THE ARTIFACT ASSEMBLAGE FROM THE PEPPER WRECK: AN EARLY SEVENTEENTH CENTURY PORTUGUESE EAST-INDIAMAN THAT WRECKED IN THE TAGUS RIVER

A Thesis
by
SARA R. BRIGADIER

Submitted to the Office of Graduate Studies of Texas A&M University in partial fulfillment of the requirements for the degree of
MASTER OF ARTS

December 2002

Major Subject: Anthropology
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Approved as to style and content by:

Kevin J. Crisman
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December 2002

Major Subject: Nautical Archaeology
ABSTRACT

The Artifact Assemblage From the Pepper Wreck: An Early Seventeenth Century Portuguese East-Indiaman That Wrecked in the Tagus River. (December 2002)

Sara R. Brigadier, B.A., Birmingham-Southern College

Chair of Advisory Committee: Dr. Kevin J. Crisman

Almost four hundred years after the wrecking of the Portuguese East-Indiaman Nossa Senhora dos Mártires in 1606, excavations were begun at São Julião de Barra by the Centro Nacional de Arqueologia Náutica e Subaquática (CNANS). The 1996-1998 field seasons yielded thousands of individual artifacts from the wreck that is almost certainly Mártires, today known as the Pepper Wreck. These items represent the remains of one of the first archaeologically excavated Portuguese East Indiamen to date. Even after an immediate contemporary salvage effort and four hundred years in a heavy surge zone, the remains of the Pepper Wreck are extensive in their size (large portions of the ship’s hull survived) and variety. The range of artifacts recovered includes some of the ship’s navigational instruments, Asian trade goods such as pepper and porcelain dishes, and personal items. Other materials recovered include everything from modern signage and trash to hundreds of ceramic sherds and balls of lead shot. The collection was found in varying states of preservation, from pristine to unrecognizable, depending on the amount of protection received on the site.

This thesis will focus on the artifacts that were originally carried aboard the Pepper Wreck. The area containing the wreck site is in a location that has been the site
of numerous shipwrecks from all time periods. Subsequently, all manner of objects were collected from the bottom during the CNANS excavation. Therefore, the main portion of the thesis will only focus on artifacts that can be linked with the Pepper Wreck. This thesis contains a broad historical background of the trade routes traversed by the Portuguese, along with more specific historical and practical research concerning the particular artifacts themselves. These artifacts will be grouped into the following categories: navigational instruments, porcelains, pewter ware, and a miscellaneous category (for items ranging from Asian stonewares to a Japanese sword guard or tsuba). This thesis will strive to place this mix of trade and personal goods into the historical context of the Portuguese Empire at the turn of the seventeenth century.
ACKNOWLEDGMENTS

This study of the artifacts from the Pepper Wreck would not have been possible without the generous support and assistance of many different individuals and organizations. I would like to start by thanking Dr. Kevin Crisman, chairman of my thesis committee, for sharing his time and vast knowledge about all things nautical and maritime. I am indebted to him for his continuous support and encouragement through every phase of this project. I would also like to thank Dr. Wayne Smith for his ongoing technical and moral support, and both he and Dr. James Rosenheim for contributing their time to my cause. Thanks, as well, to Dr. Donny Hamilton for teaching me about conservation and ceramics, I had no idea how important that would become.

A special thanks to Dr. Filipe Vieira da Castro, who initially proposed the project to me; his tireless work in securing funding and acting as a Portuguese liaison made my research in Lisbon not only successful, but fun. This experience has helped me to grow as an archaeologist, a historian, and a person, thank you.

Funding for my research was provided by the Institute of Nautical Archaeology, Texas A&M University (thank you Kevin), and the Centro Nacional de Arqueologia Náutica e Subaquática (CNANS), and I am grateful for the support. I would like to acknowledge Dr. Francisco Alves’ support; without permission and assistance from him and the wonderful people at CNANS, this project would not have happened.

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thank you so much for sharing your knowledge and time with me, it was a pleasure to work with you. A friendship forged in fire, you might say. Many thanks as well to Erika Laanela and Mason Miller for helping me and keeping me sane in Lisbon (and beyond). You guys are wonderful.

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 CHAPTER I

INTRODUCTION

Figure 1: Map of São Julião da Barra.

It was a dark and stormy night when the Portuguese East-Indiaman Nossa Senhora dos Mártires met her fate in the mouth of the Tagus River. In September of 1606, Mártires had reached the final phase of a grueling nine-month journey from Goa, India to Lisbon, Portugal, a sailing route known as the Carreira da India. The pepper-laden nao arrived within view of the beach at Cascais, located on the northern shore of the Tagus River where it flows into the Atlantic Ocean (figure 1), on September 12. As the ship drew towards its final destination of Lisbon with its companion ship, Nossa

This thesis follows the style and format of American Neptune.
Senhora da Salvação, a storm arose from the south. The intensity of the storm broke the anchor cables of Salvação, which then proceeded to lose its tiller and ground in the sand in front of the castle of Cascais. In the same storm, Mártires sustained minor damage. Despite the circumstances, the captain determined that the ship would press forward, braving the sandbar at the mouth of the Tagus River. The ship never made it past the hazardous sandbar. At the Fortress of São Julião de Barra, located on dangerous rocks at the edge of the sandbar, a sudden loss of wind left Mártires unable to steer in the midst of a heavy current. The ship was thrown against the rocks below the fortress with such force that only small pieces of the hull washed ashore.\(^1\) Two hundred lives were lost in the shipwreck, and the valuable cargo, primarily the Crown’s pepper, was washed ashore for five leagues down to Cascais. The water is said to have run black with the pepper spilled from the hull of Mártires.\(^2\) An immediate salvage operation was carried out to save as much of the cargo as possible, merchandise that had been in transit from India alone for three quarters of a year.

Almost four hundred years later excavations begun at São Julião da Barra by the Centro Nacional de Arqueologia Náutica e Subaquática (CNANS) in Lisbon have revealed information about all aspects of Portuguese East-Indiamen. The 1996-1998 field seasons spent excavating the Pepper Wreck site yielded thousands of individual artifacts. As the Pepper Wreck is almost certainly Nossa Senhora dos Mártires, these items represent the remains of one of the first archaeologically excavated Portuguese East-Indiamen to date. Even after the contemporary salvage effort and four hundred years in a heavy surge zone, the remains of the Pepper Wreck are extensive in both size
(large portions of the ship’s hull survived) and variety. The range of artifacts recovered includes some of the ship’s navigational instruments, Indo-Asian trade goods such as pepper and porcelain dishes, and personal items. Other materials recovered include everything from modern signage and trash to hundreds of ceramic sherds and lead shot. The collection was found in varying states of preservation, from pristine to unrecognizable, depending on the amount of protection received on the site.

The rocks of São Julião da Barra have been a treacherous point for ships and sailors for centuries, resulting in scores of shipwrecks that have left archaeological materials anachronistic to the early seventeenth century strewn across the site. While everything from the excavation is included in the catalogue (see the attached cd-rom in Appendix A), only artifacts found associated with the Pepper Wreck are discussed in this thesis. These remains fall into the following categories: navigational instruments, porcelain dishes, pewter flatware, and miscellaneous pieces.

There is a wide range of preservation among the artifacts with everything from complete items to tiny sherds recovered from the site. The navigational instruments include three astrolabes, one complete with legible markings, and two intact charting compasses. The Wan-Li porcelains include items from intact plates, found with remnants of their original packing materials, to fragments from what was probably a large, heavy vase, and everything in between. The collection of pewter plates, some of them found beneath pepper from the wreck, are in varying sizes and degrees of preservation. There are a large number of stoneware sherds that correspond to the known features of Chinese Tradescent Jars (a buff colored stoneware body and a green
exterior glaze) and Martaban Jars (highly fired stoneware partially or entirely covered by an exterior dark brown glaze), as well as one intact jar. The miscellaneous artifacts include gaming pieces, chunks of trade coral, pepper, a Japanese sword guard or tsuba, and cupreous decorative elements. Organic remains from cargo items were found with the wreck (including the large quantity of pepper kernels, pieces of coconut, and numerous fruit pits) and will be mentioned when relevant. They will not be discussed in depth, however, as they have not been analyzed by archaeobotanists and the organic material alone is a large enough subject to merit its own thesis.

The artifact assemblage from the Pepper Wreck, containing such a wide variety of trade goods from Asia, has presented a rare opportunity to examine Portuguese trading activities in the Far East with specific merchandise in mind. The Carreira da India, which Múrtires had almost completed when she wrecked, was only one leg of the journey made by many of the goods aboard the ship. The Carreira has been a popular subject for study by historians, but Portugal’s Far Eastern empire consisted of much more than just this route. By the early seventeenth century Portuguese merchants had established an extensive trade network that encompassed India, Asia, the Japanese archipelago, and many islands in the South China Sea. The lucrative trade in spices and other luxury goods like perfumes, hardwoods, ceramics, and silks, was completely self-contained within that hemisphere. The collection and shipment of goods from India to Portugal was thus merely one aspect of the exchange system developed in the Eastern Hemisphere. This chapter will discuss the entirety of the trade network that the Pepper Wreck artifacts traversed.
TRADE AND THE ECONOMY

At the end of the Medieval Period, Portuguese society had reached a new height in its development. Having outgrown the subsistence lifestyle of feudalism, Portugal had begun to develop further aspects of knowledge, technology, religion, and capitalism, converting ideas into focal points for societal resources. Such resources as time, labor, and money were made available for the pursuit of a higher mission for Portugal, a mission for the spiritual and material advancement of the entire society. The twin missions begun in the fifteenth century, global exploration and religious conversion of non-Christian populations, would continue throughout the next two centuries.

Under the direction of Prince Henry the Navigator, Portuguese seafaring and navigational skills advanced to the point of allowing the Portuguese to successfully search for an alternative route to the East Indies. The Italian and Muslim domination of Far Eastern trade through the Mediterranean route had previously precluded the Portuguese from direct trade with the India and Asia. However, the route around the Cape of Good Hope, discovered by Vasco da Gama in the late fifteenth century, not only gave Portugal direct access to this trade, but it made Portugal the only western European country with direct access to exotic Eastern spices and luxury goods. The annual trading voyage following this path to the East Indies came to be called the Carreira da India or “India Route.”

The Portuguese Carreira da India was well known for its extensive length and the inevitable hardships encountered by contemporary voyagers. One Italian Jesuit traveling in the late sixteenth century called the journey “without a doubt the greatest
and most arduous of any that are known in the world.” However, the Indian spice trade was an incredibly lucrative trade and from the time of da Gama’s voyage in 1498 until the final decades of the sixteenth century, the Portuguese were unchallenged by other European nations in the Indian Ocean. This potential for wealth and adventure, when combined with the seductive reputation of the Far East for exotic perfumes, textiles, spices, people, and lifestyles, was a justifiably irresistible temptation for many Portuguese. If they survived the rewards far outweighed the difficulties of such a journey; thus, a year and a half trek with a high possibility for tragedy became an annual undertaking made by a fleet of trade ships. The luster of Indian adventure would wear thin for Portuguese sailors early in the life of the Carreira, but the Carreira da India remained an annual custom, albeit in reduced form, until the advent of steam ships in the nineteenth century.4

The multiethnic crews of the Portuguese East-Indiamen reflected a society compiled of international elements, and one of the characterizing elements of the Portuguese Empire was its multi-racial composition. The court of Dom Manuel, the Fortunate King, was a mecca for international travelers at the turn of the sixteenth century. “Ambassadors from Eastern courts attended his levees. The Shah of Persia and the kings of Java and of Siam sent him gifts. Here you might meet black monks of Ethiopia, envoys from Prestor John of Abyssinia, Arab pilots from the Red Sea, and Chinese travelers picked up at Malacca.”5 This multiethnic standard set during the rise of the Portuguese Empire continued to exist throughout the next two centuries.
The vast majority of outward-bound passengers (soldiers, sailors, government officials) were single males, who married local women in Portuguese ports and settlements from Brazil to Japan. The children of these unions were usually raised in the Catholic faith following Portuguese practices, creating an ever-expanding Portugal. Therefore, in relation to the numbers in the local populations, although a relatively small percentage of Portuguese natives established families outside of Portugal, their influence spread throughout the globe, and, more importantly for this thesis, into the trade of the Indian Ocean and South China Sea.

THE ROUTE TO THE INDIES

The Carreira da India, based on the annual weather patterns of the Atlantic and Indian Oceans, was well planned out and became familiar to Portuguese pilots. Ocean currents, winds, storm seasons, and geographic features (such as islands, capes and channels) that could help or hinder a ship were painstakingly recorded by fifteenth- and sixteenth-century sailors in logs called Roteiros. Based upon the information collected in Roteiros, the route of the Carreira was planned to take advantage of winds and currents. However, ships leaving both Lisbon and Goa could easily run behind schedule. Missing a sailing time meant waiting a year for the next good opportunity, and this was often considered unacceptable by merchants who would reap the great profits of the venture. Thus, many ships sailed whether they were on schedule or not. For the multitude of ships destroyed by storms or by wrecking, the true tragedy lay not only in
the resulting loss of crew and valuable merchandise, but also in the knowledge that in many cases the loss was likely avoidable.

The best time of departure from Lisbon was in February or early March, in order to allow ships to reach Goa in September before the monsoon season began in the Indian Ocean. The monsoon blew southwest at the beginning of the season, and then shifted to blow from the northeast by the end of winter, in April. The Portuguese tried to catch the favorable winds at either end of the season to hasten their journey, but a miscalculation could spell disaster. To sail during the winter months in the Indian Ocean was a deadly prospect, and often ships would take shelter for the winter at Mozambique or an African port rather than risk sailing. Despite the danger, departures from Lisbon were frequently delayed until late in March or the first half of April, sometimes resulting in a successful voyage, sometimes not.

The outward voyage began in the Tagus River and ran south parallel to the African coast (figure 2). At Sierra Leone, the ships headed southwest, taking advantage of the Southeast trade winds. Then, at approximately 20° south latitude, the route cut east, riding on ocean currents, below and beyond the Cape of Good Hope. Beyond the Horn of Africa, the officers and pilot chose the inner or outer passage around Madagascar. The inner passage, the Mozambique Channel, permitted a stopover at the port of Mozambique, while ships taking the outer passage completely bypassed Madagascar and headed straight for Goa. This was a crucial decision, as evidenced by the fate of the crew of the nao São Paulo, whose captain thought “that it was best to take
the outer passage... And this decision was the cause of the ship sailing so far away beyond India.”\textsuperscript{11} The loss of the ship in a subsequent storm left few survivors.

During the homeward voyage, a ship either took the inner or outer passage around Madagascar depending upon the month of departure from Goa. According to one contemporary source “ships leaving from Goa up to the end of December should take the inside passage, since the voyage is safer; from the first of January onwards this voyage is riskier, and they should take the outer passage.”\textsuperscript{12} Beyond the Cape of Good Hope a northwest route was taken, ideally with following winds and ocean currents, up to the point of $10^\circ$ north latitude. The route then curved north through the Azores before finally reaching Lisbon. The entire round trip was expected to take eighteen to twenty-four months, including time spent in Goa.
From our twenty-first century perspective, the route appears reasonable and straightforward. The ideal voyage was planned to take advantage of known sailing winds and currents, with an emphasis upon departure dates that would prevent ships from sailing during times when the weather was known to be lethal. It seems incredible that these safety guidelines could be as frequently violated as they often were, and the danger of these late departures was often compounded by the ships being overloaded. Lack of regulations concerning cargo size and lading often resulted in cargo being stowed unevenly and in such quantities that the ships could barely stay afloat in calm waters, much less sail in treacherous seas (the unsafe cargo lading practices will be discussed in the following section). It seems even more unbelievable that men would agree to sail in such hazardous ships, whether officers or sailors, yet it happened every year. Despite the difficulties with seafaring, the Portuguese enjoyed a great deal of success in maintaining the global empire, established in the fifteenth century, throughout the next two centuries.

TRANSPORTING THE CARGO

The Portuguese mercantile attitude during the sixteenth and seventeenth centuries is expressed clearly in the ships that they built for the important task of transporting eastern merchandise, both throughout the east and to the west. The goal was to reap large profits (i.e. large cargos) as quickly as possible, and cargo quantity took precedence over sailing speed. Two basic ship types were built to accomplish this goal: galleons and carracks, though galleons were not used as frequently on the Carreira.
Galleons were generally warships, and their tonnage was kept below 500 tons to enhance their maneuverability and speed. Carracks were the standard cargo carriers, although galleons were used for this purpose as well. Both vessel types are often lumped into the category of naos, but in this thesis ‘nao’ will be used to refer to carracks.

In a society in which the pursuit of Empire for the greater glory of God seems to have been best achieved by greater size in its various components, greater ships carrying greater cargoes were the obvious choice for trade. The preference for larger ships was not entirely whimsical, of course, and larger ships had the advantages of being more easily defended than smaller vessels while carrying more cargo. As a result, Portuguese shipwrights expanded the modest medieval carrack (about 400 tons) to proportions that are almost unimaginable. Jan Huygen van Linschoten, a Dutch traveler and writer, departed from the Lisbon for the Indies in April 1583 in a fleet of five ships, each having a burden of 1400 or 1500 tons. In his account, there is nothing to indicate that ships of this size were out of the ordinary.

The basic design of a carrack makes it quite conducive to carrying vast amounts of cargo and men. The standard 3:1 length to beam ratio described for carracks in treatises across the Mediterranean makes for a broad, full hull from bow to stern. These full proportions, while creating ample cargo space, made for a sluggish sailing vessel. The trademark high fore and stern castles of the carrack contributed to their top-heavy weight distribution which, when exaggerated by unbalanced lading, made these vessels difficult to handle. Still, the proportions of the carrack made it a relatively simple matter
for shipwrights to expand the hull dimensions from a modest 400-ton capacity to the 2000-ton behemoths produced by the Portuguese.\textsuperscript{15}

There was a marked difference between ships built in the Goa shipyards and those built in Lisbon shipyards. Although Portuguese shipwrights designed both the eastern and western carracks, ships constructed in Goa could last a decade longer than those constructed in Portugal. The use of teak as a building material in India, as opposed to the pine and oak of Portugal, probably accounts for the difference. Teak is a strong and durable hardwood that is resistant to attacks by the mollusks known as teredo worms, contributing to the benefits of using it in shipbuilding. \textit{São Paulo} “had been built in India, and she was very strong and like a firm rock in all the winds that blew, sailing wonderfully well with a following wind, when she skimmed over the sea.”\textsuperscript{16} On the converse side, teak was heavier than pine, a problem for the naos, which were sluggish to begin with. \textit{São Paulo} was said to be “so heavy, she was an ill sailor when close-hauled, and difficult and hard to steer.”\textsuperscript{17}

The lead sheathing nailed on top of the planking was a modification for naos of the East India trade to protect against a lengthy voyage through both warm and cold waters. However, if the hull began leaking, the lead could not be relied upon to slow the flow of water, as seen during the water-logging of \textit{São Thomé}, a nao that sailed out of Cochin in 1589. The sinking is described as being caused in part by “the water which was very violent, as it was expelling oakum from the seams and the lead plates which were nailed on top.”\textsuperscript{18} This incident illustrates that the layer of lead protecting the hull was not a substitute for well-caulked seams. Lead is also an amphoterric metal;
therefore whenever it is wet, in either fresh or salt water, it undergoes electro-chemical
disintegration.

The sinking of São Thomé is also an example of negligence in the caulking
process; the oakum caulking washing out of the seams was the result of a process called
careening being poorly executed. In his account of the sinking of Santo Alberto, João
Baptista Lavanha, the Cosmographer Royal of His Majesty Dom Philip, states that the
shipwreck was “caused, not by the storms of the Cape of Good Hope (for she was lost
before reaching it, in favourable weather), but by careening and overloading, through
which this great ship and many others lie buried at the bottom of the sea.”
He continues
in his account to blame poor careening and overloading on the “covetousness of the
contractors and navigators.” The contractors hired to either repair old ships or to secure
new ones, attempted to cut corners wherever they could. Careening a hull, which was
the standard practice to repair and maintain caulking, was simply the process of tipping
the hull over onto both its port and starboard sides, exposing the planking so that it could
be caulked. This process is difficult, especially when performed on large vessels, and
later when the ships were at sea in strong winds and waves, poorly installed caulking
would be washed out of the seams, as in São Thomé.

The other problem Lavanha describes was poor lading of the ships. By placing
lighter cargo on the lower decks, and heavier cargo on the upper decks, the already-top-
heavy carracks could not be sailed properly. Also, ships were so vastly overladen that
crews could not handle the sails, as with Santo Antonio. “This wind blew so hard and
the ship was so overloaded that she could not bear her sails well, and we were compelled
to begin throwing some of the cargo into the sea, hoping that this would make the ship more trim."

The tendency among merchants and navigators seems to have been one of playing the odds. Of voyages undertaken between the years 1500-1635, 912 ships sailed from Lisbon to Goa, with 768 arriving, and 550 ships sailed west, with 470 reaching Portugal, this yields a total of 224 unsuccessful ships. Therefore, on an eastward voyage ships faced only a sixteen percent chance of sinking, and on the homeward leg only a fifteen percent chance. With those odds, greed dictated that ships be laden to the brim with merchandise in order to produce a larger return upon arrival in Lisbon. Those statistics seem to refer strictly to ships that were lost at sea, without taking into account ships that were so crippled by poor caulking and overloading that they were forced to return to their port of departure to avoid being lost. Naos of the Carreira reflected the Portuguese desire for profitable trade. Unfortunately many individuals involved with the ships’ maintenance and preparation were concerned with their personal pay, not with performing their jobs well for the safety of those who would ultimately be sailing aboard the ships.

THE PORTUGUESE FAR-EASTERN EMPIRE

The Pepper Wreck’s cargo was lost during the vessel’s final voyage on the Carreira da Índia, but the establishment and operation of Portuguese trade networks within the Indo-Asian sphere is certainly the first part of the story. With Vasco da Gama’s successful passage around the Cape of Good Hope in 1498, the Portuguese
became the first Western Europeans to go to the sources of the Eastern spice trade. Until that point European access to the exotic luxury items of the East had been monopolized by the Italians (Venetians, Genoans, and Florentines) operating via established trading fairs in Middle Eastern gateway cities such as Ormuz or North African entrepots like Alexandria. While the Italians certainly controlled Mediterranean access to goods, they did not have a physical presence in the East for the procurement of spices, silks, and other commodities. Instead they relied on the established Muslim trade networks (of which the Arabs were the principal merchants) for the accumulation of those goods.

The Portuguese in the early sixteenth century were the first Europeans to break into the existing arena of trade in the Indian Ocean and seek out the sources of the commodities so highly valued in Europe. As a result of this Portuguese quest, the sixteenth century was a highly dynamic period for maritime activity as well as economics in the Far East. That hundred-year period would see the growth and peak of a Portuguese Empire in the region, as well as the beginnings of its decline.

Vasco da Gama’s entry into the Indian trading world is a case study for shaky initial trade encounters. Despite information gathered from the 1487 Covilhã-Paiva mission sponsored by the Portuguese Crown, da Gama’s expedition arrived after a difficult voyage with insultingly inadequate gifts for the Indian rulers in Calicut. Portuguese frustration in finding their cargoes void of anything desired by the Calicutans led to violent skirmishes. However, the final outcome of the expedition was surprisingly rosy. Da Gama managed to return to Portugal with a cargo of spices and silks, and, more importantly, he had acquired valuable information about which
Portuguese commodities would be marketable in the East. He also gained insight into the manner in which trade was conducted in the Indian Ocean and how the Portuguese could infiltrate it.

What followed was a protracted Portuguese effort to dominate trade in the Indian Ocean, an effort that was sustained for over a century. The empire envisioned and ultimately realized was one that touched the Americas, Africa, Asia, and of course Europe, i.e. nearly every point in the known world. Goods were traded amongst all Portuguese global depots, and the Portuguese people were exposed to a diversity of political regimes, commercial practices and religions, a combination that produced a sophisticated trading machine. According to A.J. Russell-Wood, the genius of the Portuguese in breaking into the lucrative Eastern market lay in three specific areas. First, the Portuguese accurately identified the key strategic military points for the long distance Muslim-dominated trade routes. They then accurately assessed the size of the force they needed to dominate these strategic points. Finally, they avoided the need for widespread territorial possessions by establishing forts or trading factories that allowed for maximum control with a minimal presence.26

To accomplish their goals the Portuguese utilized their strengths, namely superior weaponry and ships, and the weaknesses of the existing trade. First and foremost, unarmed junks or dhows were the vehicles for the peaceful, long-established Muslim maritime trade in the Indian Ocean. Not only were the regional ships generally unarmed, but they were lightweight vessels that, despite their size, were constructed without iron fastenings, a characteristic that made them particularly vulnerable to the
Portuguese carracks, always heavily armed with cannon. As well, trade entrepots like Macao and Malacca in China and Southeast Asia were unaccustomed to outside traders using force to acquire their desired products and prices, much less to having the native competitors strong-armed by foreign barbarians. The ultimate result was that by the 1520s, the Portuguese had not only taken strategic ports throughout the Persian Gulf, the Indian Ocean, and the South China Sea, but they were agents for European trade as well as middle-men for inter-regional Asian commerce. The Portuguese Crown would monopolize trade in the region until the Dutch and English made their way East at the close of the sixteenth century.

A FOOTHOLD IN ASIA

Due to the vast distance between the Portuguese mainland and the Indo-Asian sphere, the Portuguese viewed conquest and trade as a linked objective. In order to protect themselves and their goods thousands of miles from reinforcements, their main trading centers needed to be Portuguese in government and population. Hence, the Portuguese Crown granted all manner of incentives, from voting privileges to trading opportunities, to Portuguese men willing to settle and raise families (either with Portuguese or local women) in the Far East. Goa, on the southwest coast of India, was the first port to fall to the Portuguese in 1510. Goa not only gave the Portuguese a commanding foothold in the Indian Ocean from a military standpoint, it gave the Portuguese a doorway to the sources of valuable Malabar pepper and Indian cottons (see figure 3).
If Goa was a doorway to the Orient, Malacca was the key. Malacca’s location on the Malay Peninsula placed its possessor in range of China as well as the numerous islands of the South China Sea, from whence came so many spices and aromatic woods. In 1509, when the Portuguese first sailed to Malacca, the city was a bustling trade center.²⁹ Governed by the Sultan Mahomet and a tributary to the Chinese Emperor, Malacca was home to the trading activities of Chinese, Indian, Arabian, Malay, and non-Malay indigenous traders.³⁰ One European remarked: “No trading post as large as Malacca is known, nor any where they deal in such fine and highly prized merchandise.
Goods from all over the East are found here; goods from all over the West are sold here. It is at the end of the monsoons, where you find what you want, and sometimes more than you were looking for.\textsuperscript{31}

In July of 1511, while poised in the harbor of Malacca to lay siege to the city, Portuguese Captain Afonso de Albuquerque impressed some Chinese junk captains being detained by the Malaccan Sultan with his generous diplomacy. Thanks to this occurrence and the distance from Malacca to the Chinese court, the emperor made no effort to interfere with the Portuguese seizure of a Chinese vassalage.\textsuperscript{32} Thus in 1511 Malacca became a Portuguese possession, and in 1512 the Portuguese began explorations of the Molucca and Banda Islands, otherwise known as the Spice Islands, the only source in the world for cloves, nutmegs, and mace.\textsuperscript{33}

As merchants representing the Portuguese king, with control over valuable commodities like pepper, nutmeg, cloves, mace, and Indian textiles, the Portuguese were prepared to attempt direct trade with the Chinese Empire. In their favor, the Portuguese had the amity of the Chinese and the knowledge that with the exception of three coastal provinces, Fukien, Chekiang, and Kwangtung, the law forbade Chinese citizens to leave their homeland. These advantageous conditions aided a venture led by Fernão Peres in 1516-1518 that successfully reached Canton.\textsuperscript{34} Unfortunately, the following year, 1519, brought the utter destruction of these good relations with China in an expedition led by Peres’ brother Simão d’Andrade.\textsuperscript{35} D’Andrade’s expedition resulted in not only the Portuguese, but all foreign traders being kicked out of China.\textsuperscript{36} It would be thirty-eight years later, in 1557, when the Portuguese again gained a foothold into China with the
founding of Macao. With Macao, the Portuguese had “legitimate” access to every significant market (including Japan) in Asia. By the close of the sixteenth century, Portuguese maritime trade within Asia dwarfed in both volume and value trade from India to Lisbon via the Cape of Good Hope. Moreover, the Portuguese retained their influential position for over forty years, until the Dutch wrested away the Moluccas in 1605.

The year 1605, when Nossa Senhora dos Mártires departed from Cochin on its fateful voyage home, saw Portuguese Asia on the cusp of Dutch piratical activity. When Philip II of Spain succeeded to the Portuguese throne in 1580, he discontinued Portuguese trade with Dutch merchants in reprisal for a revolt against Spanish rule in the Low Countries. Cut out of the European spice trade, the Dutch began their own venturing into the Far East. After initial piratical forays, the VOC (the Verenigde Oostindische Compagnie or Dutch East India Company) was formed in 1601. With more funding and stronger ships than the Portuguese, and nothing to lose, the Dutch privateers soon made their presence felt by taking not only laden Portuguese ships as prizes, but also the isolated, poorly defended Spice Islands. Nossa Senhora dos Mártires, embarking in 1605, would have been one of the last ships to sail from India to Portugal with any feeling of security from Dutch pirates in Asian waters. The next decades would see the growth of Dutch influence with the recession of Portuguese influence in the East.
ESTABLISHING TRADE ROUTES

Although they are the best-known Portuguese political centers in the East, Goa, Malacca and Macao were primarily distribution centers for Asian goods gathered throughout the hemisphere. Ships sailing for the West usually departed from Goa or Cochin on the southwestern coast of the Indian subcontinent, and took on their final lading at one of these ports before departure. This merchandise, far from being supplied by foreign merchants, was in fact the product of many separate trade routes operated by Portuguese merchants. After the Portuguese found their way to Calicut on Vasco da Gama’s 1498 expedition, they spent the next half-century engaged primarily in trading and missionary activities throughout the region. These ventures resulted in the Portuguese becoming the first Europeans to conduct trade expeditions to the Bandas, the Moluccas, and Canton (all within fifteen years). Portuguese merchants began introducing themselves into all manner of trade enterprises, acting as middlemen not only for mainland Portugal’s trade interests, but for Eastern trading powers like China and Korea, as well. The trade between India, China, Malacca, and Japan rapidly became lucrative thanks to the large cargo capacity of the Portuguese naos. In fact, in 1570, the Portuguese crown was operating twenty-seven different routes originating from Goa, Macao, and Malacca.²

Some of these routes, particularly those operating in the South China Sea, were of longer duration even than the Carreira da India. The roundtrip route from Goa (or Cochin), through Malacca, to the Molucca Islands could take anywhere from twenty-three to thirty months depending on whether the ship took the Borneo or the Bandas
route. The Borneo route was significantly shorter, but the Bandas yielded the highly desired spices nutmeg and mace, which were frequently worth the extra half-year at sea. It was, in fact, the duration of the voyages in combination with Asian political intrigue that made many of the routes profitable for the Portuguese. For example, the Emperor of China forbade the Chinese from participating in external trade with Japan, and Japanese vessels from entering Chinese waters and ports. The Portuguese, though, were granted trading privileges with both as long as they followed local customs and did not pollute either country with their Christian ideology.

The Portuguese participated intensely in the trade of Indian textiles for spices from the Spice Islands in the South China Sea. Along with the routes controlled by a crown monopoly (Macao to Japan, or Goa to Lisbon, for example), a great deal of trade was funded and undertaken by Portuguese casados—married Portuguese settlers who were influential and wealthy personages in the East. George Bryan Souza goes so far as to say that the majority of Portuguese traders were smaller investors; they were, however, influenced in Goa and Macao by the concentrated political and economic power of casados.

All of the trade undertaken in the East was dependent on the monsoon cycle. Trading fairs were arranged by the annual cycle, and ships sailed according to the winds. At the turn of the seventeenth century, Portugal’s three trading hubs of Goa, Malacca, and Macao sent their fleets out according to the dictates of nature. Ships sailed from Goa to Ormuz, Mozambique, Ceylon, the Moluccas, Coromandel, the Bay of Bengal, and Malacca. From Malacca fleets sailed for Siam, Macao, Japan, Burma, the
Moluccas, and the Bandas. Finally Macao sent ships to Japan, Indonesia, Siam, and Timor (see figure 4). A prime example of trade following the monsoon cycles was the Goa-Macao-Japan run. Ships departed from Goa in April or May; after a stop in Malacca, they arrived in Macao between June and August. Their departure from Macao depended upon both the southwest monsoon in the China Sea and the bi-annual Cantonese silk fairs. If a ship’s arrival in Macao was timed well, cargo could be traded immediately and the ship could sail for Japan right away. If not, the ship would have to wait for the next year’s June-August monsoon to sail for Nagasaki. On the return trip, a ship could depart from Nagasaki anytime before March. If delays were incurred, the
round trip from Goa to Japan and back could take as long as three years. The main rule of thumb was that ships did not sail without following the monsoons. As the constancy of the winds was a known variable, it was simply foolish to risk sailing in contrary winds or wasting time at sea with no wind.

In order to obtain the desired Eastern products, the Portuguese traded commodities from the entirety of their global empire. Their most important foreign exports were: gold from Guinea, south-west Africa, and Sumatra; sugar from Madeira, São Tomé, and Brazil; horses from Persia and Arabia; pepper from Malabar and Indonesia; mace and nutmeg from Banda; cloves from Ternate, Tidore, and Ambon; cinnamon from Ceylon; gold, silks, and porcelain from China; silver from Japan; and cotton textiles from Cambay and Coromandel. Generally speaking, these items were so highly valued that they were used as currency globally. A cargo of spices, pepper, and silver bullion taken to Macao might be exchanged for any of the following merchandise: gold, refined silver, raw white silk, silk piece-goods and brocades, satin, gold lacquers, pearls, rubies, musk, quicksilver, zinc, porcelain, Pau de Chine, rhubarb, vermilion, alum, and other such items.

For those voyages, some of which lasted for two to three years in seas unfamiliar to the Portuguese, Portuguese captains and officers usually employed foreign pilots and crews. For voyages in the Indian Ocean, Arab pilots were employed; in the South China Sea, Arab, Gujarati, or Malayan pilots were used; and for Japan runs, from Malacca or Macao, Chinese pilots were used. Using foreign experts allowed Portuguese ships to
explore the Maldives, Ceylon, the Bay of Bengal, Sumatra, Java, Borneo, the Bandas, and the Moluccas before 1515.\textsuperscript{51} 

The bulk of the merchandise acquired by Portuguese traders throughout the Eastern hemisphere was never intended for shipment to Europe. Every year a small fleet of three to five naos would sail from Goa or Cochin to Lisbon laden with but a sampling of the Eastern offerings. Four ships arriving in Lisbon from India in 1580 carried the following cargo: pepper (in by far the largest quantity), cloves, mace, nutmegs, cinnamon, ginger, ginger for preserving, tufted cloves, indigo, wax, resin, raw silk, China silk, incense, amber, and small pearls.\textsuperscript{52} It is entirely likely that the Portuguese East-Indiaman now known as the Pepper Wreck would have had a similar cargo. From artifacts found during the CNANS excavation, archaeologists are fairly certain that the following cargo was aboard: pepper, porcelain, coconuts, unworked coral, and Asian stoneware. It seems likely that, at a minimum, other spices like cloves, nutmeg, mace, and cinnamon would have been aboard, along with silks and silk – piece goods. There is, of course, no way to be certain.

The Eastern artifacts from \textit{Nossa Senhora dos Mártires} are elements from the broader trade picture, but there are disappointingly few of them. Pepper was found in substantial quantities at the wreck site, both dispersed on top of the hull remains as well as among some of the other artifacts (like the pewter plates). While no testing has been performed by CNANS to determine the exact origin of these pepper kernels, it is likely that they are from the Malabar coast of India. Several porcelain items were found, both intact and broken, and based upon their design and markings they are Chinese, likely
from the Ching-tê-Chên region of porcelain manufacture, near Nanking. Other Asian ceramics include Martaban jars, made in Martaban at the top of the Malay Peninsula, and Trandescent Jars, from southeast China. The remains of coconuts found on the site were probably imported from islands in the China Sea, but I have not found any specific references to particular islands. Trade coral is equally ambiguous, I have read accounts of coral being both exported and imported from China and the islands of the South China Sea. It seems likely at this point that it was harvested from reefs around the islands in the South China Sea and exported to both Asia and Portugal in an unworked state for use in jewelry manufacture. This thesis will attempt to integrate the current knowledge about these artifacts with the archaeological data from the shipwreck site.
NOTES


4 Ibid.


8 Boxer, Portuguese Seaborne Empire, 206.

9 Ibid.

10 C.R. Boxer, ed. Further Selections from the Tragic History of the Sea 1559-1655 (London: Cambridge UP, 1968), Figure 2.

11 Ibid., 68.


15 Boxer, Portuguese Seaborne Empire, 208.

16 Boxer, Further Selections from the Tragic History of the Sea, 59.

17 Ibid., 59-60.

18 Boxer, The Tragic History of the Sea, 55.

19 Ibid., 115.

20 Ibid., 117.

21 Boxer, Further Selections from the Tragic History of the Sea, 119.

22 Boxer, Portuguese Seaborne Empire, 219.


24 Ibid., 12.


27 Boxer, The Portuguese Seaborne Empire, 44.


32 Chang, Sino-Portuguese Trade, 33-34.


34 Chang, Sino-Portuguese Trade, 38-44.


36 Ibid., 51-53.


38 Ibid., 213.


41 Ibid., 32.
42 Ibid., 38-40.
44 Ibid., 30.

Ormuz is the gateway city at the top of the Persian Gulf through which eastern goods traditionally passed to reach the Levantine market.

46 Russell-Wood, A World on the Move, 32.
47 Ibid., 38.
48 Boxer, The Portuguese Seaborne Empire, 51.
49 C.R. Boxer, ed. Seventeenth Century Macau in Contemporary Documents and Illustrations (Hong Kong: Wing Ting Tong Co., Ltd., 1984), 36, 76, 80.
51 Ibid., 40.
52 Mathew, Indo-Portuguese Trade and the Fuggers of Germany, 171.

CHAPTER II

NAVIGATIONAL INSTRUMENTS

The excavation of the Pepper Wreck yielded an extraordinary number of navigational instruments, extraordinary when compared to most shipwrecks and the conditions of the wreck site. In total, fewer than one hundred astrolabes have been recovered from shipwreck sites around the world. Three astrolabes and two pairs of charting compasses (or dividers) have been recovered from the Pepper Wreck site. Another partial pair of dividers was discovered at São Julião da Barra and will be discussed with the Pepper Wreck compasses. These instruments played an important role in Portuguese East-India shipping, rather like the steering wheel in a car - motion can be generated without steering the wheel, but the car will probably not arrive at its predicted destination. In order to reach the other side of the world from Portugal, navigators needed to know the position of their ships and how to maneuver through the ocean’s winds and currents. The astrolabe gave them this power.

THE OCEAN ROAD - OBSTACLE OR PATHWAY?

One important piece of the technology that allowed the existence of Europe’s East India trade came in the form of the astrolabe. This device, roughly the diameter of a human head, changed the way men looked at the world, initiating a series of events that opened up the oceans, joining East and West. Although man’s knowledge of the
compass and of nautical charts stretches back two thousand years, astronomical navigation was not developed until the fifteenth century.\(^1\) The Portuguese pioneered this process in the mid-fifteenth century with the school of Prince Henry the Navigator at Sagres (on the southern coast of Portugal), and by the end of the century the best navigators could fairly accurately calculate their position at sea by a combination of observed latitude and dead reckoning.\(^2\) The system they followed incorporated utilizing known weather patterns, currents, and winds, then using mechanical instruments to take advantage of those factors.

By 1497 Vasco da Gama had the navigational capabilities to make a voyage around Africa to the Indian Ocean, a voyage that changed the world. In one sweeping stroke, the European world expanded its trading sphere to encompass - indeed to dominate - the eastern half of the globe. The technology that allowed men to accomplish such ocean voyages, sailing out of the sight of land for days, weeks, and months at a time was already in use. Columbus had crossed the Atlantic to reach the New World (unbeknownst to himself, of course) in 1492, and the Portuguese had been developing celestial instruments for recording nautical navigational for half a century. What da Gama’s voyage marked was the technological culmination of decades of navigational experimentation filled with trials and triumph. Finally, the goal of finding a route to India - alternative to the Venetian and Arab-dominated Mediterranean route - had been achieved. One instrument that made this vast empire possible was the astrolabe, a celestial navigational instrument that gave sailors the ability to determine their latitude with a high level of accuracy.
The thirteenth century witnessed the development of a blue water sailing technique called the *volta do mar*, a Portuguese phrase meaning to either return by sea or to go out and around by sea, and the technique continued in use. Sailing into the wind was not possible for the fifteenth century caravel, and if faced with adverse winds a ship would be forced to lie to until the wind shifted. Sailing in coastal waters, for example, down the Atlantic coast of the Iberian Peninsula and on to Africa, was an easy route because of the following winds. The trip home was another story. In order to return to Portugal from the African coast, sailors would sail northwest until they caught the ‘Westerly’ trade winds as following winds for the trip home. The *volta da mar* was therefore the relatively straightforward technique of sailing around adverse winds to reach favorable ones that could be used in both the Atlantic and Pacific Oceans, provided the pilot knew where favorable winds were located and had the ability to find them. Until the end of the fifteenth century, European navigators primarily used two celestial landmarks to determine their location - Polaris, the North Star, and the sun. In the northern hemisphere, these landmarks meant that latitude could easily be visually estimated during either the day or night, if desired. The southern hemisphere, lacking a view of the North Star, presented the challenge of only having navigational references during the daytime - unless another method was conceived.

Ocean currents and winds run in similar patterns in the Atlantic and Pacific, but are reversed in the northern to southern hemispheres. For example, in 1487, Bartholomeu Dias easily sailed down the coast of West Africa beyond the Congo River before he hit Nambia, where the winds shift to blow north rather than south. The
adverse winds at that spot are the South Atlantic counterpart to the winds between the Iberian Peninsula and Madeira, the inspiration for the *volta da mar*. Using this principle, Dias sailed southwest into the Atlantic to sail around the wind. He then caught the prevailing Westerlies at the 40th parallel and sailed around the Cape of Good Hope.⁵ Though Dias was the first man to sail around the Cape of Good Hope, he made no further progress, leaving later sailors to forge their way into the Indian Ocean. Once on the eastern coast of Africa sailors (like da Gama) were able to take advantage of the southwest monsoon to sail to India, and later the northeast monsoon winds carried them back to the African coast. “The Indian Ocean’s winds, whose directions and velocities were dictated by the fevers and chills of Asia’s climate, were a matter of seasonal shifts. In that body of water a calendar was as important as a compass.”⁶ Once Europeans understood this weather pattern, it became the deadline around which the timing of trade voyages was planned. Astrolabes provided the ability to scientifically and accurately determine the latitude of fair winds in order to utilize them efficiently.

**LONGITUDE AND THE CHARTING COMPASS**

During the mid-eighteenth century, an Englishman named John Harrison invented the chronometer, an instrument that changed the nature of seagoing navigation by providing a timepiece accurate to within 38.4 seconds over a period of seven weeks.⁷ Prior to this time, accurate charts and navigation were not possible because it was difficult to reliably determine longitude. In the centuries of sail prior to the chronometer, the dead reckoning method of the Portuguese, which used charting and charting
compasses to determine longitude at sea, was the best method available. This method grew increasingly inaccurate as a voyage proceeded because each new location was based on estimations relative to the previous location. The cumulative error of such a method, based on an inaccurate premise (i.e. dead reckoning), could be dramatic. sailors would find themselves at sea for months longer than expected, searching vainly for islands misrepresented on maps, helpless as they succumbed to the hardships and privations of life at sea.

According to Jean Randier, "At sea, compass carelessness of helmsmen is such that a divergence in one direction is never offset in the other. Dead reckoning is no more than a jumble of pieces, all of them wrong to varying degrees. Hence the results obtained in this way can bear no resemblance to reality unless by some miracle the errors cancel one another out, which is a severe drawback of this method." dead reckoning was one way to determine the position (calculated or estimated) of a vessel at sea. Generally, this term applied to the ship's position as calculated from courses and distances sailed. The estimated position of a vessel took into account dead reckoning as well as other factors such as currents and leeway from strong winds in order to have a more accurate idea of where the ship was. In order to determine the longitudinal position of the ship, Portuguese sailors used speed, distance, and direction to chart their progress from one location to another. By the early seventeenth century, the ship's compass could yield a reasonably accurate reading, making the direction of travel a straightforward determination. Then the direction and speed of the ship were combined
with any elements suspected of causing leeway - currents and winds - to determine the actual direction traveled by the vessel on a given day.

By the sixteenth century, if not earlier, the speed at which a ship sailed was determined with a ‘ship’s log’, or a similar system. This method involved measuring the time it took the ship to traverse a set distance. On the open sea, the only distance known is the length of the ship. Therefore, a log could be dropped at the bow and the time required for the ship to pass it recorded. The log reel system from the sixteenth century involved using an easy-turning reel to play out pre-measured, knotted line. The log was thrown overboard and at the passage of a certain mark on the line, a twenty-eight second hourglass was started. When the hourglass was emptied, the line was stopped and the length run out noted. The twenty-eight second interval was multiplied to determine the distance traversed at the ship’s speed in one hour. Time and distance then produced the speed of the ship. The speed at which the ship sailed in a twenty-four hour period would then be used to determine the distance sailed in that period. The system was not very accurate, two major flaws being the ease with which mistakes could be made while measuring the speed, and the accounting for unquantifiable elements like how far the wind pushed the ship east or west. However, this was the best method for determining longitude until the invention of the chronometer in the eighteenth century.

The bright spot in this pit of imprecision lay in the charting compasses, or dividers, used to relay estimated distances back and forth on charts and tables. An instrument foolproof in its simplicity, the charting compass consists of two legs and a hinge. Dividers from the post-medieval period can today be categorized by the materials
of which they were made - all brass dividers or dividers with brass upper legs and steel points. The latter tended to be more finely made. These categories can be further broken down into three shapes. The first shape, and most common type, has straight legs with a simple, closed head. Aside from the São Julião da Barra (SJB) dividers, which will be discussed below, a pair of dividers from Mary Rose (1545), the flagship of Henry VIII of England, fit this category (figure 5). The second shape is a common sixteenth century type having a round opening at the head (these can be opened by squeezing with one hand). They are sometimes called one-handed dividers - a term misleading because all dividers can be used with one hand, not just the open-headed type. This second type differs from the first in that the head is open, like the third type; unlike the third type, the second type has legs that are straight and not bowed. The third type tends to be found in northern Europe during the seventeenth century, and characteristically has straight legs with a bowed-out section about a third of the way down from the head to the points. The remains of a pair of dividers from the VOC ship Amsterdam (1749) are an example of this type (figure 6). The open head type was made from two identical pieces cast in a mold, often all in brass, with a joint that usually consisted of two blades on each leg that mesh, with a rivet through them. Other shaped dividers may contain a similar type of joint, but they tended to have an odd number on one leg (ideally three) and an even number on the opposite leg (two). More expensive and well-made dividers had a screw and nut holding the joint intact, rather than a rivet, or forelock bolt as from some medieval examples. If a screw and nut were used, the
joint would be tightened with a spanner, a small bar with two pins on it that fit into two holes on the screw head or nut surfaces.\(^{15}\)

**CHARTING COMPASSES FROM THE PEPPER WRECK**

The two sets of dividers, lots 172.01 and 172.02, found on the Pepper Wreck are of the same type (see figures 7 and 8). The two pairs are in fact almost identical, while the \textit{SJB} set, 04673.01.009 (figure 9), that is missing a leg has a slightly less elaborate head. All three pairs fit into the first divider category - those made entirely of a copper alloy, probably brass. They also fit into the first shape category, having two straight legs. These dividers are as simple as they come, consisting of two identical pieces riveted together at the top. Each leg has an arc at the head that makes a 90-degree turn after completing half a circle to form the leg. The two complete pairs have an additional
decorative ear on either side of the head rivet, along with decorative cross-hatching. The third pair lacks the ears, but does appear to have engravings. On all three pairs there are two horizontal lines present on the leg at the base of the head, and two more horizontal lines about one third of the distance down the leg. None of the compasses appear to have perfectly straight legs, and the tip of the leg on 04673.01.009 is bent. This damage could have occurred before the wreck or in the 394 years the dividers spent at the bottom of the Tagus River.

Although the photographs of the charting compasses illustrate that they are of almost the same size, their pictures and measurements show that none of the three compasses are identical. During the late sixteenth century, charting compasses were
often cast as sets, and they could be used for indefinite periods of time as long as they were not lost or abused. Therefore, while these compasses are more characteristic of the late sixteenth century, it is not surprising that they were still in use during the early seventeenth century.\textsuperscript{16} The compass numbered 172.01 has a length of 9.2 cm, and a head diameter of 2.5 cm. Number 172.02 has a length of 9.9 cm and a head diameter of 2.6 cm. Number 04673.01.009, the half compass, has an 11.8 cm length and a head diameter of 2.6 cm. Numbers 172.01 and 172.02 have ears on either side of their rivet joints, and both have decorative cross hatching on the tops of their legs, however 172.01 has a slightly flatter head than 172.02, with a wider circle. The ears are smaller and sharper on 172.01. They have cross-hatching in the same two places on the legs (just under the head and one third of the length down the legs), but 172.02 has more lines etched into it. 172.02 has four hatch marks under the head, while 172.01 has only two of these marks in that location; they both have three hatch marks lower on the legs. The third compass, 04673.01.009, has only two hatch marks in the two locations where it is marked.

Charting compasses found on other shipwreck sites from the same period as the Pepper Wreck bear similar characteristics. Two charting compasses from \textit{Atocha} (a Spanish shipwreck from 1622), in particular, are strikingly similar and may help with the description of the decorative features on the SJB compasses. The two pairs pictured from \textit{Atocha} are shown without a scale (figure 10).\textsuperscript{17} These two pairs, though one is longer than the other, are of the same type and decoration as the Pepper Wreck dividers. Both sets have decorative ears on either side of the joint rivet. They also have
decorative cross-hatching below the head and down the leg, and the photos reveal that the cross-hatching is in the same manner on dividers from the two wrecks, with the cross-hatching as a prominent, raised portion of the leg. In contrast, the charting compass found with the 1554 Spanish Plate Fleet is of the same type, but has an altogether different decorative pattern on the legs (figure 11). As well, the head, though closed, is simply round and lacks the ears of the Pepper Wreck and Atocha dividers. The Spanish Atocha postdates Martires by sixteen years, but due to the longevity of charting compasses and the almost identical design of these particular dividers, this time span is not an important factor for the comparison.
LATITUDE AND THE ASTROLABE

The ability of humans to measure latitude was not a skill discovered by Europeans in the fifteenth century, nor was the astrolabe a new invention for taking this measurement. The astrolabe has a history as a timekeeping instrument that dates from the time of Ptolemy in the second century A.D. Stereographic projection, the mathematical theory upon which the astrolabe is based, dates back at least one more generation.\(^9\) The technology of this portable instrument was certainly used by Arab traders in the ninth century A.D., and found its way into Europe from the Islamic world during the eleventh century A.D.\(^{20}\) However, it was a Portuguese adaptation that made the terrestrial astrolabe suitable for use as a nautical instrument.

The astrolabe was a device that measured the angle of a celestial body in the sky (see figure 12). It could be used with the sun or other stars for solving such problems as determining the hour of day, forecasting the hour of sunrise and sunset, locating the position of a certain star on a given date, or simply measuring the height of anything. Consisting of a circular metal plate with a central alidade arm and degree markings, the arm of a nautical astrolabe was pointed at the body in question then the degree was read off the rim of the disc. Used in conjunction with declination charts and tables, the latitude was then determined.

When the Portuguese began their series of exploratory voyages down the coast of West Africa, they determined their latitude by comparing the altitude of the Pole star at the port of departure with its height at places along the way. A correction for the circumpolar motion of the star was also applied.\(^{21}\) This method was later refined to
convert the distance between these heights into distances sailed and actual differences in latitudes. By 1471, after the equator had been reached and the Pole star was no longer visible, a new solution was sought. In 1484 a commission set up by King João II of Portugal produced a manual of solar declination tables. These tables allowed pilots to measure the height of the sun at meridian passage at noon daily to calculate their latitude.

The open mariner’s astrolabe described in Alexander Zorzi’s Manuscript of 1517 was probably adapted from the planispheric astrolabe used on land. The planispheric astrolabe was comprised of a flat set of discs with sighting alidades that allowed the height of stars to be translated onto positions on the discs. These measurements allowed for the mechanical calculation of the positions of stars for different times and latitudes.
The evolution of this type of astrolabe into its marine counterpart was the result of practicality. At sea, with winds blowing constantly (if one was lucky), a vertically-hanging disc would invariably be blown about. In order to decrease wind resistance and increase stability for the angle measurement, the center of the disc was all but removed, leaving only a cross to hold the alidade. The bottom of the astrolabe was ballasted by increasing its thickness, since additional weight at the bottom created more stability for the instrument.

The size of astrolabes decreased, as well. Astrolabes intended for use on land were large - a wooden astrolabe used by da Gama measured about two feet (0.61 m) in diameter\(^{24}\) - and unwieldy. The optimal size seems to have been about eight inches (20.32 cm) in diameter. Metal astrolabes were also more desirable, probably because a wooden precision instrument used in a perpetually wet environment could not remain precise for long. According to John Blagrave in his 1585 treatise on terrestrial astrolabes, the two plates, the fixed one called the *mater* and the moving one called the *rete*, were best made of “pure tynne, and tynno glasse, of ech like quantitie melted together, and it will be stiffe, and looke faire like silver almost,” otherwise he recommended brass.\(^{25}\) He advised on making the plates “somewhat thicke for it is a great fault if your Jewel be too light in taking altitudes, because every small winde will stirre him and other causes also.”\(^{26}\) Blagrave also said that silver is best and easier to work than brass and the rete should conversely be made of the same material as the mater, but should be as thin as possible. Thus far, there have not been any silver sea astrolabes recovered from shipwreck sites; those found have all been made of cupreous
alloys (generally bronze), and their styles and conditions of preservation range from one end of the spectrum to the other. From the Pepper Wreck site alone, the three bronze astrolabes range in condition from a legible, well-preserved instrument to two badly eroded ones.

ASTROLABES FROM THE PEPPER WRECK

The site of the Pepper Wreck at the mouth of the Tagus River experiences constant site formation activity. The heavy surge zone is churned up frequently by storms, and although the three astrolabes were all recovered from the Pepper Wreck site and are associated with the wreck, as with the vast majority of the artifacts recovered from the site they are not definitely from the Pepper Wreck. It is likely that they are from that wreck, but only SJB III was found beneath a protective cannon that would have been difficult to move in a storm. The other two astrolabes could be from another wreck as easily as from the Pepper Wreck but their typologies suggest that they are from the same period as the Pepper Wreck.

The astrolabe known as São Julião da Barra II (SJB II) was badly damaged by abrasion during its time in the Tagus River (figure 13). It was found near the pristine astrolabe SJB III on the wreck, but lacked the same protection from the ravages of abrasion and corrosion. The current size of the astrolabe is 17.3-17.5 cm in diameter, with a thickness of 2.2 cm at the upper end and 2.0 cm at the lower end; it weighs 1769 grams. SJB II lost its suspension ring and alidade, but conservation of the instrument revealed features that allowed the astrolabe’s nationality and date to be identified. The
Portuguese astrolabe design used a calibrated scale for obtaining zenith distances, and when one appeared on SJB II, its origin became clear (figure 14). This is only the fourth known astrolabe to show five and ten degree perforations in the same plane as the scale. At the point where the alidade would have connected with the ring, the upper and longitudinal spokes grow larger, forming a frame with a design identical to nineteen sea astrolabes (of which sixteen are Portuguese) manufactured between 1540 and 1650. The lower spoke is cut out of a semi-circle. There is also a groove dividing the lower right arc on a diagonal, and the hypothesis concerning this mark is that it was probably generated during casting when the molten bronze failed to fill up the mold. If this astrolabe is from the same wreck as SJB III, its date of manufacture would have been anywhere from the late sixteenth to the early seventeenth centuries, as the astrolabe’s visible features indicate.

The astrolabe known as São Julião da Barra I (SJB I), is here described following SJB II because it was found at a location approximately 20m away from the bulk of the Pepper Wreck (figure 15). This location by no means excludes the possibility that the astrolabe is from this wreck, but it does introduce a greater possibility that the astrolabe may be from another of the wrecks in the area. SJB I, like SJB II, is in a poor state of preservation. Over the centuries it has lost its suspension ring, though the fastening rivet remains intact, and the alidade has deteriorated considerably, leaving only a small section - the sighting vanes are gone. While there are no visible markings remaining, three rivets are set into the ring at seemingly random locations. One is at the top, slightly to the left of the upper spoke and two are on the right side. They may have
Figure 13: Astrolabe $SJB\ II$. Photo by S. Brigadier, A. Randolph, and G. Garcia.

Figure 14: $SJB\ II$ Markings. Photo by S. Brigadier, A. Randolph, and G. Garcia.

Figure 15: Astrolabe $SJB\ I$. Photo by S. Brigadier, A. Randolph, and G. Garcia.
been placed to conceal holes made during the instrument’s manufacture. The shape of
SJBI’s lower curve is identical to that of twenty-two other nautical astrolabes, of which
seventeen are Portuguese. When judged by diameter (16.7 cm), the astrolabe
corresponds with a manufacture date of between 1616 and 1648, but when judged by
weight (1690 g) it corresponds to those dated to the latter half of the sixteenth century.
Neither of these measurements is entirely accurate and reliable with regard to the
original instrument, however, due to its deteriorated condition. Stylistically, the shape of
the quadrant is similar to SJBII and SJBIII, and others from the last quarter of the
sixteenth century and the first quarter of the seventeenth.

Of the three astrolabes found on the Pepper Wreck site, the one identified as São
Julião da Barra III (SJBIII) is in the best state of preservation (figure 16). SJBIII was
protected from current and sand abrasion by a large rock, and from molecular
deterioration by an iron cannon resting on top of it. As the iron decomposed, releasing
its electrons into the surrounding water, it fed a constant flow of electrons to the bronze
astrolabe, forming a protective galvanic cell. The astrolabe, manufactured in 1605, bears
a Portuguese mark of four six-pointed stars surrounding the date engraved on the lower
portion of the ring. It is also marked with the letter ‘G’, identified as the mark of
Francisco de Goes (figure 17). The shape of the lower quadrants of SJBIII is semi-
circular up to the ring where the alidade connects to the mater. There are decorative ears
on the top of the astrolabe on either side of the suspension ring (figure 18). The
suspension ring adds an extra element of stability to the astrolabe with its hinge - a
double tilting system with axes set at right angles to one another. The scale engraved
Figure 16: Astrolabe SJB III. Photo by S. Brigadier, A. Randolph, and G. Garcia.

Figure 17: SJB III, Half Moon Markings. Photo by S. Brigadier, A. Randolph, and G. Garcia.

Figure 18: SJB III, Azimuth Markings. Photo by S. Brigadier, A. Randolph, and G. Garcia.
into the two upper quadrants marks ‘1’ at the ‘0’ point, a feature seen on other astrolabes from this period.

In the early sixteenth century, the Spanish Crown required that all astronomical navigational instruments for Spanish vessels be examined and approved by the Pilot Major of the Casa de Contratación before being taken to sea. Before taking office, an applicant for the position had to prove his ability by making an accurate astrolabe. This insured his expertise on the subject. Faulty instruments were melted down and satisfactory ones were stamped with the Casa’s seal of approval, which has been identified in two forms – the tower stamp and the pillars of Hercules. SJB III bears neither of these marks, however, the maker’s mark ‘G’ found on the astrolabe may indicate manufacture by the Goes family of Portuguese instrument makers who were active from 1587 until 1676.

In Portugal, astrolabe manufacturers were required to pass an examination of senior members in the field of navigational instruments, and Francisco de Goes (of Lisbon) was examined and approved as a maker of sundials, sand glasses, astrolabes, and compass needles in 1587. Then in 1630 Agostinho de Goes Raposo was issued a certificate of approval for a similar examination. Later, in 1658, Agostinho’s son João was given military exemption because he was a maker of navigational instruments.

The Florence astrolabe (figure 19), a Portuguese instrument from 1608, is attributed to the instrument maker Francisco de Goes (also Gois). The instrument is remarkably similar to SJB III, bearing the same decorative markings and alidade shape, but Florence has the mark ‘GOIS’ engraved onto its lower ring. ‘GOIS’ is the mark
generally accepted to be that of Francisco de Goes, and is also found on the astrolabes 
Santa Ecolastica (1624) and Concepcion C (1632). Both Concepcion C (figure 20)\textsuperscript{38} 
and Santa Ecolastica (figure 21)\textsuperscript{39} have a different shape than SJB III and Florence.

One of the astrolabes found on the wreck of Atocha, Atocha III (figure 22)\textsuperscript{40}, 
appears in an exciting coincidence to be from the same manufacturer and date as SJB III. 
Atocha III bears identical markings of 'G' and '1605', even the '1' at the '0' position is 
present. The mark of 'G', as opposed to 'GOIS', found on more than one instrument 
may indicate that the astrolabes were from the same workshop but different craftsmen. 
If 'GOIS' is the mark of Francisco de Goes, then he may or may not have made the 
astrolabes marked 'G'. It was not uncommon for metal workers to use several marks 
throughout their careers, and in this instance there is no other information available 
about Goes' marks. Upon photographic examination of the astrolabes SJB III and 
Atocha III, they appear to be identical. The similarities are so pronounced that they have 
raised questions about the actual molding process for casting astrolabes. The reported 
measurements are slightly different (SJB III at 17.4 cm is 1.8 cm larger in diameter than 
the 15.6 cm Atocha III).

Molds for casting cupreous alloys were generally made out of clay, and the clay 
mold would have been formed around a permanent pattern. The molds from which 
astrolabes were cast were broken after each use.\textsuperscript{41} To create a model for molds is a time 
consuming and precise undertaking, and it seems improbable that skilled craftsmen 
would expend resources to repeat the same task when it was not necessary. I think it is
Figure 19: *Florence Astrolabe*, 1608. Photo from Stimson, *The Mariner's Astrolabe*.

Figure 20: *Concepcion C Astrolabe*, 1632. Photo from Stimson, *The Mariner's Astrolabe*.

Figure 21: *Santa Ecolastica Astrolabe*, 1624. Photo from Stimson, *The Mariner's Astrolabe*.

Figure 22: *Atocha III Astrolabe*, 1605. Photo from Stimson, *The Mariner's Astrolabe*.
possible that the original model for these astrolabes was the same, but it is unlikely that we will ever know with certainty. The difference in the size of these instruments could be accounted for by adjustments to the clay molds or a final balancing of the bronze instruments; however, they could just as easily be two astrolabes from different molds of the same manufacturer.

CONCLUSION

The importance of the late Medieval advances in navigation can not be stressed enough regarding their role in the development of the Portuguese Empire. Without the ability to efficiently utilize the resources of oceans and coastal regions — winds, currents, watering holes — an organized trading venture around the world would not have been possible. The annual fleets, and the fleets they inspired from other European countries, connected the world and opened up new horizons for the growth of mankind. A few astrolabes and dividers may not seem important at first glance, but in the broader context of their role in history they take on a fresh luster.
NOTES

2 Ibid.
4 Ibid., 6.
5 Ibid., 5.
6 Ibid., 6.
7 G.J. Whitrow. Time in History: Views of Time from Prehistory to the Present Day (Oxford: Oxford UP, 1988), 143-144: In 1714 the English Queen Anne gave the Royal Assent to ‘A Bill for Providing a Publick Reward for such Person or Persons who shall Discover the Longitude at Sea.’ Harrison eventually won the contest in 1765 and the 20,000 pound prize in 1775.
11 Green, Australia’s Oldest Wreck, 10-11.
12 McEwen and Lewis, Encyclopedia of Nautical Knowledge, 305.
15 Fred Hocker. Personal communication regarding information about divider types and examples, 1999.
16 Ibid.
17 Duncan R. Matthewson III. Treasure of the Atocha (Hong Kong: Pisces Books, 1986), 82.
19 Whitrow, Time in History, 78.
20 Ibid., 77.
23 Ibid., 17-18.
24 Ibid., 16.
26 Ibid.
28 Stimson, The Mariner’s Astrolabe.
29 Ibid., 102.
30 Ibid., 101.
32 Stimson, The Mariner’s Astrolabe, 32-33
33 Ibid., 29-32.
34 Ibid., 32-35.
35 Ibid., 74.
36 Ibid., 75.
37 Ibid., 74.
38 Ibid., 133.
39 Ibid., 147.
40 Ibid., 167.
CHAPTER III
PORCELAIN

PORCELAIN AND THE EAST INDIA TRADE

If any one thing was predictable about the six to nine month Carreira da India, it was that a wooden ship sailing upon rough seas would leak and items stored in the hold would get wet. The hardships of the journey and the perishable nature of most cargo items (spices, textiles, exotic woods, lacquers, furniture, etc.) made porcelain a popular item for transport. This highly vitrified ceramic was unlike anything produced in European kilns; prized for its hardness, whiteness, and translucency, these characteristics also made it a perfect ballast item. Stored deep in the hold, if porcelain got wet its impermeability prevented it from becoming damaged; it was easily packed and stored, and heavy enough to act as ballast. Unlike the delicate spices and textiles, porcelain had practical value aboard an East Indiaman. It was with porcelain that Portugal made a huge tactical error in its trade policy.

Having established their first trading post in the Far East in Goa, on the southwestern coast of India, in 1510, the Portuguese began to infiltrate the Eastern trading networks and exert control over trade routes by taking strategic ports in the Persian Gulf and Red Sea. They then turned their gaze farther east towards China, and the Portuguese became the first Europeans permitted to trade directly with the Chinese, after they violently forced their way into the market at Guangzhou in 1517. They were allowed to settle at Macao in 1517 and establish direct merchant relations, but were
kicked out in 1522 for piratical behavior. However, this did not faze the Portuguese, who had already established another base at Malacca; they merely operated from this base and directly off the coast of China until they were readmitted by the Chinese in 1557. Although the Portuguese initially purchased porcelains for their own tastes, the Ming blue and white porcelains became hugely popular throughout Europe and were in constant demand. The Dutch, ever the savvy merchants, picked up on this marketing trend, and infiltrated the Portuguese monopoly in both Chinese ceramics and the broader East India trade. It was not until the Dutch (who organized the VOC in 1601) and the Spanish (with the Manila Galleon Trade in 1573) established a Chinese trading presence that a major stylistic impact was made upon the shapes and patterns of Chinese blue and white porcelains. The desire for this commodity throughout Europe ultimately played a major role in the seventeenth century decline of the Portuguese Empire and left an indelible mark on the history of global East-West relations.

A BRIEF HISTORY OF THE DEVELOPMENT OF CHINESE PORCELAIN

The Chinese have been referring to porcelains with the character tz’u since the Han Dynasty (206 B.C. - A.D. 220), but it was not until the T’ang Dynasty (A.D. 618-906) that the porcelains produced conformed to the modern European definition of porcelain. The Chinese traditionally considered the classification ‘porcelain’ to include any type of stoneware that had the hardness and musical resonance of precious stones. The European class of porcelain had a more rigid definition, requiring a pure white body that was highly vitrified and translucent when held up to light. True porcelain developed out
of a long period of experimentation with a particular set of ingredients in what is now southeast China (figure 23).

Figure 23: Map of China, With Major Ceramic Producing Provinces Labeled.

The evolution of stoneware into porcelain took place in China over the course of approximately seven hundred years. The first link in a long chain of developmental porcellanous wares was the proto-porcelain of the Han Dynasty. This hard grayish ceramic contained impure kaolin and typically had an olive-brown glaze.² Specimens of Han proto-porcelain have been analyzed and shown to have true feldspathic glazes, meaning that the glaze is an aluminosilicate of potassium, sodium, or calcium.³ Proto-porcelains were also being made at Wen-choufu in Chekiang province from A.D. 265-
During the Ch’en Dynasty (A.D. 557-589), the fourth major porcelain factory of the time period at Ch’ang-nan was later renamed Ching-te Chen, and it was this factory that had become the major porcelain-producing center of the region by the Ming Dynasty (A.D. 1368-1619).

References to porcelains continue throughout the period of the Six Dynasties, and true porcelain emerged by the late T’ang Dynasty (A.D. 618-906). At the excavated ninth century city of Samarra in Mesopotamia on the Tigris River, fragments of hard white and green translucent wares were found with fragments of the green glazed porcellanous celadon that prove the manufacture of porcelain by the time of the city’s abandonment in A.D. 883. Eighth century literary references indicate three principle centers of pottery manufacture in China at that time. The first is in the north, in the Chihli and Honan provinces, and is the area where white, buff, and cream colored wares were produced. The second, in the eastern Chekiang province, produced green wares. The third center was in the Kiangsi province in the south. The white and light bodied wares produced in Kiangsi were the precursors to modern white porcelain, and it is primarily the porcelains produced there that will be discussed in this chapter.

Kiangsi province was the home of Ching-tê Chen, a large unwalled town that grew around the ceramic industry. This town had the necessary elements to become a thriving industrial center - a riverine transport system and the finest raw materials drew talented potters to the region. Ching-tê Chen (or Kingtehchen) was located on the bank of the Ch’ang River that connected via Poyang Lake to the Yangtze River which flows into the Yellow Sea near modern day Shanghai. The surrounding region is rich in high
quality kaolin clay and petuntse, or porcelain stone, the two prime ingredients in porcelain.

Porcelain behaves differently from stonewares when fired at extremely high temperatures (≈1450°F) because of the particular composition of the petuntse used in its manufacture. This porcelain stone is formed during late-stage volcanic processes, when quartz-feldspar rock is altered by high-temperature fluids, and consists mainly of quartz, secondary mica, and clay. Secondary mica is structurally composed of tiny, plate-shaped crystals that have the ability to slide over one another, allowing the material to have a high degree of plasticity despite a low moisture and clay content. The earliest porcelains were created using a body of pure porcelain stone, called pai tun tze (petuntse) by the Chinese because it was delivered to factories in the form of white brickettes or tun. In Kingtehchen petuntse was used directly from the ground during the tenth century, but later, from the twelfth through the fourteenth centuries, kaolin was increasingly added to the body to increase whiteness and plasticity, and to introduce a broader firing range for the finished pieces.

The northern Song Quinbai wares have a pure petuntse body, and are generally considered the earliest true porcelain wares. In the tenth and eleventh centuries their bluish cast came from the reducing atmosphere in pine fueled kilns; conversely an ivory tone was produced by the oxidizing atmosphere of coal fueled kilns. While the Song Dynasty in its entirety exhibited surface characteristics of a refined aesthetic, savoring artistic endeavors and intellectual pursuits, inwardly the dynasty was in a weakened state. When the Tartars invaded northern China in 1127, Emperor Hui Tsung fled the
capital near Nanking and traveled south to the Chekiang province. His entire court followed him, including refugee potters who brought their art with them to the south. The Ting wares formerly produced at Ting Chou in Chihli were moved to a new kiln in the southern Kiangsi province where they had a major influence upon the porcelain aesthetic. Ting wares had a close-grained grayish white body that was translucent in its thinner parts, and the Southern wares bore a warm ivory-white glaze. The fine body was often used to create pure white pieces decorated with incised ornamentation after the classic Song tradition of subtle decoration with linear elegance. The style and make-up of these Ting wares were likely the form upon which the Ming Dynasty porcelains were modeled.

During the Yuan Dynasty (A.D. 1279-1368), the Mongol rulers encouraged trade and established a safe system of highways throughout their Empire. These conditions led to a boom in the ceramics trade within Asia and the western Islamic countries. The style of underglazed blue and white decoration over pure white porcelain is thought to date from the mid-fifteenth century. While this color scheme appears to have been wildly popular abroad, it was not considered desirable within China, where red or green underglazes were preferred. The style of decoration upon the blue and white pieces was tailored to appeal to the country of export, and Chinese potters were able to take orders and deliver shipments of different styles. For example, though the Chinese favored delicately ornamented pieces in underglaze red, the Persian and Islamic markets preferred densely decorated blue and white pieces with arabesque motifs and crowded geometric patterns. Quingbai and blue and white wares were both mass-produced for
export at Kingtehchen during this period, establishing the town as a large manufacturing center.

PORCELAIN MANUFACTURE AT KINGTEHCHEN

Macintosh gives detailed descriptions of the city of Kingtehchen and the porcelain manufacturing process that date from the eighteenth century, and it is generally accepted that porcelains were produced in this manner for centuries. At the beginning of the eighteenth century, the city had a total population of one million, including 18,000 families of potters.16 These potters maintained 3,000 kilns that were kept operating throughout the year, and along with the kiln operations there were considerable mining operations in the surrounding area. Once the petuntse and kaolin were mined, they were ground, formed into bricks, and taken to the kilns. At the kilns they were mixed with water and mineral salts that acted as a flux during the firing. The finest porcelain paste was mixed in equal proportions of kaolin and petuntse; coarser wares could contain as much as 75% petuntse and 25% kaolin. This mixture was then stirred with a rod and trodden underfoot by men and boys. Heated and pulverized quartz was added, the paste then matured for several years before it was ready for use. Once the clay was mature, the potter beat out any air bubbles and then threw the ceramic body on a wheel into the desired shape.17

The next step in the production process was to paint the blue underglaze upon the ceramic body. Cobalt was ground, and sometimes mixed with manganese, to create the desired blue. During the Yuan and early Ming Dynasties, a fine blue-violet cobalt
known as *Mohammedan Blue* was imported from the Middle East for use on high quality blue and whites. Aesthetically this color was preferred over the local cobalt that gave a dusky blue hue rather than the vibrant violet-blue. In the early sixteenth century, a new source of bright blue cobalt was discovered in Kiangsi that enabled the use of bright pigments even when trade with the Middle East was unstable. By the latter half of the fifteenth century, potters etched their motifs first then filled them with a blue wash, a technique that cut down on smudging and blotching. The decoration was allowed to dry, then the glaze was either sprayed on to the vessel, or the vessel was dipped into the glaze. The initially opaque glaze consisted of petuntse, water, ash, and lime, and became translucent after firing.

The vessels were fired inside saggars, high-sided containers used to stack and protect the porcelain in the kiln. The saggars were dusted with a layer of sand that kept the porcelain from bonding to them inside the kiln, and it is characteristic for kraak porcelain to have grains of sand melted to the footing on any given piece. For prestige pieces and wares for the domestic market, potters would polish the sand off after firing, but for the mass-produced export wares, this was not a priority. The Pepper Wreck collection was no exception to the general rule, and every plate in the assemblage has grains of sand present on the footing.

Inside the kilns, porcelain was fired at temperatures around 1450°F. At Kingtehchen down-draft kilns were used rather than the dragon kilns of former periods. These down-draft kilns were brick, and could be as large as 20ft high and 50ft long. The high temperature firing would last for at least 36 hours, then the porcelains would
continue to fire at lower temperatures for 10 days, as the kiln cooled. A strong reducing atmosphere was desirable to prevent the cobalt silicates from reconverting to cobalt oxide in the presence of oxygen. By the Wan-li period (A.D. 1573-1619), firing at Kingtehchen had become a science, and most firings were successful.²⁰

When the Ming Dynasty was established in 1368, Emperor Hongwu passed a decree banning overseas trade. While this decree affected export porcelain, it was still produced in mass quantities for the domestic market. During this period of introspection, designs with Buddhist iconography, floral symbols, and other linguistically expressive icons were developed to appeal to the domestic market, evolving further a traditional language spoken by Chinese ceramics. Despite the slowed exportation of porcelains, thousands of items passed as gifts of state and there was a boom in trade when the market reopened.

WAN-LI PORCELAIN CHARACTERISTICS

The Wan-li period of the Ming Dynasty is marked by the intense popularity of a style known as kraak porcelain, so called because the Dutch referred to this style of porcelain as the ‘kraakporselein’ or ‘carrack porcelain’ carried by the Portuguese East-Indiamen. This underglaze blue and white porcelain style tended to mimic motifs from the early Ming by incorporating symbols from traditional ceramics into landscape patterns that focused upon animals in their natural environment. The motifs, designed to capture a fleeting mood or motion, typically incorporated deer, horses, plants, or birds as design standards. The animals were framed by a background and foreground that gave
the impression of looking into the natural habitat of the creatures. The Wan-li designs
generally lacked the exuberance and vitality of the earlier pieces, which is not surprising
because this reign is considered to be the waning period of the Ming Dynasty, before the
Transitional Period (AD 1620-1683). The years of the Wan-li period correspond to the
early phases of exhaustion in the kaolin and petuntse deposits surrounding Kingtehchen,
and there was a subsequent decline in the quality of ware produced for the export market
in order to preserve supplies for domestic use.

Kraak porcelain characteristically has decorations radiating from panels to a
bracketed rim; on bowls and vases the entire piece may be organized in panels, but on
plates and dishes the panels are usually confined to the border of the piece. The patterns
were not made to order during the Wan-li period as they were later, but they were made
specifically for the European market, where these patterns were greatly admired.\(^{21}\)

Despite this commercial market targeting, kraak wares were invested with a high level of
symbolic meaning. To the foreign eye, the animals and plants that decorated the
porcelain were enchanting, lovely, serene; to the Chinese, these symbols had multi-
layered meanings drawn from religious iconography, mythology, and word
pronunciation - usually these elements were intertwined.

SYMBOLS ON THE PEPPER WRECK PORCELAIN

The particular combinations of symbols present on the porcelains recovered from
the Pepper Wreck seem to convey an overarching message of longevity and happiness.
Some of the more common symbols appearing on these porcelains have the following
meanings\textsuperscript{22} - because they are identified below, they will not be discussed in detail in the individual artifact analyses (see figure 24 for illustrations corresponding to the numbers below):

1. The *endless knot* is an emblem of longevity, and is said to represent Buddha’s entrails. The *swastika* is similar to the endless knot in appearance, and both symbols imply infinity and are sacred to Buddhism.

2. *Ju-i* is the wish-fulfilling scepter; the head is often used in scrolled border ornamentation, and it appears on artifact 496.29.

3. The *pine tree*, with its characteristic evergreen needle growth, is a symbol of longevity and endurance; their everlasting life fills them with a spirit of vitality. The pine tree, plum tree, and bamboo trees together symbolize the Three Friends, or the founders of China’s three religions - Confucius, Lao Tzù, and Buddha.

4. The *chrysanthemum* is a symbol of the sun’s disk and is considered a life giving plant. It also represents the tenth month of the lunar calendar, autumn and joviality, and a life of ease and comfort.

5. The *lotus flower* is one of the eight Buddhist Emblems of happy augury and expresses the Indian idea of superhuman origin and purity. It represents happiness, purity, fruitfulness, and good luck, and is said to embody Buddha’s liver.

6. *Morning glory* is an emblem of love and marriage.

7. In Chinese mythology, the *peach tree* of the Gods bore fruit which ripened once
Figure 24: Symbols from the Pepper Wreck Porcelain. Images from photos of the porcelains taken by S. Brigadier and A. Randolph.
every three thousand years. The spoken word for peach, shou, is also the word for longevity. A symbol of marriage and longevity, the peach symbolizes lengthy happiness.

Three peonies represent threefold good fortune.

The Butterfly is the Chinese cupid and a symbol of marital happiness.

The Crow is a symbol of filial piety and the sun. As a sun symbol, the crow has life giving properties.

Deer are creatures that live for one thousand years. They represent longevity, and are the only animals with the ability to find Lingzi, the sacred fungus of immortality.

Grasshoppers are considered to be demons in Chinese mythology. They have the ability to change form and seduce humans.

A BORDER TYPOLOGY FOR MING DYNASTY PORCELAINS

Due to a recently conducted study of the border patterns of kraak porcelains from securely dated shipwreck sites, a reliable typology has been assembled by Clarence Shangraw and Edward Von der Porten. The evolutionary sequence that they have established traces the developing decorative patterns used in border styles and layouts on blue and white dishes. The Pepper Wreck artifacts possess borders from three out of five border styles used in the years between 1590 and 1600, all of which substantiate the identity of the shipwreck as that of Nossa Senhora dos Mártires, which wrecked in 1606. The artifacts will be classified according to this typology in the following analysis.
These five typologies (see figure 25) contain the following characteristics:

VI  The "Beaded Pendants" type introduced the separation of rim-divider lines to permit secondary rim designs that alternate with the main designs. First seen as a row of dots, the design soon evolved into designs of small symbols with dots on top and bottom; curved lines were later added to the top and bottom of the pendants.

VIIA  Called "Double Line Medallions with Dividers", this type replaced simple panels with rim medallions using two line dividers with a light blue wash in between. Rim medallions were defined with single lines.

VIIB  "I Wedge" is a later version of VIIA. The two divider lines are spread top and bottom to follow the shape of the medallion.

VIIIA  The type "Beaded Pendants between Open Medallions" is a combination of types VI and VIIB. The space between the rim medallion lines is filled with a blue wash; the rim medallions are separated from the rim line by an extra line and an extension of the wash. The medallions are open at the bottom.

IX  "Beaded Pendants with Diapers" introduced a diaper-filled separator between the cavetto and central roundel. The lobed border of the central scene was derived from low bowls in the 1590s.

XB  "Beaded Pendants between Closed Medallions with Diapers" is an example of closed medallions with the diaper separators in between them. This is the most intricate pattern of the turn of the seventeenth century.
Figure 25: Kraak Porcelain Border Design Typologies from 1590-1600. From Shangraw and Von der Porten, *Kraak Porcelain Design Sequence*, 8-9.
PORCELAINS FROM THE PEPPER WRECK

All of the blue and white porcelains from the Pepper Wreck were broken by the time of their recovery by CNANS. If they survived the initial pounding against the rocks during the shipwreck, even the hardness of porcelain was no match for four centuries of abuse on the bottom of the Tagus River, and parts of the collection survive only in fragments. Amazingly all of the plates have survived in their entirety, though not intact, due to the care taken in their original packing. Painstaking sorting and reconstructive work by the Portuguese team have thus far yielded a collection that includes two platters, seven plates, one bowl or vase base, and the neck of one vase. All of the pieces exhibit the characteristics discussed above that are associated with kraak porcelains of the Ming Dynasty’s Wan-li period, specifically those produced around the year 1600.

The first platter (figure 26), lot 130.01, consists of preserved portions of the platter base and some fragments from the rim. These remaining six sherds were reconstructed to yield a dish diameter of 46.0 cm, with a height of 9.5 cm. The platter has a Type XB border design, “Beaded Penants between Closed Medallions with Diapers,” that dates to circa 1600. This border type was the dominant border from this time period, and it compliments the intricacy of the artwork upon the inside of the dish. The inner border of the dish, below the medallions, carries two border patterns, like those upon porcelains from San Diego and Witte Leeuw, respectively a Spanish nao that sank in 1600 and a Dutch ship from 1613. This is one of the more intricate borders used with the swastika and concentric geometric rings. The highly detailed surviving
flowers inside the border medallions, a chrysanthemum and peonie, are perhaps indications of a higher level of artistic effort or ability than on many of the plates in this assembly. The motif of the platter, two spotted deer under the shade of a pine tree, was the most popular of the kraak porcelain motifs, carrying a symbolic message of longevity and good fortune. The quality of the artwork on platter 130.01 makes it one of the most aesthetically pleasing pieces from this assemblage of porcelain.

The only other platter of the assemblage (figure 27), lot 166.01, was reconstructed from five fragments. The resulting dish has a diameter of 30.8 cm and a height of 5.2 cm. This dish is also Type XB, but has a slightly different pattern of
pendant dots than 130.01. Two medallions on the rim have survived, one contains two peaches and the other has a butterfly about to alight upon some leaves. The inner border is made of two different patterns that likely would have alternated back and forth beneath the eight medallions. The motif of this piece is also of two deer beneath a pine tree, but here the execution has been done with a lighter hand. The male and female deer are easily distinguishable based on their relative sizes and shapes and they gaze at each other over a single peach, indicating that their union will be long and happy. The major iconography of this piece - deer, peaches, butterflies, and pine trees - projects the message of a long and happy marital union.

Figure 27: Porcelain Platter 166.01. Photo from Filipe Castro
The first in the series of plates is lot 183.09 (figures 28 and 29), a plate having a 20.5 cm diameter and 2.7 cm height. This plate has a Type VIIB border design, "I Wedge", dating to 1595. Small amounts of this border type have been recovered from San Diego and San Agustin, Spanish wrecks from 1600 and 1595, respectively. The medallions contain alternating grasshoppers, peaches, and what may be plum blossoms; the blossoms reappear in the landscape of the dish with fruits that resemble plums. The motif is of two deer in a natural landscape, but here the artwork is much more vague than the decorations of the platters. The fruits and flowers are so loosely drawn that they are barely recognizable and insects that appear to be grasshoppers may actually be intended as butterflies. Although the insects on plate 183.09 do not fit the traditional butterfly form, the grasshopper is regarded as a demon in Chinese mythology and such a serious symbol was not usually included in the decoration of kraak porcelain. Hence, the insects are probably butterflies, despite appearances to the contrary. Two pine trees have intertwining trunks that blend with the clouds at the top of the image.

Plate 183.10 (figures 30 and 31) has a slightly larger diameter than 183.09, at 20.8 cm and 2.9 cm in height. This Type VIIB design has markings on the underside that adhere to Von der Porten's dating standards, giving the plate a date of manufacture in 1595. These marks consist of four dots surrounding a circle with a central dot on each of the eight marked rim medallions; these marks appear on all of the other plates. On the dish's face, the medallions contain more diversity in their fruits and flowers, but no insects. Along with some images too vague to truly be identified, lotus blossoms and peaches adorn the medallions. The two deer motif is present, along with pine trees
and peaches; here rocks take up the foreground, and the entire scene is structured atop a hill. The decorative rocks are positioned in a garden pattern called Taïhu that was a popular decoration of the image of a natural paradise.

Of the seven plates in the collection, lot 183.11 (figures 32 and 33) is the least detailed; it has a diameter of 20.5 cm and a height of 3.0 cm. This plate is one of two in the collection with the Type VIIA design, “Double-line Dividers with Medallions”, and has a slightly earlier date than Type VIIIB, probably between 1590 and 1595. While they are covered in the study, Von der Porten had not physically examined any porcelain flatware with this rim design when his study was done in 1997. While this simple border style affects the overall look of the dish, it is the rough artwork that gives the plate its hastily-decorated appearance. This plate appears to have been executed quickly, with little attention to detail or placement. The medallions contain alternating lotus and plum blossoms, and the interior of the plate has again the deer motif. The style of 183.11 appears jumbled; the requisite elements are all in place - deer, pine trees, rocks, peaches - but they seem to have been painted with little attention to their placement within the traditional three planes of the nature motif.

Plate 183.12 is a plate unique among the others in its main design motif (figures 34 and 35). The border of this plate is one of two that appear to be a cross between the Type VIII A design, “Beaded Pendants between Open Medallions”, and Type IX, “Beaded Pendants between Diapers”; both designs date to 1600. It has a Type IX rim, but lacks the diaper pattern comprising the inner border on this type. It is 20.5 m in
diameter and 2.9 cm in height. The medallions are decorated with alternating
grasshopper/butterflies, lotus blossoms, chrysanthemums, and plum blossoms. Although
it carries a main design motif that is essentially different from the two deer, the pattern is
still a variation on the kraak porcelain themes of animals in natural landscapes; this motif
was the second most popular for kraak wares. Plate 183.12 bears a crow sitting amongst
flowers and leafy plants; the crow has been captured as it looks over its back at
something outside of the scene. The action in the bird motif takes place on multiple
planes, but there are no limits applied to edges of the fore and backgrounds, as there
seem to be in the deer motif pieces. The forms are drawn loosely, but attentively in the
scene, indicating a skilled artisan.

Plate 183.13 is the second plate from the Pepper Wreck with a Type VIIA border
design (figures 36 and 37). This plate has a 20.4 cm diameter and a height of 2.8 cm.
The work on this piece was executed with a heavy hand, meaning that the underglaze
blue has been laid on quite thickly, resulting in dark images. This differs from the
standard kraak style, which outlines images with dark edges and fills them with a light
blue wash inside the edge. The darkness subtracts from the light gracefulness and
whimsical appeal that characterize most kraak porcelains. The eight medallions on
183.13 contain alternating fruits, flowers, and insects; and the motif is of two deer in a
landscape. This scene has multiple pine trees in the background, which gives a different
effect than the other plates, and a few rocks in the foreground, but it lacks the peaches
that have added meaning between the deer on other pieces. This piece may have been
painted by an artist new to painting kraak designs.
Plate 183.14 is a well-executed example of the kraak style (figures 38 and 39) and is the smallest plate in the collection at 20.0 cm in diameter and 2.7 cm in height. The medallions in between this Type VIIB’s “I Wedge” borders are filled with insects (grasshoppers/butterflies), peaches, plum blossoms, and what may be lotus blossoms. The interior of the dish contains a two deer motif in which the male and female spotted deer frolic playfully under two pine trees with intertwined trunks. The sky on this plate is also home to a flock of birds, a feature that does not appear on any of the other porcelains in the assemblage. The clouds and rocks are both painted in a circular spiral pattern, and the work was done lightly and gracefully.

The final plate in the collection is 183.15 (figures 40 and 41) and it is the other plate with a border design crossing between Types VIIA and IX, (see 183.12 for a further description). It has a 20.8 cm diameter and 2.5 cm height. The pendants enclose insects, lotus blossoms, morning glory, and chrysanthemums; these flowers reappear in

Figure 40: Porcelain Plate 183.15, Top. Photo by S. Brigadier and A. Randolph.
Figure 41: Porcelain Plate 183.15, Bottom. Photo by S. Brigadier and A. Randolph.
the main motif, which is two deer in nature. The rocks are painted in a different, flat iconography, and the background has an intentionally hazy appearance, with the pine tree blending into the clouds. The deer are painted in a dark wash, like the tree, but here it looks purposeful, rather than the unskilled impression from 183.13. The overall effect is that the action and foreground stand out from a background that fades away. The female deer is shown approaching the male, who looks up as she draws near.

Item 29.01 is the basal remains of a jar, pot, or vase of some kind (figure 42). The base diameter is 16.5 cm, and the broken opening at top has a 17.3 cm diameter; the height of the piece is 27.3 cm. Desroches believes that the shape of its foot and bulbous bottom curve indicate that it was originally a pot with rounded shoulders and a small mouth; while he may be correct there is simply not enough left of the object to say with

Figure 42: Porcelain Base 29.01, Profile. Photo by S. Brigadier and A. Randolph.

Figure 43: Porcelain Base 29.01, Bottom Marking. Photo by S. Brigadier and A. Randolph.
any certainty what it once was. The piece is marked with four *fugui-jiaqi* characters on the bottom that translate to say, "this object brings you wealth and happiness" (figure 43). This was a common mark first used during the Jiajing period of the Ming Dynasty (1522-1566) that continued in use into the Wan-li period.26 The lower border of the base is divided by spindles into thirteen lotus petal panels. The area containing foreground imagery is painted with waves and foam and a J-ui head can be seen in the center of a cloud floating above the foam. This piece contains powerful imagery of wealth and wish fulfillment and was painted by a light and skilled hand. Despite the care that went into crafting the piece, grains of sand can be seen in figure 43, indicating that after firing, no extra time was spent perfecting the object.

The final ware in the collection is item 166.01.02 (figures 44 and 45), the neck of a pear-shaped vase. The height of this fragment is 25.5 cm, but there is no referenced diameter. The main decorative motif would have encircled the bulge of the body, but all that remains are the border patterns around the neck. The top segment contains at least one oval in which the swastika pattern, implying infinity, is enclosed. Underneath this level there is at least one medallion containing a chrysanthemum that is adjacent to a morning glory set atop a different interlocking geometric design. These images are executed with such intricate detail that the entire vase must have been a beautiful piece.

Along with the complete plates and platters and the vase remains, the Pepper Wreck yielded fifty-four fragments of blue and white porcelain and one sherd of green-glazed porcelain. The pale, delicate tone of the green glaze indicates that is likely from a
piece of celadon ware, and lot 196.04 is unique in its type to this assemblage. Its presence indicates that there was some celadon aboard the ship, although the role it played, personal possession or cargo item, will never be known. The fragments of blue and white porcelain bear the same kraak porcelain features as the items discussed at length in this chapter, but for the interested reader, they are all pictured in Appendix A, the artifact catalogue. As well, I have compiled a list of the porcelain fragments, Appendix B, to aid in their location in the catalogue.

CONCLUSION

The Pepper Wreck’s ceramic assembly contains several examples of Ming Dynasty blue and white porcelain wares from the Wan’li period (A.D. 1580-1619). This
time period is considered the final period of the Ming Dynasty and the initial stage of China’s fascination with Europe. Although there were two more reigns in the Ming Dynasty, they are considered part of the Transitional Period into the Ching Dynasty. The popular artistic styles and motifs of these years are indicative of both of these characteristics as traditional Chinese styles begin to incorporate the European aesthetic into their themes. Beginning with kraak porcelains, which incorporated a selection of Chinese themes that were wildly popular in Europe, Chinese artisans began taking specific commissions from Europeans for designs by the early seventeenth century. By the time of the Ching Dynasty (1644), preferred European images, like scenes of people engaged in activity (not just animals and plants in nature, or immortals in postures of contemplation), are found on porcelains manufactured for Chinese consumption. The dated astrolabe SJBIII and the date provided by the porcelain dishes found with the Pepper Wreck are some of the most important clues for establishing a date for the wreck and evidence for the wreck to be Nossa Senhora dos Mártires.
NOTES

5 Honey, *The Ceramic Art of China*, 47
6 Ibid.
8 Ibid., 124.
10 Vainker, *Chinese Pottery and Porcelain*, 133.
11 Ibid., 124.
17 Vainker, *Chinese Pottery and Porcelain*, 123.
19 Helen Catherine DeWolff. “Chinese Porcelain and Seventeenth-Century Port Royal, Jamaica” (Ph.D. diss., Texas A&M University, 1998), 82.
24 Ibid., 3.
25 Ibid., 11.
CHAPTER IV

PEWTER

The pewter collection found at São Julião da Barra is one of the largest and oldest archaeological caches ever found, containing twenty-three pieces of flatware that date from the late sixteenth to the early seventeenth century. Of these artifacts, four plates and two deep dishes were excavated in direct association with the Pepper Wreck and are the only pewters likely to be from the wreck. These artifacts will be compared with the entire São Julião da Barra assemblage for type similarities since they were found in the same general area, but the SJB pewter is of a distinctly different type than the Pepper Wreck pewter and is unlikely to be from the Pepper Wreck. Therefore, the Pepper Wreck pewters are the only items that will be discussed in depth in this thesis.

Until recent years, pewter has been most notable archaeologically as a missing artifact. There are two primary reasons for this absence. First, damaged or outdated pewter pieces had economic value when sold or recycled at the local pewter shop. Pewter has a low melting point, which makes it easy to repair or recast; as a result, pewterers traditionally purchased old pewter by weight to be reworked and sold. Second, pewter corrodes quickly when buried (as in trash heaps, wells, etc.); therefore, most terrestrial archaeological sites yield pewter fragments at best and no pewter artifacts at worst. What makes this absence of pewter from the archaeological record interesting is its prevalence in daily life according to the historical record.
Pewter is mentioned in Shakespearean plays, in contemporary poems, and is present in artwork from every period from the fifteenth century onwards. By the sixteenth century, pewter had migrated down the social ladder to grace the tables of members of every social class (along with wooden and ceramic tableware, of course), rather than just the wealthy (see figure 46). It remained the dinnerware of choice – easy to dent but hard to break - until ceramics became more affordable and accessible in the nineteenth century. Yet the only major archaeological caches of pewter come from catastrophic sites, like Port Royal, Jamaica, or shipwreck sites, like São Julião da Barra.¹ This reality makes such finds all the more valuable for the information they contribute.
towards comparing the archaeological record with the historic one in order to create a
more complete picture of the past.

PEWTER: A BRIEF HISTORY

The history of pewter is a long and relatively anonymous one. Knowledge of the
tin alloy called pewter has existed in China for at least two thousand years, but it was the
Romans who introduced the Western world to pewter in the fourth century AD. They
mined tin extensively in Cornwall, Great Britain and melted it with a high percentage of
lead (up to 50%) to create the desired alloy composition.\textsuperscript{2} The popularity of pewter
apparently waned when the Romans left the British Isles, not to grow again until
approximately the twelfth century.

In the eleventh and twelfth centuries there is evidence of European pewter guilds
operating in large urban centers to regulate apprenticeships, pewter prices, and alloys.
There are records of an established German pewter industry as early as the eleventh
century, contemporaneous to the rise of the French and Flemish pewter industries.\textsuperscript{3}
These pewterers produced highly decorated items for ecclesiastical and commemorative
use as well as more utilitarian pieces for daily use.

In Germany, guild regulations were in place by the year 1324. Master pewterers
of the guild inspected workshops and placed restrictions on masters and apprentices,
alloy compositions, and general competency levels.\textsuperscript{4} The Paris Guild had a comparable
level of stringency in regulating pewter and probably influenced the London Worshipful
Company of Pewterers, established in 1348. By 1600 the powerful guilds of Paris,
Lubeck, Frankfurt, Nuremberg, London, Augsburg, Hamburg, Strasbourg, Rouen, and
York had been weakened by the shifting of the social order from medieval feudalism to
Renaissance urbanism and humanism. However, this weakening was a gradual process
and guilds like the Worshipful Company of Pewtersers in London continued to exert great
influence over their pewtersers.

In the fourteenth century, pewtersers were so prevalent in England that the
"Worshipful Company of Pewtersers" was created as a guild in London to regulate
pewtersers and the manufacture of pewter. The London Company demanded the most
exacting compliance from its pewtersers, regulating the most minute details of their
world: apprentice training, labor hours, workshops, alloys, manufacturing techniques,
and touch marks. The Company also kept records of all its members and their marks.
These records were unfortunately destroyed in the Great London Fire of 1666. Some of
the dies recording touchmarks were recast, but only those of surviving pewtersers; the
rest of the historical record was lost. Unfortunately for this thesis, that means that if the
marked pewter collection from São Julião da Barra is English, the most prolific
manufacturers and distributors of pewter from the fifteenth century forward, the origin of
the artifact's marks will likely never be discovered.

By the early seventeenth century there were three primary tin sources actively
mined in Europe - in Saxony, Bohemia, and Cornwall - and any other veins fell into
disuse or were tapped out. Cornwall, at the southern tip of England, had been a major
producer of tin for Europe since the Middle Ages and still contains hundreds of
extensive tunnels carved even underneath the seabed. From 1700 to 1709, 79% of
Cornish tin was exported to Europe and worked by foreign artisans. As a comparison, during the entire eighteenth century Saxony and Bohemia produced about 30,000 tons of tin, less than one-seventh of Cornish production for the same time period.  

PEWTER ABOARD SHIPS

The hierarchy between officers and sailors aboard ships during the fifteenth and sixteenth centuries was clearly delineated in many ways, including dining practices. Ordinary sailors and soldiers acted as their own wait staff for meals, serving food to their messmates on a communal wooden board, and cleaning up afterwards. If they had individual plates or bowls, they were generally made of wood, with personal knives used as the only utensil. Officers aboard Iberian ships customarily carried a separate collection of cooking implements that their servants used to prepare meals. They also used tablecloths, dishes and eating utensils, luxuries not afforded to the common sailors and soldiers aboard ships. The most common dishes were plates and jars made of various metals – tin, copper, or pewter. Therefore in any shipwreck assembly, it is not unusual to find a small selection of pewter wares that would likely have been used by the ship’s officers or high-ranked passengers.

PORTUGUESE PEWTER

Of primary interest for this thesis is information about the manufacture of Portuguese pewter, as the Pepper Wreck was most likely a Portuguese vessel. There is a slag site in Portugal, at Cavalhelhos, which contains low tin high iron slag. These are
probably iron-smelting slags from which tin could have been extracted as a by-product. Tin recovered from slag of this composition is generally of high quality, having very little iron in the final refined tin. The article by Tylecote, Photos, and Earl, contains one of the only references I have seen to a Portuguese tin source, but this could certainly have supplied some tin to Portuguese pewterers. The other reference refers to tin ores of northern Portugal and northwest Spain being exploited by Phoenician traders. Dayton goes on to categorize the tin sources of Portugal and northwest Spain as plentiful, but little is known about their workings.

Lisbon, being a huge urban center, the capital of an Empire, would certainly have had many pewter workshops. Unfortunately, though Portuguese pewter workshops were active from the sixteenth century on, pewterers rarely used touchmarks to identify their work, and the origins of most Portuguese pewter pieces can not be traced as a result. The Great Lisbon Earthquake of 1755 destroyed many records as well, creating dead ends for research on the topic. At the present time, there is virtually no information about any aspect of pewter production specific to Portugal.

PEWTER MANUFACTURE

The metal pewter is a tin alloy, generally composed of tin combined with lead, copper, antimony, or bismuth. Tin is a lightweight metal, but in its pure form it is too brittle to be durable and too stiff to be worked easily. Initially in Western pewtering, large amounts of lead were added to the tin, as indicated by Roman metallurgical samples. This high percentage of lead in pewter had fortunately dropped to around 10%
for the higher-grade pewter used in tableware and other daily objects by the Medieval Period. While the addition of lead or copper certainly decreased the brittle quality of tin, pewter remains a famously soft metal – both easily worked and easily damaged.

Although composition standards were always regulated by the pewter guilds, they were also guild specific, never widespread. In France qualities ranged from 10% lead in the highest grade to 26% lead in the lowest grade; in Holland the highest standard ranged from 94-95% tin in the mid-seventeenth century; and in Antwerp the highest grade required an alloy with 97.5% tin. The Worshipful Company in London required from 3-10% copper for top quality pewter, and about 20% lead for the lowest grade.\(^\text{12}\)

The pewter alloy is made by simply adding tin and lead, copper, antimony, or bismuth to an iron crucible in the established formulaic proportions and heating until the metals melt together. The resulting alloy was then either poured into sheets or molds; the sheets could easily be hammered into plates and dishes. Before the sixteenth century, molds were generally made of clay or stone – in Italy a soft marble called touffa was used. From the sixteenth century onwards, bronze molds became the standard; although they were expensive, they were also permanent. The molds had to be heated evenly prior to pouring in the molten metal to ensure an even flow throughout the mold and to prevent the first two pieces cast from emerging with defects.\(^\text{13}\) The molds were treated with lubricants like ochre, egg white, pumice, or carbon black to improve the flow of the molten metal through the mold's interior.\(^\text{14}\)

After the casting was cooled, clay molds could be broken or permanent molds opened to remove the pewter object. Simple objects, like plates, only needed one mold,
but more complex pieces could require several separately cast elements. The casting
was then trimmed, cleaned, scraped, and planished by hand and wheel. Flatware was
often hammered to provide extra strength between the rim and the well, or the 'bouge'.
These mechanical working processes change the external shape of the metal, causing
internal stresses. After a certain point of working most metals (copper, bronze, silver,
etc.), these stresses have to be relieved by annealing (heating to above the metal's
recrystallization temperature). Generally tin, lead, and pewter are cast and finished with
only minimal internal stresses caused, but they also recrystallize at room temperature
and do not require annealing even when worked extensively. The drawing of a pewter
workshop from Diderot's Encyclopedia, 1762-1777, illustrates the different stages of

Figure 47: Typical Pewter Workshop, 1762-1777.
casting pewter (figure 47).\textsuperscript{16} One man pours molten pewter into a mold, another opens the mold to remove the cast piece, two men work the lathe to polish the piece, and a fourth engraves details upon the finished piece. Although Diderot’s Encyclopedia was created in the late eighteenth century, the mode and manner of production followed by the pewter industry a century and a half earlier, i.e. small to medium sized workshops, were virtually the same.

Working the metal, whether from castings or sheets, required a wide array of tools. Many of these tools were associated with a wide array of trades, not only pewter-working. These included hammers, files, awls, punches, and chisels. Other tools used were dies, whetstones, abrasives, wheels, lathes\textsuperscript{17}, benches, cauldrons, and forges; for examples, see plate 8, figures 48 and 49. Most of these tools were expensive, especially the bronze molds, so pewterers frequently borrowed items like molds from one another, or shared communal molds (figure 50).

**TERMINOLOGY AND TYPOLOGY**

There are three main types of pewter, defined by manufacture methodology and not composition: ‘sad-ware’, ‘hollow-ware’, and ‘trifles’. Sad-ware consisted of items hammered from flat sheets, such as plates and chargers. Craftsmen producing sad-ware were the lowest paid pewterers and the least-respected. The hollow-ware category included large pots, measures, tankards, and flagons. In other words, objects that required casting, and thus more skill and resources.\textsuperscript{18} Trifles included many miscellaneous items, like buttons, thimbles, candlesticks, boxes, and so on. Apparently
Figure 48: Tools of the Pewterer.  

Figure 49: More Tools of the Pewterer.  

Figure 50: Pewter Molds.  
the word ‘Sadware’ was derived from an Old English word meaning ‘solid-ware’ that referred to items requiring additional strength from hammering. ‘Sad-ware’ is used as a synonym for ‘flatware’, which is defined as items that “have a rim, well, bouge (the curved section between the rim and well), are cast in one piece, and are used for food service.”

To describe the pewter flatware in the Pepper Wreck collection, this thesis will use the guidelines established by Shirley Gotelipe-Miller in her Master’s thesis on the pewter recovered from the English city of Port Royal, Jamaica, sunk in an earthquake in 1692.

Gotelipe-Miller defines the different types of flatware as follows:

Charger - A serving tray measuring over 16 ½ inches (41.9 cm) in diameter.

Dish - 10 ½ to 16-½ inch (26.7 – 41.9 cm) diameter serving tray.

Deep Dish - A dish over 3 centimeters deep, but not as deep as a bowl or basin. Also called a soup dish.

Plate - 6 ½ to 10-½ inch (16.5 – 26.7 cm) diameter, used for individual food service.

Saucer - Under 6 ½ inches (16.5 cm) diameter, also called a butter plate.

Paten - Flatware used for ecclesiastical purposes.

Bowl - Deep container with rounded sides.

Basin - Deep container with somewhat straight sides and a flat bottom.
Rim-types are another important characteristic in assigning flatware to a typological category, mainly because there are few distinguishing characteristics about the shapes of many styles of undecorated pewter plates. Rim styles are grouped in five categories as per Gotelipe-Miller: Type 1) Plain rim; Type 2) Single Reed; Type 3) Simple Raised Multiple Reed; Type 4) Incised Multiple Reed; and Type 5) Complex Multiple Reed. Brownsworth and Pitt add another level of identification properties to the 5 Types of reeding. Type 2 includes the subcategories a through e as follows: Type a) if angled; Type c) if grooved; Type d) if rounded; and Type e) if below. Type b is an incised simple reed designed rim. The artifacts will be discussed typologically as they fall into the above number and letter types (see table 1 and figure 51: rim type illustrations).

PEWTER FROM THE PEPPER WRECK SITE

As mentioned above, only six of the twenty-three pewter pieces from São Julião da Barra were actually found at the specific site of the Pepper Wreck (SJB 2). In the collection from the Pepper Wreck, the only types of pieces are flatware of two categories - two deep dishes and four plates. Table 2, assembled by Filipe Vieira da Castro shows the distribution of the pewter artifacts found at São Julião da Barra across several (and separate) archaeological locations. The site known as SJB2 is the specific location of the Pepper Wreck, and the archaeological provenience of the plates described below. For full information about the particular weights and sizes of the Pepper Wreck pewter, see Appendix C.
### Table 1: Pewter Flatware Rim Types.
Typology from Gotelipe-Miller and Brownsword and Pitt.

<table>
<thead>
<tr>
<th>Rim type</th>
<th>Gotelipe-Miller</th>
<th>Brownsword &amp; Pitt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain Rim</td>
<td>Type 1</td>
<td>Not considered</td>
</tr>
<tr>
<td>Single reed</td>
<td>Type 2</td>
<td>Type a if angled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Type c if with groove</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Type d if rounded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Type e if below</td>
</tr>
<tr>
<td>Simple raised multiple reed</td>
<td>Type 3</td>
<td>Not considered</td>
</tr>
<tr>
<td>Incised simple reed</td>
<td>Not considered</td>
<td>Type b</td>
</tr>
<tr>
<td>Incised multiple reed</td>
<td>Type 4</td>
<td>Not considered</td>
</tr>
<tr>
<td>Complex multiple reed</td>
<td>Type 5</td>
<td>Not considered</td>
</tr>
</tbody>
</table>

### Figure 51: Flatware Rim Types from São Julião da Barra.
Table 2: São Julião da Barra – Pewter Flatware.
From Castro, “Pewter Plates from São Julião da Barra,” 11.

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Description</th>
<th>Provenience</th>
</tr>
</thead>
<tbody>
<tr>
<td>0465.02.0016</td>
<td>Plate</td>
<td>SJB1/1994</td>
</tr>
<tr>
<td>0465.02.0017</td>
<td>Plate</td>
<td>SJB1/1994</td>
</tr>
<tr>
<td>63.04</td>
<td>Small plate</td>
<td>SJB4/1996-97</td>
</tr>
<tr>
<td>148.01</td>
<td>Plate</td>
<td>SJB2/1996-97</td>
</tr>
<tr>
<td>161.09</td>
<td>5 plates and 9 saucers</td>
<td>SJB1/1996-97</td>
</tr>
<tr>
<td>165.01</td>
<td>Deep dish</td>
<td>SJB2/1996-97</td>
</tr>
<tr>
<td>168.01</td>
<td>Deep dish</td>
<td>SJB2/1996-97</td>
</tr>
<tr>
<td>171.01</td>
<td>Plate</td>
<td>SJB2/1996-97</td>
</tr>
<tr>
<td>171.02</td>
<td>Plate</td>
<td>SJB2/1996-97</td>
</tr>
<tr>
<td>205.01</td>
<td>Plate</td>
<td>SJB2/1996-97</td>
</tr>
</tbody>
</table>

The two deep dishes, lots 165.01 and 168.01 (see figures 52, 53 and 54, and figures 55 and 56), are well-preserved pieces of similar size and design. Dish 165.01 is 28.3 cm in diameter and weighs 749 grams, and dish 168.01 is 29 cm in diameter and weighs 758 grams. Dish 165.01 has a slightly greater rim width than dish 168.01, but they are both of the same basic dish design. There is a difference in the artifacts’ rim types. Dish 168.01 bears rim type 1a, meaning an angled plain rim, and dish 165.01 has rim type 4, or incised multiple reeds – in this case one incised reed on the outer edge and another on the inner edge, visible in figures 55 and 52, respectively. Both dishes lack touchmarks, but bear owner’s marks: dish 165.01 has a ‘M’ incised upon it, (see figure 54); dish 168.01 has an incised ‘V’, (figure 57).
Figure 52: Pewter Deep Dish 165.01, Top.  
Photo by S. Brigadier and A. Randolph.

Figure 53: Pewter Deep Dish 165.01, Bottom.  
Photo by S. Brigadier and A. Randolph.

Figure 54: Deep Dish 165.01,  
Ownership Mark 'M'.  
Photo by S. Brigadier and A. Randolph.
Figure 55: Pewter Deep Dish 168.01, Top.
Photo by S. Brigadier and A. Randolph.

Figure 56: Pewter Deep Dish 168.01, Bottom.
Photo by S. Brigadier and A. Randolph.

Figure 57: Deep Dish 168.01,
Ownership Mark 'V'.
Photo by S. Brigadier and A. Randolph.
Only a handful of passengers aboard *Nossa Senhora dos Mártires* have been identified, but neither a 'V' nor a 'M' corresponds with any of the known names.

The four plates, lots 148.01 (figure 58), 171.01 (figures 59 and 60), 171.02 (figures 61 and 62), and 205.01 (figures 63 and 64), are all of similar size (ranging from 21 – 21.5 cm), but their weights fluctuate considerably, generally based on the preservation of the plate. The best-preserved plate of the group, 171.01, weighs 460 grams while the least well-preserved plate, 148.01, weighs only 295 grams. They also have similar rim widths, all of them being narrow – about 2 cm wide. The most telling differences between the plates are their rim types. Plate 148.01 has rim type 2a (an angled rim with a single reed), and has undergone some reconstructive work. The well, broken when excavated, has since been repaired, and the artifact has no markings. Plates 171.01 and 205.01 also have type 2a rims. All three plates have the single reed on the outer edge of the plate rim and, like 148.01, 171.01 and 205.01 lack any markings. The final plate in the assemblage, 171.02, is one of the better-preserved plates, and has a rim type 4, with one reed on the outer edge and one on the inner edge.

All of the pewter flatware in the Pepper Wreck collection bears the ravages of tin pest, a tin corrosion that results in pitting on the surface of the metal as minerals bubble inside the metal and then work their way out. They also appear to have been hammerred, and of course flatware was strengthened in that manner. Plates and dishes alike have the same narrow rim style, though there are discrepancies in rim typology as far as the presence and number of reeds goes.
Figure 58: Pewter Plate 148.01, Top. Photo from Filipe Castro.

Figure 59: Pewter Plate 171.01, Top. Photo by S. Brigadier and A. Randolph.

Figure 60: Pewter Plate 171.01, Bottom. Photo by S. Brigadier and A. Randolph.
Figure 61: Pewter Plate 171.02, Top. Photo by S. Brigadier and A. Randolph.

Figure 62: Pewter Plate 171.02, Bottom. Photo by S. Brigadier and A. Randolph.

Figure 63: Pewter Plate 205.01, Top. Photo by S. Brigadier and A. Randolph.

Figure 64: Pewter Plate 205.01, Bottom. Photo by S. Brigadier and A. Randolph.
None of the pieces from the Pepper Wreck have touchmarks, although the deep dishes do have ownership marks scratched into them, a fact that may be indicative of Portuguese manufacture. At the turn of the seventeenth century, guild regulations in most European countries and cities allowed only licensed pewterers with registered touchmarks to work as pewterers. However, the pewter workshops of Lisbon and Oporto had no such restrictions, and most practicing pewterers operated without using touchmarks. Because the Pepper Wreck pewter had to originate in a locale uncontrolled by guilds requiring touchmarks, such as those in Portugal, it is possible that the pewter was made in the wreck’s country of origin. Unfortunately no metallurgical analyses have been performed on any of the SJB pewter flatware, so the alloy compositions, and the possibility of establishing the pewter’s origin based on its metallic proportions, remain unknown at this point.

Identifying the Pepper Wreck pewter based on design has proven equally difficult. The dominating medieval form for flatware was a narrow-rimmed plate with shallow, sloping sides and a central well. This form continued in use into the seventeenth century throughout Britain and Europe. In the sixteenth century flatware with broader rims, steeper sides, and a flatter bowl became popular. Rims grew in width until the middle of the century then began to narrow towards the end of the seventeenth century. What complicates the ability to date pewter flatware by general trends like the expansion and reduction of rim width is the sheer durability of pewter. Flatware could easily be used for half a century, and could certainly continue in use indefinitely. Moreover, though there are some general trends, personal preference (of both the
pewterers and the customer) played a key role in determining what styles pewterers produced in any time period. Therefore dating unmarked pewter based on shape is simply impossible.

In comparison to the rest of the pewter flatware from São Julião da Barra, the Pepper Wreck collection is certainly of different manufacture. There are four basic design types in the São Julião da Barra pewter collection. Type 1 consists of a group of saucers characterized by a wide plate rim and the touchmark  on the plate rim (figure 65). Type 2 contains plates with plain, broad rims and no visible markings. There is only one plate of this type, and it is significantly darker in color than the rest of the SJB flatware, having an almost black sheen (figure 66). The Type 3 plate has a narrow rim and bears the touchmark  upon its rim (figure 67). Type 4 refers to the Pepper Wreck collection, whose characteristics have been discussed above. There is one other plate in the SJB collection, 04613.03.0017, bearing similar characteristics to the flatware associated with the Pepper Wreck in rim type (4), proportions, and lack of touchmark, but whether it is from the wreck or not is unknown. Other than plate 04613.03.0017, the Pepper Wreck collection is distinctly different from the rest of the SJB flatware.

Pewter plates have been recovered from the shipwrecks of the 1554 Spanish Plate Fleet (from Espíritu Santo), the Spanish Armada of 1588 (Trinidad Valencera, Santa Maria Rosa, and Girona), and Nuestra Señora de Atocha, from the 1622 Spanish fleet. These wrecks, while not immediately contemporary to Nossa Senhora dos Mártires, are all of Iberian origin and within a reasonable time span for comparison.
Figure 65: Type 1 SJ/B Pewter Plate, INSAS: 04613.05.0080.  
Photo from Castro, “Pewter Plates from São Julião da Barra”, catalogue.

Figure 66: Type 2 SJ/B Pewter Plate, INSAS: 04613.05.0075.  
Photo from Castro, “Pewter Plates from São Julião da Barra”, catalogue.

Figure 67: Type 3 SJ/B Pewter Plate, INSAS: 04613.03.0016.  
Photo from Castro, “Pewter Plates from São Julião da Barra”, catalogue.
Figure 68: Pewter Dish 9.3 from *Trinidad Valencera*. Photo from Flanagan, *Ireland's Armada Legacy*, 123.

Figure 69: Pewter Plate 9.15 from *Trinidad Valencera*. Photo from Flanagan, *Ireland's Armada Legacy*, 125.
The only truly similar plates to those from the Pepper Wreck are from *Trinidad Valencera.* Dish 9.3 has a diameter of 35.4 cm and plate 9.15 has a diameter of 20.3 cm (see figures 68 and 69). However, dish 9.3, although it does have a Type 2 (single reed) rim, also has decorative detailing on the bottom of its flat well. Plate 9.15 has a slightly wider rim, proportionally, and also has a flat well. With both of these pewter plates their most obvious characteristic, and difference from the Pepper Wreck pewter, is that their metallic surfaces are smooth, for they have not been hammered.

The pewter collection from the Pepper Wreck at this point appears to be unique in style amongst known pewter flatware. There are no contemporary examples with more than a slight similarity to the design and layout of the deep dishes and plates. This is not surprising, however, because pewter corrodes easily in most archaeological environments, knowledge about the Portuguese pewter industry in general is scant, unmarked pewter is extremely difficult to identify, and the Pepper Wreck is the first archaeologically excavated and academically studied Portuguese East-Indiaman. At this time, this study can offer no more than a reference for future discoveries and possible comparisons.
NOTES

2 Peter R. G. Hornsby, Pewter of the Western World, 1600-1850 (Exton: Schiffer Publisher Ltd., 1983), 11.
4 Ibid. 4-5.
5 Ibid. 5.
6 The Cornish pasty, a well-known food item, was actually created by tin miners’ wives. The miners would hold on to the thick outer edge of dough with their toxin covered hands and eat the middle part. This helped to prevent them from consuming tin dust as a meal in addition to absorbing it through their skin and lungs.
7 Hornsby, Pewter of the Western World, 12.
11 Filipe Vicira da Castro, "Pewter Plates from São Julião da Barra, a 17th century site at the mouth of the Tagus river, Portugal, spring 2000." (Department of Anthropology, Texas A&M University, computer file), 7.
12 Hornsby, Pewter of the Western World, 11.
14 Hornsby, Pewter of the Western World, 12.
17 Bayley, "Anglo-Saxon Non-Ferrous Metalworking." 121.
18 Osburn and Wilber, Pewter: Spun, Wrought, and Cast, 8.
19 Gotelipe-Miller, "Pewter and Pewterers from Port Royal, Jamaica." 28.
20 Ibid. 28.
21 Colonial archival sources seem to use the term “basin” for all deep containers so “bowl” is used by Gotelipe-Miller rather than “bowl.” As there are neither bowls nor basins in the Pepper Wreck collection, it has little bearing on the subject at hand.
22 Gotelipe-Miller, "Pewter and Pewterers from Port Royal, Jamaica." 126.
CHAPTER V
MISCELLANEOUS ARTIFACTS

THE CERAMIC ASSEMBLAGE

Throughout the history of seafaring, one of the most important factors in planning a voyage has been provisioning the vessel with food and water. The method initially used by the Portuguese to store perishable supplies on their trading expeditions follows the Mediterranean tradition of using amphora for storing perishables. The post-medieval version of the amphora was the Spanish olive jar, a curved earthenware jar that was sealed at the top with a wooden lid; an internal glaze sealed the porous earthenware itself. While the designation ‘olive jar’ is certainly indicative of one food product considered a necessity on every voyage undertaken by inhabitants of the Iberian Peninsula, it is also misleading because olive jars were used to transport everything from water to salt pork - occasionally human remains were carried back to their homeland sealed in olive jars.

After reaching the Indian Ocean and South China Sea, the Portuguese discovered the superior skill of the inhabitants of southeast Asia in ceramic manufacture and began using Asian storage jars, along with olive jars, to carry their foodstuffs. The Asian jars were usually stoneware, and were therefore non-porous and stronger than earthenware jars. Large storage jars were manufactured and traded throughout the Indo-Asian sphere, though Martaban, in south Burma, is probably the most famous port for exporting these jars. Asian jars were sealed with either cork or teak discs fit into the
mouth of the jar and tied to lugs located around the shoulder of the jar. The lugs were also used to secure jars in the hold of the ship, but they were not strong enough to support the weight of the unwieldy jars, which can reach upwards of 1.3 m in height. Instead the jars were wrapped with netting that functioned to both support the jar while being carried and to act as a buffer between jars while in storage. This illustration from the Kano Naizen Namban screen (circa 1603-1610) shows the netting with woven handles used to carry the cumbersome jars (figure 70).¹

These jars came in many different shapes, sizes, and glazes. They could be either refilled and reused when empty, a useful feature when a ship stopped for fresh water en route, or sold at the end of the voyage into a receptive market. The Japanese had a particular liking for Martaban-style jars from Pegu or Siam, believing them to be the best
for storing water for brewing tea. The Portuguese would use the containers on the
voyage to Japan, then sell these jars that were originally worth one-half tael for up to
several hundred taels apiece once they arrived. “Usually they prefer the older kind, but
only Japanese can distinguish between them; if the Portuguese twit them about this
caprice of theirs, they reply that those are still more foolish who pay many thousand
ducats for a diamond or other precious stone which has no inherent value, whereas these
pots have the redeeming one of keeping that water which is of such service to their
health.”

The assemblage of ceramic sherds from the Pepper Wreck consists of five
different types of ceramic wares, with only one almost-intact jar in the collection. None
of the variety present is surprising, and most of the sherds can be categorized in one way
or another. Almost all of the sherds examined by myself and Anthony Randolph were
classified as either stoneware or earthenware, and they are further distinguished by paste
color and glaze (where present). The categories are as follows: category 1 – buff-
pasted, brown glazed stoneware; category 2 – Tradescent jar stoneware fragments;
category 3 – gray to red bodied stoneware; category 4 – red bodied earthenware; and
category 5 – buff pasted earthenware sherds. While the actual number of fragments in
any given category will be listed, this number is not actually indicative of quantity, as
one large fragment can equal in amount multiple smaller fragments, and should not be
interpreted as anything other than a report of the findings from the excavation. What are
significant are the types of ceramics found, their origin, if it can be inferred, and what
this information reveals about Portuguese activities in Asia.
The only relatively intact jar recovered from the Pepper Wreck fits into category 1, buff-pasted, brown-glazed stoneware. Lot 3 is a small jar, measuring only 30 cm in height, with a basal diameter of 22 cm and a maximum diameter (around the shoulder) of 37 cm. Both the dark brown glaze and the buff-pasted body can be seen in figure 71. One lug handle remains intact near the mouth of the jar, which is finished with a rolled mouth rim – the jar has no neck. This jar is quite similar to some of the jars recovered from *Nuestra Señora de la Concepción*, a Manila galleon shipwrecked in 1638. Like Pepper Wreck lot 3, the *Concepción* jars (nine jars were classed as Type E from the

Figure 71: Pepper Wreck Jar 3. Photo by S. Brigadier snd A. Randolph.

Figure 72: South Chinese Storage Jars from *Concepción*. Rinaldi, “The Ceramic Cargo of the *Concepción*,” 440.
wreck) are small (ranging in height from 30 - 38 cm), with no neck and a mouth rim attached directly to the shoulders (figure 72). The paste is light buff in color, and the dark brown glaze covers the interior and exterior of the jar, excepting the mouth rim and the base, because the jars were fired stacked upon one another. Based on their size and shape, the jars from Concepcion are attributed to the kilns of South China by ceramic experts, and it is probable that the almost identical lot 3 from the Pepper Wreck is from the same region.³

Category 1 also contains 107 other sherds of various sizes and conditions. There were many different types of storage jars made throughout southern Asia from buff-pasted stoneware with a dark brown glaze, and without any indication to the form of a vessel, it is impossible to further categorize the sherds.

Category 2 consists of sherds from a specific type of southern Chinese stoneware used to store and transport water; today this class of ceramics is known as Tradescant jars. The name Tradescant comes from a man named John Tradescant who brought an example of this type of ware back from Asia with him in the early seventeenth century. Tradescant died in 1627 leaving his collection to his son John, who died in 1659 and bequeathed the curio collection to Elias Ashmole (of the Oxford Ashmolean Museum fame).⁴ Tradescant jars are characterized by a light buff-colored stoneware body with a vibrant green external glaze. The vessel exteriors typically bear motifs of suns, flowers, dragons, and phoenixes in applied relief over the entire external surface. The designs are glazed with a light yellow color, and occasionally aubergine purple accents are applied
to the green background. This class consistently has five lug handles and stylized motifs (see figures 73, 74 and 75).

The Pepper Wreck yielded thirty fragments of Tradescant stoneware, enabling a partial reconstruction of lot 84; the height of the reconstructed jar is 30 cm (figures 73 and 74). While the sherds comprising lot 84 have no external glaze surviving, they do have a light layer of dark glaze on the interior (see figure 74). Of the other fragments in the collection, several of them do have green glaze affixed to their exterior, and the relief decoration is present on all of the sherds in this category. Four well-preserved Tradescant jars were recovered during the excavation of the Manila galleon San Diego, shipwrecked in 1600. The example shown here is Inventory Number 1033, and is 25.5 cm in height, comparable to the size of lot 84 from the Pepper Wreck (figure 75).

The final category of stoneware, category 3, includes fragments with bodies ranging from gray to reddish-gray. Only four out of forty-three sherds survived with their glaze affixed – three sherds have an exterior black glaze and one has a greenish glaze on both the exterior and the interior. The pastes in this category tend to be roughly tempered. Based on this scant amount of information, an educated guess can be made that the sherds came from vessels produced anywhere along the South China coast to Vietnam, where stoneware storage jars were manufactured in Asia. It is possible that this category of sherds come from Martaban jars, produced in Pegu and Siam for export from Martaban. Martaban jars were characteristically made from dark red or pinkish-gray pastes and partially covered with a thick, lustrous, and irregular black glaze. They
Figure 73: Tradescent Jar Lot 84, Exterior. Photo by S. Brigadier and A. Randolph.

Figure 74: Tradescent Jar Lot 84, Interior. Photo by S. Brigadier and A. Randolph.

Figure 75: Tradescent Jar 1033 from San Diego. Desroches, Treasures of the San Diego, 245.
came in all sizes and were used for storing anything and everything aboard ships during the seventeenth century. Figure 76 shows examples of Martaban jars from *San Diego*.

![Martaban Jars](image)

**Figure 76**: Martaban Jars from *San Diego*. Desroches, *Treasures of the San Diego*, 235.

Category 4 begins the earthenware sherds found with the Pepper Wreck. This type encompasses the standard and prolific coarse-tempered, red-bodied family of fragments. Of the sixty-seven sherds of this variety found, only two had surviving glaze affixed to their surface, and in both cases the glaze was green. The sherds are primarily body sherds and vessel types could not be determined from them. Other than classifying them as generic redware, not much can be said about these remains.
The final category, 5, contains buff-bodied earthenware fragments. There are relatively few of these sherds, numbering only thirteen; two pieces have brown glaze attached to their exterior side and one has exterior green glaze attached. As with Categories 3 and 4, these sherds could be from any type of vessel, and in this case no educated guesses can be made with any level of accuracy.

JAPANESE TSUBA, OR SWORDGUARD

One of the most interesting artifacts from the Pepper Wreck assemblage is a Japanese tsuba, or sword guard. On the sword of a traditional Japanese samurai, the tsuba is a utilitarian element located above the handle to protect the hand from cuts during battle. Tsuka 211.01 (figure 77) is a cupreous disc 5.6 cm in diameter. The design is simple, with two openings and no surviving engravings or decorations on either side of the sword guard. During the Edo Period in Japan (A.D. 1600-1868) samurai were allowed to wear two swords at all times, a katana or long sword and a wakizashi or shorter companion blade. Tsuka 211.01 contains two cutouts, the larger would have secured the sword blade, katana or wakizashi, and the other would have held an accessory. Figure 78 shows the different elements of a seventeenth century Japanese samurai sword. In an example of seventeenth century wakizashi mounts from the British Museum (figure 79), the blade accessories are a pair of chopsticks (kōgai) and a utility blade (kokatana). The sword mounts pictured also include the hilt, scabbard, seppa (spacers), and habaki (sword collar). This style is typical of the Momoyama
Period (1568-1600), and as on *tsuba* 211.01, copper was a typical metal for *tsuba* composition – in most cases, though, the copper would be painted.

Several *tsuba* were recovered from the wreck of *San Diego*, and all twenty of them were made of some type of cupreous alloy. Like the Portuguese, the Spanish employed samurais as mercenaries. In the case of *San Diego*, the Japanese warriors were present aboard the ship specifically for the impending battle with the Dutch (the battle in which *San Diego* was sunk). The shapes of the *tsubas* from *San Diego* are quite varied and the designs range from the plain (like the Pepper Wreck *tsuba*) to those ornately cast in a pattern of flower petals. It is easy to imagine the character of *katana* and *wakizashi* differing as much as the personalities of the warriors wielding the weapons.

Japanese samurais, warriors serving a *Daimyo*, or feudal lord, have always held a reputation of strength, courage, and fiercely expert fighting prowess. They were highly
Figure 78: Elements of a Japanese Sword.
Delacour, Treasures of the San Diego, 218.

Figure 79: Wakizashi Mounting.
Photo from the British Museum, 1958.7-30.46.a-d.
sought as mercenary troops throughout the entire Asian sphere, and were in fact employed by the Portuguese at Malacca.\textsuperscript{9}

The strength and courage of the Japanese in arms is such that there is no nation whatsoever which would dare to invade Japan; likewise their self-confidence and pride is greater than that of any other people yet discovered, wherefore wheresoever they go they are universally esteemed for their courage, and have proved it in deeds. For this reason they are highly paid as mercenaries in all of these Oriental Kingdoms, because they always keep that contempt of death in which they are brought up, are very strong physically, and of a most daring spirit, they are justly reputed as courageous.\textsuperscript{10}

The \textit{tsuba} found with the Pepper Wreck could be an indication of any number of situations, with the following three being among the most likely. 1) The \textit{tsuba} could have been an Asian souvenir (with or without a blade) of a European merchant or sailor. There was one passenger aboard \textit{Nossa Senhora dos Mårtires} known to be returning from Japan, a Father Francisco Rodrigues, and there could easily have been more. It was quite common for a ship sailing the Carreira da India to continue on from Goa or Cochín to trade with countries as far east as Japan before returning to Lisbon, and sailors loved to collect mementos from exotic ports. 2) The \textit{tsuba} could have been attached to one of the sword blades of a Japanese mercenary en route to the Royal Court in Lisbon. In the early seventeenth century, the Court of Dom Manuel was one of the most dynamic in the world, drawing visitors from every part of the global Portuguese Empire.

"Ambassadors from Eastern courts attended his levees. The Shah of Persia and the kings of Java and of Siam sent him gifts. Here you might meet black monks of Ethiopia, envoys from Prestor John of Abyssinia, Arab pilots from the Red Sea, and Chinese
travelers picked up at Malacca.\textsuperscript{11} 3) The \textit{tsuba}, again with or without the blade, could have been purchased as an exotic trinket from the Far East intended for sale as a novelty in Europe.

BARBER-SURGEON’S MORTAR

Barber-surgeons played a role in maintaining the health of the ship’s compliment aboard any vessel. The climate and conditions under which both sailors and passengers lived were unavoidably filthy and cramped. These daily trials were compounded by a lack of fresh fruits and vegetables, constant dehydration, and physical and emotional stresses. The overall result was that sickness ran rampant at sea, often only the ship’s surgeon, with his arsenal of herbs and leeches, stood between a man and death. His odds of success were slim; on a run from Portugal to India a fifty-percent mortality rate among the ship’s inhabitants was not uncommon. There were special rations allotted to the sick, but more often than not those goods were kept by the officers for their personal consumption.\textsuperscript{12}

The Pepper Wreck site contained a cupreous, probably bronze, barber-surgeon’s mortar. In contrast to some other examples of mortars found from shipwrecks of the same period, the Pepper Wreck mortar (figure 80) is plain in appearance. Its overall height is 6.9 cm, the diameter at the mouth is 10.2 cm, and the basal diameter is 7 cm. There are two incised lines encircling the mortar just below the upper lip and four vertical handles stand out from the mortar sides. In figure 79, the dark areas that appear to be sections cut out of the mortar sides are actually shadows from the vertical handles.
Although this mortar is in a battered condition from its time at the bottom of the Tagus River, the bronze is fairly well preserved.

The best example of a barber-surgeon’s assemblage is the complete chest from King Henry VIII’s flagship, Mary Rose, that sank in 1545. Among its contents were lidded wooden canisters, ceramic medicine jars, field dressings, a pewter bleeding bowl, and a heavy mortar for mixing drugs.\textsuperscript{13} Mortars have also been found on several ships with dates contemporary to Nossa Senhora dos Mártires. Trinidad Valencera (1588), San Diego (1600), Atocha (1622), and Batavia, a Dutch VOC ship that wrecked off western Australia in 1629, all yielded cupreous mortars, and the Swedish warship Vasa (1628) carried a wooden mortar in its medical chest. In other words, mortars were a necessary implement for a barber-surgeon of any nationality and are regularly found with pestles in shipwreck assemblages (see figures 81 and 82 for examples of mortars.
and pestles from *San Diego* and *Atocha*). In the case of the Pepper Wreck, several pestles were found scattered about São Julião da Barra, but none with the wreck itself.

GAMING PIECES

In his contemporary sixteenth century account of an ocean voyage, Eugenio Salazar described the monotony of life aboard ship for the sailor and the passenger. Both of these inhabitants spent the long days sailing “through those cerulean, greenish-black realms, with their dark and fearsome terrain, without knowing if he moves at all from one place... he seems to see himself always surrounded by the same horizon.” Daily life for sailors revolved around the changes in the watch and the prayers chanted as the watchglass was turned. The majority of sailors kept two four-hour watches a day. While not on duty, sailors passed the time sleeping or hunting for some entertainment.
Their pastimes of choice included playing musical instruments, singing, dancing, gambling, reading, or fishing for sharks.\textsuperscript{17} Chess and checkers were the games of the officers and aristocratic passengers, while sailors played games of chance like cards or dice. In order to prevent soldiers and sailors from gambling away their last stitch of clothing, restrictions were placed upon the gaming that took place and strictly enforced.\textsuperscript{18}

Mementos of the gamblers, at least, were found on the Pepper Wreck in the form of gaming pieces – one chess pawn, and three wooden checker pieces. The chess pawn, lot 198.06, is made of bone or ivory, and has a height of 2.8 cm and a basal diameter of 2.3 cm (figure 83). The checker pieces, lots 71.01, 206.09, and 209.01, are also made of ivory and bone, and are of comparable size with diameters of 3.2 cm apiece. The checker pieces are dished on their upper surfaces (see example, figure 84). Similar checkers and chess pieces were also found aboard San Diego (figure 85).

Figure 83: Chess Pawn, Lot 198.06. Photo from CNANS.

Figure 84: Checker Piece, Lot 71.01. Photo from CNANS.
DECORATIVE ELEMENTS

As with any good shipwreck, the Pepper Wreck contained numerous cupreous bits and pieces. Some of these artifacts from the wreck are identifiable as decorative elements for clothing. Among the odds and ends were several copper rosette buttons and a bronze shield. Such large decorations and buttons for clothing were extremely popular as shows of wealth and status amongst upper class Europeans. The bronze medal of arms found with the wreck, lot 184.02, has rivets surviving on its back, indicating that it was thusly attached to its owner’s clothing (figures 86 and 87). The loops surviving on the back could also have been used to hold the shield as a medallion on a chain. The cupreous rosette buttons, of which nine were recovered from the site (figure 88), have thirteen lobes and appear to be of the same type as the rosette button
Figure 86: Bronze Shield, Lot 184.02, Top.  
Photo by S. Brigadier and A. Randolph.

Figure 87: Bronze Shield, Lot 184.02, Bottom.  
Photo by S. Brigadier and A. Randolph.

Figure 88: Cupreous Rosette Buttons, Lot 184.07.  
Photo from CNANS.

Figure 89: Cupreous Rosette Button from Trinidad Valencera.  
Flanagan, Ireland's Armada Legacy, 149.
found on the Armada wreck *Trinidad Valencera* (figure 89). The back of the *Trinidad Valencera* button is missing, leaving only a solder mark in its wake, but the backings have survived on the Pepper Wreck rosettes. On lot 184.07, it appears that the back slipped over a pointed post soldered to the button, something akin to a modern pierced earring backing. Figure 90, from the Kano Naizen Namban screen, shows a detail of a typical Portuguese merchant with large buttons adorning the front of his costume.

Figure 90: Large Decorative Buttons. Pinto, *Biombos Namban*, 39.
TRADE CORAL

Along with spices, textiles, and bullion, certain animal species became valuable trade commodities in the sixteenth century. Pearly nautilus, murex (prized for the purple color produced by their body glands), and various species of corals were all highly desired for jewelry manufacture. Coral is mentioned as a trade good throughout the empire, but it is not clear where the coral originated. It is listed among items shipped to Goa from Lisbon in one source, and in another source, it is mentioned as a trade item from Malacca. The latter source, Chang’s *Sino-Portuguese Trade from 1514-1644*, lists coral, both wrought and unwrought, as an item imported into China by the Portuguese, but it does not mention where it is imported from. Ultimately, whether it came from Europe, Asia, both, or elsewhere in the empire, coral was popular for jewelry, rosaries, and other types of ornamental decoration.

Several fragments of unworked coral were found with the Pepper Wreck. Items 171.01 (figure 91), 202.03 (figure 92) have the same coloration, and fragments 216.01 (figure 93), and 217.02 (figure 94) have the same surface characteristics. Coral piece 171.01 has a natural unworked roughness, whereas 202.03 actually appears to have vertical lines running down its length, whether natural or imposed is not evident, but they are not regular in their spacing. However, both items have a darker coloration in their crevices, with the tone lightening towards the edges. They have a slightly rosier cast to their “coral” color than 216.01 and 217.02.

Coral pieces 216.01 and 217.02 have a smooth finish, perhaps indicating that they have been subjected to some working. While their surfaces are even, neither
fragment appears to have been shaped into anything. The latter two pieces are significantly darker than 171.01 and 202.03, having a deep peach tone to their 'coral' shade. All four of the fragments are small (the scales are marked at one centimeter), and would have been ideal as elements of jewelry or decorative work.

Figure 91: Coral Piece 171.07. Photo by S. Brigadier and A. Randolph.

Figure 92: Coral Piece 202.03. Photo from CNANS.

Figure 93: Coral Piece 216.01. Photo from CNANS.

Figure 94: Coral Piece 217.02. Photo from CNANS.
SUMMARY

The artifacts discussed in this miscellaneous chapter all reveal different aspects about the activities of the Portuguese in Asia during the early seventeenth century. The ceramic assemblage illustrates the tendency for ships sailing from the trade routes of the Far East to use Asian stoneware storage jars rather than continuing to rely upon the traditional Iberian earthenware olive jar. The variety of the sherd types indicate that the Portuguese used what was available, instead of relying only on one type of jar.

The presence of a Japanese tsuha aboard the ship highlights the personal contact that the Portuguese had with not only the Japanese, but other Asian cultures in the region as well. Whether the tsuha indicates the presence of a samurai warrior aboard Nossa Senora dos Mártires or merely that of a katana or wakizashi, it does point to the tendency of the Portuguese to hire mercenaries from the Asian sphere to aid in their conflicts in the region.

The Barber-surgeon's mortar is another reminder of the human element of Portuguese trading activities. Sickness and death aboard ships was a constant presence and danger to be dealt with. It was up to the individuals to determine if the benefits of such a voyage outweighed the high risks they took merely by embarking. The cupreous decorative elements and gaming pieces again bring to mind the men who wore or used them. The same men who decided that the potential wealth and status to be gained from such a tremendously dangerous venture was worth the risk.

Finally the fragments of trade coral point to the variety and obscurity of many of the exotic luxury items that lured the Portuguese into India and Asia to begin with.
Their tiny size is a stark contrast to the enormous profits that trade in such items could yield. Moreover, to possess a piece of jewelry made from such an item would connect its owner to a culture half a world way, suddenly made tangible by a small, pink fragment of sea life.

In its entirety, the material presented in this Chapter is valuable as an archaeological foil to the historical records of the Portuguese East India trade. The artifacts retrieved from the Pepper Wreck all support the available historical evidence pertaining to Portuguese activities in Asia. From the cultures they interacted with to the dangers involved in the undertaking and the items they risked their lives for, these artifacts paint a vivid picture of the merchants and sailors who lived and died four hundred years ago.
NOTES

6 Ibid., 234.
7 *Wakizashi Mounting*. www.thebritishmuseum.ac.uk (The British Museum: Department of Japanese Antiquities, sixteenth century), 1958.7-30.46.a-d.
9 Bocarro, “Description of the City of the Name of God in China,” 34.
10 Ibid.
17 Ibid., 162.
22 Ibid., 62-3.
CHAPTER VI

CONCLUSION

The artifact assemblage from the Pepper Wreck is nothing if not extensive. Considering the dynamic nature of the wreck site at São Julião da Barra, it is a minor miracle that artifacts survived at all, much less intact like some of the flatware, both porcelain and pewter, and the southern Chinese storage jar. While it is true that the turbulent waters at the mouth of the Tagus River have eliminated the possibility of a meaningful stratigraphical analysis of the Pepper Wreck, the artifact assemblage can be analyzed regarding time frame. What artifacts should be aboard a Portuguese East-Indiaman returning home to Lisbon from India at the beginning of the seventeenth century? Moreover, what artifacts could be aboard such a ship? The entirety of the artifact collection excavated from 1996-1998 by CNANS was examined with these questions in mind. The objects discussed in this thesis were determined to be relevant to this study after extensive historical research into Portuguese trading activities during the sixteenth and seventeenth centuries.

Some of the artifacts from the Pepper Wreck not only fit into the temporal range immediately prior to 1606, when Nossa Senhora dos Mártires wrecked, they helped to create it. The dated astrolabe SJB III, and the kraak porcelain can be positively attributed to the early seventeenth century. The charting compasses, while having no absolute date, are typologically comparable to other pairs of navigational dividers from the turn of the seventeenth century. The cupreous rosette buttons also have a dated
parallel placing them in this time frame. The sherds of the southern Chinese storage jars, both the dark-brown glazed jar and the Tradescent jar, are examples of Asian stoneware known to be in circulation in the early seventeenth century.

The other artifacts from the assemblage that are discussed in the thesis fit the profile created from the established time frame of interest and the historical record. The pewter flatware, though unmarked and untraceable, is appropriate in this context. Stylistically it fits with the known data about pewter of the early seventeenth century. The fact that it is unmarked actually lends credence to the idea that it is of Portuguese origin, because Portugal was one of the only countries that did not rigorously enforce pewter regulations during that time period. Likewise, the presence of the Japanese tsuba, trade coral, and the barber-surgeon’s mortar all correlate with items that would have been aboard a Portuguese East-Indiaman, even considering that the tsuba and the coral were unexpected finds. In all, there is nothing in the Pepper Wreck artifact collection to indicate that the wreck is not Nossa Senhora dos Mártires. In fact, all the evidence thus far uncovered supports the theory.
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APPENDIX A

THE CATALOGUE OF ARTIFACTS EXCAVATED FROM SÃO JULIÃO DA BARRA FROM THE 1996-1998 FIELD SEASONS
INTRODUCTION

From 1996-1998 excavations by the Portuguese Centro Nacional de Arqueologia Náutica e Subaquática (CNANS) at São Julião da Barra unearthed thousands of artifacts from the Pepper Wreck on the bottom of the Tagus River. Everything from the excavation is included in this catalogue, though only artifacts that could have been aboard Nossa Senhora dos Mártires are discussed in the thesis.

The rocky point of São Julião da Barra, located conveniently near a sandbar, has been a treacherous point for ships and sailors for centuries. The heavy surge has thoroughly mixed the remains of shipwrecks to produce a site that yields fragments from modern cola bottles to sixteenth century majolica. The artifacts from the site likely to have been aboard Mártires primarily consist of the items photographed at the Museu da Marinha in Lisbon, and fall into the following categories: navigational instruments, porcelain dishes, pewter plates, and miscellaneous pieces (including Asian stoneware, coral fragments and gaming pieces). Within the context of this catalogue, none of these artifacts are highlighted, and all of the photographs are from the original documentation following their recovery from the site.

When compiling the catalogue, I discovered that some of the artifacts had a record and no photograph, some had been photographed then later disappeared, and some were affected by other recording incongruities. Therefore, the catalogue presents the artifacts in two separate sections. The first section includes all the artifacts that were photographed prior to the summer of 2000 or were photographed at that time. These artifacts are displayed with photographs and basic information (almost all have a scale in
the photograph, but none have been measured). The truly diagnostic artifacts are all discussed at greater depth in the thesis. The second section consists of a list of all the known artifacts, basic information about their material and identification, and whether they have or have not been photographed. Unless they are missing, all of the artifacts are either located at CNANS or the Museu da Marinha in Lisbon.
APPENDIX B

A LIST OF PORCELAIN FRAGMENTS FROM THE PEPPER WRECK ASSEMBLAGE
FIFTY-FOUR PORCELAIN FRAGMENTS FROM THE PEPPER WRECK

<table>
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<th>No.</th>
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<tr>
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<tr>
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<td>5.</td>
<td>18.16.02</td>
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<td>42.</td>
<td>172.03</td>
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</table>
APPENDIX C

THE PEWTER COLLECTION FROM THE PEPPER WRECK
Pewter Plate 148.01

Figure C-1: Pewter plate 148.01 before restoration. Photo from CNANS 1996-98 excavation

Figure C-2: Pewter plate 148.01 after reconstruction. Photo from Filine Castro

Form: Plate
Diameter: 210 mm.
Rim width: 22 mm
Rim ratio: 0.105
Depth: 34 mm
Weight: 295 grams
Rim type: 2a.
Well diam.: 166 mm
Thickness: 3 mm

Origin: Unknown

Description: Badly preserved, narrow plain rim with one reed on the outer edge, 21 cm in diameter, bearing no touchmarks. Some later restoration performed.

Touchmarks: None
Quality or Hallmarks: None
Ownership marks: None

Metal analysis: Not yet performed
Parallels: Unknown

Archaeological provenience: SJB2 - 1996-97 field season ref. 148.01.
Pewter Deep Dish 165.01

Figure C-3: Pewter deep dish 165.01, top.  Photo by S. Brigadier and A. Randolph

Figure C-4: Pewter deep dish 165.01, bottom.  Photo by S. Brigadier and A. Randolph

Form: Deep dish

Diameter: 283 mm

Rim width: 31 mm

Rim ratio: 0.110

Depth: 42 mm

Weight: 749 grams

Rim type: 4

Well diam.: 221 mm

Thickness: 2 mm

Origin: Unknown

Description: Fairly well preserved, narrow rim with one incised reed on the outer edge and another on the inner edge, 28.3 cm in diameter, no touchmarks, ownership mark: "M".  Found on a layer of pepper.

Touchmarks: None      Quality or Hallmarks: None      Ownership marks: "M"

Metal analysis: Not yet performed      Parallels: Unknown

Archaeological provenience: SJB2 – 1996-97 field season ref. 165.01.
Pewter Deep Dish 168.01

Form: Deep dish
Rim width: 27 mm
Depth: 30 mm

Diameter: 290 mm
Rim ratio: 0.093
Weight: 758 grams

Rim type: 1a.
Well diam.: 236 mm
Thickness: 2 mm

Origin: Unknown

Description: Fairly well preserved, narrow plain rim, 30 cm in diameter, no touchmarks preserved, ownership mark: "V".

Touchmarks: None
Quality or Hallmarks: None
Ownership marks: "V".

Metal analysis: Not yet performed
Parallels: Unknown

Archaeological provenience: SJB2 – 1996-97 field season ref. 168.01.
Pewter Plate 171.01

Figure C-7: Pewter plate 171.01, top.
Photo by S. Brigadier and A. Randolph

Figure C-8: Pewter plate 171.01, bottom.
Photo by S. Brigadier and A. Randolph

Form: Plate          Diameter: 212 mm          Rim type: 2a.
Rim width: 17 mm     Rim ratio: 0.080           Well diam.: 178 mm
Depth: 23 mm         Weight: 460 grams        Thickness: 2 mm

Origin: Unknown

Description: Fairly well preserved, narrow rim with one reed on the outer edge, 21.2 cm in diameter, no preserved touchmarks.

Touchmarks: None       Quality or Hallmarks: None       Ownership marks: None
Metal analysis: Not yet performed               Parallels: Unknown
Archaeological provenience: SJB2 – 1996-97 field season ref. 171.01.
Pewter Plate 171.02

Figure C-9: Pewter plate 171.02, top.  
Photo by S. Brigadier and A. Randolph

Figure C-10: Pewter plate 171.02, bottom.  
Photo by S. Brigadier and A. Randolph

Form: Plate  
Diameter: 215 mm  
Rim type: 4

Rim width: 23 mm  
Rim ratio: 0.107  
Well diam.: 169 cm

Depth: 19 cm  
Weight: 375 grams  
Thickness: 2 mm

Origin: Unknown

Description: Not very well preserved, but has since been reconstructed; with a narrow rim with one incised reed on the outer edge and another on the inner edge, 21.5 cm in diameter, no preserved touchmarks.

Touchmarks: None  
Quality or Hallmarks: None  
Ownership marks: None

Metal analysis: Not yet performed  
Parallels: Unknown

Archaeological provenience: SJB2 – 1996-97 field season ref. 171.02.
**Pewter Plate 205.01**

![Figure C-11: Pewter plate 205.01, top. Photo by S. Brigadier and A. Randolph](image1)

![Figure C-12: Pewter plate 205.01, bottom. Photo by S. Brigadier and A. Randolph](image2)

<table>
<thead>
<tr>
<th>Form</th>
<th>Diameter: 215 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rim width:</td>
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<tr>
<td>Rim ratio:</td>
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<tr>
<td>Depth:</td>
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</tr>
<tr>
<td>Weight:</td>
<td>300 grams</td>
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<td>Rim type:</td>
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<tr>
<td>Well diam.:</td>
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<td>Thickness:</td>
<td>2 mm</td>
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</table>

**Origin:** Unknown

**Description:** Badly preserved, narrow rim with one reed on the outer edge, 21.5 cm in diameter, bearing no preserved touchmarks.

**Touchmarks:** None  **Quality or Hallmarks:** None  **Ownership marks:** None

**Metal analysis:** Not yet performed  **Parallels:** Unknown

**Archaeological provenience:** SJB2 – 1996-97 field season ref. 205.01.
VITA

Sara R. Brigadier has recently moved to the beautiful state of Vermont. She received her Bachelor of the Arts in History at Birmingham-Southern College in Birmingham, Alabama in 1998. Sara is presently a research assistant, nautical archaeologist, conservation technician, and editor at the Lake Champlain Maritime Museum at Basin Harbor, Vermont. She is quite happily living across the street from the lake and next door to many cows.

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