware

The *Flying Fish Wreck* contained one type of black-ware in the form of the famed Temmoku tea bowl. Some have a black ink inscription on the base, with the Chinese character 'gang'. There are two sub-types.

Type A

Black Glazed Bowl with a Flared Rim

This bowl is conically shaped, on a ring foot with a shallow base well. A thick black glaze stops just short of the base. A hare-fur-type decoration appears on the interior of some examples.

Type B black glazed bowl, base.

Type B black glazed bowl, interior.

Type B

Black Glazed Bowl with a Constricted Rim

This bowl is conically shaped, on a ring foot with a shallow base well. The rim is slightly constricted. A thick black glaze stops short of the base. Some examples have the Chinese character 'gang' in ink on the base well. 'Gang' refers to a 'consignment' of cargo on the interior of some examples.

Type B black glazed bowl, side profile.

Northern green-ware, side profile.

Northern green-ware, interior.

Northern greenware, base.

4. Green-Ware

There are two main types of green-ware as defined by production location: northern greenware and the southern green-ware.

4.1 Northern Green-Ware

The only type of northern green-ware is a bowl very similar to Yaozhou-ware from Shaanxi province. It may indeed derive from this famous kiln complex. This bowl has an everted rim, with a deep body on a ring foot. The interior is decorated with five raised radial lines emanating from an indented centre, while the exterior displays a carved floral pattern. The green glaze has been applied to all but the ring foot.

Very similar bowl excavated from the Yaozhou kilns (Yaozhou Kiln of the Song Dynasty, 1998, plate XIX no.3)

4.2 Southern Green-Ware

Southern green-ware comes in a variety of shapes such as bowls, covered bowls, and kendis.

4.2.1 Southern Green-Ware Bowl

The southern green-ware bowls are similar to Longquan-wares, and may indeed be from these kilns. Otherwise they are a product of Fujian kilns. There are three sub-types.

Type A

Southern Green-Ware Bowl with a Flared Rim

This bowl has a flared rim, with flared sides on a small ring foot. The interior is decorated with carved leaf scrolls, interspersed with a zigzag pattern. Some examples have a carved chrysanthemum in the indented centre. The exterior is decorated with a combed 'cat's claw' pattern. A green glaze stops short at the ring foot, but sometime covers it. Product of Longquan.

Type A southern green-ware with cat's claw pattern on the exterior, side profile.

Type A southern green-ware, interior.

Type A southern green-ware, base.

A similar bowl excavated from the Longquan kilns (Eastern Longquan Excavation Report 2005, colour plate 6 fig. 1-2)

Type B southern green-ware, side profile.

Type B southern greenware, interior.

Type B southern green-ware, base.

Type B

Southern Green-Ware Bowl with a Shallow Body and a Slightly Everted Rim

This bowl has a slightly everted rim and a shallow body with flared sides on a small ring foot. The interior is decorated with carved leaf scrolls, interspersed with a zigzag pattern. Some examples have a stamped floral pattern in the centre. The exterior is decorated with a combed 'cat's claw' pattern. The glaze stops short at the ring foot. Product of Longquan.

Type C

Southern Green-Ware Bowl with a Deep Body and an Everted Rim

This bowl has a pronounced everted rim, with a deep body rounded to the base on a rather high ring foot. The exterior is decorated with lotus petals and combed lines. A glassy green glaze covers all but the base. Product of Longquan, Zhejiang province.

A very similar bowl excavated from the Longquan kilns (Eastern Longquan Excavation Report 2005, colour plate 27, fig. 6).

Type C southern green-ware bowl, side profile.

Type C southern green-ware bowl, interior.

Type C southern green-ware bow, base.

Southern green-ware covered bowl.

Southern green-ware covered bowl.

4.2.2 Southern Green-Ware Covered Bowl

This bowl has a straight rim, with a very deep body on a high ring foot. The lid is dome-shaped with a lug handle, and a flattened and undercut rim. Both the bowl and lid are decorated with a carved diaper pattern on the exterior. Green glaze has been applied to both except beneath the rim of the lid and the base of the bowl.

Southern green-ware covered bowl, base.

Southern green-ware kendi.

4.2.3 Southern Green-Ware Kendi

This kendi has a wide flared mouth rim above a flange on a long constricted neck. The globular body stands on a ring foot. A long straight spout stands almost vertical from the shoulder. The only decoration is an incised ring around the shoulder. A green glaze stops short of the base.

Type A brown-ware ewer.

Type B brown-ware ewer.

Type C brown-ware ewer.

5.1 Brown-Ware Ewer

The brown-ware ewers are typical of Cizao-ware from Fujian province. There are several sub-types.

Type A

Brown-Ware Ewer with a Flattened and Raised Rim

This ewer has a flattened and raised rim on a long constricted neck, with an oval body on a flat base. A strap handle curves from the middle of the neck to the shoulder. A long curved spout protrudes from the shoulder opposite. Small ear handles on each side of the neck are decorated with various patterns on a shield-like element. The brown glaze stops short of the base.

Type B

Brown-Ware Ewer with a Straight Rim Above a Flange

This ewer has a straight rim above a flange on the neck, with an oval body on a flat base. A strap handle curves from the upper neck to the shoulder. A long curved spout protrudes from the shoulder opposite. Small ear handles are applied at the interface of the shoulder and neck on each side. The brown glaze stops short of the base.

Type C

Brown-Ware Ewer with a Straight and Thickened Rim

This ewer has a thickened rim on a straight neck, with a conical shoulder on a squat round body tapering towards a flat base. A strap handle curves from the middle of the neck to the shoulder. A long curved spout protrudes from the shoulder opposite. The brown glaze stops short of the base.

Type C ewer excavated from the Cizao kilns (Fujian Jinjiang Cizao Kiln Sites Archaeological Survey and Excavation Report, plate 69:3).

Type D brown-ware ewer, side profile.

Type D brown-ware ewer, top.

Type D

Brown-Ware Ewer with a Flared Rim

This ewer has a flared and thickened rim on narrow neck, with a squat round body tapering towards a flat base. A curved strap handle decorated with multiple grooves is attached to the shoulder. A short spout protrudes from the shoulder opposite. The brown glaze stops short of the base.

Type E brown-ware ewer, side profile.

Type E brown-ware ewer, top.

Type E

Brown-Ware Ewer with Flattened and Raised Rim on a Short Body

This ewer has a flattened and raised rim on a short narrow neck, with a flattened globular body on a flat base. The curved strap handle is applied to the shoulder. A short curved spout protrudes from the shoulder opposite. The brown glaze stops half way down the body.

Similar Type E ewer excavated from the Cizao kilns (Fujian Jinjiang Cizao Kiln Sites Archaeological Survey and Excavation Report, plate 36:3).

5.2 Brown-Ware Small Mouth Jar

Taller versions of the small mouth jar are sometimes referred to as 'mercury jars', or as meiping (plum vase). The latter usually contains wine but it is often recycled for other purposes. There are two types. They are products of Cizao, Fujian provence.

Type A: Fat Small Mouth Jar

This jar has a flat rim, with a very short neck and a rounded shoulder tapered towards a flatbase. The brown glaze is only applied to the shoulder.

Type B: Squat Small Mouth Jar

This jar has a flared rim on a short neck and a flat shoulder, with a squat body on a flat base. The brown glaze stops just short of the base.

Type A small mouth jar.

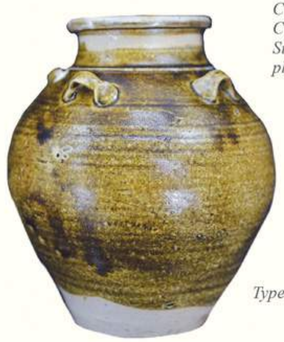
A Type A small mouth jar excavated from the Cizao kilns (Fujian Jinjiang Cizao Kiln Sites Archaeological Survey and Excavation Report, plate 79: 3).

Type B small mouth jar.

A Type B small mouth jar excavated from the Cizao kilns (Fujian Jinjiang Cizao Kiln Sites Archaeological Survey and Excavation Report, plate 42:2).

Type A brown-ware jar.

Type A jar excavated from the Cizao kilns (Fujian Jinjiang Cizao Kiln Sites Archaeological Survey and Excavation Report, plate 98:2).



Type B brown-ware jar.

5.3 Brown-Ware Jar

There are two types of brown-ware jar.

Type A

Brown-Ware Covered Jar

This jar has a dome-shaped lid with low lug handle and a flattened and undercut rim. The body has a folded rim, with an oval-shaped body on a flat base. There are two opposed lug handles on the shoulder. The brown glaze has only been applied to the top half of the body.

Type B

Brown-Ware Four-Lugged Jar

This Jar has an outward rolled rim, with an ovoid body on a flat base. There are four lug handles applied to the shoulder. One example has Chinese characters, including the word 'tea', written on the base. It is a product of Cizao.

Brown-ware kendi.

5.4 Brown-Ware Kendi

This kendi has a flattened and raised rim on a long tapering neck, with a squat body tapering towards a flat base. A long curved spout protrudes from a rounded shoulder. The brown glaze stops short of the base. Product of Cizao.

Large brown-ware jar with four lug handles.

Large brown-ware jar with four lug handles and wavy decoration on the shoulder, and an iron-wash on the interior.

Large brown-ware jar with six ear handles.

5.5 Brown-Ware Large Jar

Many large storage jars were recovered from the Flying Fish Wreck. They have an everted rim on a short neck, with a rounded shoulder tapering towards a flat base. Four lug handles are applied to the shoulder. Some examples have six ear handles on the shoulder. The brown glaze stops short of the base. Some have an iron-wash applied to the interior and an incised wavy decoration on the shoulder. They were used as storage jars, containing anything from water to ceramic bowls.

Inscriptions on the Ceramics

There are two types of inscription on the ceramics from the Flying Fish Wreck. One is a moulded workshop mark, while the other is a written ink inscription on the base of the ceramics.

1. Moulded Workshop Mark

The moulded workshop mark occurs on the base of a covered box and reads "Ye Jia He Zi Ji" (葉家合子记) which means "covered box of the Ye family workshop". Similar covered boxes with moulded workshop marks have been found in shipwreck and kiln sites, demonstrating a certain brand consciousness in the ceramics industry as early as the 12th century.

Moulded workshop mark, Ye Jia He Zi Ji (葉家合子記).

Close up of moulded mark.

The workshops were proud of their fine quality products. The mention of the type of product may indicate that the Ye family workshop specialised in covered boxes, and was no doubt highly competitive.

2. Ink inscriptions

2.1 Ink Inscriptions of 'Horse' and 'Consignment'

A group of Fujian ceramic bowls has the following ink inscriptions: gang (綱), ma gang (馬綱), ma hu (馬戶), and Ma (馬).

'Gang' means a consignment of goods. 'Ma gang' specifically means a consignment of horses. In the Song dynasty, a 'horse consignment' constituted 50 horses in Sichuan, and 30 horses in Guangxi. There are other types of consignment mentioned during the Song dynasty, such as 'fine cargo consignment' meaning 10,000 catties of incense or others fine goods and 'coarse cargo consignment' meaning 20,000 catties of raw ivory or other coarse goods. These are recorded in the context of tax in kind levied at the various ports by the Shipping Superintendent and then sent to the capital.

'Ma hu' means 'horse (raising) household', or the people who take care of the horses. Horse administration is an important topic in the Song dynasty history. During the Northern Song dynasty tea was traded for Tibetan horses in Sichuan and Shaanxi. During the Southern Song dynasty this occurred in Guangxi. The 'horse consignment' would then be sent to the capital or frontline in times of battle. There is one record in the Song Dynasty History that mentions the Chinese contacting the Jurchens by sea in 1087 CE to persuade them to sell horses[4]. On the other hand, the 17th century Chinese rutter Shun-feng hsiang-sung mentioned 'the side of ma-hu', which referred to 'starboard side'.

4 Tuo Tuo, 1343: juan 21.

Gang (綱), consignment.

Ma Gang (馬綱), horse consignment.

Ma Hu (馬户), horse raising household.

Gang (綱), consignment.

Ma Gang (馬綱), horse consignment.

Ma Hu (馬户), horse raising household.

Fan-pu (忱鋪sail's side)

Fan-pu (忱鋪sail's side).

Fan-pu (忱鋪sail's side).

2.2 Inscriptions of Nautical Terms

Some bowls have an ink inscription, 'fan-pu' (忱鋪) which means sail's side, or port (left) side.

2.3 Ink Inscriptions of Names

The majority of the ink inscriptions are names. They have probably been written to indicate the ownership of the ceramics on the ship. From the limited numbers, the inscriptions may only be on the bottom bowl in a stack. The first group of names are Chen… (陳□), Wu… X (吴□X), Yang… (楊□), and Lin… (林□). The second character is illegible.

The second group of names includes Chen (陳), Chen Qi… (陳七□), and Guo…… (郭□□) . The calligraphy of the character Chen on two qingbai dishes is much better than on other pieces. The calligrapher has used two different writing styles: regular script (kai-shu); and cursive script (cao-shu). The fact that the better calligraphy is on the finer ceramics may indicate that this merchant was better educated and was targeting the high-end market.

Chen… (陳□).

Wu… (吴□).

Yang… (楊□).

Lin… (林□).

Chen (陳).

Chen (陳).

Chen Qi… (陳七□).

Guo…… (郭□□).

2.4 Miscellaneous Inscriptions

This group includes a number of illegible or partly legible ink inscriptions. The Huang… (黄□) on a qingbai ewer is a common Chinese surname. The Xie Ba…… (谢八□□) on some brown-ware pieces is a common surname and given name. The tu…… (茶□□) on the base of a brown-ware jar with four lug handles means tea. This jar may have been used to store tea on board the Flying Fish ship. During the Song dynasty, tea leaves were made into tea cakes which were then ground into power for making tea. It would have been logical to use a ceramic container for storage.

Illegible ink inscription.

Huang… (黄□).

Xie Ba…… (谢八□□).

tu…… (茶□□ tea).

12 names includes Wang (王),Ye (葉), Xu (徐),Yang (楊), Ma (馬), Zhang (张), Guo (郭), Xie (謝), Chen (陳), Wu (吴), Huang (黄), Lin (林).

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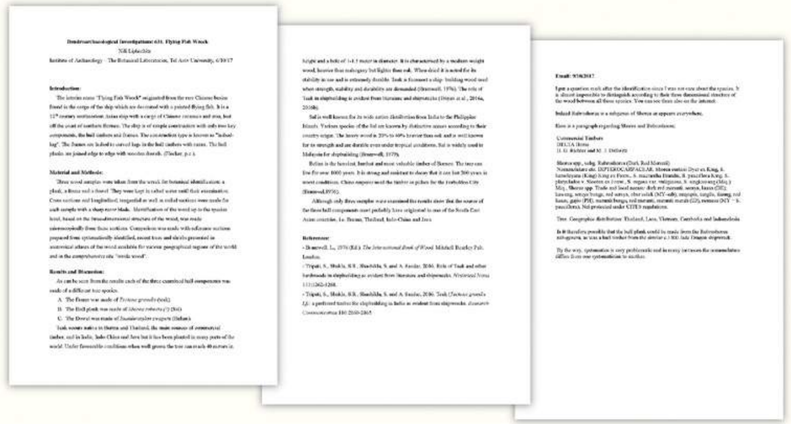

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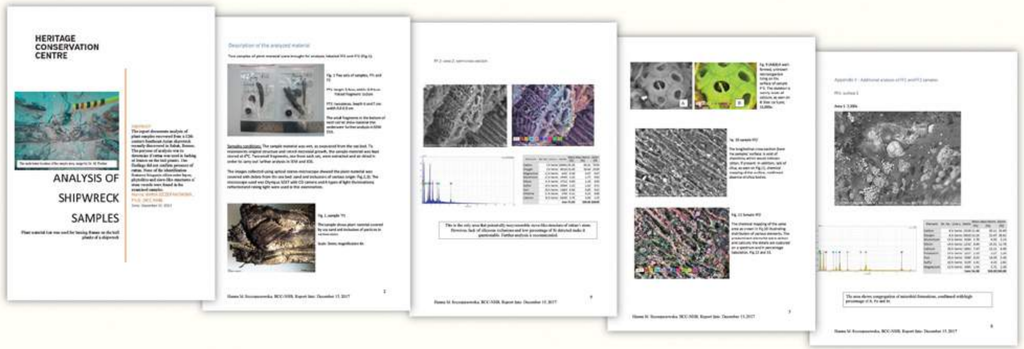

Analysis of rattan-like sample

QUANZHOU

LUZON

PALAWAN

FLYING FISH WRECK

SABAH

BRUNEI

SARAWAK

FLYING FISH WRECK NORTHERN SONG (960-1127)

北宋飞鱼沉船录

The Flying Fish Wreck derives its name from the freely painted decoration in the centre of one of the first finds, a large stoneware basin. The graceful gliding flying fish design is known from the Cizao kilns of Fujian Province, China, but it has never been seen in a shipwreck cargo before.

Maritime archaeologist, Dr Michael Flecker, concludes that the Flying Fish Wreck is a Southeast Asian lashed-lug ship, following a shipbuilding tradition that lasted for over a thousand years. She has been dated to the first quarter of the 12th century, corresponding to the rule of Emperor Huizong during the late Northern Song dynasty. The ship followed the eastern route down the South China Sea bound for northwest Borneo. Most of the ceramic cargo was manufactured in Fujian province, suggesting that Quanzhou was the port of embarkation. Individual pieces were marked with surnames such as Chen, Lin, Huang, Xie, Wu, Yang, Guo, Zhang, Xu, Wang, Ma and Ye. Dr Tai Yew Seng, a Chinese ceramic specialist, contributes a comprehensive analysis of every ceramic type excavated from the wreck. Non-ceramic artefacts include wrought and cast iron, lead ingots and rings, ship's equipment, personal belongings, and one of the original voyagers whose bones survived deep inside the wreckage.

飞鱼沉船的名字来自最早出水的一件瓷盆内底中心的写意纹饰。这些优雅地翱翔着的飞鱼纹饰，源自中国福建的磁灶窑，在此之前没有在其他沉船上发现过。

水下考古学家麦克·弗莱克认为这艘船是东南亚绑系拼板船，这种造船法具超过一千年的历史。这艘船的断代是12世纪前25年，相当于北宋晚期的徽宗朝。这艘船沿着南海东部航线，抵达婆罗洲东北岸，船货主要是来自福建，说明其始发港是泉州。多件瓷器上有陈、林、黄、谢、吴、杨、郭、张、徐、王、马、叶等姓氏。陶瓷考古学家戴柔星博士对出水陶瓷进行了分析工作，其他非陶瓷出土物有生铁、熟铁、铅铤和铅环，以及船上用具、个人随身物品和船骸深处一具罹难者的骨架。