When an old frond and ceramics collector first informed me of a new shipwreck discovery off Kata Kinabalu, Sabah, I was thrilled by the prospect 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 shipwreck of the Chinese Longquan ceramic and lost off the northern coast of Borneo. Prior to the Museum documenting the remains 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 several excavations, the intended destination of all these ships becomes apparent. Visit-quantities of contemporaneous Chinese ceramics have been unearthed in Iberia and around Sunning in Swatow. The early trade route from China to Tsui, the ancient port, for shifting trade centers in north-west Borneo, is well established.

Despite clear evidence of landing on the new wreck site, a pre-attendance survey revealed that much of the cargo and some of the ship's structure remain intact. A full archaeological excavation was definitively 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 its first finds, a gliding flying fish finely painted in the centre of a snowflake base. The Flying Fish Wreck is a Southeast Asian early 13th-century vessel, following a shipbuilding tradition that lasted for over a thousand years. It has been dated to the first quarter of the 13th century, corresponding to the late Northern Song dynasty, when the Chinese export trade was flourishing. Most of the ceramic 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 goods, if not years, worth of ceramics, iron and other important foreign products to a key port-city, together with its spread 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 insights into 12th-13th 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 Artique 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.

Michael started working life in 1985 as a civil engineer in a Singapore-based company. Two years later he changed course, joining Pacific Sun Resources for the two-year excavation of the Manila Galleon, Nastra Simron de la Conception, in Surabaya. Then he has directed some of the most important shipwreck excavations in Asia, either directly through his company, Maritime Excavations, or with other licensed companies, or for government institutions. They include the 9th century Belitung (Tang) Wreck, the 10th-11th century Javan Wreck, the 13th century Java Sea Wreck, the 15th century Aksah Wreck, the c.1608 Anak Dua Wreck, and the c.1890 Hang Tua 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 Anak Dua. This thesis was published as a book by the British Archaeological Report Series (2002). Other works include the book, Perakian from the Hang Tua Wreck (2001), chapters in Southeast Asian Ceramics: New Light on Old Pottery (2009), Shipwrecks: Tang Treasures and Munson Woods (2010) and numerous other books, along with a wide range of articles in international journals. Apart from archaeological work, he has written extensively on others, politics, legislation and pragmatics in the troubled realm of underwater cultural heritage in Southeast Asia.
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In November 2016, a fisherman approached a collector in Kota Kinabalu, Sabah, offering an array of brown wares, 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 excavated at corals. Another ancient shipwreck had been found.

A stone ware 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 Cizhou kilns of Fujian Province, China, but none had ever been found on a shipwreck before. This unique nautical-themed artifact embodies the new discovery, and therefore attributes the name, the Flying Fish Wreck.

Some six years earlier dealers in Kuching, a town nestled in a bay near the northern tip of Sabah, had 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 Wreck. 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.

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 Antiques 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 analyze 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.
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 be resorted to GPS.

The depth sounder indicated 25 m. To the north a weed post marked a perpendicular 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 “Debant Shoal”, “D’lau” in 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 Pelupas Tiga. 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 15 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 coursing course. They probably steamed at night. During the day the shoals stood 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 leave themselves off. As the cargo holds were filled to capacity there was no internal access to the damaged planks. The captain changed course towards the shore in a desperate bid to ground his ship in shallower waters. It was not to be. He barely made it a mile before the ingress of the sea overwhelmed the ballasts, and his ship slipped below the surface.

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 tunnus. 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.
CHAPTER 3
HULL REMAINS

While Wujai had mentioned wooden hull remains, none could be seen when excavation commenced. Small sunken depressions contained waffling wood fragments, but initial excavations stopped short at amorphous iron concretions with entrapped ceramics. 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 each 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-laying bowl while the fringes had suffered the ravages of teredo navals. 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.

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-hull 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 ipok (sugar palm fibre), which was typically used for lashing. The dowels were used to edge-join hull planks, traditionally with a layer of Melolouca (papery bark) as lining. The darker wood of the dowels was relatively unaffected by teredo suggesting that it might be the off-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 6 cm across. The lugs and connecting strips varied from 3 to 5 cm in height.

[Images of wooden fragments and计划 view of hull planks and frame]
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 a handy tool for determining an earliest date could not be utilized. 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 damage. 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 Irsh Hijaz 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).

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 Yanzhou kilns in Shandong province, 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 ‘Hāji cap’ bowls due to their close resemblance to the dome-shaped headdress worn by pilgrims to Mecca. An example of this type was found at a Chinese tomb that has been accurately dated to 1127 CE. The tomb, belonging to Madam Zhang, was located in Wuyang county in Jiangxi province, adjacent to the Jingdezhen production centre. Five more ‘Hāji cap’ bowls were recovered from the Pulau Buaya Wreck, 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, which has been quite concisely dated to the period 1111 to 1127 CE.
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 shoresa genus, frames of teak, and dowels of betel. Betel can be 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. Betel, 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 likely the 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 Punjalanjaro 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 Mangin, notes that all pre-16th 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 barge. The planks are edge-joined with wooden dowels, which in earlier examples are interspersed with internal stitching. The planks are curved, rather than best 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. Harridge, 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 m³. 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 lashing between the seams of hull and deck planks on vessels with dowel edge joining in Indonesia. 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 pits in particular. They had up to four tripod masts and a bowsprit, and probably used casted 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.

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 Yiqiujing yingzi of 815, Hui Lin notes that kaiyun ho (Southeast Asian ships) were arriving regularly at the Gulf of Tonkin and along the south-eastern Chinese coast. 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.”

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. This Office was intended to coordinate overseas trade and impose and collect taxes. Superintendents were appointed to Hangzhou in 989 and to Mingzhou (Ningbo) in 992 in order to maximize 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 Nanshi 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 Srivijayan was even designated headman of the port. This Southeast Asian entrepot was a key supplier of aromatics such as camphor, sandalwood incense and frankincense.

Interestingly, the camphor originated from Borneo and was transported on Southeast Asian ships, while the frankincense came from the Middle-East or Arab shores. Chinese sea-going junks were late on the scene.

It was only in 999 that the Song court began to permit Chinese private vessels to sail abroad for the purpose of trade. 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. 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. This is the earliest reference emphasizing 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.
CHAPTER 7
ANCIENT BORNEO - INTENDED DESTINATION

Textual Evidence

The earliest textual reference to Boni, or at least a possible 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 huaan yu (Universal Geography of the Taiping Era) by Ye Shilü, 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, Puhshie, who was perhaps an Arab, Persian or Indian. They brought Borneo camphor, turtle shell, sandalwood and elephant tusks. 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 huaan yu is the original source for all other books dealing with Boni in Song times. The Zhuhai 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 huaan yu and Lingxai daida of 1178 by Zhou Qu lei. 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 19,000 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 Japanese textiles on a regular basis.

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 encyclopedia 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, Xiuliang, is consistent with earlier reports, but again the exact location of Boni remains a mystery.

The Wenxian tongkao (General History of Institutions and Critical Examination of Documents and Studies) of 1508 by Ma Daolin 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. Xiulinou is named as the king of Boni in 1082.

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 50 days from Champa.
CHAPTER 08
THE PROBABLE ROUTE

The fact that the cargo of the Flying Fish Wreck, a lashed-lg 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 ceramic jars, there is no doubt that the Flying Fish ship’s last voyage originated in China, and from longevity 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 northwestern 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 at off-laying 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 60 miles. The 12th century Tanjung Simpang Mengayau Wreck and the late 13th century Jade Dragon Wreck attest to the significance of this landfall. These wrecks lie within a kilometer 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-laying dangers until reaching Delura Shoals, which, of course, claimed the Flying Fish ship.

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 must point on Borneo before continuing on to Java. This cross route is mentioned in Song and Yuan texts, linking Champa to Cape Dato. For shipsbound from Quanzhou to Sambong, 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 Sambong.
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. It 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 Huaqiangzao I in China, and Breaker Shoal in the Philippines.

Lingga Wreck

The Lingga Wreck 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. It went down some 8 nautical miles southwest of Pulau Tiara, 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 of 1111 to 1127 CE for the Lingga Wreck.

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 Xian kilns, 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 gangas 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 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 whichever 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 gangas, 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 wares 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 Guangzhou and Guangzhou.
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. 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 (1,350° 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.

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 phosphorus, 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 hummedered 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 3, maps the Chinese iron production centres in the late Northern Song period. The largest centres by far were in Xingzhou and Zibu in Hebei province in the far north of China. The five medium sized centres were all in the surrounding northern provinces of Honan, Shansi, Shandong and Jiangsu. There was relatively little production in the south of China. Smaller centres could be found in Yunzhou 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, 1986, 223
2. Needham, 1986, 226
3. Needham, 1986, 229

Iron concrete formed by conical benefits of wrought iron bars. The ceramics have been encrusted in the concretion.
CHAPTER 11
THE CERAMICS CARGO  BY DR 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, qinghai-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 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.

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 stuck-firing. A glassy glaze with a yellowish tinge is applied, stopping short at the lower exterior. It is a product of Cizao, Fujian province.

2. Qinghai-Ware

Qinghai-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 Qinghai Bowl

Type A

Qinghai 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 qinghai 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.
FLYING FISH WRECK

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

Maritime archeologist Dr. Michael Freeden concludes that the FIng Fish Wreck is a Southeast Asian Indochina 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 Burma. Most of the stoneware cargo was manufactured in Fujian province, suggesting that Quanzhou was the port of embarkation. Individual pieces were marked with stencils such as Chou, Lin, Huang, Yi, Wei, Yang, Guo, Zhang, Xu, Wang, Ma and Yu. The Earthenware is a Chinese ceramic specialist, contributes a comprehensive analysis of every ceramic type excavated from the wreck. For example, stoneware articles, wares, and jars from land graves and ship's equipment, personal belongings, and one of the original voyagers whose bodies survived deep inside the stoneware.