

**AN ANALYSIS OF THE PORT ROYAL SHIPWRECK AND ITS ROLE
IN THE MARITIME HISTORY OF SEVENTEENTH-CENTURY
PORT ROYAL, JAMAICA**

A Thesis

by

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To Y.D.

ABSTRACT

An Analysis of the Port Royal Shipwreck and Its Role in the Maritime History of Seventeenth-Century

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During the 1989 and 1990 seasons of Texas A&M University's underwater archaeological field school at Port Royal, Jamaica, a shipwreck was excavated as it lay amidst the submerged remains of a 17th-century building.

There were several noteworthy construction features evident on this shipwreck. The majority of the extant structure of the vessel was constructed of white oak while the keel was of slippery elm, a species native to the eastern half of North America. The keel of this vessel had only simple chamfered upper edges, against which the garboards lay, and had at least one scarf joint, the flat of which was in the vertical plain. None of the frame elements (floors and first futtocks) were laterally fastened and the first futtocks were offset from the keel by a distance of over one foot.

The relatively small artifact collection recovered from the wreck included fasteners, rigging elements, a shot gauge, barshot, various sizes of iron and lead shot, tobacco pipes, glass stemware fragments, ceramics, and tools.

The artifact collection, various construction features, and a Carbon-14 date place the date of this vessel's construction in the last quarter of the 17th century; furthermore, an English or Dutch port of origin is suggested.

This vessel must have been a part of the large scale, intricate, and lucrative maritime activity conducted out of 17th-century Port Royal, Jamaica. Particularly, the Port Royal shipwreck bears some striking similarities to the H.M.S. Swan, a small Fifth Rate English warship of Dutch origin that was being careened, or repaired, at the time of the earthquake. The Swan was ripped from the carenage wharf by seismic sea waves associated with the earthquake, and carried into the sinking town where she came to rest in the midst of a Mr. Pike's house.

While this shipwreck cannot be positively identified, the excavation and recording of the wreck have nonetheless contributed information to the extremely small body of knowledge available concerning 17th-century ship construction.

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INTRODUCTION

Seventeenth-century Port Royal, Jamaica, was a vibrant trade hub existing by virtue of an accessible, spacious and deep harbor. Situated on the end of a sand spit on the south coast of Jamaica (Figure 1), the densely populated town was visited throughout the year by over one hundred merchant vessels hailing from Europe, Africa, North America and the Caribbean (Taylor MS:267). On June 7, 1692, disaster befell this active trade center when an earthquake rocked the island of Jamaica. Liquefaction of the sand bed on which the town was built caused 33 acres, or two-thirds of the town, to sink below the harbor waters (Hamilton 1984:12). As houses and buildings quickly submerged, tsunamis generated by the earthquake capsized many boats at their harbor moorings and washed others into the sinking town (Oldmixon 1969:324).

As a catastrophic site, the submerged remains of Port Royal constitute a valuable archaeological time capsule of 17th-century material. The site has been studied throughout the intervening centuries by several individuals including Edward Link (1960) and Robert Marx (1968); however, by far the most accurate archaeological work is that conducted over the ten-year period from 1981-1990 by the participants in the Texas A&M University (TAMU) field school at Port Royal directed by Dr. D.L. Hamilton (1984, 1988, 1992). During these 10 years, Dr. Hamilton and the students systematically excavated the remains of eight buildings at

This thesis follows the style and format of Historical Archaeology.

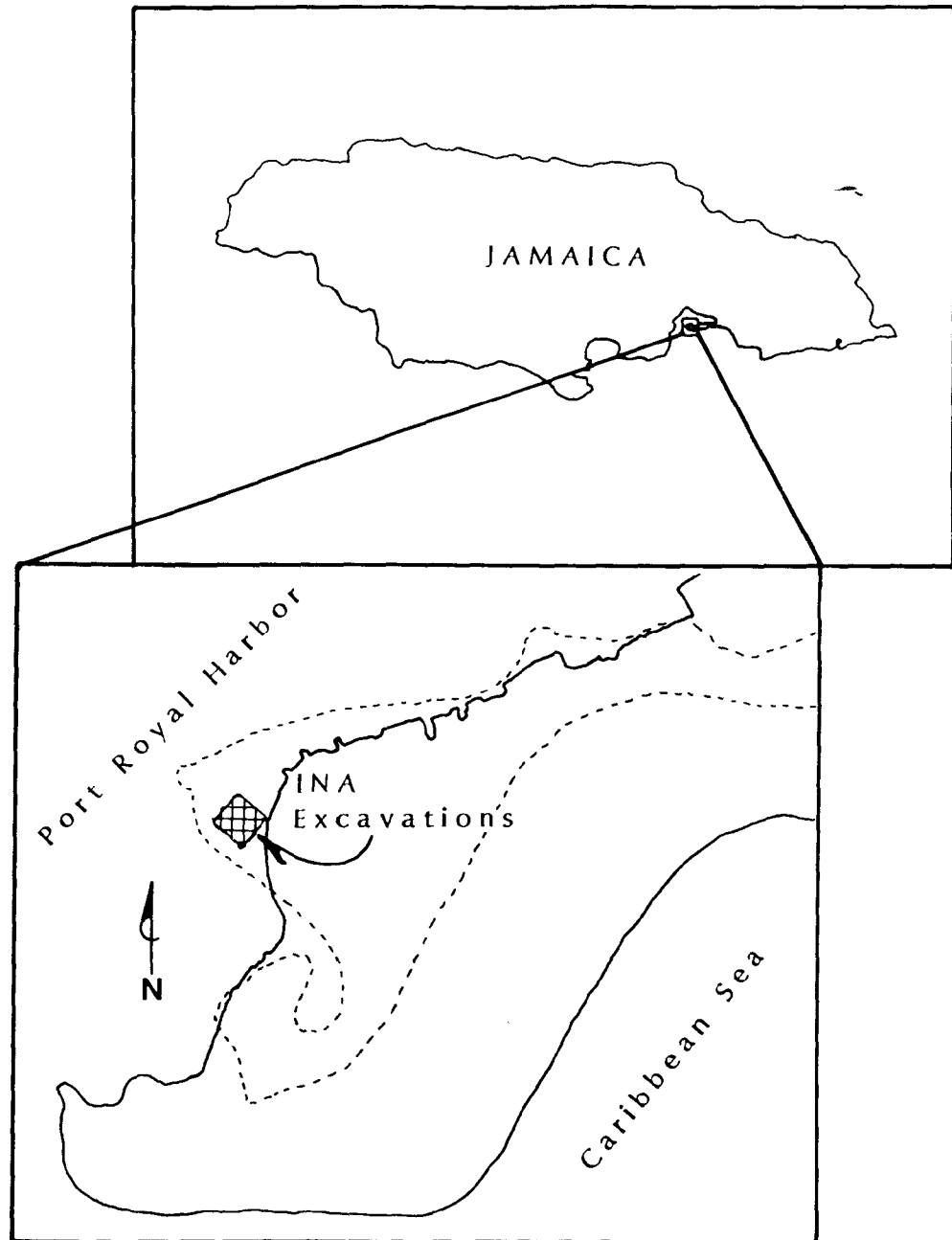


Figure 1. The Island of Jamaica and the Location of Port Royal
(Dotted line represents 17th-century coastline)

the intersections of Lime and Queen Streets (Figure 2).

During the 1989 and 1990 field seasons, a shipwreck was excavated as it lay amidst the remains of the last of these excavated buildings, the Building 4/5 complex (Figure 3). The significant dislocation of the southern walls of this building and the complete absence of debris from the front, or northern walls has led me to conclude that this vessel was washed into town during the earthquake by the accompanying seismic sea waves (Clifford 1991).

A relatively small amount of this vessel's hull remains. The keel and false keel assembly is preserved to a length of 74 ft. 2 in. Twelve outer hull planking strakes (nine to port, three to starboard), and portions of 33 frame components survive along the after two-thirds of the keel. Portions of the stern deadwood assembly also remain at the aft end of the keel. A small collection of artifacts including ammunition, animal bone fragments, hardware, and tobacco pipe fragments, was recovered from the wreck.

The Port Royal shipwreck is one of only three, or possibly four, 17th-century English vessels excavated in the Western Hemisphere. This fact stands in stark contrast to the well documented high level of sea-borne trade conducted between Europe, North America and the Caribbean during this time period (Dunn 1972; Pawson and Buisseret 1975).

During the 16th and early 17th centuries, the Spanish led in the colonization of the Caribbean region while, during the early decades of the 17th century, the Dutch dominated the seaborne trade in the area. With the seizure of Jamaica by the

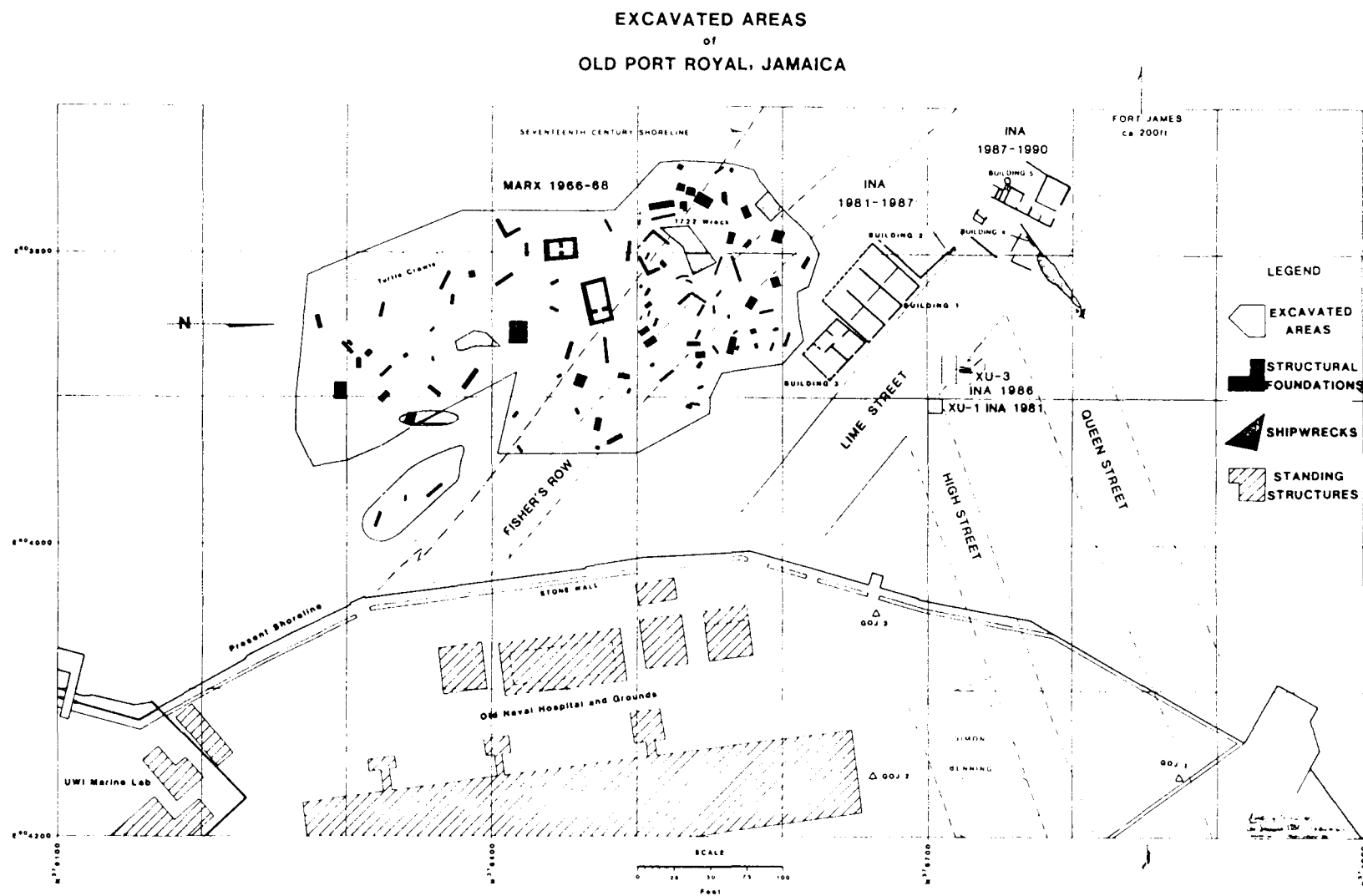


Figure 2. TAMU/INA Excavations at Port Royal, Jamaica

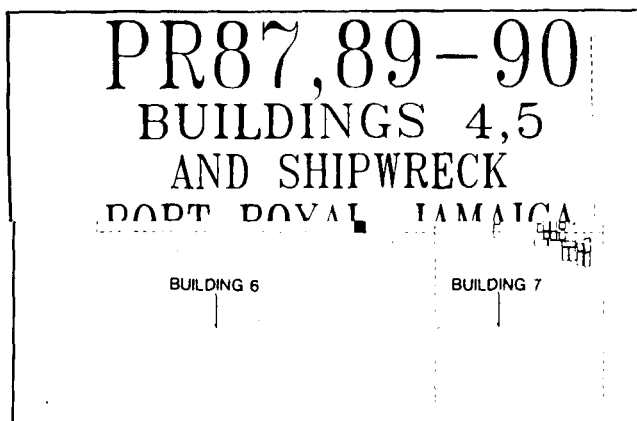
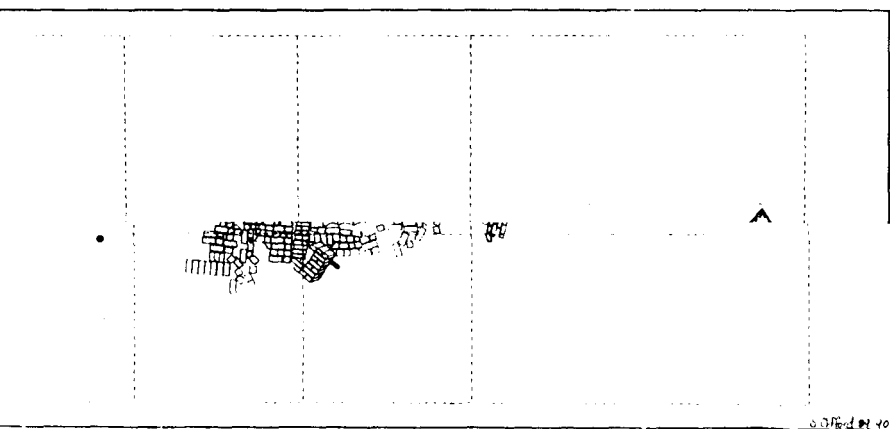


Figure 3. The Buil



Building 4/5 Complex and Shipwreck

English in 1655, however, the Dutch soon lost their trade supremacy. Jamaica was ideally situated within the Spanish Caribbean empire to allow pirates to plunder rich shipments of Spanish gold and silver headed for the mother country, and enterprising Englishmen to establish lucrative, although illicit, trade contacts with the Spanish colonies (Zahedieh 1986a). Pirates and merchants alike found Port Royal, with its exceptional harbor, to be an ideal base for their operations.

As the only legal port of entry on the island until the earthquake of 1692, Port Royal was also visited by large English merchant vessels of several hundred tons, which brought European home furnishings, fine cloth and foodstuffs in exchange for Jamaican sugar and tobacco. Smaller North American vessels brought salted cod and timber, and then would often make a run from Port Royal to the Bay of Campeche to illegally collect a cargo of precious logwood (dyewood). Port Royal also harbored many small sloops that were used to redistribute European goods throughout the Caribbean and for fishing and turtling.

In order to understand the role that the excavated vessel may have played in Port Royal's history, it is first necessary to consider the actions of the major maritime powers of the 17th century, the nature of maritime trade at Port Royal during this period, and the types of vessels that were plying the seas.

Study of pertinent literature and contemporary shipwrecks has revealed that relatively little is actually known about 17th-century ship construction techniques. What is often suggested as fact is instead supposition based on known 16th- and 18th-century techniques. Many authors also cite contemporary English Admiralty

the Isthmus of Panama. This area came to be known as the Spanish Main. They also seized control of the land extending from the Isthmus of Panama, through the Yucatan Peninsula, and up through Mexico; however, their New World forces were rarely strong enough to maintain absolute control over this vast area. The Spanish also established footholds in North America, founding the colonies of St. Augustine (1560) and Pensacola (1696) in present-day Florida.

While the Spanish were very adept at exploring and initially establishing colonies, they were not as successful as other European powers at supplying and defending these settlements (Zahedieh 1986a:572). Consequently, Spanish dominance of the Caribbean was effectively challenged and eclipsed by the English, who colonized St. Christopher (1623), Barbados (1627), Nevis (1628) and Jamaica (1655, after seizing the island from the Spanish); by the Dutch, who settled Saba (1632), St. Eustatius (1632), Curaçao (1634) and St. Martin (1648); and to a lesser degree by the French who colonized Dominica (1633), Guadeloupe (1635), Martinique (1635), St. Lucia (1650), Grenada (1650), and the western half of Hispaniola (present-day Haiti, 1664). During the early 17th century, these French settlements were particularly piratical in nature, preferring "...to trade by force and plunder." It was not until the last decades of the 17th century that the French Government turned its attention to the Caribbean to such a degree as to encourage peaceful, organized trade (Zahedieh 1986a:593).

By the second half of the 17th century, the English, Dutch and French colonies were actively exploiting the natural resources of the different regions, and

intricate, lucrative trade routes were established between the North American settlements, the West Indies, and the mother countries in Europe (See the following section, THE MARITIME HISTORY OF SEVENTEENTH-CENTURY PORT ROYAL, JAMAICA).

The establishment and defense of these myriad settlements depended almost entirely upon the wooden sailing vessel. We know surprisingly little about 17th-century watercraft, and this stands in stark contrast to the relative wealth of knowledge available on the colonization, industry, legal and illicit trade, piracy and riches that were present in the New World at this time. Also, it is clear that vessels of English, Dutch, French, Iberian and North American origin would have been plying the many trade routes along the Atlantic coast of North America, throughout the Caribbean and across the Atlantic to Europe; however, by far the greatest volume of accessible, pertinent, material from the 17th century concerns English shipwrightry.

ENGLAND

Beginning in the late 16th century, there was an increasing movement toward the written explication and codification of the arts of ship design and construction specifically as they pertained to English warship design. Three of the better-known examples of this trend toward the recording of shipwrights' knowledge are by men associated with the English Royal Navy.

Matthew Baker, the Royal Navy's first Master Shipwright, is believed to have collected much contemporary knowledge into a manuscript known today as

Fragments of Ancient English Shipwrightry which is dated to approximately 1586.

This manuscript contains drawings, plans and descriptive passages concerning many designs for various sizes of warships. Baker is also believed to have been the first English shipwright to lay out the lines of a vessel on paper and one of the first to record a method for establishing the tonnage of a sailing vessel (Abell 1948:38-39).

A second work, believed to have been authored between 1620-1625 by John Wells, Storekeeper at Deptford Yard (Salisbury and Anderson 1958:2) addresses more of the actual mechanics of building a ship. This treatise covers draughting, timber moulding and whole moulding, and actually provides a general step-by-step discussion of the construction of a vessel.

Finally, there is Anthony Deane's Doctrine of Naval Architecture published in 1670. This landmark work, which established general practices and trends followed into the 1800s, laid out the specifics for building a warship from each of the six Rates, from the 100 gun First Rate Ship of the Line to the considerably smaller 15 gun Sixth Rate vessel. His well organized work presents relevant geometry and mathematical principles and proceeds with an enumeration of all the components of a vessel, from keel to uppermost mast component. Deane also covered the gunning, provisioning and manning of these warships. It is generally held (Abell 1948; Lavery 1981) that Deane was one of the first to develop shipwrightry from an art to more of a science. Deane's volume would become the model for many of the later textbooks, which began to appear in 1711 with the

publication of William Sutherland's The Shipbuilder's Assistant (Abell 1948:53-56, 65).

While these works seem to demonstrate an increase in organization and systematization of Naval shipwrihty throughout the 17th century, it is important to note that individual shipwrights still retained almost complete control over the design and scantlings of vessels they were building. While the Admiralty specified the desired sizes and gun capacities for its vessels, it appears that shipwrights were not held to these requests. It was not until 1719 that shipwrights were made to adhere to scantlings lists dictated by the Admiralty, as the central administration slowly began to take an increasing amount of control over the warships it ordered (Lavery 1983:30).

In the mid 17th century, the Admiralty decreed that plans of all English warships were to be drawn up and preserved, and that the same was to be done for any vessels purchased or captured by the Navy (Chapelle 1935:18). This exceptional paper trail, coupled with the familiarity of the language, has provided the base for several present-day volumes (Lavery 1983 and 1984; Goodwin 1987) which deal with 17th century English Naval construction.

Characteristics of Seventeenth-Century English Warships

The principal goal of the English Admiralty throughout the late 16th and early 17th centuries was to build a vessel that was exceptionally large, strong and swift. It was eventually realized, however, that the optimum degree of all of these qualities could not be achieved in one vessel, so different classes of vessels, or

Rates, were established to accomplish different goals (Chapelle 1935:48). With the development during the First Anglo-Dutch War of the naval tactic known as the Line of Battle, the usefulness of these different Rates became even clearer. Rather than individual ships battling the enemy and employing the traditional tactic of "turning and boarding" (Lavery 1983:26), the largest, most heavily gunned vessels (First through Third Rates) were now used to establish lines of battle to present the enemy with a formidable line of broadsides. Some Fourth Rate vessels could be employed in these lines as well, while others would join the swifter Fifth and Sixth Rate vessels behind these battle lines, ready to act as couriers and to quickly intercept fireships sent to disrupt the battle lines (Lavery 1983:28).

Throughout the 17th century, the Rates were often reorganized and the size and gunpower of all naval vessels increased. By way of example, however, Table 1 lists average values for keel length, breadth by beam, depth in hold, and number of tons for the six rates of vessels in the Royal Navy as Anthony Deane described them in 1670 (Lavery 1981:104-113).

It is somewhat ironic to note that as the First and Second Rate vessels increased in size and as they were consistently overloaded with guns, they became unwieldy and far too expensive to man, outfit, and risk in any but the most dire of circumstances (Lavery 1983:34,54). Another shortcoming of the Admiralty throughout the 17th century was that it consistently ordered a number of vessels constructed according to particular specifications without first trying a single vessel of the type. Consequently, the Royal Navy consisted of a hodgepodge of vessels,

Table 1. Characteristics of the Six Rates of 17th-Century Warships

Measurements: ft-in	Keel Length	Breadth by Beam	Depth in Hold	Number of Tons	Number of Ships in Rate Category
First Rate	128	44-4	18-2	1327	6
Second Rate	119	39-4	16-4	980	10
Third Rate	117-2	35-4	15-5	787	20
Fourth Rate	101-2	30-4	13-4	508	33
Fifth Rate	82	25-2	10-2	275	16
Misc: Sixth Rates, sloops and yachts	53	17-3	7-3	91	21

several of which were poorly designed and very ineffective. The Admiralty demonstrated a remarkable inability to learn from its mistakes. It was not until the mid 1700s that formal feedback in the form of sailing reports was actively solicited by the Admiralty from those who actually had to operate these vessels (Lavery 1983:108), and it was not until 1811 that the English established a school for the teaching of naval architectural theory.

In general, the 17th-century English warship employed a moderately bluff bow running to a finely tapering stern and incorporated the "signature" English elements of a flat floor and rounded bilges at midships (Lavery 1983:150). Matthew Baker indicated the desirability of this shape by incorporating the aspects of a cod's head and a mackerel's tail into his vessel designs at the bow and stern respectively

(Abell 1948:34; Steffy 1988:123, Figure 29). These English hulls also had relatively deep drafts, a characteristic that was made possible by the very deep English harbors (Baker 1983:30).

The general construction sequence of the lower hull of one of these vessels was as follows. First, the keel sections were joined and a false keel was attached to the underside of the keel, usually with metal staples. The stem and sternpost assemblies were then joined to the bow and stern ends of the keel respectively. At this point, rising wood might be laid along the top of the keel, while deadwood was added at the ends of the vessel to build up the stem and stern. Floor timbers were then laid across the keel and fastened to the keel assembly with treenails or drift bolts. A keelson, running parallel to the keel, was then laid over the floors and fastened to the keel and frame assembly (Goodwin 1987:3-30,39,47,50,54-55). Outer hull planking was added, beginning with the garboards (the first planks on either side of the keel) and proceeded outward and upward. These planks were attached to the floors with iron spikes and wooden treenails.

As the planking reached the ends of the floors, the second components of the frames were added, these being the first futtocks. English vessels of the 17th century did not usually have laterally fastened floors and first futtocks. Instead, the first futtocks were attached only to the outer hull planking with iron fasteners, the shipwrights relying on the "bending action" of the exterior planking to assist in holding the frames together (Baker 1983:22). The planking and framing of the vessel would proceed in this manner up the sides of the vessel. Baker (1983:22)

does caution, however, that the actual framing of 17th-century vessels was much more irregular than a simple verbal description like the one above, or the perfection of the Admiralty ship models, would indicate.

Seventeenth-Century English Merchant Vessels

During the late 1550s and early 1600s, when the major European powers were expanding their trade routes to include Africa and the New World, one of the principle dangers they faced was from Moorish pirates - piratical groups of Muslims operating from bases in North Africa. Each of the European powers dealt with this threat in a different manner. The Netherlands either armed their merchant vessels or sent them out with a military escort, while the French chose to build small, swift vessels which they manned heavily. The English, however, opted for larger vessels that were essentially scaled-down warships.

It was not until 1677 that the specialization of English warship and merchant hull design advanced to a point where the two became distinctly separate. At this point, warships began to grow in size and strength while merchant hulls were being developed into more economical cargo carriers (Lavery 1983:47). Still, Lavery (1988:9) notes that "...[English] merchant ships were built to be defensible and ships over 100 tons received a subsidy from the government so that they could be taken over by the navy in wartime if necessary." Edward Barlow, an English seaman, provides an indication of this situation when he states that he served aboard the English vessel Maderosse, "...which was bound to Guinea both as a merchant and man-of-war..." during the years 1664-1665 (Barlow 1934:92).

Very little is known specifically about English merchant ship construction. This is particularly evident in Lavery's theoretical reconstruction of the early 17th-century 120 ton merchant vessel Susan Constant (Lavery 1988). For this work, he had to rely upon the largely theoretical/mathematical works of Matthew Baker, an anonymous shipbuilding treatise concerning a 500 ton warship; various dictionaries such as Henry Mainwayring's The Seaman's Dictionary (1644) and John Smith's Sea Grammar (1627); and, unpublished manuscripts found in the State Papers in the Public Records Office at Chancery Lane (Lavery 1988:9). None of these sources lay out a step-by-step construction scheme, nor do they provide a thorough scantlings list for a 17th-century English merchant hull.

Perhaps the most significant source of primary material is the wreck of the 17th-century English vessel Sea Venture, lost off Bermuda in 1609 (Adams 1985). Yet, while the remains of this vessel do provide information on lower hull construction, a relatively small amount of the vessel's hull is extant.

One can, only speculate that merchant vessels would have been constructed along the same general principles as an English warship, although with less internal strength and bracing, as the merchant vessel would have carried fewer and lighter guns. Given the fact that the design and the specifications of naval vessels of the 17th century depended so largely on the whim of a particular shipwright, one can only imagine the ways that 17th-century English merchant hulls strayed from the "rules" and practices that have survived in the written record.

THE NETHERLANDS

"...for Holland is a low land and full of rivers and creeks, so that a man cannot travel twenty miles in all Holland but that he will come to some place or other that leadeth into the sea (Barlow 1934:246)."

Given the low-lying, estuarine nature of much of the Netherlands, the inhabitants, by necessity, developed their shipbuilding industry at an early date. By the early 17th century, the Dutch were the "most enterprising and experienced sea-going people" (Bridenbaugh 1972:63); indeed, the 17th century is considered the "Golden Age" of Dutch history, when a booming economy was spurred and supported by exceptional maritime strength (Hoving 1988:211).

As Hoving (1988) points out, however, few primary sources or actual shipwrecks remain to illustrate how the vessels of this maritime power were constructed. One of the greatest archaeological treasures is the 17th-century Dutch warship Wasa that was recovered nearly intact from Stockholm harbor in 1961. The study of this vessel will illuminate the area of Dutch warship construction, and thorough publication of this vessel is eagerly awaited. It is important to remember, however, that she was a capital ship, a top-of-the-line vessel both extremely ornate and well appointed, and is perhaps, in this respect, not particularly indicative of the majority of Dutch warships, or of the merchant hulls that supported the Dutch trade empire. Another shipwreck, the Amsterdam not only dates to the 18th century but also remains to be excavated. Finally, information garnered from ship models suffers in quality due to several factors including the restoration and loss of some of the models (Hoving 1988:211-212).

Seventeenth-Century Dutch Ship Construction Practices

As in England, ship construction in the Netherlands had its chroniclers. Unfortunately, the two most significant, accessible works, Aeloude en Hedendaegse Scheepsbouw en Bestier written by Nicolaes Witsen in 1671 and De Nederlandse Scheepsbouwkonst opengesteld written by Cornelis van Yk in 1697 have yet to be translated into English. Hoving does, however, elucidate some specific points as follows:

Van Yk details ship construction practices that have been labeled by Hoving as the "Southern method", a method very similar to that employed by the English and French. A new vessel's keel, stem and stern posts were joined, and to this were added the garboard strakes. A series of master frames was then set along the keel at key points at the bow, stern and mid-sections. Several ribbands were fastened to these guide frames to define the shape of the vessel, after which all intermediate frames were added. It was not until all these frames were fit that the vessel was planked (Hoving 1988:216).

The method described by Witsen (the "Northern method") differs significantly from the previous one in that, once a vessel's keel, stem and sternposts were fastened together, all of the hull bottom planking strakes were affixed using planking tongs and chains and held together by multiple wooden clamps (Figure 6). At this point, a floor timber and two bilge futtocks were added at the widest point of the hull, after which the vessel was planked up through the bilges. All remaining

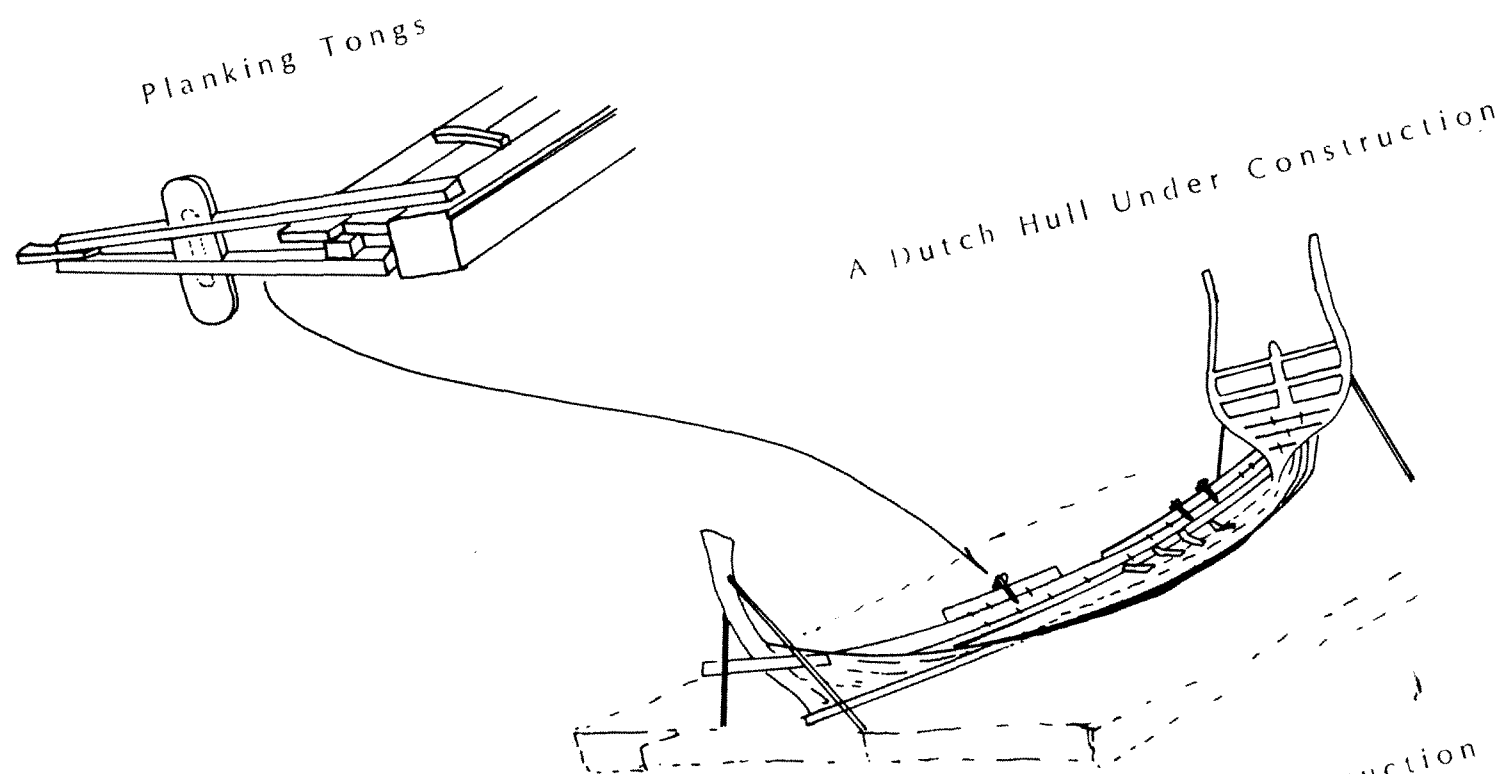


Figure 6. The "Northern" Method of Dutch Ship Construction
After de Groot 1980:139 and Hoving 1988:215

floor timbers and bilge futtocks were then added, followed by upper futtocks, ceiling, top timbers and the remaining planking (Hoving 1988:216).

By the late 17th century, most of the Netherlands' larger hulls were being built according to the method described by van Yk, although smaller vessels were constructed according to Witsen's method into the 19th century. Hoving (1988:217) notes that vessels built according to this latter method would have had a strikingly angled bilge; unfortunately, there is no extant model or picture that demonstrates such a bilge (Hoving 1988:217,218). Finally, it is important to remember that van Yk and Witsen are only the two best known sources for 17th-century Dutch ship construction. One should, therefore, be cautious of drawing broad generalizations concerning Dutch ship construction based solely on these volumes.

Characteristics of Seventeenth-Century Dutch Merchant Vessels

A significant determining factor of the overall shape of Dutch hulls was the extremely shallow nature of the majority of the waterways and harbors in the Netherlands (Baker 1983:30, Lavery 1983:26). Also, the Dutch built up their merchant fleet during the 15th and 16th centuries. During this period, before focus had shifted to trans-Atlantic trade routes, Dutch merchants were concentrating on bulk transport of cheap commodities such as salt, timber, and grain; and, they were conducting this trade primarily in and out of the Baltic where little defense was required. To maximize capacity and profit, they developed a merchant hull form that was much flatter-floored (Hoving 1988:220) and lighter (Lavery 1983:26) than anything the English would develop. The Dutch hulls also had fairly square sides,

bluff bows and were rigged for easy handling. Finally, these Dutch craft had little strengthening or space for guns. Consequently, despite the Moorish threat of the 16th and 17th centuries, many of these earlier characteristics remained, and therefore a comparison of a 17th-century Dutch vessel with a contemporary English vessel of similar length and beam would show that the Dutch vessel's carrying capacity would have been roughly double that of the English vessel (Davis 1975:10).

During the three Anglo-Dutch Wars (1652-54, 1665-67 and 1673-74), England captured a large number of Dutch vessels, perhaps due to the fact that Dutch merchant hulls were not well equipped to defend themselves, and were generally lightly canvassed and slow sailing (Crisman pers.comm.). From 1654-1680 nearly one half of England's merchant hull tonnage was composed of these confiscated hulls. When the wars ended and the Dutch hulls began to age, however, the English incorporated many characteristics of the vessels into a new generation of English merchant hulls (Davis 1975:11).

Seventeenth-Century Dutch Warships

The Dutch navy, like those of the other 17th-century European powers relied on the merchant fleet to significantly bolster its ranks during times of crisis. Consequently, naval hull construction was extensively influenced by merchant hull design. Not until 1664 did the Dutch order the construction of a large number of "purpose-built" warships. These vessels were, by necessity, shallower in draft and beamier than English warships. The Dutch vessels were also constructed with only

two decks. These vessels were, therefore, more stable than the English warships and could carry their lowest tier of guns higher above the water.

Dutch warships could also carry more provisions than their English equivalents (Lavery 1983:32). It is interesting to note, however, that this added capacity may not have always worked in favor of the Dutch. Edward Barlow, an English sailor and diarist from the 17th century noted that Dutch sailors were of much poorer health than their English equivalents. He attributed this to the fact that Dutch vessels undertook much longer passages than did English vessels and that Dutch provisions were often older than English rations. While Dutch vessels may have been able to store food for these long voyages, contemporary food preservation was less than adequate, and obviously adversely affected the men (Barlow 1934:242).

Finally, Barlow noted that the Dutch "...abound in shipping, but (their ships) are not so strong and well built as our English ships...(Barlow 1934:249)."

Undoubtedly, nationalistic pride must be taken into consideration; however, this is nonetheless an interesting insight into Dutch ship construction. This opinion is echoed by Lavery (1983:26) who states that Dutch vessels were more lightly constructed than English vessels and, as a result, were less expensive.

FRANCE

France also played a significant role in 17th-century maritime history, although little primary source material, either in the form of written records or shipwrecks, is readily accessible. As noted earlier, the French did not emphasize the

establishment of long-term settlements as did the English or the Dutch, and their incursions into the New World were never followed by large-scale immigration from France. Instead, the French focused on extensive trade with the native populations, as exemplified by their fur trading network throughout the eastern half of present-day Canada (Crisman 1988:129).

Specific construction characteristics of 17th-century French vessels are not well-known. Regardless of the lack of information concerning 17th-century French hulls, Lavery accords these vessels a fair degree of respect.

In the early decades of the 17th century, when Holland was recognized as the leading naval power in Europe, France ordered several ships from this nation. By 1645, however, the French had developed a fast, small vessel called a "frigate" which the English eagerly copied. After turning once again to the Dutch in the 1660s for more vessels, France rallied in the 1670s under Louis XIV. French shipbuilders, melding the better qualities of both English and Dutch vessels, produced a number of stable, well-constructed two-decked vessels that, like those of the Dutch, could carry their guns higher out of the water. Furthermore, the French did not over-gun their vessels as the English consistently did, a factor which also contributed to the French vessels' effectiveness. The French navy was so effective that it was able to defeat the combined forces of the English and the Dutch in 1690. The French did not capitalize on this victory, however, and their fleet was largely destroyed by enemy fireships in 1692. Rebuilding their fleet while under the

pressures of war, they emphasized the construction of smaller, faster cruisers and targeted their enemies' commerce (Lavery 1983:16-18,32,38-39,53,59).

Chapelle (1935:79) states that, in the late 17th century and into the 18th century the French were the leaders in naval architecture. With their emphasis on theory, and quality over quantity (Lavery 1983:81), the French built vessels that were faster, better constructed and larger for their class than the warships of other European nations (Chapelle 1935:79). One might suggest, after reviewing H.M.S. Hazardous' characteristics (she was built by the French in 1698, then captured by the English), that the lateral fastening of her frame elements, along with the substantial amount of framing itself, suggest that the French sought greater hull strength through these techniques sooner than did the English (Owen 1988:328).

IBERIAN PENINSULA

Spain and Portugal were particularly energetic and effective maritime powers during the 15th and 16th centuries. Diego Garcia de Palacio's Nautical Instruction :A.D. 1587 (1988) provides some indication of Iberian accomplishment. The four books that comprise the Nautical Instruction contain discussions of the earth and heavens; the use of the mariner's compass, quadrant, astrolabe and sea charts; the principles of celestial navigation; calculations of ship's proportions; rigging; personnel; and theories of warship attack and defense.

While the maritime strength of the Iberian nations enabled them to explore extensively and to establish many colonies in the New World, they claimed more land than they could effectively defend. This overextension, combined with multi-

and Navy Board records as an authority. While it is clear that these records are an invaluable source of information, it is often the case that the procedures outlined in, and conclusions drawn from, these records are not evidenced in contemporary shipwrecks. It is necessary to keep these cautions in mind while studying some of the most highly regarded works in the field including Peter Goodwin's 1987 The Construction and Fitting of the English Man of War 1650-1850, and Brian Lavery's 1984 The Ship of the Line Volume II: Design, Construction and Fittings. Goodwin (1987:15), for example, states that in the 17th-century, the floors and first futtocks of a warship were laterally fastened with copper bolts. However, not only does the H.M.S. Dartmouth, wrecked in 1690, not exhibit laterally fastened frame elements (Martin 1978:47), but also copper was not used below the waterline of vessels until the late 18th century (Dodds and Moore 1984:17).

As the majority of the work in the field of 17th-century ship construction concerns warship construction, Brian Lavery's 1988 The Colonial Merchantman Susan Constant, 1605 seems to address a serious need. While the book is informative, it nevertheless draws its information (necessarily) from documents and not from actual shipwrecks.

The most valuable comparative information comes, therefore, from rare examples of archaeologically excavated contemporary wrecks such as the Sea Venture, an English immigrant vessel lost off Bermuda in 1609 (Adams 1985), and the H.M.S. Dartmouth, a fifth-rate English warship lost off Mull in 1690 (Martin 1978).

Shipwrecks from the 16th century such as the Highborn Cay (Oertling 1989a) and Molasses Reef (Oertling 1989b) vessels as well as those from the 18th century, such as the Boscawen (Crisman 1985), H.M.S. Charon (Steffy 1981) and the Betsy (Morris 1991), are worthy of study for comparative construction information.

Therefore, while the following overviews of 17th-century naval powers, Port Royal's maritime history, and 17th-century vessel types will give the excavated Port Royal vessel an historical context, the comparative analyses of artifacts and ship construction may give the vessel an identity. Should it prove impossible to establish the exact nationality or type of this vessel, the data concerning the Port Royal shipwreck will nevertheless be a valuable contribution to the small body of current knowledge pertaining to 17th-century ship construction.

AN OVERVIEW OF THE MAJOR SEVENTEENTH-CENTURY NAVAL POWERS AND THEIR SHIPS

The 17th century was a dynamic period of European conquest, colonization, and trade expansion in the New World (Figure 4). In North America, the English founded the colonies of Plimouth (1620), Massachusetts Bay (1630), Connecticut (1633), Rhode Island (1636), and New Hampshire (1679) in the North East; New Jersey (1664) and Delaware (1681) in the "Middle States" region; Virginia (1607) and Maryland (1634) in the Chesapeake Bay area; and North Carolina (1653) and South Carolina (1670) in the South. Meanwhile, the Dutch established the colony of New Netherlands, from New Amsterdam (present day Manhattan) to Fort Orange (Albany), as well as along the Delaware River, in the early 1620s. The French concentrated their efforts to the north, establishing trading (particularly fur trading) communities such as Port Royal (1604) and Quebec (1608) in the colony of New France (present-day Canada), and founding the coastal colony of Acadia, (Nova Scotia) in 1605 (Crisman 1988:129; Steffy 1988:107).

The European powers were also active throughout the Caribbean region (Figure 5). Iberian mariners first explored here during the 15th and 16th centuries, visiting most of the islands and establishing significant settlements on the eastern half of Hispaniola (the north coast of present-day Dominican Republic (1493), at Puerto Rico (1511) and Cuba (1515). The Spanish used these islands as stepping stones to their conquest of the South American mainland from the Orinoco River to

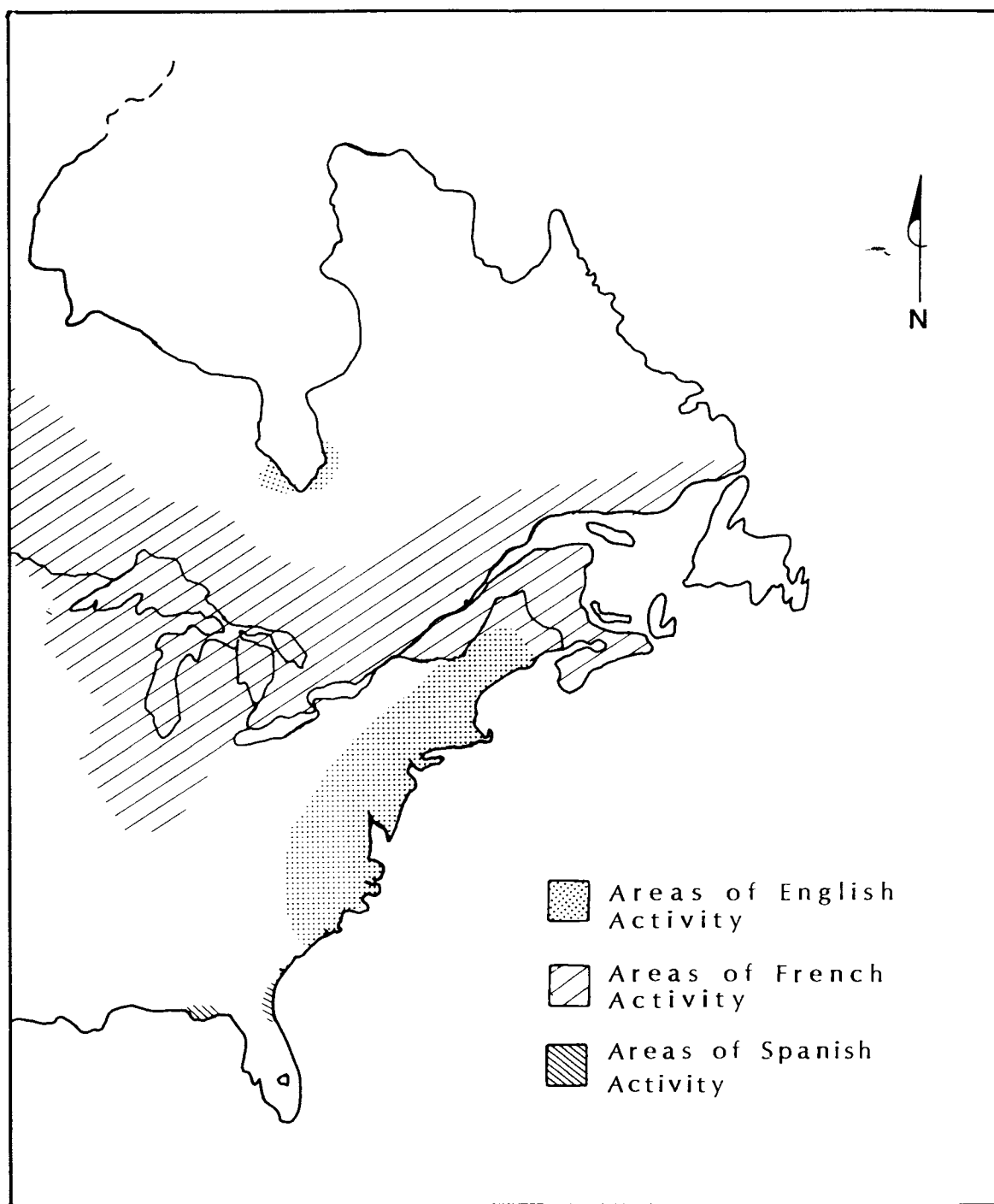
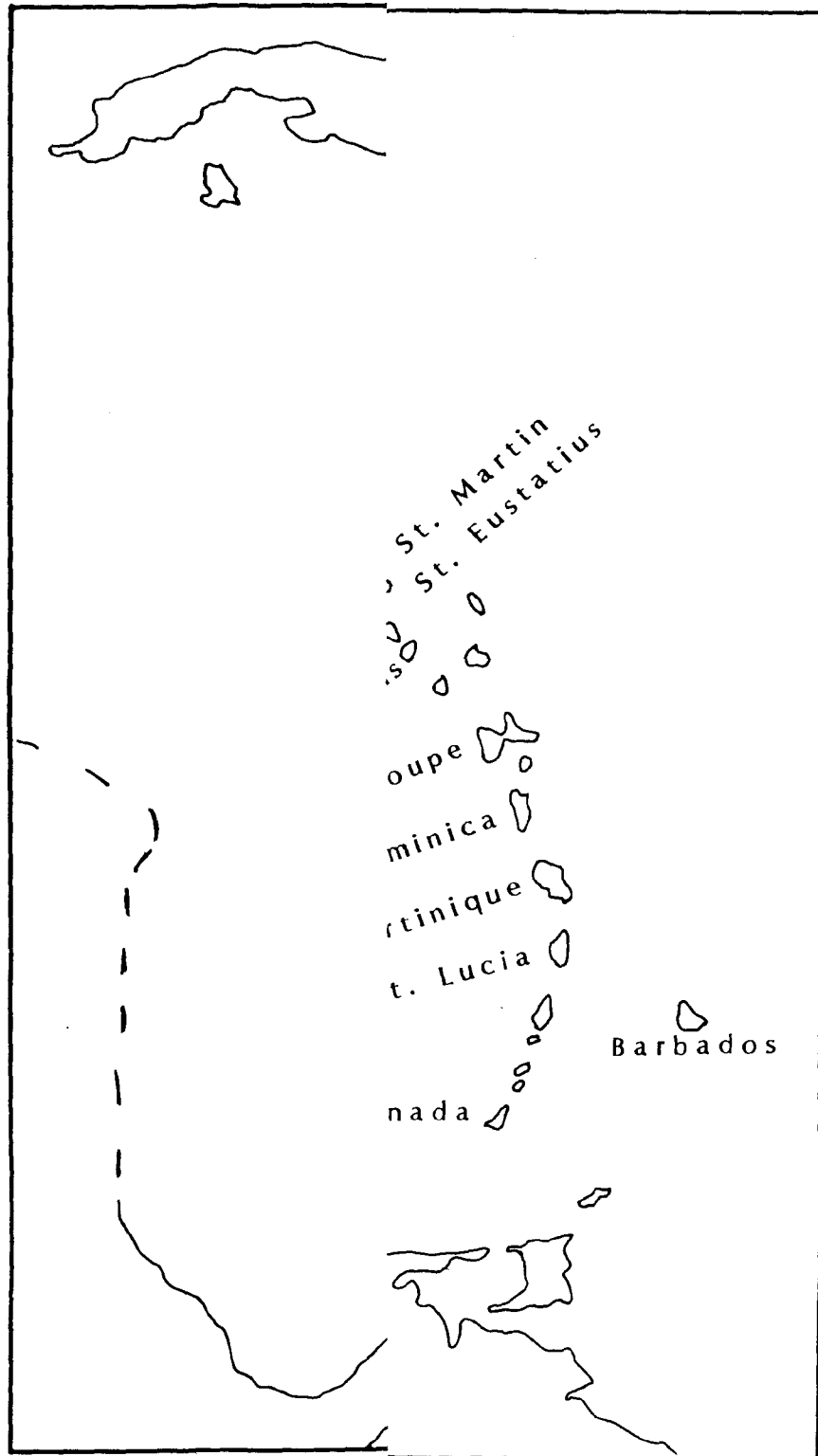


Figure 4. Areas of North American Colonization by European Powers
During the Seventeenth Century
After Eccles (1972:61)



Beginning in 1651, Parliament issued a series of Navigation Acts, designed to bring increased revenues into England, to bolster the English merchant marine and shipyards, and to prevent the Dutch from underselling the English in the colonies. The Navigation Act of 1660 decreed that only English ships could trade at English colonies and that, while most products could be exported freely, seven items were "enumerated" and therefore had to be carried directly from their sources to England or to another English holding. These enumerated goods included sugar, tobacco, cotton, logwood, indigo, and ginger (Bridenbaugh 1972:284; Claypole 1972:114). Furthermore, the Staple Act of 1663 stated that all European goods destined for the English colonies had to pass first through an English port (Bridenbaugh 1972:308; Steffy 1988:116). These various acts made mercantile shipping more expensive as well as more inconvenient, and invariably encouraged illicit trade throughout the New World.

The Spanish crown banned any trade between the other European powers and the Spanish colonies; however, it failed to adequately support these colonies itself. The flotas and galleones that, in theory, were to regularly supply the Spanish Caribbean colonies were extremely irregular. Consequently, the Spanish colonists became desperate for commodities that the Dutch and the English were eager to provide (Zahedieh 1986a:572).

While the Dutch dominated this trade with the Spanish colonies in the early 17th century, they made few serious efforts to establish colonies in the West Indies (Goslinga 1971:55,65). They were eclipsed by the English shortly after the

establishment of Port Royal. If Jamaica was ideally suited for plunder and piracy, it was also ideally located for illicit trade with the Spanish Caribbean settlements. This trade would prove to be an early and long-term source of wealth for Port Royal and for Jamaica as a whole.

Port Royal merchants readily supplied eager Spanish clientele in Cuba and the Spanish Main with European linen, silk, ironware, and liquor (Zahedieh 1986a:582). Perhaps the most lucrative aspect of this illicit trade, however, involved slaves (Rediker, 1987:60). The Spanish did not have access to slave markets on the African coast and therefore could not supply the Spanish Caribbean haciendas and plantations directly. The Spanish Crown, therefore, allowed vessels from Portobelo, Cartagena and Havana to travel to Port Royal and purchase slaves. Espying a " '...much easier way of making money...(Helyar in Zahedieh 1986a:591)' " than through sugar production a group of Port Royal merchants took to buying slaves at Port Royal and delivering them (with the protection of a convoy) to Spanish Caribbean ports where the English traders received immediate payment, including 35% interest, in cash. The frequent trips made in the "35% trade" also provided a most convenient means of smuggling other goods into Spanish ports (Zahedieh 1986a:589-592). Payment was not always made in cash, however, and Jamaican merchants frequently returned to Port Royal from the Spanish colonies carrying cocoa, hides, indigo, jewels, plate, hogs, horses and mules (Claypole 1972:127,129-30; see Appendix 3).

Finally, records show that English vessels traded at Hispaniola, where French merchants exchanged hides for English goods, and at Curaçao, where Dutch merchants traded salt, horses, and mules for Jamaican salt turtle, North American naval stores, and Madeira wines (Claypole 1972:136; Zahedieh 1986a:578).

THE LOGWOOD TRADE

The trade in logwood deserves special mention due to its illicit and highly dangerous nature. Logwood is a tree that grows in the swampy Yucatan lowlands, such as the coastal regions bordering the Bay of Campeche and the Bay of Honduras (Figure 8). The heartwood of this tree, when placed in water, would turn the water inky-black. When ground up, boiled and treated with alkali, the heartwood could produce shades of blue, purple, gray, green or black. Therefore, logwood (or dyewood) was considered a valuable dyestuff and became an important trade good. The economic value of logwood is illustrated by the fact that in 1671, 2,000 tons of logwood was worth £40,000 which, at the time, was four times the value of Jamaica's sugar exports (Zahedieh 1986a:585). It is estimated that 2,000 tons of logwood is equivalent to 60-70 shiploads. This estimate is based on Zahedieh's figures for ships trading at Port Royal from 1686-1688. These figures suggest that the average load of logwood delivered by a single vessel was 30 tons (Zahedieh 1986a:577, Table 1). Therefore, 2,000 tons, divided by an average load of 30 tons, suggests the figure of 60-70 shiploads. This figure coincides well with Bridenbaugh's comment (1972:341) that many small vessels plied the logwood routes. The specific example Bridenbaugh gives is of a 30 ton vessel.

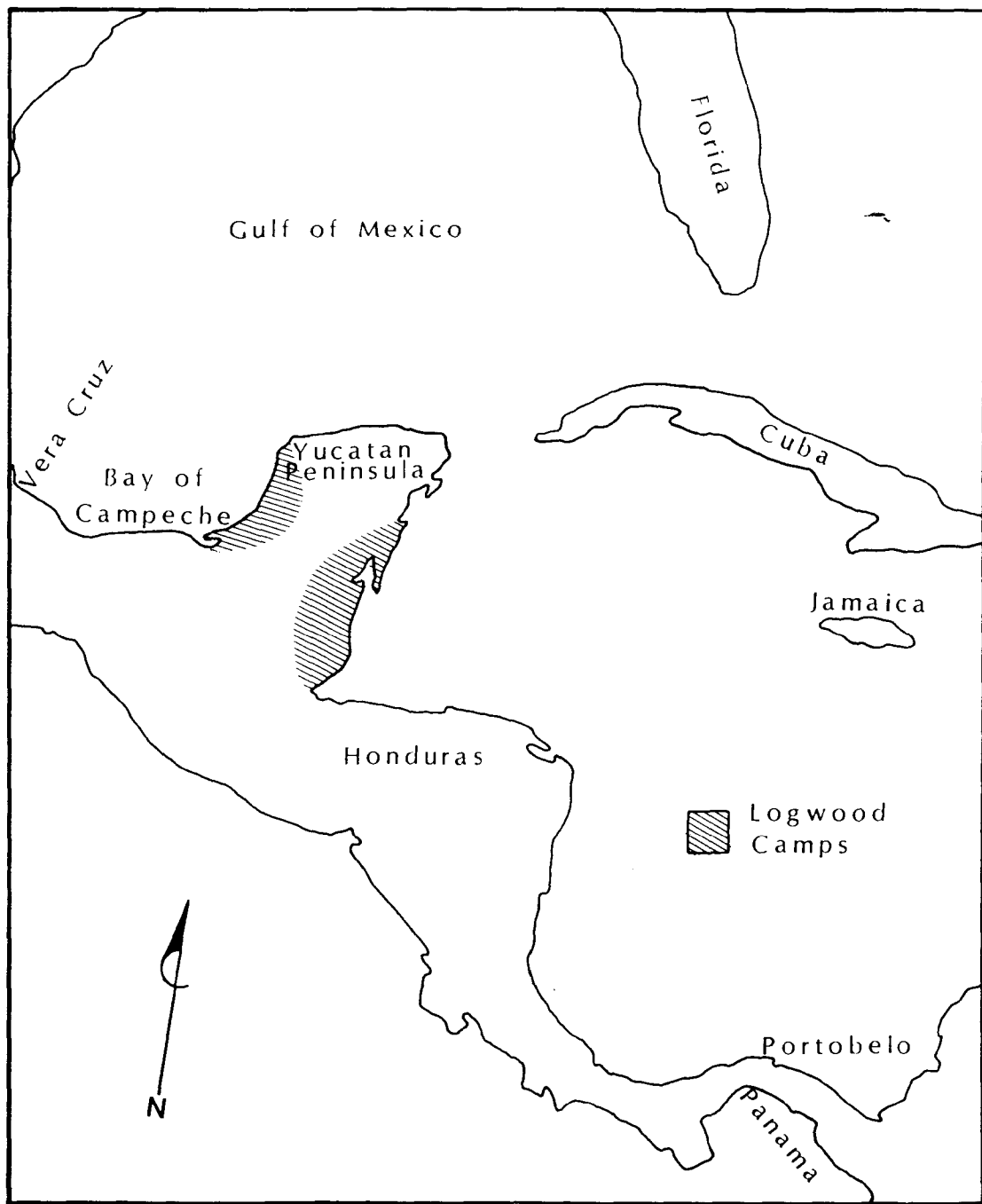


Figure 8. Logwood Harvesting Areas
(After Pope 1977: xv-xvi)

The danger of the logwood trade was twofold. First, logwood grew in a "war-zone" area, as Campeche and Honduras were claimed by Spain. English sailors caught loading the wood were often enslaved by the Spanish (Rediker 1987:159). Second, although logwood was an enumerated good and therefore subject to English import taxes, English rule didn't extend far enough into the Caribbean to effectively regulate the trade. The merchant vessels and makeshift logging villages were therefore subject to sporadic English raids. Thus, due to the inherent danger of the voyage, sailors could command much higher wages for the Jamaica to Campeche run than for the voyage from Jamaica to England (Rediker 1987:139).

Given the remote nature of the logwood ports, "far from the watchful eyes of English inspectors" (Rossano 1988:24), logwood traders could easily circumvent English merchant strictures imposed under the Navigation Acts concerning enumerated commodities. Merchants would stop off at Jamaica to and from Campeche or Honduras. This way, the records would show an arrival at, and departure from a sugar island, rather than a wood coast (Rossano 1988:20).

It is known that the logwood route was highly traveled, particularly by New England vessels and to a lesser degree by Port Royal vessels. In the 1680s, 30-35 ships with logwood cargoes were cleared through Jamaica each year. As a large amount of the logwood trade was illicitly conducted, however, these figures may be far from complete (Rossano 1988:20).

THE JAMAICAN SLOOP FLEET

All of the above forms of contraband trade were, by necessity, usually carried out in the smaller, less accessible harbors and creeks of the various islands (Zahedieh 1986b:218). Great efforts were made to avoid the Spanish guarda-costas who would seize any English vessel, whether it was an "innocent" fishing vessel or a contraband trader. Despite their best efforts to elude the Spanish, it is possible that 300-400 Englishmen were held captive by the Spanish in the Indies in 1680 alone (Zahedieh 1986a:585).

Port Royal was the base for a sizeable fleet of small trading vessels, or sloops. This fleet grew in size from 40 vessels in 1670 to roughly 100 vessels by 1689 (Zahedieh 1986b:218). As these vessels were fairly shallow, small, swift, and maneuverable, they were ideally suited to elude Spanish vessels and to enter small, difficult harbors. In response to the danger of the guarda-costas, the typical Jamaican sloop conducting a contraband trade run was heavily armed and manned by a crew three times its regular size. Furthermore, these crewmembers could expect a wage of 45 shillings per month, significantly higher than the 20-30 shillings per month wage of a naval seaman or a plantation worker (Zahedieh 1986a:586). Clearly then, illicit trade ventures decreased the potential plantation workforce as did piratical ventures.

LEGAL MARITIME TRADE AT PORT ROYAL, JAMAICA

While pirates were off plundering, and illicit traders were slinking around at night, a tremendous amount of legal trade was conducted each day at Port Royal,

largely due to the port's excellent, commodious harbor and to the fact that, until 1692, Port Royal was the only legal port of entry on Jamaica for overseas trading vessels (Claypole 1972:95).

For the Jamaican planters, overseas trade was a necessity. Unlike the planters of North America, those of the Caribbean depended upon outside contacts for their very survival. Essentials (that is, for a reasonable quality of life) such as clothing, household furnishings, and foodstuffs were brought to Jamaica in exchange for sugar, indigo, and cocoa (Dunn 1972:207; Taylor MS:266). Therefore, "the history of Port Royal's economic development is above all the history of her traders; the heart of [the town's] prosperity lay in long-distance trade" (Pawson and Buisseret 1975:63). Jamaican merchants imported products from England, Africa, North America, Ireland, and from other ports in the Caribbean. Many of these goods were in turn re-exported, with European goods being traded throughout the Caribbean and Caribbean goods being carried back to Europe. Port Royal's overseas trade hit its zenith around 1688, suffering somewhat thereafter due to the War of the League of Augsburg, fought between England and France, which began in 1689. Subsequent disasters such as the 1692 earthquake and, later, fires and hurricanes prevented Port Royal from ever regaining the prosperity it enjoyed in the late 1680s.

TRADE GOODS IMPORTED TO JAMAICA, AND THEIR SOURCES

England

One aspect of Jamaica's trade with England was that involving the importation of black slaves from Africa via the Royal African Company. This English firm was granted a monopoly on the slave trade by the crown. The official monopoly by no means prevented private interests from carrying out illicit slave runs and there is evidence that sugar planters often joined with the illegal slavers in defiance of the Royal African Company (Dunn 1972:157). Consequently, the royal monopoly had effectively been broken by the private "interlopers" by the year 1689, when it was officially revoked (Dunn 1972:231).

The slave trade grew in accordance with the growth of the sugar industry. Commercial statistics indicate that from 1671 to 1684 Jamaica imported 1,500 slaves per year (Dunn 1972:170). This number increased to 1,700 during the years from 1686-1691 (Pawson and Buisseret 1975:66). One should keep in mind that this figure only reflects the number of slaves legally brought to Jamaica aboard English vessels. The slave cargoes of private vessels that eluded port record-keepers must have contributed significantly to an overall total.

A slave vessel generally began her voyage from England, fitted out to carry human cargo. She traveled to Africa, took on a cargo of slaves and sailed for Jamaica. There she unloaded, was refitted to carry general, non-human cargo (as described below) and after loading these goods she sailed for Europe (Claypole 1972:141).

Jamaica imported a wide variety of commodities directly from England as well. As common sense dictated, merchants shipped highly varied cargoes (relatively small amounts of many items, rather than a ship's hold full of one item) to lessen the risk of loss to an individual merchant. This practice also served to keep prices reasonable by preventing a large quantity of one item from flooding the market upon delivery (Dunn 1972:209). The variety of these imported goods included foodstuffs, alcoholic beverages, naval stores, arms and household goods. Specifically these included:

Food: bacon, beef, pork; oats, peas, rice; fruit; biscuits; butter, cheese, flour, oil

Drink: beer, brandy, canary, cider, claret, sherry, port; Madeira, Malaga and Rhenish wines

Naval Stores: canvas, cordage, pitch, tar

Arms: muskets, pistols, gunpowder

Household Goods: bricks, candles, cart-wheels, cloth (linens, camlets, Oznabriggs, taffetas, canvas and lace), clothing, earthenware, furniture, glass, grindstones, iron pots, nails, pipes, ploughs, silks, soap, stills, tin ware

(Dunn 1972:209; Pawson and Buisseret 1975:67; Taylor MS:266; Jamaica Public Archives, Probate Inventory of Samuel Allann, Vol.2 Fol.164).

An example of an import cargo from England is that brought to Port Royal from Bristol, England on board the Friendship in 1671. This single cargo included

beer, rum, wine; flour, oil; clothing; earthenware, glass, tinware; guns, powder, shot; pitch, tar and pipes (Dunn 1972:208; See further examples in Appendix 1).

New England

In the late 1600s, Jamaica received by far the highest amount of trade goods from England. The second highest amount of goods came from New England (Pawson and Buisseret 1975:64). Dunn (1972:210) makes the following distinction between the goods from these two areas. Whereas a large percentage of English trade goods were high quality items brought in for the "master class," New England goods were somewhat cheaper and of average quality and were therefore accessible to the majority of tradespeople and slaves. The steady supply of staple products from New England was a mainstay of Port Royal's economy. Jamaican merchants complained however that the New England traders " 'never bring any servants or will take off any goods, but in exchange for their fish, peas and port, carry away our plate and pieces of eight' (Pope 1977:287)."

A wide variety of items, most notably fish, vegetables, and wood products was imported from New England. Specifically these items included:

Food: ale-wife, salted cod, mackerel, oysters, salmon, sturgeon; mutton, pork; apples, cabbage, corn, cranberries, garlic, onions, peas, quinces; butter, cheese, flour, honey

Drink: beer, cider, rose-water

Dry Goods: casks, chairs, deal-boards, shingles; staves, tubs; candles, grindstones, small-arms

Animals: horses

(Bridenbaugh 1972:291; Dunn 1972:210; Pawson and Buisseret 1975:67; Taylor MS:266)

The Katheryne was a 45 ton New England pink that traded regularly at Port Royal, bringing imports of timber, food and fish from North America (Pawson and Buisseret 1975:75). Other examples of New England vessels and their cargoes can be found in Appendix 2.

Ireland

Imports from Ireland generally consisted of foodstuffs similar to those from England, including barrels of salted beef and firkins of butter (Bridenbaugh 1972:318). Ireland also provided herring and salmon.

JAMAICAN EXPORTS

For all the above items, Jamaica primarily provided sugar and sugar products such as rum and molasses. Smaller amounts of cocoa, coconut, cotton, ginger, hides, indigo, limes, logwood, pimentos, tobacco, and tortoise-shell were also regularly included in export cargoes (Dunn 1972:208, 210; Pawson and Buisseret 1975:68).

One example of such an export cargo from Jamaica is that which was shipped from Port Royal to Bristol in 1685 on board the Samuel. This vessel contained 120 hogsheads of sugar, 13 bags of cotton, five small casks of indigo and 18 tons of logwood (Dunn 1972:208). See further examples in Appendices 1 and 3.

TRADE TO AND FROM JAMAICA AND THROUGHOUT THE CARIBBEAN

Jamaica's trans-Atlantic trade with England, Ireland and Africa followed a fairly regular pattern. Large European vessels would arrive at Jamaica in the late winter/early spring months in order to avoid hurricane season and in order to arrive at the peak period of sugar harvest. These 200-400 ton vessels would load up with sugar, cotton and various other Jamaican exports and return home. While Jamaica imported the highest tonnage of goods from England as mentioned above, this does not mean that more English vessels traded at Port Royal than did any other nationality of vessel. From 1686-1691, records show that 240 vessels arrived at Port Royal from England and Africa while 363 arrived from North America (Pawson and Buisseret 1975:65). Interestingly, however, over the same period of years, 309 vessels cleared Jamaican customs for England while only 130 cleared customs heading for the colonies (Pawson and Buisseret 1975:69).

The smaller (25-75 ton) vessels from New England were able to run more flexible routes (Pawson and Buisseret 1975:70). Less dependent upon a large return cargo of sugar, these New England vessels would arrive at Port Royal regularly throughout the year as their smaller hulls could usually be filled with whatever export items were available, whether the items were in season or not.

As indicated by the above figures, these smaller vessels would often not return immediately to New England with Jamaican goods. Their captains would instead load them with European goods acquired from the merchants of Port Royal for re-export throughout the Caribbean (Pawson and Buisseret 1975:69).

New England vessels were also joined in the Caribbean by small Jamaican merchantmen. All of these vessels would travel about, redistributing goods such as turtle (from the Cayman Islands), logwood, ebony, cedar and mahogany (from the Bay of Campeche) (Zahedieh 1986a:138), and European food and dry-goods (such as Oznabrigg, brandy and ivory) among the islands (See Appendix 3). The smaller size and fore and aft rigs of these New England and Caribbean boats made them far more maneuverable in adverse prevailing winds within the Caribbean (Davis 1975:8), as well as better suited to negotiate smaller, shallow harbors off-limits to the large trans-Atlantic vessels (Bridenbaugh 1972:333).

ENGLISH NAVAL PRESENCE AT PORT ROYAL

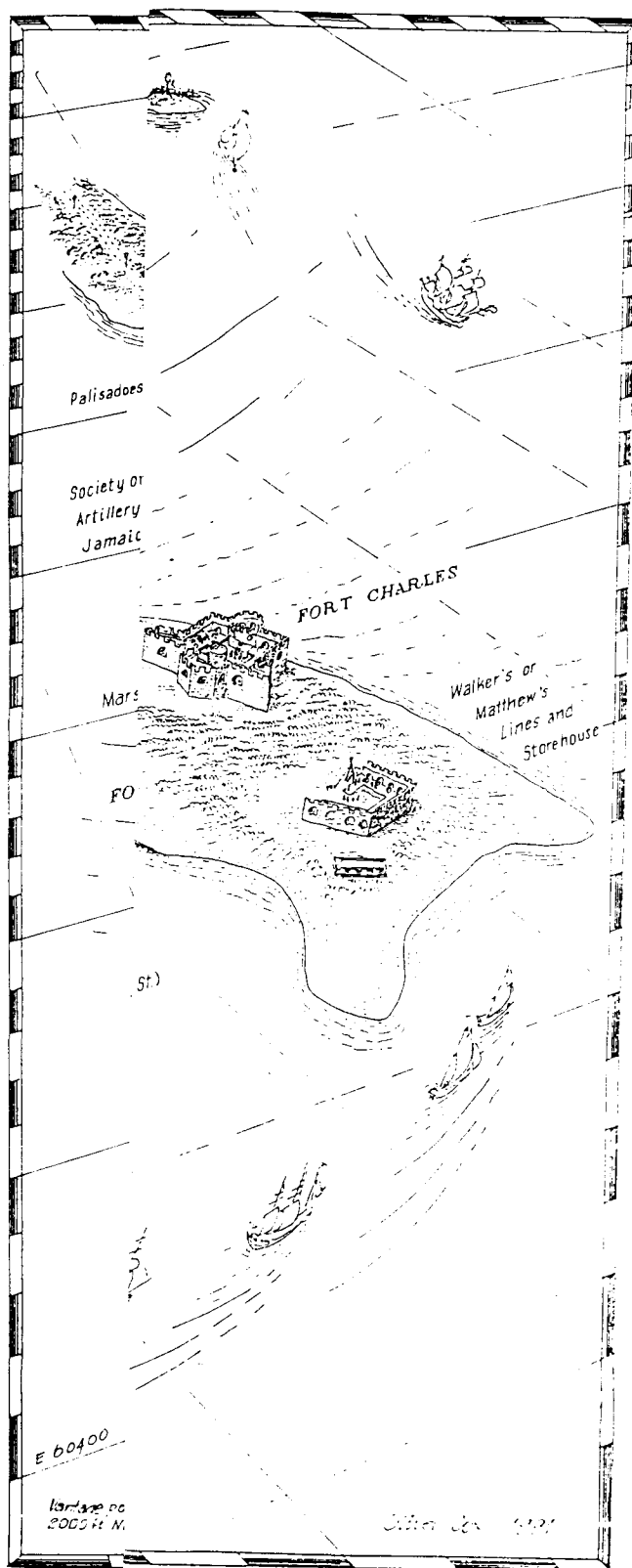
Port Royal was the center for another type of maritime activity in the 17th century. This was the constant, protective presence of English warships in Port Royal's harbor.

By 1660 the British had full control of the island of Jamaica and, from 1660 to the late 1680s, they set about fortifying the sandy spit of Port Royal until it was ultimately ringed by forts (Pawson and Buisseret 1975:39; Taylor MS:254-257).

The first guard ship from the English navy to be regularly stationed at Port Royal arrived in 1668. By 1690 there were several vessels permanently stationed there. It is noteworthy however, that these vessels generally stayed no more than a year due to the serious damage incurred by wooden hulls from the teredo worm that infests tropical waters (Pawson and Buisseret 1975:42).

While the ostensible duty of these vessels was to protect the city of Port Royal from hostile fleets, the naval vessels were generally not strong enough to offer anything more than defensive broadsides as back-ups for Port Royal's forts. Such action, however, never proved necessary. The vessels' other duties included shadowing hostile fleets, relaying messages, engaging pirate vessels, intercepting illegal slave traders as well as vessels engaged in illicit trade with Spanish America (Hornstein 1988:114), and salvaging shipwrecks, especially the cannon and shot carried in most vessels (Pawson and Buisseret 1975:49-55). When these vessels were not employed in any of the activities listed above, they returned to Port Royal and rode at anchor near the mouth of the harbor (Taylor MS:259).

Clearly, Port Royal was a quintessential port city during the 17th century by virtue of its peerless harbor which, even today, accepts the world's largest cargo transport vessels. Taylor (MS:258) describes a very strong wharf located on the north side of town "...by the watterside nex the Harbours..." at which ships of 500 or more tons could careen. The water was 6 fathoms deep at this wharf and continued so to Fort James and on toward the wherry bridge (Figure 9). From the wherry bridge to Fort Carlisle, however, the water was much shallower and there was a smooth beach area that provided an excellent location for shallops and other small craft to beach and load or unload their cargo. Edward Barlow (1934:331,344) also testified to the superiority of Port Royal's facilities when he noted that, in 1681, the 28 gun frigate Richmond, stationed at Barbados, was taken to Jamaica to be



Figurmission from O. Cox

careened and refitted. Also, because the harbor was "...fine smooth clear...", divers were able to recover a 400 ton vessel that sank in nine fathoms of water in the harbor. Barlow states that, in any other harbor, this vessel would have been lost.

Also, with a population of 7-10,000 in 1690, Port Royal was larger than Boston, Massachusetts, with its population of 7,000 (Bridenbaugh 1972:316; Hamilton 1992:40). Bridenbaugh asserts that, contrary to popular opinion, in the 17th century, Port Royal, not Boston, was the leading urban center of English America. The exceptional wealth of many Port Royal residents, as compared to their Boston counterparts, is evident in the comparison of the inventories of deceased individuals from the two towns (Thornton 1992:52).

Yet the intriguing aspects of Port Royal run far deeper than the wealth of a fair portion of her population. This town was not founded by a government-chartered group as was Jamestown, Virginia, or by a disenfranchised religious group seeking a safe place to practice their faith, as was the case of Rhode Island and, to a certain degree, Massachusetts. Instead, Jamaica was absorbed into the English empire in an offhand manner as a "consolation prize (Zahedieh 1986b:210)." When the potential of the island's location and harbor was realized, an atmosphere developed in Port Royal that was unique to New World settlements.

People ventured to Jamaica to make their fortunes and few intended to settle for a long period of time. The town became a hotbed of vice, greed, capitalism and enterprise. The traffic in and out of the port must have been staggering, as a mere one-quarter of all things exported from Port Royal were actual Jamaican products

(Zahedieh 1986b:216). The tremendous volume of trade carried out at Port Royal is further indicated by examples such as that of pewterer Simon Benning who had a stock of over 3,000 pewter plates at the time of the 1692 earthquake (Hamilton 1992:49). Furthermore, while trade in most other New World settlements consisted of an exchange of merchandise, Jamaican tradespeople were being paid in cash. This extraordinary focus upon trade and quick financial success appears to have caused people to be less concerned with other aspects of community living such as religion (Bridenbaugh 1972:377). At Port Royal, little prejudice was displayed, and all religions were free to worship. Bridenbaugh (1972:383-4) notes that members of the Church of England, Presbyterians, Roman Catholics, Quakers, Jews and Dominicans had individual houses of worship in the town.

The vibrance and energy of Port Royal must have been stunning. This highly over-crowded, over-developed sand spit bristled with well-stocked stores offering furnishings, foodstuffs and hardware, and swarmed with representatives of all the major European and native African cultures and religions: pirates; prostitutes; merchants; military personnel; sailors; children; and slaves, all stewing together under the hot Caribbean sun.

DESCRIPTIONS OF COMMON SEVENTEENTH-CENTURY SHIP TYPES

Having outlined the nature of 17th-century European and North American shipbuilding, and of the maritime history and commerce of 17th-century Port Royal, Jamaica, it is now important to consider the specific types of vessels that may have been present in Port Royal Harbor on June 7th, 1692.

According to port records, probate inventories, wills, and various other colonial records, a wide variety of vessels was employed in the legal and illegal seaborne trade throughout the Atlantic and Caribbean. The vessel types mentioned in such documents include ships, fluyts, frigates, ketches, barks, snows, sloops, yachts, pinnaces, caravelões, pinks and shallops.

Unfortunately, relatively little is known about the specific construction details of these various ship types. Rigging schemes are better understood as rigging is one of the more obvious aspects of a vessel and, consequently, was noted most often by painters and diarists.

Throughout the 17th-century, rigging remained fairly uniform, with most vessels from 80 to several hundred tons equipped with three masts and a minimal sail compliment consisting of a spritsail, foresail, and foretopsail; main course and maintopsail; and a lateen mizzen. Smaller coastal vessels would have had considerably varying rigs (Davis 1975:8). By the 19th-century, however, several rigging schemes had developed, and vessels came to be typed, and described, by the rigging scheme they employed (Baker 1983:ix).

In earlier centuries, however, vessel types had been distinguished by the size, form and construction of the hull (Baker 1983:ix). Unfortunately, few of these determining characteristics and construction details are clear to today's historian due either to the fact that such information was common knowledge at the time and therefore didn't merit mention, or to the fact that such details were trade secrets (Baker 1983:10). The situation is further muddled by transitional 19th-century information that falsely attributes 19th-century hull characteristics to earlier vessel types based upon the continued use of similar type names, which, by the 19th-century, only referred to rigging styles.

To the best of current knowledge, then, the above-mentioned ship types might have appeared as follows in the 17th century. Generalized profiles have been included to illustrate hull differences, but also to demonstrate how little is known about 17th-century hull forms.

SHIP (Figure 10)

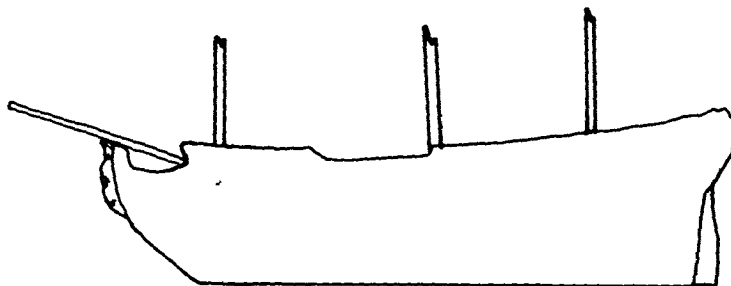


Figure 10. A Ship. After de Groot (1980:19, Ill.24).

The term "ship" generally applied to the "highest" form of sailing vessel during any particular period (Baker 1983:2). Baker (1983:17) describes the sheer plan of a 17th-century ship in the following manner, from bow to stern: a "ram-like structure" or beakhead extended forward from the upper portion of the stem; moving aft, the vessel had a short super-structure or forecastle, leading to a low midships area or waist; aft of the waist, and extending from the mainmast to the stern, was a higher superstructure, or sterncastle. The actual stern of the vessel was flat above the waterline and rounded below (Baker 1983:9).

These vessels had two or three decks, which probably did not run smoothly from bow to stern, but were stepped to accommodate cargo in a better manner (Baker 1983:20). Ships were also square-rigged with two or three masts.

Most large merchant vessels and warships were of this type, although size was not in itself a requirement, as the term can be applied to a 45 ft. long vessel as well as to a 130 ft. long vessel.

FLUYT (Figure 11)

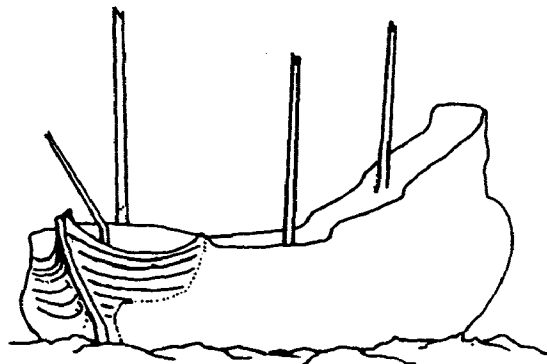


Figure 11. A Fluyt. After de Groot (1980:98).

The fluyt (or flyboat) was the cornerstone of Dutch seaborne trade supremacy from the end of the 16th century through the 17th century. Furthermore, one of the ways by which the English co-opted this supremacy in the mid to late 17th century was through the adoption of aspects of the fluyt's design into the English shipbuilding repertoire (Davies 1974:33; Davis 1975:11-17).

Davies (1974:33) describes the fluyt as "the most notable development in merchant shipbuilding in the later sixteenth century." The Dutch built these vessels with similar designs and scantlings, thus facilitating repair, especially overseas (Wilcoxon 1991:57).

Developed to accommodate the Baltic trade, the fluyt was a purpose-built cargo carrier, fitted with very few guns. Usually square-rigged with three masts, these vessels had rounded bows and sterns, broad, flat floors, and hulls that rose to their greatest width at the water line. From here, however, the sides of the vessel tapered sharply inward to the sheerstrake; this pronounced tumble-home gave the vessel a decidedly pear-shaped appearance when viewed from the stern (Wilcoxon 1991:57). These vessels were also designed to be narrower at deck-level midships than at the bow and stern; consequently, as calculations of various tolls involved the breadth of the vessel's deck amidships, fluyts essentially evaded a good portion of these tariffs (Hoving 1988:219).

Finally, fluyts ranged in size from relatively small vessels of 80-90 tons, to large cargo vessels of 600 tons (Wilcoxon 1991:57).

FRIGATE (Figure 12)

Figure 12. A Frigate. After de Groot (1980:76).

The term "frigate" is especially ambiguous. Lavery (1983:19) states that, in terms of English maritime history, it was only during the years 1645-49 that the term was used in its "pure" form, signifying a lightly armed, single-decked vessel with no forecastle. Square-rigged with three masts, these vessels were fairly small and fast, and had a length to beam ratio of 10:3, whereas beamier purpose-built merchant vessels such as the Adventure of Ipswich had length to beam ratios of 10:4 or a little more (Lavery 1988:10).

By 1650, however, the size and variety of frigates had increased (Lavery 1983:19-21) and the specific nature of the term became lost. Regardless, it appears that the general qualities associated with the term "frigate" included a fair degree of speed and more armament than was characteristic of purpose-built trading vessels such as the fluyt. While the lightly armed, capacious fluyt was the ideal cargo transport vessel, its bluff bow and stern and lack of significant armament made it a

slow sailing, vulnerable vessel. The frigate, however, was designed with a much sharper bow, a square-tucked stern, and a mid-section that more closely approximated a "V" in shape. While the frigate did not have the cargo capacity of a fluyt, it could carry enough cargo to be profitable while standing a much better chance of out-running or out-maneuvering an enemy (Reiss 1991:178-179). Frigates were popular for coastal protection; escorting merchant vessels; exploration; trading; and, privateering, especially in the Caribbean and along the North Atlantic coast (Boudriot 1981: 229; Wilcoxon 1991:59).

KETCH (Figure 13)

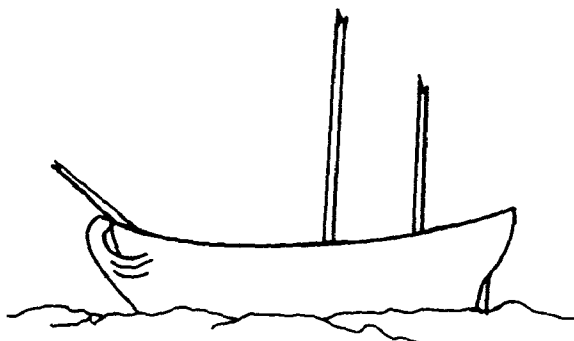


Figure 13. A Ketch. After Grant in Culver (1924:148).

Ketches, barks, snows, pinks, and sloops comprise a group of intermediate size trans-Atlantic and coastal trading vessels. In terms of expenses, it seems that these vessels were more easily owned and operated by the majority of 17th-century merchants than were the larger vessels discussed above, as Bridenbaugh (1972:323) discusses a group of business partners who owned "...several ketches and brigs...".

These intermediate size vessels also demonstrated more variations and adaptations which made them better suited to a wider variety of tasks and waterways than were the larger trading vessels.

For example, the basic elements of a ketch were its two masts and single deck. These vessels could, however, be double-ended or square-sterned, and square-rigged (for ocean work), or fore-and-aft rigged (for coastal and in-shore duty) (Baker 1983:122-137).

These relatively short, stoutly built craft were extremely versatile. Ketches were used both in shallow harbors and riverine environments (Baker 1983:121), as well as offshore in the fishing industry (Chapelle 1935:13). Also, it is clear from primary sources that these types of vessels were very popular on the trade routes between New England, Campeche, and Honduras, and throughout the Caribbean, as well as between Europe and the New World.

Appendix 4 contains the will of Isaack Winslow, a resident of New England, who died in Port Royal, Jamaica, apparently while on a trade run. In the will, he leaves his portion of the Ketch Pellican to his wife. Bridenbaugh's research also uncovered the record of Dutch seizure of a New England ketch off Surinam in 1666, and the record of a New England ketch of 30 tons plying the logwood route between Campeche and Port Royal in 1671 (Bridenbaugh 1972:169,340-341). Finally, the Bristol Port Records for the year 1682 list the two ketches Comfort and Vine as lading supplies and merchandise for trips to Nevis and Barbados (Bristol Port Records 1682:July 7, September 28, October 2,4,9).

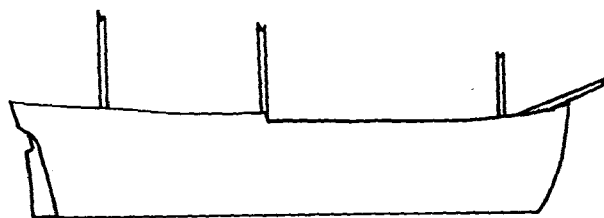
BARK (Figure 14)

Figure 14. A Bark. After Landström (1961:172).

Barks are also mentioned in 17th-century records. Bridenbaugh (1972:340) cites William Dampier, a young Englishman who traveled with others to Campeche in 1675 aboard a small Jamaican bark and a New England ketch. Furthermore, the 1687 Port Royal probate inventory of Francis Randolph indicates partial ownership of the bark Companion (Thornton 1992:218).

According to Baker (1983:95-98,137-139) and Chapelle (1935:15), small barks were very similar to ketches in that they could be either square-sterned or double-ended, and single-decked. It seems, however, that the majority of barks were larger than ketches and carried three masts (as the term "bark" was often used in place of "ship" or "vessel"), and were square-rigged on the fore and main masts and fore-and-aft rigged on the mizzen. Finally, some of the larger barks were constructed with raised quarter decks and lightly sheltered areas aft, thus heightening their similarity to ships.

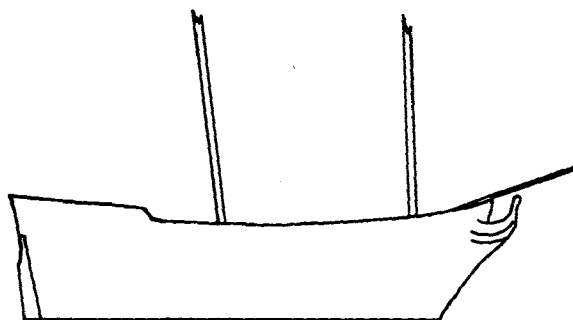
SNOW (Figure 15)

Figure 15. A Snow. After Botting (1978:41).

Snows appear in documents in the last quarter of the 17th century but aren't widely mentioned until the early 18th century. These vessels were also square-rigged with two masts, but had an additional fore-and-aft sail, or spanker, set on a separate mast about a foot abaft the main mast (Baker 1983:114). Very little is known about the snow's hull form, but Baker (1983:114-115) cites Szymanski who suggests that the English term "snow" derives from the Dutch "snauw" or snout and may therefore indicate that snows were constructed with sharper, thinner bows like frigates and yachts.

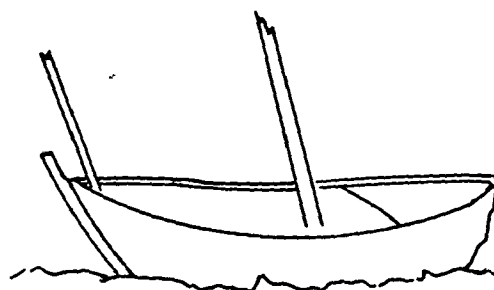
PINK (Figure 16)

Figure 16. A Pink-Like Vessel. After de Groot (1980:27).

Pinks approximated ketches in size and were constructed with sharp, narrow stems and false overhangs. These vessels did not have a distinguishing rig but, instead, used that of a ship or a ketch (Chapelle 1935:15). Pinks functioned in many roles, including offshore fisheries and coastal and western Atlantic trade, as indicated by their mention in contemporary records of Port Royal. The probate inventories of William Moore and Josia Warner, dating to 1687, mention partial ownership of the pinks New York and Samuel, respectively (Thornton 1992:218). Furthermore, the Bristol Port Records indicate that pinks plied the trans-Atlantic trade routes as well, as evidenced by the lading records of the pink Jon (also Jonn) which was bound for Cork and Barbados in September, 1682 (Bristol Port Records 1682:September 15,22,23).

SLOOP (Figure 17)

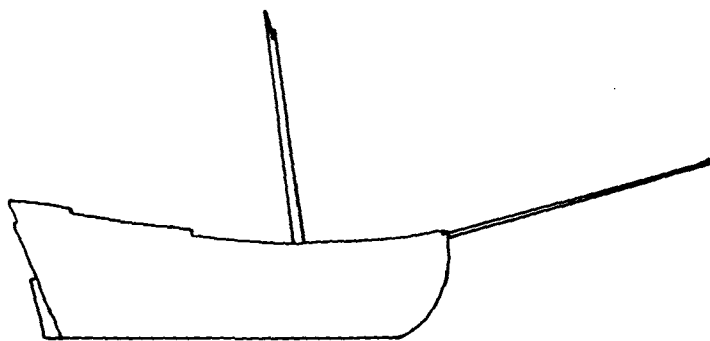


Figure 17. A Sloop. After Botting (1978:39).

Chapelle (1935:11) states that the majority of colonial vessels were recorded as sloops. These vessels ranged from 25-75 tons, carried a single mast with a fore-

and-aft rig, and could be decked or undecked. Sloops were used extensively for coastal and river travel and are mentioned frequently in the records of New Netherlands as travelling between New Amsterdam and New England (Wilcoxon 1991:65-66). These vessels were equally useful for coastal work in the Caribbean. In reference to Port Royal, the contemporary diarist John Taylor (MS:259) noted that, "To this Port belongs allway about one Hundred Stout Sloops or Shaloops, which trade about the Island, and with the Spaniards, and Indians, in those parts." These vessels were usually "plantation-built" (more or less "home-made") and also engaged in "...turtling, fishing, fetching salt, treasure hunting, and transporting produce to Port Royal..." Therefore, as the day-to-day workhorses, these vessels were instrumental in the expansion of the Jamaican merchant marine (Zahedieh 1986a:580-581).

YACHT (Figure 18)

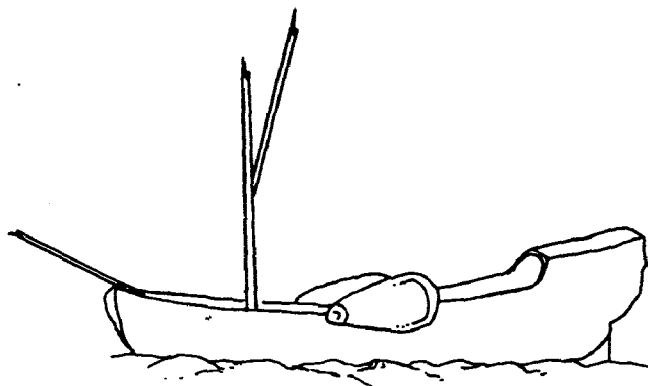


Figure 18. A Yacht. After de Groot (1980:93).

Yachts receive considerable mention in the colonial records of New Netherlands (Wilcoxon 1991:60-64). These vessels were multi-functional - in shallow or deep water - and were built in many sizes. They were swift, shallow-drafted and highly maneuverable. The smallest yachts were workboats with high flat sterns, flat floors and leeboards. They had a single mast, with a fore-and-aft rig and a gaff. The intermediate and largest yachts (60-80 tons) had flat sterns, rounded bows, a high poop and forecastle. These vessels were square-rigged and carried up to three masts. Furthermore, the intermediate and large yachts could carry from 4-5 or from 10-14 guns. Consequently, the largest examples of these yachts were often referred to as "'little ships'".

The larger yachts were known not only for their speed and maneuverability, but also for their fair degree of capacity. This combination of characteristics obviously made them quite economical to operate, and therefore suited to a host of tasks such as exploration; coastal, as well as trans-Atlantic trade; passenger transport; official dispatch delivery; in short, any duty in the Atlantic and Caribbean that called for a light, fast vessel.

CARAVELÕES (Figure 19)

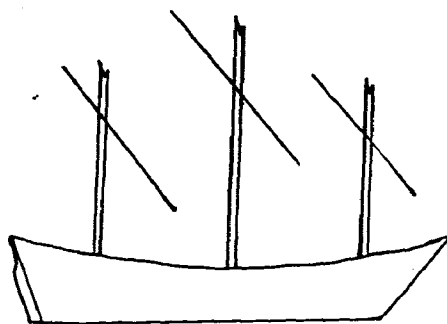


Figure 19. A Caravelão. After Moura (1991:191).

Caravelões were relatively small, 40-50 ton vessels, well suited to sugar transport and coastal defense where larger vessels would have been too unwieldy. The Portuguese used caravelões extensively, particularly along the coast of Brazil from the 16th century until the early decades of the 18th century.

These shallow-drafted vessels had 2 or 3 masts with lateen sails, although they could be powered by oars as well. While most of these coastal craft were single-decked, some had quarter decks. A caravelõe of 40-50 tons could have mounted up to 16 guns, including falcons, berços and mounted harquebuses (Moura 1991:190-194).

Caravelões were particularly appropriate for use in the New World not only because of their shallow draught and maneuverability, but also because their construction was particularly "straightforward", and therefore practicable by the shipbuilders of the New World, particularly those of the Caribbean and Brazil, who may not have been as familiar with building large vessels as were their European-based counterparts (Moura 1991:193).

PINNACE (Figure 20)

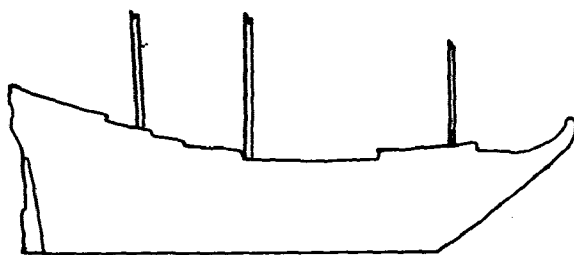


Figure 20. A Pinnace. After Landström (1961:154).

Pinnaces, like yachts, varied considerably in size. Baker (1983:75-93) notes that they could range from a small open pulling boat to a fairly large, transom-sterned, square-rigged ocean-going vessel, carrying between 10 and 14 guns. Examples of larger pinnaces include the 40 ft. Deliverance and 29 ft. Patience, the two vessels constructed in 1609 in Bermuda by shipwrecked settlers en route to Jamestown, Virginia (Baker 1983:90-93), as well as the 85 ft. Dutch trans-Atlantic merchant vessel de Witte Kloofd (Wilcoxon 1991:56). These vessels were useful in exploration, privateering and coastal trade.

SHALLOPS (Figure 21)

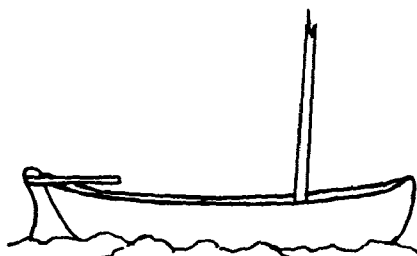


Figure 21. A Shallop. After de Groot (1980:42).

Shallops were usually small, shallow-water vessels that were undecked, and which carried a single mast, although Switzer (1991:187-188) states that they could reach 30 or 40 ft. and carry two masts. These vessels were double-ended and were probably of variable rig to suit the location and task. Diego Garcia de Palacio (1988:138) outlines a number of uses for shallops, including setting and recovering

of 80 tons (Appendix 1), and the Bonadventure of 25 tons (Appendix 3), were found to be profitable enough to make repeated trans-Atlantic journeys.

Therefore, a person walking along Port Royal Harbor in the first week of June, 1692, might have seen quite an assortment of vessels. The vista may have included a large merchant vessel arriving from Europe just ahead of hurricane season; a small English warship guarding the harbor entrance; a New England ketch or bark unloading its salt cod and wooden casks before slipping off for a load of dyewood; a Jamaican sloop unloading sea turtles; and a myriad of pinnaces and shallops running from shore, to the larger vessels and throughout the harbor. In order to determine how the vessel excavated at Port Royal fit into this picture, it is necessary now to consider the physical evidence.

ARCHAEOLOGICAL METHODOLOGY

Salvage and plundering began at Port Royal even before the final tremors had subsided (Oldmixon 1969:324). The shallow depth of the submerged buildings undoubtedly encouraged looters, but also allowed residents to retrieve some household furnishings, valuables and building materials.

The archaeological potential of the site has induced several people to excavate portions of the sunken city. The submerged ruins of Port Royal include remarkably well preserved floor plans, brick patterns, and sections of walls, as well as perishable organic artifactual material rarely recovered from terrestrial sites. Furthermore, the sunken city is considered a "catastrophic site", that is, a site "created by some disaster that preserves both the cultural features and material and the all-important archaeological context (Hamilton 1992:41)."

In this century, the site was excavated by Edwin Link (1960) and Robert Marx (1968). Their excavation tools included powerful air lifts that quickly created large craters in the seabed; consequently, their work more closely resembled artifact mining than systematic archaeological excavation.

Beginning in 1981, and continuing through 1990, Dr. D.L. Hamilton of Texas A&M University (TAMU) directed summer archaeological field schools at the submerged site of Port Royal under the auspices of TAMU, the Institute of Nautical Archaeology (INA) and the Jamaica National Heritage Trust. After establishing that accurate, systematic archaeology could be conducted at the site (Hamilton, 1984),

Dr. Hamilton proceeded with a long-term excavation of the site because of the excellent opportunities that the cultural remains and contemporary historical documentation provided for the reconstruction of an accurate picture of a 17th-century community.

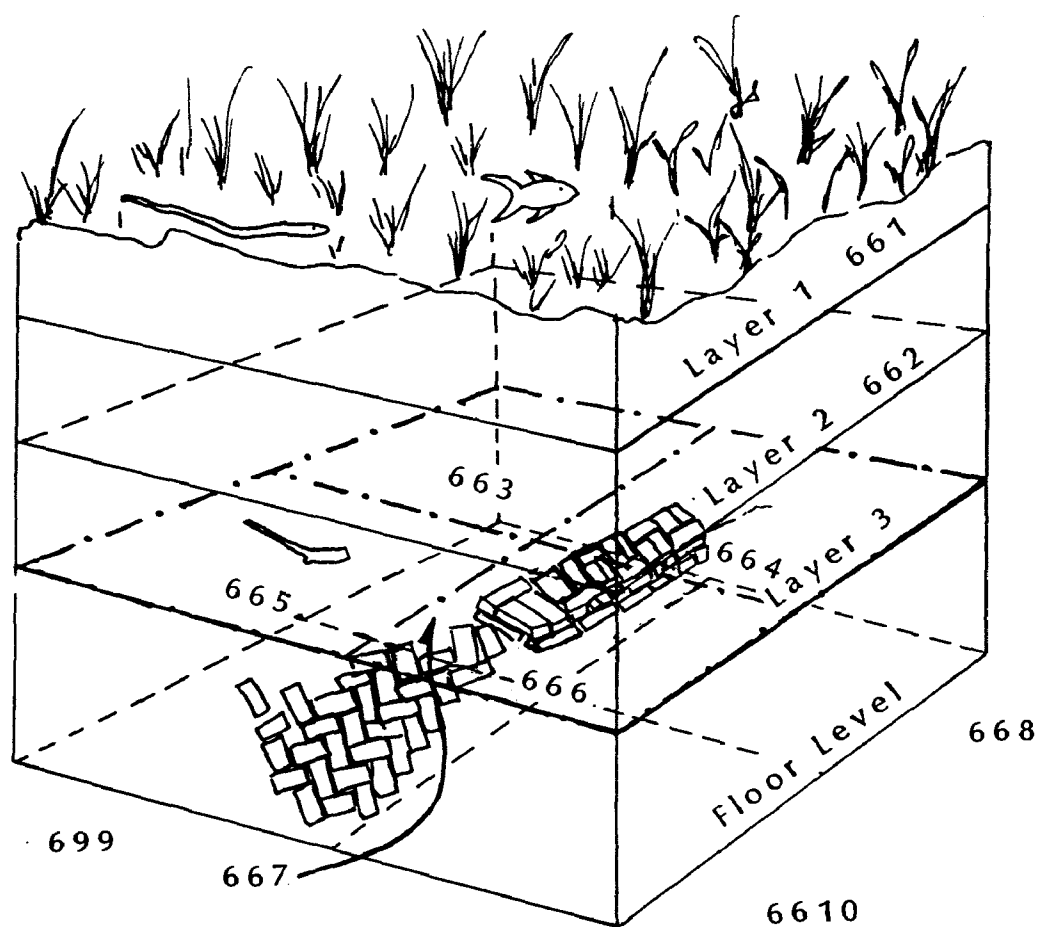
One of Dr. Hamilton's principal goals was the accurate recording and mapping of the submerged remains that the excavation teams uncovered. To this end, he requested, and received, the placement of permanent survey points by the Jamaica Survey Department, on land adjacent to the harbor (Hamilton 1984:17).

Through triangulation, these survey points enabled the establishment of a grid over the site, a grid that could be tied into existing map co-ordinates. Iron stakes were driven into the seabed to mark the 10-x-10-ft. squares of this grid. These 10-ft. square units were labeled with even numbers, ending in zero, beginning with 100 (100,110,120, etc.).

The clearly defined, natural stratigraphy of the harbor provided vertical layer designations for any cultural or architectural material uncovered. As described by Hamilton (1984:22), the top layer, or Layer 1, consisted of "...thick,...loose silt, turtle grass and roots,...recent trash and occasional 19th-century ceramics..." Layer 2, consisted of a tightly packed layer of finger and elkhorn coral and contained few, if any, artifacts. It is believed that the hurricanes of 1722 caused the deposition of this coral layer; the presence of this layer thus provides a terminus post quem for any material found beneath it (Hamilton 1984:23). Layer 3 contained 17th-century architectural features and artifacts in a silt/sand matrix.

The numbers assigned to artifacts reflect the year they were excavated and their location within the grid and stratigraphy (Figure 22). Artifacts bearing the number PR90 661 or 662 were recovered in 1990 from Layer 1 and Layer 2 (respectively) in the 10-x-10-ft. square 660. When the 17th-century layer was reached the 10-x-10-ft. squares were subdivided into four 5-x-5-ft. squares, designated 3, 4, 5, and 6. Each of these four squares was subdivided again into four 2.5-x-2.5-ft. squares labeled 1, 2, 3, and 4. Therefore, an artifact bearing the number 663-1 was recovered from the 2.5-x-2.5-ft. square #1 within the 5-x-5-ft. square #3 of Layer 3 in Square 660. Similarly, an artifact bearing the number 665-2 was recovered from 2.5-ft.-square unit #2, within the 5-ft.-square unit #5, in Layer 3 of square 660. For squares that contained both fallen walls with intact floors beneath, a second level of 5-x-5-ft. squares was established below 3, 4, 5, and 6. These new 5-ft.-square divisions were labeled 7, 8, 9, and 10 and were also divided into 2.5-ft.-square units labeled 1 through 4. The 5-ft.-square divisions were reserved for artifacts resting directly upon the remains of floors.

For objects such as large encrustations, intact ceramics and ship timbers that warranted very specific locational information, fiberglass measuring tapes and line levels were stretched to the object from two of the four stakes bounding the square in which the item was found. These measurements allowed for the precise placement of the artifact on a map at a later time. The objects triangulated, in this manner were given artifact numbers that reflected this fact. The last digit of a triangulated artifact's number was ≥ 5 , indicating that the object did not come from a



663-1	663-2	664
663-3	663-4	
665		666

Figure 22. Excavation Layers and Grid Numbering System. Courtesy of the Port Royal Project. (Not to scale)

general 2.5-ft-square unit, but that it had specific locational information associated with it. The actual number ≥ 5 that was assigned to the artifact was determined on land, when lists of triangulated artifacts were collated. Therefore, by following the procedures outlined above, artifacts could be quickly and accurately mapped in a manner that allowed highly accurate horizontal and vertical control.

The TAMU/INA archaeological teams oriented their excavations along the hypothesized edge of the submerged remains of Lime Street. The project culminated in the excavation of the building complex (designated Building 4/5) at the intersection of Lime and Queen Streets from 1987 to 1990 (Figure 3).

During the 1989 field season a portion of a ship's keel was uncovered lying within Room 1 of Building 4. The vessel was completely exposed during the 1990 field season with the assistance of Marianne Franklin and Jessica Harvey.

Additional stakes were added to the grid established by Dr. Hamilton for the Building 4/5 complex to include the shipwreck, and the grid numbering system was also extended to cover these shipwreck grids. All excavation, artifact numbering, triangulation, and recording techniques were identical to those used by Dr. Hamilton so that the shipwreck data could be fully integrated into the entire body of site data (Figure 23).

The excavation site lay in relatively shallow water, usually not exceeding 20 ft. in depth. A hookah (surface-supply) system of air delivery was used, supplied by an air compressor located on a barge anchored over the site. This system enabled divers to remain on the site as long as they wished during the work day.

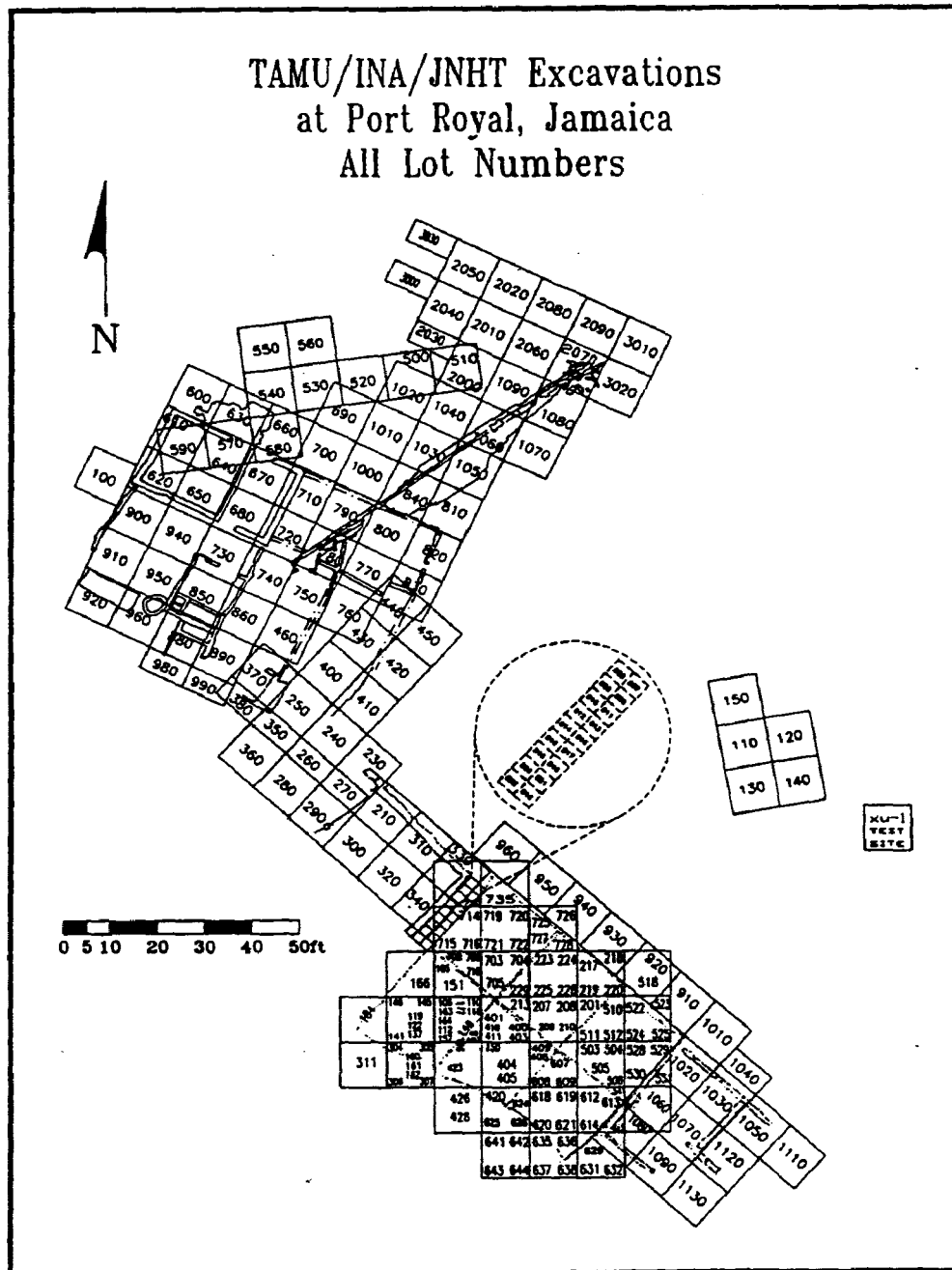


Figure 23. AutoCAD Rendering of INA Excavations - All Lot Numbers.
Courtesy of the Port Royal Project.

Overburden (Layers 1 and 2) was removed with water dredges powered by water pumps which were also located on the barge. These dredges were used more delicately, and in consort with trowels and hand-fanning, when Layer 3 was reached.

As the vessel was exposed, artifacts, including metal concretions, lead shot, and ceramic tobacco pipes, were removed and placed in fresh-water rinsing tanks on shore. These artifacts were then shipped back to the Conservation Research Lab at Texas A&M University's Riverside Campus to undergo conservation treatment and study.

Wood samples were taken from the vessel's keel, false keel, frames, planks, and a treenail, to be sent to the Forest Products Laboratory in Wisconsin for type (genus) identification.

Finally, after as much of the vessel had been exposed as time would permitted, the timbers were videotaped and photographed. The wreck was not backfilled so that a maximum amount of time could be spent recording the hull. Backfilling was not considered imperative given the pre-existing deteriorated nature of the wood and the fairly rapid rate at which excavated structures in the harbor were again covered with sand. Subsequent visits to the site have confirmed that the wreck is now completely silted over.

THE DISPOSITION OF THE PORT ROYAL SHIPWRECK

The disposition of this shipwreck is remarkable in that it lies amidst the ruins of a 17th-century building that unquestionably sank into present-day Kingston Harbor during the devastating earthquake that occurred on June 7, 1692. It has also been determined that relatively little lateral distortion was suffered during this upheaval by the buildings excavated by the TAMU archaeology students. Instead, the majority of these structures sank vertically below the waters due in large part to the liquefaction of the sand on which the town of Port Royal was built (Hamilton 1992:41,44). Floor plans survive that very closely approximate original layouts, large portions of brick flooring remain undisturbed and walls are preserved to various heights - some to at least 3 feet.

This is all of significance when one considers the disposition of the shipwreck and the condition of the architectural features immediately surrounding the wreck.

First, this shipwreck was covered, as were the surrounding architectural features, with two distinct layers of depositional material - Layers 1 and 2 as described in the ARCHAEOLOGICAL METHODOLOGY section of this thesis.

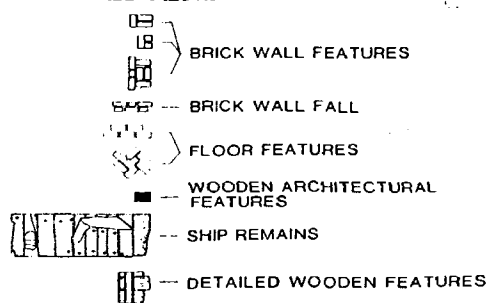
Second, there was significant lateral displacement of the floor of Building 4 directly in front of the shipwreck (Figure 24). It is clear that the walls at points C and D should be directly in line with each other and form one continuous wall. Furthermore, point B should be in line with point A, for, at point A it is clear that

PR87,89-90

BUILDINGS 4,5 AND SHIPWRECK

PORT ROYAL, JAMAICA

LEGEND



SCALE
0 5 10M

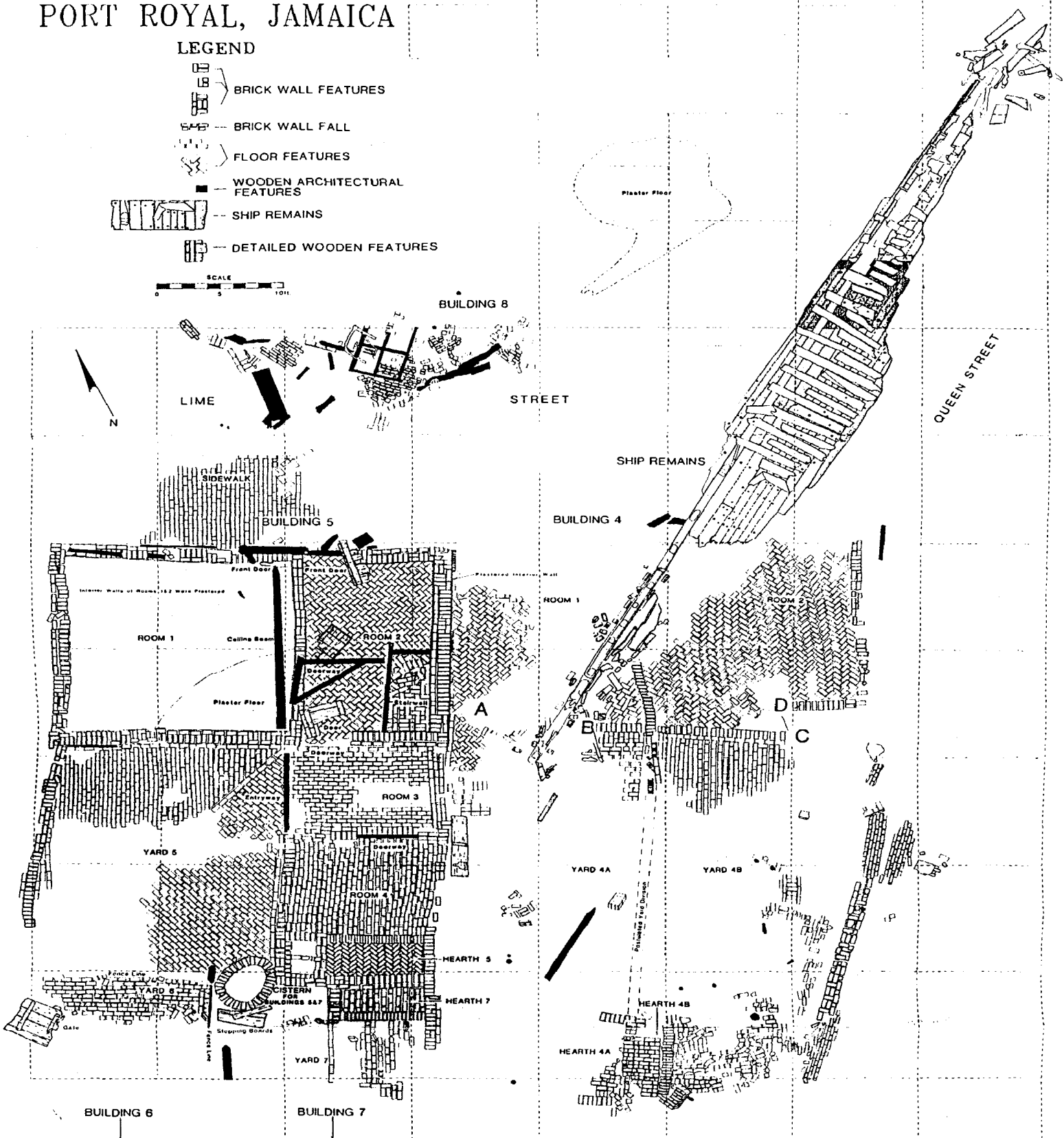


Figure 24. The Displacement of the Floors of Building 4

two different brick floor patterns are meeting, although a dividing wall, as at point B, is no longer visible.

Third, absolutely no evidence of the northeast (front) wall of Building 4 was found during excavation of the site. There were several instances during Dr. Hamilton's excavations at Port Royal where large sections of fallen walls were identified and could be theoretically replaced in their original locations. In the case of the front wall of Building 4, however, there were no sections of fallen wall lying anywhere in Rooms 1 or 3 of Building 4, or even further to the northeast, to shed light on what happened to that wall during the cataclysm. Perhaps the only remaining evidence of the front wall of Building 4 was the 4 ft.-x-6 in. timber (broken in two pieces) found directly beneath the shipwreck's keel/false keel assembly, approximately 25 ft. 6 in. from the forward end of the keel and running perpendicular to it. I firmly believe that this was not a piece of the lower hull assembly, especially not of the false keel, as the latter was much thinner and of a different wood type than the unidentified timber. Instead, this timber greatly resembled the door sills found throughout Building 5. Its location is also analogous to the placement of the sills found in the front wall of Building 5. It is likely that this was a door sill of Building 4 and that it indicates the approximate location of the front wall of Building 4.

Finally, the complete absence of any stem assembly and the marked dearth of lower hull planks and frame timbers from the forward third of the wreck are significant. Also, a number of ship-related artifacts such as cannon balls and a shot-

gauge (see THE ARTIFACTS - *Armament*) were found well to the southwest of the forward end of the vessel in Room 4 and Yard 4A. These clues, combined with the lateral distortion of the building and the absence of any surviving portions of the front wall of Building 4, together strongly suggest that there was a forceful, head-on collision between the ship and the building. It also seems less likely that the building and the ship would have suffered such a high level of damage had the ship grounded on the remains of the building sometime after the earthquake. In such an instance, one would expect to find some evidence of a collapsed wall, and more architectural debris under the shipwreck. It also seems unlikely that a later grounding would cause the marked degree of lateral distortion that is present in Building 4. Furthermore, in such a case of grounding, one would also expect the shipwreck's lower hull to be more completely preserved.

These are important considerations when attempting to date this wreck in the absence of any unquestionably diagnostic artifacts or construction techniques. It is far more likely that this vessel smashed into Building 4 during the 1692 earthquake than that it grounded upon the building at a later date. In light of supporting artifactual material and construction details, I feel fairly confident in assigning a mid to late 17th-century date of construction to this vessel.

DESCRIPTION OF THE HULL REMAINS OF THE PORT ROYAL SHIPWRECK

The excavated remains of this vessel consisted of a 74 ft. 2 in. (22.3 m) section of keel with a false keel attached, sections of nine port side external planking strakes, sections of three starboard side external planking strakes, and portions of 33 frames (Figure 25). These frames were assigned numbers 1 through 33, beginning with the forward-most timber. Hull structure above (and including) the keelson did not survive. Two large encrustations raised from the eastern end of the wreck have been determined, upon closer study, to be two rudder gudgeons; thus, the western end of the wreck was the bow and the eastern end the stern.

It is possible that the entirety of this vessel was not excavated. Time and monetary constraints did not permit excavation beyond the apparent limits of the wreck. Test pits were dredged in units 1040, 1070, 1090, 2090, and 3010 and no indications of timbers or ballast were present in these areas (Figure 23).

THE KEEL

At least two lengths of slippery elm (Ulmus rubra) comprised the keel which measured approximately 8 in. (20.3 cm) molded and sided, and was preserved to a length of 74ft. 2in. The upper edges of the keel were chamfered (not rabbetted) to accept the similarly chamfered garboard strakes. It is quite possible that this chamfer became a 90° notch near the bow and stern (the forward portion of the keel was badly eroded and the stern deadwood area was never dismantled and studied); however, it definitely remained a chamfer along most of the vessel's length. A 2 ft.

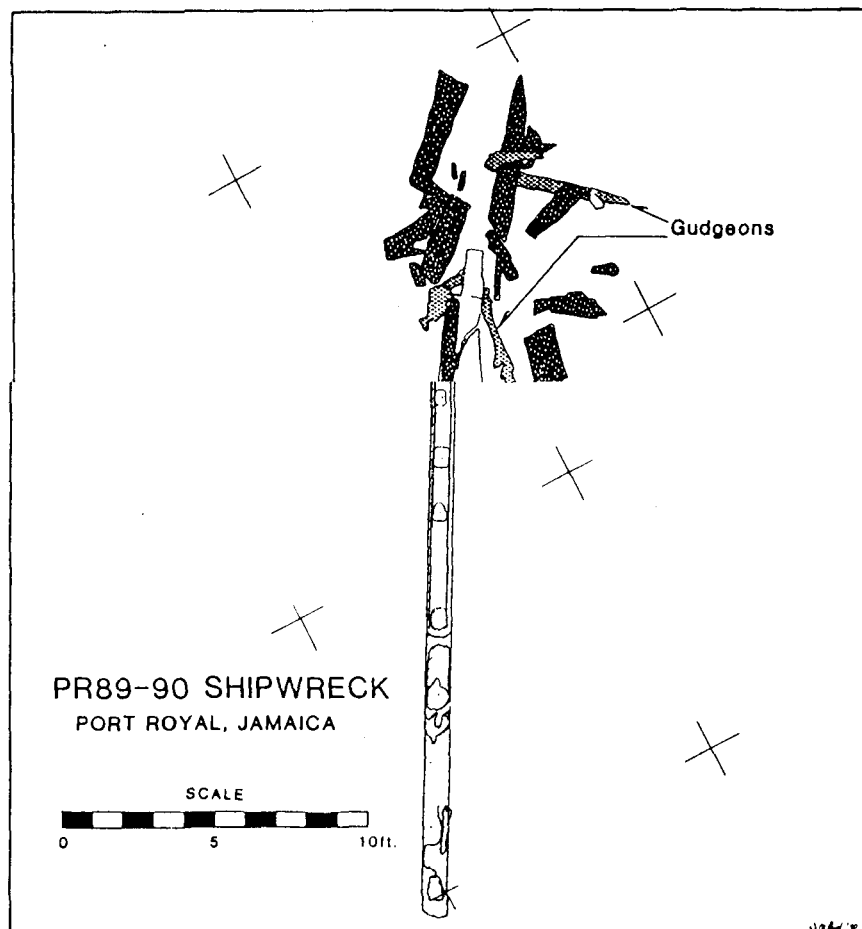


Figure 25. Plan of the Port Royal Shipwreck

began to build up the stern. Four to five deadwood sections were evident. More sections surely exist below these, although their presence and arrangement were not discernible. The sterndeadwood sections that were recorded exhibited vertical notches on their port and starboard sides to accept the lower ends of half-frames. The keel and deadwood ended abruptly at a heavily concreted iron gudgeon, portions of which were removed. A second, more intact example of a gudgeon was recovered slightly off the wreck on the port side (see *THE ARTIFACTS - Ship Related Artifacts* for a discussion of the gudgeons).

THE PLANKING

The remains of planking began 25 ft. (7.6 m) abaft the forward end of the keel, and the majority of this extant outer hull planking was present on the port side. The garboard strake averaged 8 in. (20.3 cm) wide and 3 in. (7.6 cm) thick at the keel, tapering to 2 in. (5.1 cm), a dimension maintained throughout the successive planks. The widths of these remaining planks varied from 6 in. (15.2 cm) to 1 ft. (30.5 cm).

The garboard and two successive planks on the starboard side exhibited approximately the same dimensions as the analogous port strakes. The plan view belies this fact however for, as indicated by the series of sections presented in Figure 29, it appears that the starboard planks were somewhat crushed up against the keel.

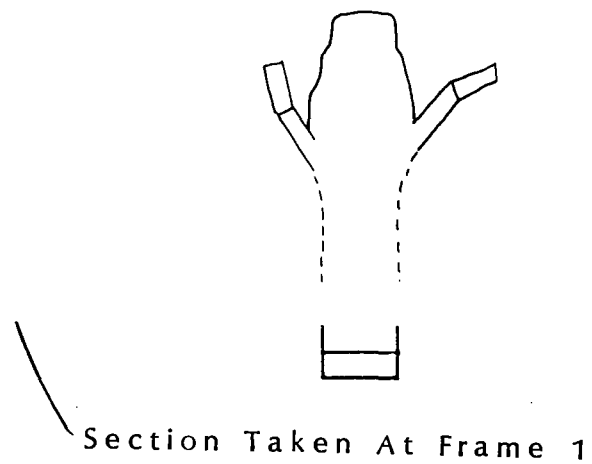
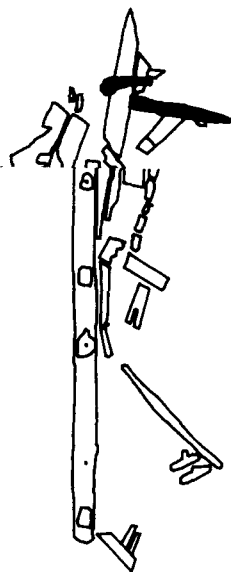


Figure 29. A Series of Sections, Beginning at the Stern and Moving Toward the Bow

The planking was fastened to the frames with treenails and spikes. Caulking was not evident between strakes and sheathing was not present on the outer faces of the few strakes that excavators dislodged amidships.

THE FRAMES

Frame floors and associated first futtocks survived only on the portion of the wreck lying outside Building 4. The extant frames began 24 ft. (7.3 m) from the forward end of the keel, and were primarily on the port side of the wreck. No evidence of second or greater futtocks survived. Constructed of white oak (Quercus), the frame timbers averaged 8 in. (20.3 cm) molded by the keel and 2-4 in. (5.1-10.2 cm) at their ends, and 9 in. (24 cm) sided. The frames had, however, suffered extensive damage from teredo worms and may even have been abraded over time after the wreck. Such wear and tear doubtless reduced the original dimensions of the frame components as occurred on the wreck of the Dartmouth, where abrasion reduced the vertical height of some of the vessel's frames "...almost to extinction" (Martin 1978:40, Figure 10 and caption).

On the starboard side, the floors ended abruptly, with unfinished ends, an average of 7 in. from the keel. This fact, combined with the previously noted distortion of the starboard planking strakes, suggests that the starboard side of the vessel suffered extensive trauma during, and wear after, the wrecking.

Judging from the regularly spaced encrustation residue on the first 24 ft. (7.3 m) of the keel, it would appear that every floor was fastened to the keel with 1 in. diameter bolts. It is not clear whether these bolts had held the keelson as well. The

center to center distance between floors averaged 2 ft. (61 cm), varying from 1 ft. 6 in. (46 cm) to 2 ft. 6 in. (76.2 cm).

Limber holes were cut in the bottom face of the floors and were usually rectangular (approximately 2-x-1-1/2 in.), although triangular examples were found in Floors 11, 15, and 26. The holes were located roughly 8-10 in. out from the keel.

The heels of the futtocks were approximately 1 ft. 8 in. (51 cm) from the keel, and there was no evidence of any sort of cross-keel connection (or chock) between the port and starboard first futtocks. No evidence of lateral fasteners was found between the floors and first futtocks.

It appears that floor/futtock pairs were assembled with the first futtock immediately forward of the floor. Due to lack of preservation, it is not clear whether this arrangement continued over the full length of the vessel.

FASTENERS

Treenail holes in the midships planking, along with actual treenails identified in surviving frames, suggest that a single treenail per plank per frame was the standard fastening pattern, although larger planks sometimes required two treenails per plank per frame. The treenails averaged 1.5 in. (3.8 cm) in diameter and were of white oak (Quercus). Iron spikes were also used to fasten the planking to the frames, particularly at planking butt joints. These spikes were roughly .5" (1.3 cm) square. The evidence for these spikes, however, consists of one example of a spike hole observed at a plank butt joint.

CEILING AND BALLAST

On the Port Royal shipwreck, there was the rather paradoxical presence of ballast stones, and absence of ceiling planks. Ostensibly, a principal role of ceiling planking is to keep ballast and debris from lodging among the frames and clogging the bilges. However, on the PR89-90 shipwreck, a small amount of ballast was found among the frames while absolutely no remnant of ceiling planking remained.

Evidence for the ceiling planking was not found, but it must be added that a careful inspection of the interior (top) surfaces of the frames for signs of the nails that would have held ceiling to those members was not carried out.

A small amount of ballast was found on the wreck. When it was removed it formed a pile roughly 2 ft. (61 cm) square. Individual pieces ranged in size and shape from large rocks measuring approximately 8 in. x 4 in. (20.3 x 10.2 cm), to smooth, slightly oval stones about 3 in. x 1.5 in. (7.6 x 3.8 cm).

While it cannot be suggested that there never was any ceiling planking on this vessel, it is noteworthy that none survived despite the survival of some ballast.

As a side note, the ballast was not analyzed, for several contemporary records indicate that ships frequently changed their ballast at ports of call. The fouled ballast would be left in the surf zone until it was well rinsed and it would then be loaded upon some other vessel. For this reason, it is difficult to draw conclusions about a vessel's ports of call or port of origin based on her ballast type.

DISCUSSION OF THE CONSTRUCTION CHARACTERISTICS OF THE PORT ROYAL SHIPWRECK

The scant remains of this shipwreck and the cosmopolitan nature of 17th-century Port Royal shipping together make it unlikely that the wreck will ever be positively identified. Through a comparative analysis of lower hull construction details of other excavated shipwrecks, however, a few theories regarding the Port Royal vessel's nationality and purpose can be proposed.

Tables 2, 3, 4, and 5 list excavated, well-documented 16th-, 17th-, 18th-, and 19th-century shipwrecks, their principal scantlings, and some of their construction characteristics. Columns 1 through 6 and the last, "Sources", of these Tables are self-explanatory. Column 7 shows whether a vessel's keel was bolstered with deadwood, or a hog, extending over the keel but beneath the floors; Column 8 shows whether a vessel's keel was rabbetted or simply chamfered; Column 9 lists the distance between floor centers; Column 10 notes whether the floors and first futtocks of a vessel were laterally fastened; Column 11 describes the relative position of the floors and their associated first futtocks fore and aft of midships; Column 12 notes the distance that the first futtocks were set away from the keel, or if they in fact met over the keel; Column 13 lists fastening information; and, Column 14 lists wood type information.

The statements made in this section refer only to the vessels described in Tables 2, 3, 4, and 5. Therefore, when it is suggested, for example, that a certain construction feature appears in English vessels and not in Spanish vessels, the reader

recks

NAME	DATE	FASTENING INFORMATION	WOOD TYPES	SOURCES
Molasses Reef Wreck	early 1500s		All wood of the hull was white oak	(Oertling 1989b)
Cattewater Wreck	1530	Planks fastened with nails and trenails	Keel, Garboard, Outer planks, Floors, Keelson: Oak	(Redknap 1984)
<u>San Esteban</u>	1554	Keelson bolted at every fourth frame		(Rosloff and Arnold 1984)
Highborn Cay	16th-c.			(Oertling 1989a)
IMAH3/ <u>Santa Lucia</u>	1577?			(J.W. Morris 1992:pers. commun.)

9-1

vrecks

NAME	DATE	FASTENING INFORMATION	WOOD TYPES	SOURCES
<u>Mauritius</u>	1601-1609	Floors fastened to keel alternately with spikes and treenails	Sheathing: Pine Keel, Frames, Treenails: Oak	(L'Hour, Long and Rieth 1990)
<u>Sea Venture</u>	1609	Planks treenailed to frames		(Adams 1985)
<u>Wasa</u>	1628	1 in. diameter iron bolts and treenails	Mostly oak	(Kvarning 1981)
<u>Batavia</u>	1629			(Green 1991)
<u>Kraken</u>	1651			(Morris 1991)
Monte Cristi Pipe Wreck	1651-1665	Iron fasteners and treenails	Mostly oak except for soft wood (pine) sheathing	(Hall 1992; pers. comm.)
H.M.S. <u>Dartmouth</u>	1690	Planking was fastened with treenails and nails		(Martin 1978)
<u>Sparrowhawk</u>	17th-c?	Floors treenailed to keel	Keel: elm; Floors and Planks: oak	(Holly 1953; Steffy 1988)
Noordoostpolder Hull	17th-c			(Oosting 1991)
Port Royal Shipwreck	17th-c.	Iron bolts and treenails	Keel & False Keel: Slippery Elm; Frames: oak	

wrecks

NAME	DATE	FASTENING INFORMATION	WOOD TYPES	SOURCES
H.M.S. <u>Hazardous</u>	1698-1706	Planks fastened to frames with treenails and round-headed iron nails	Frames: oak	(Owen 1988; 1991)
Rouson Ship	1st quarter 18th century	Frames bolted to the keel and keelson	Most structures made of white oak	(Riess 1987)
<u>Boscawen</u>	1759	Planking attached with spikes and treenails; Floors attached to keel with iron drift bolts	Keel and Frames - White oak	(Crisman 1985)
Deadman's Island	Mid-late 18th-c.		Most of structure was of white oak	(Feingold 1990)
<u>El Nuevo Constante</u>	1766	Keelson bolted to frames and keel with iron bolts; Planks treenailed to frames		(Pearson 1981)
YO88/ <u>Betsy</u>	1781	Planking spiked and treenailed to frames	Keel and Planking: oak	(Morris 1991)
H.M.S. <u>Charon</u>	1781		Structures of oad and elm	(Steffy 1981)
East Indiaman	18th-c.		Keel: Oak	(R.A. Lightly, <u>IJNA</u> , 1976, 305-316)

ip wrecks

NAME	DATE	FASTENING INFORMATION	WOOD TYPES	SOURCES
<u>Eagle</u>	1814	Planks fastened to frames with iron spikes	Keel: Maple and Oak Planks: mostly White Oak	(Crisman 1987)
<u>Jefferson</u>	1814	Planks fastened to frames with iron spikes; no treenails	Keel: White Oak; Floors: Oak, Maple; Futtocks: Elm & White Oak; Upper Works: Pine, Hemlock and Spruce; Lower planks: Oak; Upper Planks: White Pine	(Crisman 1989)
<u>Ticonderoga</u>	1814	Planks fastened to frames with iron spikes; no treenails		(Crisman 1982)

should understand that this observation is true for only those vessels represented in the chart. As mentioned earlier, this is a listing of some of the best documented, excavated 16th-, 17th-, 18th-, and 19th-century shipwrecks. It may in fact present a false picture of ship construction characteristics due to negative evidence, but it is a fair representation of what is available in accessible, published material.

WOOD TYPES

White oak was, throughout the centuries, the construction material of choice for most elements within a ship's hull. The Port Royal vessel's oak deadwood, frames and planking can be considered typical. Furthermore, the elm keel of the Port Royal shipwreck is not an anomaly. An English shipbuilding treatise from the early 17th century states that elm was well-suited for ships keels because it "...lasteth best under water or where it is always wet..."(Salisbury and Anderson 1958:10). Elm is also cross-grained and resistant to splitting when pierced with fasteners (Hora 1981:150; Dodds and Moore 1984:18).

The wood of the Port Royal vessel's keel was further identified as Ulmus rubra or slippery elm, a species found only in southeastern Canada and the eastern United States (Hora 1981:150). This fact neither precludes the Port Royal vessel from being European-built nor does it necessarily indicate that this vessel had her keel replaced in the New World. Soon after the establishment of the North American colonies, the value of New England timber was realized and it became a profitable trade good shipped to the Caribbean and to Europe. West Indian sugar plantation owners used this lumber to build and maintain their facilities, while the

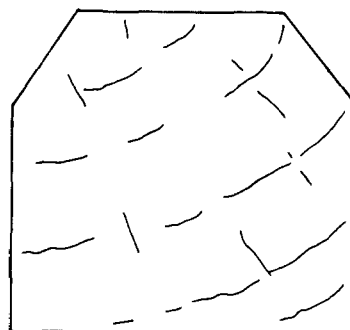
Portuguese and Spanish favored it for wine casks. The English, however, valued this wood for shipbuilding (Perlin 1989:263-278); consequently, it is possible that a vessel built in Europe, or repaired in the Americas, could have been fitted with components fashioned from North American timber.

THE KEEL

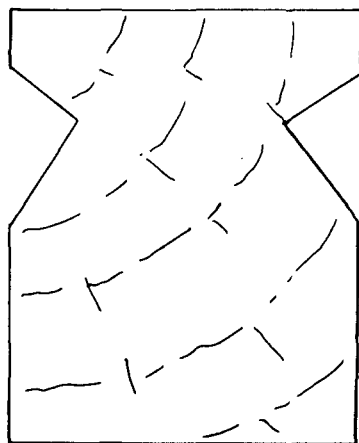
The chamfered, non-rabbetted aspect of the Port Royal wreck's keel is a rarity. Of the wrecks presented in Tables 2A, B, C, and D, only one, IMAH3 or the Western Ledge Wreck, demonstrates this feature. Most vessels have a rabbetted keel or a chamfered keel surmounted by a trapezoidal piece of deadwood, the two of which effectively create a rabbet (Figure 30). Neither the Port Royal ship nor IMAH3 had this deadwood. IMAH3, wrecked off Bermuda, has been tentatively identified as the 16th-century Iberian vessel, Santa Lucia (Morris, per. comm.).

It has been suggested that the lack of rabbet and deadwood may indicate a replacement keel that would have been easier to fit without the rabbet. While this suggestion does seem reasonable it is unfortunately not a clear answer, for H.M.S. Dartmouth is known to have had her keel replaced and the replacement was rabbetted.

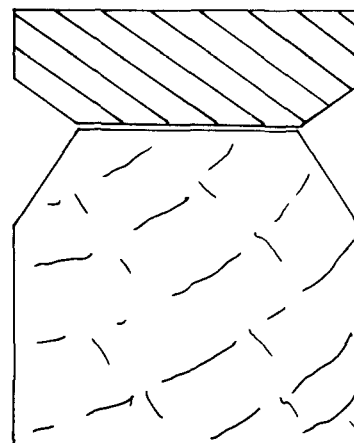
The addition of deadwood running the length of the vessel between the keel and the floors is most evident on English vessels, being absent from those vessels such as the Cattewater wreck, the Highborn Cay wreck, the San Juan, and the Molasses Reef wreck, which demonstrate characteristic Iberian dovetail mortise and tennon joints. Specifically, deadwood was used on H.M.S. Dartmouth,



Chamfered Keel



Keel with Rabbet



Chamfered Keel with Deadwood
Forming Rabbet

Figure 30. Keel Styles

H.M.S. Charon, and YO88/Betsy, the latter of which was a coal collier. Given that warships and colliers had to withstand particularly significant stresses, it would seem that the addition of longitudinal deadwood to a keel assembly was a means by which English shipwrights imparted greater strength to the hulls that required it.

The final noteworthy aspect of the Port Royal vessel's keel is the vertical scarf located 32 ft. aft of the forward end of the wreck. This scarf has parallels on the 16th-century vessel Mary Rose, the 17th-century vessels Sea Venture and H.M.S. Dartmouth, and on the 18th-century vessel Victory. Consequently, it appears that, contrary to popular opinion, during the 17th and 18th centuries, the use of vertical scarfs in a vessel's keel was the rule rather than the exception (Adams 1985:289-290; Longridge 1985:7). Furthermore, the keel scarf of the Port Royal vessel is identical to those of the Sea Venture and H.M.S. Dartmouth, in that the top seam was sealed by small sections of wood fitted into a channel cut along the seam (Figure 26). This feature was intended to prevent water from leaking into the hull.

THE PLANKING

While the planking strakes of the Port Royal wreck are relatively thin, they are by no means anomalous. It is possible that these strakes were abraded as the hull settled into the pebbly sand of the harbor bottom in the years after the earthquake. The varying thickness of the strakes throughout the hull is paralleled in a number of other shipwrecks including the Cattewater wreck, the Molasses Reef wreck and the Ronson ship.

THE FRAMING

A particularly noteworthy feature of the Port Royal shipwreck's framing system is the absence of lateral fasteners (both wooden and metal) binding the floors to the first futtocks. Ships of the 17th and early 18th centuries generally ~~did~~ not have laterally fastened floors and first futtocks. It is widely accepted that by the middle of the 18th century, lateral fastening was being used in warship construction. This is evident from the excavated examples of H.M.S. Charon (1781) and Eagle (1814) as opposed to H.M.S. Dartmouth (1690).

Lavery (1984:32) explains this evolution in warship construction by noting that in the 17th century, each futtock was fitted individually to the frame system as the hull planking was built up, and that the various components of the frame were not always laterally fastened. In the 18th century, however, every frame unit had its upper components (futtocks and toptimbers) joined outside of the slip in which the vessel was being built. These units were then transported to the main construction site, raised and joined to the keel and floor timbers. Oddly, Goodwin (1987:16-17) expresses a contrary opinion. He states that from about 1725 there was an increasing use of chocks or anchor pieces in place of flat scarfs or butt joints between futtocks. With the added strength that these chocks or anchor pieces provided, Goodwin feels that transverse fasteners between floors and first futtocks and between the upper futtocks were no longer necessary. It should be noted, however, that Goodwin still includes these transverse fasteners in his figures (1987:16, Figure 1/9). Such a system of chocked joints and no lateral fasteners was

found on the H.M.S. Dartmouth and was therefore in use well before the first quarter of the 18th century (Martin 1978:47).

At first glance, the use of transverse fasteners on merchant hulls seems to follow the same pattern of development as it did on warships. Neither the Sea Venture (1609), the Kraken (1651) nor Sparrowhawk retained any evidence of lateral fasteners, while the Ronson ship (first quarter 18th century) did have laterally fastened floors and first futtocks. The Betsy/YO88 (1781), however, did not have a consistent pattern of laterally fastened floors and first futtocks. Instead, this vessel appears to have had seven master frame units, each consisting of a floor and at least three futtocks, spaced irregularly throughout the hull. These seven paired frame sets all had transverse fasteners securing their members; consequently, it has been hypothesized that these frame units were erected first (Morris 1991:60). Ribbands would then have been attached to these master frames to act as guides as the hull planking and other frames were built up. None of the approximately 60 other frame units had transverse fasteners. It is also interesting to note that the Boscawen (1759), an English sloop built for use in the French and Indian War, did not have laterally fastened framing elements. It is now believed, however, that those who constructed this vessel were first and foremost builders of merchant hulls (Crisman, pers. comm.).

Morris (1991:85-86) suggests that the shipwreck YO88 was in fact the wreck of the Betsy, a collier built at Whitehaven, England, in 1772. Designed to carry a bulk cargo of coal, colliers were known for their sturdy construction and "hard

weather qualities" (Kemp 1976:180); and, according to Kemp (1976:180), it is for these reasons that Captain James Cook chose such vessels for his voyages of exploration. In the case of the Betsy, this strength apparently wasn't sought in transverse fasteners. Therefore, one must ask whether this construction detail was only seriously observed in 18th-century warship design and left more to the shipwright's preference in the case of a merchant hull.

Unfortunately, the presence or absence of transverse fasteners on a shipwreck is not a failsafe diagnostic element for determining a date for construction, particularly if the shipwreck is a merchant hull. In the case of a wreck of a warship, this framing detail might be a better indicator of construction date, although several more examples need to be excavated before this can be stated with any degree of conviction.

Another aspect of the PR89-90 shipwreck's framing system is that the first futtocks were offset from the keel 1ft 8 in. In their discussions of warship construction, both Lavery (1984:32) and Goodwin (1987:15-17) state that in the 17th and early 18th centuries, first futtocks did not reach the keel and in fact were set back from it 18-24 in. From the first quarter of the 18th century onward, however, "strength took priority" (Lavery 1984:32) and first futtocks began to approach the keel and eventually came to be fastened to it with a cross chock joining port and starboard first futtocks. Morris (1991:78) notes however that, for merchant hulls, shipwrights continued to use first futtocks offset from the keel "well into" the 19th century, as seen on the Ticonderoga. Once again, the Boscawen provides a notable

exception to this construction practice; but, the fact that her first futtocks do not approach the keel is in keeping with the suspected merchant vessel training of her builders (Crisman pers. comm.).

CEILING AND BALLAST

A principle role of ceiling planking is to keep ballast and debris from lodging among the frames and clogging the bilges. On the Port Royal shipwreck, there was the rather paradoxical presence of ballast stones, and absence of ceiling planks.

This detail necessitates mention of the overall "stripped" nature of the Port Royal hull remains. Relatively few artifacts were associated with the shipwreck. In particular, the spaces between floors and futtocks were surprisingly devoid of buttons, coins and other small items that often find their way into the bilges of a vessel. Furthermore, only the very bottom structure of the vessel remained. This empty condition could be the result of several factors.

First, if this vessel was carried into town by a seismic sea wave during the 1692 earthquake, the vessel would have been slammed about considerably, causing her to loose fittings, sheathing, ammunition, etc.

Second, as noted earlier, salvage began immediately following the earthquake (Hamilton 1992:41). While 33 of the 51 acres that comprised the Port Royal land spit sank into the ocean, it was not to a depth that prohibited recovery of building materials. As the spit lacked timber, any salvageable wood from the shipwreck might have been highly prized and quickly recovered. It is perhaps in this way,

then, that the wreck lost such a massive timber as her keelson, as well as her ceiling. At the same time, any remaining weapons, ammunition, tools, cargo, and ballast could also have been salvaged for use on another vessel.

The dearth of artifacts, particularly between the framing elements, suggests an original state of emptiness, as if the boat was under repair, or was being careened, at the time of the earthquake. Careening was a complicated process by which a vessel was hauled down first on one side, then the other, by means of an elaborate rope and pulley system which was attached to her masts and ran under her hull (Goelet 1986:55-150). The exposed side of the vessel was then cleaned of marine growth and repaired as necessary. Given the extreme nature of the position of a vessel during careening, it was customary to strip the hull of cargo, supplies, ordnance, ballast (except for a small amount to act as a stabilizer), and all other elements not permanently affixed to the vessel before she was careened (Goelet 1986:39). Careening was most often undertaken to replace a ship's caulking and sheathing. This might account for the clean, unsheathed planking evident on the port side of the Port Royal shipwreck. Removal and replacement of worn ceiling planking during the process of careening may also explain the exposed frame timbers on the wreck (Crisman 1992:pers. comm.).

Is it possible, then, that the Port Royal vessel was being careened at the time of the earthquake? Contemporary documents indicate that at least one vessel was being careened on that day and that she was ripped from her moorings and carried

into the sinking town by seismic sea waves. What follows is the story of this vessel, H.M.S. Swan.

THE H.M.S. SWAN

H.M.S. Swan was a small warship that began her duties at Port Royal in July of 1690 (Pawson and Buisseret, 1975:43). Records compiled by Samuel Pepys, the Secretary of the Admiralty under Charles II, describe the Swan as a 246 ton Fifth Rate frigate of 32 guns. She was 74 to 75 ft. long on keel and her breadth of beam was 25 ft.

The origins of this vessel are not entirely clear. Pepys' records do not indicate the shipyard at which she was built. Instead, the records indicate that Swan was purchased from a Captain Anthony Young in 1673. This coincides favorably with information provided by Edward Barlow (1934:268), who observed a Swan frigate in Tangier Road and noted that she was "...a ship which was taken from the Dutch in the wars in 1672." Now while it is recognized that "Swan" was a very popular ship name, the dates of acquisition and sale together with the lack of information concerning H.M.S. Swan's port of origin, suggest that the frigate captured from the Dutch and the small warship defending Port Royal in 1690 were one and the same. Colledge (1969:11-12) agrees with this association in his index of Royal Navy vessels. If this indeed was the case, H.M.S. Swan would have resembled the 17th-century Dutch Fifth Rate warship Augustaine pictured in Figure 31 as she appeared in 1661.

Pepys' records also indicate that Swan was designated a fireship in 1688, but that she was reconverted to a warship in 1689 (Fox 1980:177; Marx 1967:15). After



Figure 31. The Fifth-Rate Dutch Warship Augustaine.
From Barlow (1934:50), with permission.

being stationed at Port Royal in 1690, Swan sailed against Hispaniola and gave chase to French privateers off Jamaica's coast (Pawson & Buisseret 1975:52,56).

At the time of the earthquake on June 7, 1692, records show that Swan was being careened (Oldmixon1969:324). This is interesting from a locational standpoint as it indicates that the vessel was not riding at anchor in the harbor when the earthquake struck, but was instead located at a wharf. Unfortunately for the

modern historian, there was no established naval dockyard at this time. The merchants of Port Royal had grown in strength and influence to such a degree that they had taken over all available wharf space along the northern coast. The Crown at one point attempted to designate an "unpatented wharf" as a careening place for the naval vessels; however, merchants soon encroached on this area as well. Therefore, while it is possible that the Swan was careened at a wharf along the northern coast, it is not clear at precisely which merchant's wharf this took place (Pawson and Buisseret, 1975:48,96).

Several sources paint dramatic pictures of what happened to Swan when the earthquake and accompanying sea waves hit Port Royal. Marx notes that some sources suggest that Swan sank immediately (1967:15), but several accounts suggest otherwise. Pawson and Buisseret (1975:126) note that Swan was "cast ashore in the town and 'suckt amongst the houses' and wrecked", while Oldmixon (1969:324) relates a description of how the "violent Motion of the Sea and sinking of the wharf, forced her [the Swan] over the Tops of many Houses, and passing by that where a Person called my Lord Pike lived, Part of it fell upon her and beat in her Round-house...". He goes on to note that whereas the Swan "...did not over-set, [she] helped some Hundreds in saving their Lives..." by providing a structure to which people caught in the waves could grab hold.

A search of contemporary wills and probate inventories did not uncover evidence of a Mr. Pike residing at the intersection of Queen and Lime Streets where the Port Royal shipwreck is located. A tantalizing bit of information did surface

upon closer inspection of several pewter plates recovered from the Building 4/5 complex. Many of these plates had owner's initials "NCI" or "IC" stamped on their rims; however, a few also had the initials "SP" clearly scratched into their undersides. A large bun weight recovered from the Room 4/Hearth 5 area of Building 5 also has the initials "SP" stamped on its side. It is curious that a few pieces of a large set of flatware would bear these different additional initials. One can only speculate as to the identity of "SP", and whether or not this is evidence of Mr. Pike. If it is, perhaps he had recently come into possession of this previously owned flatware or even the entire house. It is doubtful that any of these questions will be conclusively answered, but they prove intriguing nonetheless.

SALVAGE OF THE SWAN

The wreck of the Swan received some attention after the earthquake. One source mentions the "'weighing'" of the Swan by the crew of H.M.S. Mordaunt in 1693 (Pawson and Buisseret 1975:127). References to the weighing or salvaging of a wreck do not necessarily indicate a complete recovery of all materials and removal of the entire vessel from the ocean bottom. Pawson and Buisseret do not provide the exact text of the salvage claim, a closer study of which might suggest a clearer interpretation. They do quote The truest and largest account of the late earthquake (London, 1693, no author given) which noted that the Swan "which was careening close by the wharf was so damnified by the fall of the houses that upon view since she is condemned as unfit for further service" (Pawson and Buisseret 1975:122).

The salvage of the Swan took place a year after the vessel was destroyed. One might question why anyone would waste time and effort on an aged, severely damaged hull that had been submerged in teredo-infested water for a year when, as noted earlier, ships in service spent little more than one year in such waters in order to limit the damage incurred by their hulls. It might be suggested, therefore, that if the remains of the Swan existed above or near the water-line, the crew of the Mordaunt removed enough of these remains to make navigation safer, leaving the very bottom of the hull at the site. Salvagers may also have torn the remains of the vessel apart to recover any equipment not off-loaded during careening, and valuable fastenings such as chainplates, ring bolts, drift bolts, etc. (Crisman 1992:pers. comm.).

THE ARTIFACTS

Defining the "artifact collection" from the Port Royal shipwreck is a difficult proposition at best. Here is a ship that was likely thrown with considerable force halfway into a collapsing building. What objects belong to the ship and what objects belong within the house?

While at first glance it would seem logical that cannon balls and a shot gauge found within the house must belong to the ship, it is possible that whoever lived in the Building 4/5 complex worked on the ocean, owned a shot gauge, and used old cannon balls as door stops. The inclusion within this artifact catalogue of certain objects recovered from the building is therefore based purely upon the author's judgement. Undoubtedly, items originally associated with the wreck have been classified as part of the building's artifact assemblage and inadvertently left out of this thesis. Thus, the artifact collections from the building complex and the shipwreck have been slightly skewed as a result of their intermingling during the wrecking process.

A relatively small and varied artifact assemblage was recovered from the shipwreck and surrounding excavation units. This assemblage included items of iron, lead, wood, ceramic, glass and fabric. The majority of artifacts recovered from the wreck are presented in Appendices 5, 6, and 7; however, time constraints prohibited the conservation of all encrustations in time for this publication. The remaining artifacts have been X-rayed and are believed to be small spikes. Each

artifact presented in the Appendices is described on an artifact record sheet and depicted in an accompanying illustration. In the case of the small lead shot, a singular example from the well-represented size groups was drawn. Also, due to the fact that all onion bottles were left at Port Royal for conservation, field drawings were necessarily used in place of final illustrations. Finally, the provenience, any associations and parallels, and conservation procedures were noted for each artifact when significant.

CONSERVATION

It is incumbent upon an archaeological project director to see to it that any artifacts recovered during an excavation are properly conserved. While the notes, maps and records of an excavation are intrinsic to the interpretation of the site, so too is the artifact assemblage. The artifacts must be stabilized and protected so that researchers may return to the collection at a later date, perhaps armed with new analytical tools that will allow them to cull more information from the assemblage.

The conservation of cultural resources is, however, a field of scientific study unto itself. The following paragraphs serve only to outline the conservation techniques used on the Port Royal shipwreck artifacts. Particularly noteworthy artifacts will be discussed and are elaborated upon in their respective artifact record sheets. The techniques described below were carried out under the direction of Dr. D.L. Hamilton at Texas A&M University's Conservation Research Laboratory. For more extensive conservation information, one should consult D.L. Hamilton's Conservation of Metal Objects from Underwater Sites: A Study in Methods, as well

as the course packet - and extensive bibliography contained therein - prepared for his class "Conservation of Cultural Resources I".

Iron Artifacts

The corrosive nature of saltwater is particularly evident in iron objects that have been recovered after long periods of immersion in the ocean. The actual corrosion process that iron objects undergo is very intricate. In the simplest terms, a galvanic cell-like environment is set up around metal objects submerged in saltwater. This caused a change in the Ph level around the object which in turn causes the salt water to plate out. As the calcium carbonate and magnesium hydroxide come out of solution, they combine with the surrounding material in the seabed - coral, silt, shells, etc. - to form a cement-like encrustation layer around the metal object. It is therefore necessary to X-ray the majority of encrustations to determine the location and the condition of the artifact within.

Those encrustations from the shipwreck that contained molds of corroded metal objects were broken in half and cleaned with dental picks, wire and a Waterpik. The encrusted mold was then dehydrated in an acetone bath and allowed to air dry. The mold was cast with a two-part Hysol Epoxy compound, specifically resin LE6329NA and hardener HD-3201, and re-assembled. Once the epoxy set up, the surrounding encrustation was removed with a pneumatic chisel. The cast was then coated with graphite and sealed with Krylon 1301 to impart a more realistic iron-like appearance.

Those encrustations that seemed to contain iron objects with a significant degree of structural integrity were chipped open with a pneumatic chisel to expose the artifact. The primary concern then became the removal of salts from within the object. Electrolytic reduction was deemed the most effective method for doing so. By connecting the artifact to the negative terminal of a DC power supply, immersing the object in an electrically conductive solution (in this case a 2% sodium hydroxide solution) and surrounding it with positively charged expanded steel mesh, it was possible to draw negatively charged corrosive chloride ions out of the artifact and into the electrolyte solution (Hamilton 1992:52; 1975:28-49). Once the salts were removed, the artifact was then boiled in several baths of de-ionized (DI) water. Powdered tannic acid, a rust inhibitor, was added to the last bath. When the artifact was removed from the bath and had air dried, a solution of Bakers tannic acid was applied to its surface. Finally, the artifact was sealed through immersion in molten microcrystalline wax. The wax was heated until the immersed artifact ceased to evolve water as bubbles of steam. The wax was then allowed to cool completely with the artifact within. The wax was then reheated, and the artifact removed when the wax had reached approximately 220° F (Hamilton 1975:53-56).

Lead Artifacts

Lead objects do not suffer from the corrosive properties of salt water to the extent that iron objects do. The lead objects recovered from the shipwreck consisted

of patching material and shot. It was determined that surface cleaning and rinsing in fresh water was sufficient treatment for these items.

Wooden Artifacts

When wood is exposed to salt water for long periods of time, starch and sugar leach from within the cells. Consequently, while underwater, the wood may appear unaffected and in a fine state of preservation. If, however, the wood is brought to the surface and allowed simply to air dry, the now-empty wood cells soon collapse, causing the artifact to shrink dramatically and often to split and crumble. Therefore, the theory behind the conservation of archaeological wood involves the impregnation of the wood cells with a bulking agent. Two of the more common bulking agents are the synthetic wax-like material Polyethylene Glycol (PEG) and sucrose. These bulking agents are dissolved in water (PEG may also be used with alcohol) to which the archaeological wood is added. The liquid transports the bulking agent into the wood cells slowly, over a fairly long period of time. Length of treatment depends largely upon the size of the artifact (Hamilton 1992:17-26).

The largest wooden artifact from the Port Royal shipwreck was the section of keel and attached false keel that was recovered for study. This piece recently began a fairly lengthy (6-8 months) treatment process in a heated vat of 400-4000 Blend PEG in water. The treatment began with a low concentration of PEG and this concentration will be gradually increased with regular incremental additions of PEG. When the piece has been exposed to a 100% PEG solution for about a month, it will

be removed and air dried in a slow, controlled manner in relatively high humidity. This is important for any treated wooden artifact in order to minimise surface tension and stresses within the cells. Finally, ideal storage for the keel section and any other treated wooden item would be in conditions of less than 70% humidity.

A different bulking agent was chosen for the wooden deadeye, PR90 2076-19 and pestle, PR90 2076-23. In these cases, an acetone/rosin solution was used. While the cost of the rosin and solvent, along with the flammability of the latter, limit the applicability of this procedure, this treatment nevertheless produces a light weight, dry artifact of pleasing appearance. Before treatment with the bulking agent, the deadeye and pestle were dehydrated in sequential baths of 100% isopropyl alcohol, a 50/50 mix of isopropyl alcohol/acetone, and 100% acetone. The artifacts were then placed in a heated, saturated solution of the acetone/rosin mixture for eight weeks. After treatment, the artifacts were slowly air dried.

Ceramic Artifacts

A range of ceramics was recovered from the wreck including sherds of coarse earthenware, delftware, slipware, and salt-glazed stoneware, as well as red and white clay pipe fragments. The principle concern when conserving ceramics recovered from a marine site is the removal of soluble salts. If these salts remain within the artifact when the latter has dried, variations in the relative humidity will cause the salts to leach out from the ceramic piece and, in so doing, to cause exfoliation of the ceramic surface and glazes. Soluble salts are removed by thoroughly rinsing the artifacts in fresh water. Insoluble salts can be removed from

the surface of a ceramic artifact with dental tools and judicious, delicate use of a small pneumatic chisel. If the surface of a ceramic artifact is particularly friable, a coating of a consolidant such as Acryloid B-72 or Polyvinyl Acetate (PVA) may be applied to protect the artifact (Hamilton 1992:42-44).

Glass Artifacts

Several conservation procedures exist for glass artifacts (Hamilton 1992:46-50). Most of these are beyond the scope of this thesis, given the sparse amount of glass recovered from the wreck site. These 17th-century green glass bottles are known as "onion bottles" because of the manner in which they exfoliate if not properly conserved, and because of their globular shape. Those recovered during the excavations are now undergoing conservation treatment in Port Royal, Jamaica.

The small rose glass stem fragment, PR90 1036-5, and the quatrefoil stem fragment, PR90 2074-14, were in fairly good condition when they were recovered, and were simply rinsed well in fresh water, dehydrated in alcohol, and fortified with a surface coat of the consolidant PVA.

Fabric

Finally, one noteworthy example of fabric was recovered from the shipwreck. Canvas was removed from the inner faces of the iron gudgeon, PR90 2074-17, and the gudgeon strap molds, PR90 2075-8 and 2075-9. The canvas had remnants of pitch and tar adhering to the fibers and a significant amount of sulphide and iron staining was present. A specific treatment regimen developed by the Conservation Division of the Western Australia Museum was followed. This procedure involved

soaking the canvas in baths of hydrochloric acid, acetone, oxalic acid and hydrogen peroxide to attack the pitch and various stains (Hamilton 1992:40-41). The specific procedure used is outlined in Artifact Records PR90 2074-17A, B and C and PR90 2075-9A.

DISCUSSION OF ARTIFACTS

The artifact assemblage from the Port Royal shipwreck can be broken down into three categories. Distribution maps of each of the three categories of artifacts are presented in Figures 32, 33 and 34. Those artifacts classified as "Ship Related" include the gudgeons, deadeye, fasteners and lead strips used as patching material.

Artifacts categorized as "Armament" include a cannon ball gauge, barshot, grenades, cannon balls, and small lead shot.

The third category, labeled "Personal Effects/Shipboard Life" includes two stemware fragments, a pestle, a chisel, a lead punch back, tobacco pipes, ceramic sherds, onion bottles and faunal remains.

Ship Related Artifacts (Figure 32 and Appendix 5)

Gudgeons

Gudgeons are large iron fittings, attached to the stern of a vessel to support the rudder. The ends of the gudgeons are fashioned with holes to accept the pins of the pintles which were attached to the rudder. The interior faces of the Port Royal Shipwreck gudgeons (PR90 2074-17; PR90 2075-8 and 2075-9) retained a layer of pitch, canvas and hair which must have aided the seating of these gudgeons against the ship and protected the wood against rot.

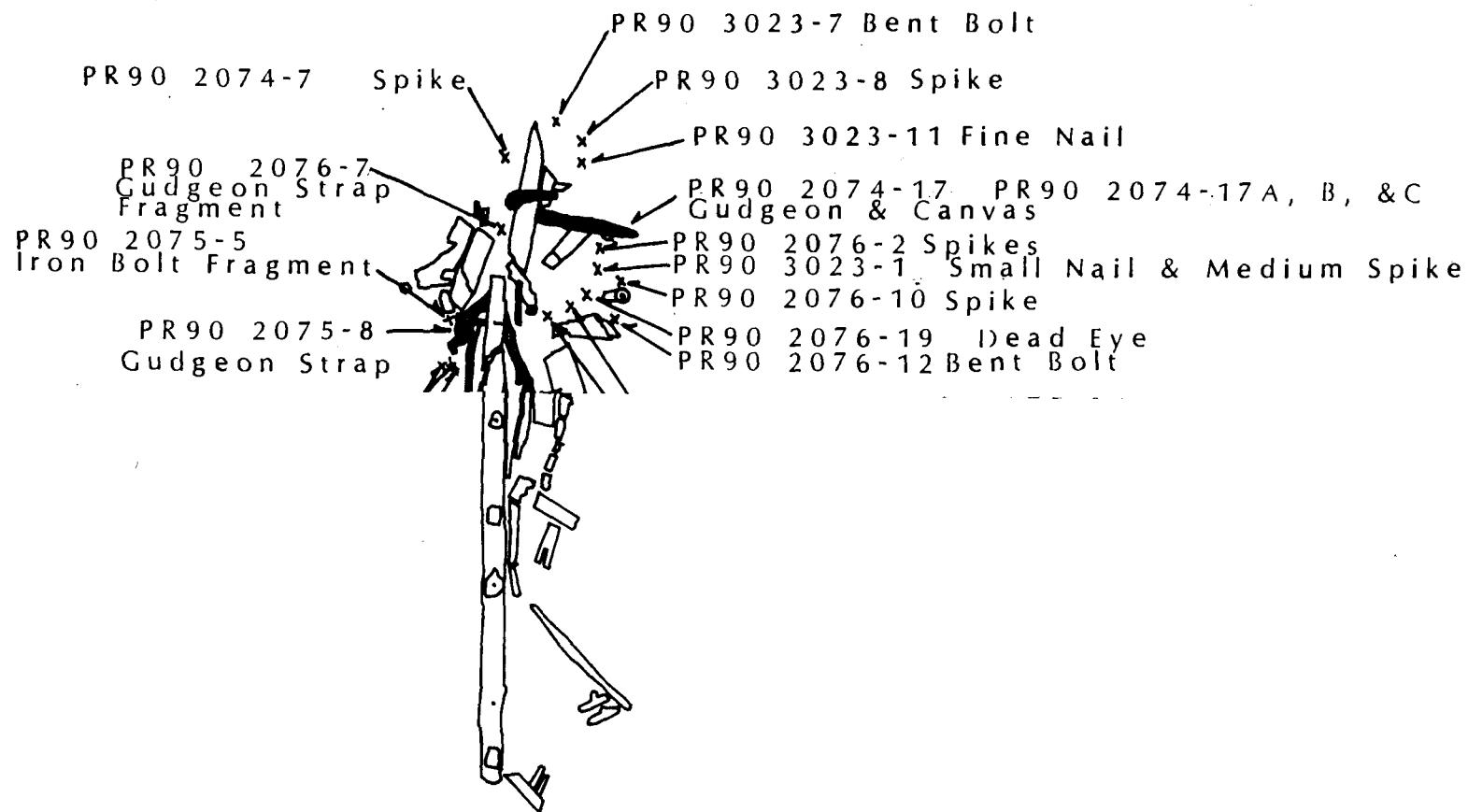


Figure 32. Distribution Map of "Ship-Related" Artifacts

The hair appeared to be either bovine or equine. The likeliness of it being cow hair is supported by a number of sources. Arnold (1978:223) notes that cow hair was used as caulking material on a shipwreck in England dating no later than the end of the 16th century. Furthermore, Lam (1985:15) notes that in Witsen's Architectura Navalis et Regimen Nauticum ofte Aaloude en Hedendaagshe Scheepsbouw en Bestier (1690), the author describes the use of a layer of tarred cow hair between the ship's hull and outer sheathing below the waterline. Finally, cow hair was also recovered from between the bottom planking and the wooden sheathing of a 17th-century European merchant vessel being excavated in Monte Christi Bay, Dominican Republic (J. Hall, pers. comm.).

While all these examples concern hair recovered from the sides of the vessel and not from beneath a large fastener such as a gudgeon, it is reasonable to assume that the same sealing material would have been used throughout the vessel.

Deadeye

It is likely that PR90 2076-19 was one of a pair of deadeyes employed in the vessel's shroud system. Shrouds consisted of a series of ropes attached to the top of a vessel's mast which then ran out to the port and starboard sides of the vessel, where they were fastened to the outer hull by means of chain-plates. This system of ropes provided the mast with lateral stability. Larger vessels with topmasts had additional pairs of shrouds supporting these masts.

The lower end of each shroud rope was fastened around a wooden deadeye. These deadeyes were paired with deadeyes attached to the chainplates (or at the

ends of the futtock shrouds in the case of topmast shrouds). Each deadeye pair was joined by a lanyard threaded through the three holes in each deadeye, which thereby allowed the shroud to be tightened (Kemp 1976:234-235; 710; 800).

Because the lower deadeyes in any of these pairs were encircled with iron bands it is believed that PR90 2076-19 was not the lower member of any pair, but was instead a deadeye fastened to the end of a shroud rope. This is suggested given the lack of any encrusted metal or metal stain around the circumference of the deadeye.

Fasteners

A varied collection of fasteners including bolts, drift pins, spikes and nails was recovered from the shipwreck.

For the purpose of this discussion, bolts are defined as large fasteners with round shanks, with or without heads. Ten examples of bolts are detailed in the artifact catalogue; these are PR90 1065-7, 1083-5, 1083-7, 1083-10, 1085-5, 1096-6, 1096-10, 2075-5, 2076-12, and 3023-7. Most of these examples averaged just under a foot in length; however, 2075-5 and 2076-12 were exceptions, being roughly 1-1/2 ft long. Also of these bolts, PR90 1083-5, 2076-12 and 3023-7 were distinctive in that they were bent at a 90° angle. In the case of 2076-12, this bend is particularly intriguing as it occurs midway along a long bolt. It is unlikely that the entire lower half of the bolt was bent over to secure the upper half in a timber, and this particular bend was perhaps incurred during the trauma of the wrecking. Of the bolts, only PR90 1083-10 retains evidence of a legitimate head. PR90 1096-6 and

2076-12 may only have "head-like" ends that are the result of their being pounded into hard timber. All of these bolts were probably used to secure major hull components such as the keelson, knees and stem and stern assemblies.

If one uses Oertling's (1989:236) definition of a drift pin as a "large, square-sectioned, non-headed" fastener, then PR90 1083-11 would appear to be an example of such a fastener. Large fasteners had multiple uses in ship construction. One possible function of this square-shanked fastener is suggested by Marsden (1972:86) in his report on the Amsterdam (1749). On this vessel, square-sectioned bolts may have been used to secure a wooden channel or shelf to the outside of the vessel. The channel served to spread out the shrouds of the vessel's standing rigging. While an identification of PR90 1083-11 as an iron channel bolt seems plausible, those on the Amsterdam were 5 x 4 cm, nearly twice the size of the bolt recovered from the Port Royal shipwreck; however, the Amsterdam was much larger than the Port Royal vessel.

PR90 2076-21 appears to be the fragments of a ring bolt, which would have seen many uses including "...hooking on tackles [and] passing lashings..... (McEwen and Lewis 1953:51), as well as securing gun breeches and training tackle (Crisman 1992:pers. comm.).

PR90 2075-12 is apparently a type of forelock bolt, adapted to accept iron wedges or keys to secure the bolt on either side of a timber.

Twelve spikes were recovered, these being PR90 1083-6, 1084-5, 2074-7, 2075-10, 2075-11, 2076-2 (2), 2076-9, 2076-10, 3023-1 (2), 3023-8. For the

purpose of this thesis, spikes are defined as "...large nail[s] of square section and, usually, of greater length than 3-1/2 inches..."(McEwen and Lewis 1953:522), and those from the Port Royal wreck appear to have had either square or bulbous, "button" heads (Oertling 1989b:236). These fasteners would have been used throughout the wreck, in a multitude of functions, particularly in concert with treenails to attach the hull planking to the frames.

Finally, one square-sectioned nail [a nail falls between a tack and a spike in size (McEwen and Lewis 1952:355)] was identified. PR90 3023-11 seems refined and finished and may have been used in the upperworks, or interior finishing work of the vessel.

Lead Strips

Several lead strips with small nail or tack holes along their edges were recovered from the site. An inspection of the outer surface of the planking proved that the wreck was not, at the time of wrecking at least, sheathed in this material, and the small quantity recovered would seem to bear this out. Lead strips exactly like these have, however, been found at many other wreck sites including that of the Molasses Reef vessel (Keith et al. 1984:56), the Campan (Larn 1985:15), the Dartmouth (Adnams 1974:271), H.M.S. Hazardous (Owen 1988:291), the Amsterdam (1972:87) and the Whydah (C.E. Hamilton 1991:155). The pliability of the metal made it an excellent patching material, to be hammered and fastened over bad planking joints, or pounded into loose seams.

Armament (Figure 33 and Appendix 6)

Manwayring (1644:93-94) provides a contemporary analysis of the uses of various kinds of shot, both large and small (some contemporary spellings have been adjusted):

There are many kinds of shot; that which flies farthest,
and pierceth most, is round-shot, the next is cross-bar,
which is good for ropes, sails and masts; the other langrell;
which will not fly so far, but is very good for the rigging,
and the like, and for men; so is chain shot and case-shot,
or barrell-shot, which is good to ply amongst men, which
stand naked, plying their small shot

Cyprian Lucar (Guilmartin 1988:37), however, provides some dry humor on the matter of weapons in 1588:

A gunner ought to be a sober, wakefull, lustie,
hardie, patient, prudent and quick-spirited man;
he ought also to have a good eyesight

Shot Gauge

PR89 884-7 is a brass shotgauge consisting of five graduated rings fastened together with a wing nut. Each ring bears an inscription of one or two letters that coincide with the names of 17th-century English ordnance. These guns are, from largest to smallest, a Demi-Culverin, Saker, Minion, Falcon and Falconet. During the 17th century, the English still referred to their types of ordnance by specific names as opposed to shot-weight designations such a "12-pounder" or "8-pounder" used by other European nations (Tippie 1990:23).

It was necessary to have a shot gauge for every set of ordnance for, although English gunfounders were producing a large quantity of ordnance, each piece varied

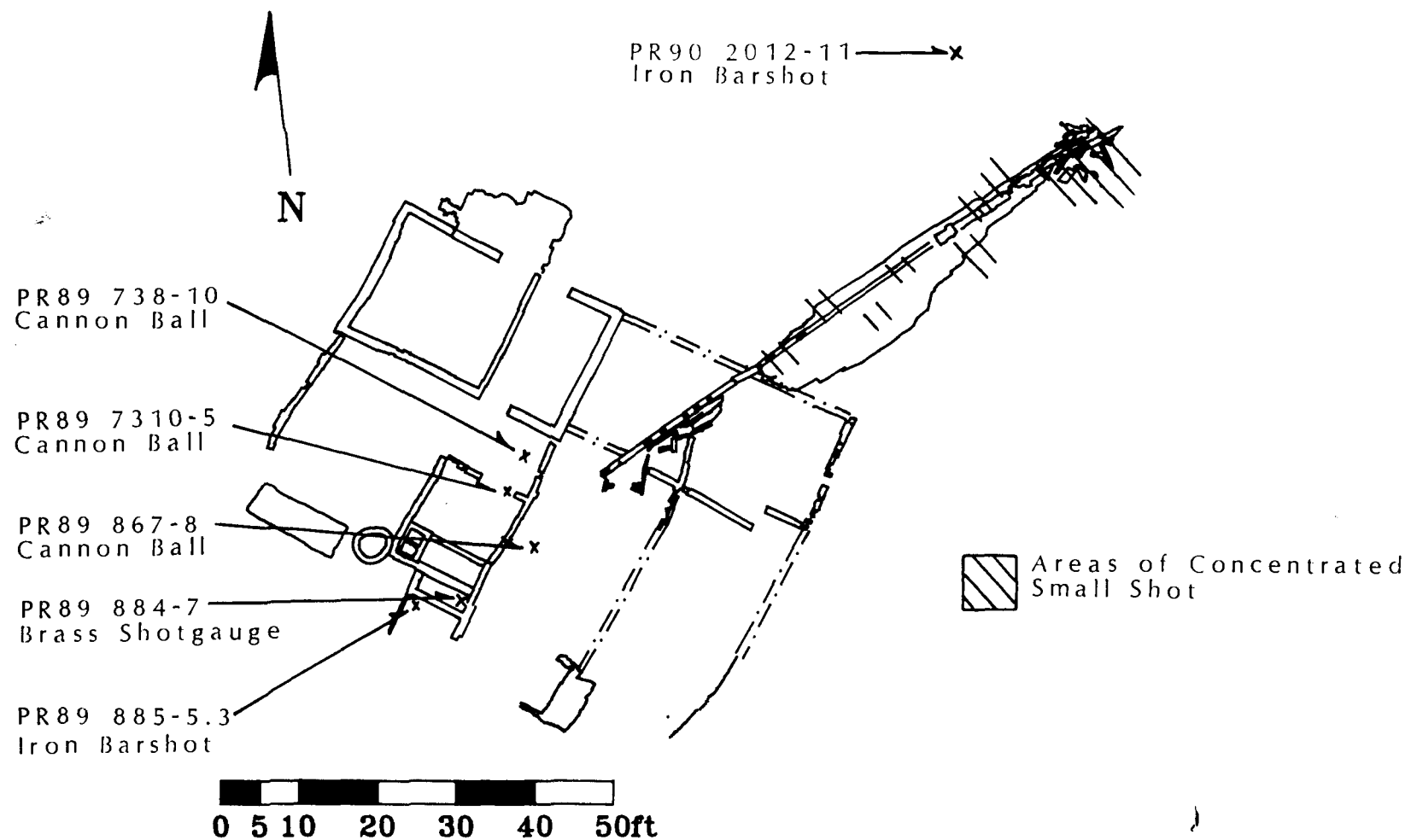


Figure 33. Distribution Map of "Armament" Artifacts

slightly from the next. Furthermore, cast iron shot was also being produced in high volume and many pieces would be imperfectly sized or, if stored onboard a vessel for a long period of time, would become disfigured due to salt-water corrosion (Tippie 1990:24). Also, iron shot on the bottom of a shot locker could be pressed out of shape by the weight of the shot above (Crisman 1992:pers. comm.).

Table 6 from Tippie (1990:24) lists the guns represented by the shot gauge, the interior diameter of the appropriate ring, the caliber of that weapon as recorded in 1643 according to ffoulkes (1937:92) and the windage, or the amount of space between the shot and the cannon. Tucker (1976:60) states that a degree of windage of 1/8 in was desirable; however, given the inherent variation of guns, the windages presented above are acceptable.

Table 6. Statistics Concerning Some 17th-Century English Ordnance

NAME	GAUGE MARK	INTERIOR DIAMETER (in.)	CALIBER (1643) (in.)	TOTAL WINDAGE (in.)
Demi-Culverin	D-C	4-1/8	4-1/2	3/8
Saker	S	3-3/8	3-1/2	1/8
Minion	M	3-1/8	3-1/4	1/8
Falcon	F	2-1/2	2-3/4	1/4
Falconet	F-N	2	2-1/4	1/4

Upon first consideration, it might seem that the Port Royal shot gauge was somewhat obsolete by 1692 for, by 1635, the two smallest guns represented by the

gauge - the Falcon and Falconet - had, theoretically, been phased out of use in the Royal Navy (Lavery 1987:103). It is interesting to note that the demi-culverin, represented by the largest of the five rings, was the principal below-deck weapon used on small Ships of the Line (particularly 5th Rate vessels) during the 17th century (Tippie 1990:24; Adnams 1974:272). This fact coincides elegantly with the hypothesis that the Port Royal shipwreck is actually the H.M.S. Swan. And, with regard to the "obsolete" guns, it is not unreasonable to assume that these weapons may still have been in use on the small ships of the line, particularly those assigned to overseas ports, well into the 17th century.

Cannon Balls

Three cannon balls were found in the vicinity of the southern end of the bow. PR89 867-8 measured 3-1/4 in. in diameter and according to Table 3, would have been suitable for use in the 17th century English cannon called a Saker, the bore diameter of which was 3-3/8 in.

PR89 738-10 measured 2-1/4 in. in diameter and would have been used in a Falcon, the bore diameter of which was 2-1/2 in. This too was a piece of 17th-century English ordnance, albeit one that had supposedly been phased out by 1635. The presence of this piece of shot, along with the inclusion of the Falcon and Falconet rings on the shot gauge, suggests that these guns may still have been in use on small warships well into the late 17th century.

PR89 7310-5, with a diameter of 2-11/16 in., does not appear to be suitable for any of the guns represented by the shot gauge. Instead, it would fit a 17th-

century Dutch gun known as a 3-pounder, as the ideal shot diameter for this gun was 2-3/4 in. (Tippie 1990:10).

Keeping in mind the hypothesis that the Port Royal shipwreck may be that of the 5th Rate warship H.M.S. Swan, it is interesting to note that both a Saket and a 3-pounder, as well as shot fit for a Falconet were recovered from the 1690 wreck of the 5th Rate English warship H.M.S. Dartmouth (McBride 1976:193-194, Tables 3A and 3C).

Barshot

Single examples of two types of barshot were recovered from the vicinity of the Port Royal shipwreck. The first of these, PR89 885-5.3 appears to be a wrought iron bar with a wrought iron disk at either end, through which the bar passes. The ends of the bar then appear to be peened down onto the outer faces of these disks. Somewhat similar examples were recovered from the Santo Christo de Castello (McBride, Larn and Davis 1975:247) and from the Campen (Larn 1985:16)

PR90 2012-11 deserves special consideration. This barshot is of an unusual design consisting of a wrought iron bar with half cannon balls at either end. The shaft is imbedded within the cannon ball halves, indicating that the halves were cast around the shaft. It is far less likely that the shaft was driven into a hole cut into the rounded surface of the cannon balls.

Evidence of sprue holes on both cannon ball halves seems to suggest that these halves were from two different cannon balls. Furthermore, the sprue holes and mold lines on each cannon ball half are lined up. It seems most likely, therefore,

that this piece was made by placing two specialized half-cannon ball molds at either end of a wrought iron shaft, and then casting these molds. It is unlikely that surplus cannon balls were sawn in half and then somehow bored out to accept the wrought iron shaft.

While no examples identical to 2012-11 have been recovered from widely published wrecks, a few examples on which the cannon ball halves were inverted (with their flat faces welded to the bar) have been noted. Such a piece was recovered from the Genoese vessel Santo Christo de Castello (McBride, Larn, and Davis 1975:247).

Small Lead Shot

Two hundred ninety-five pieces of small lead shot were recovered from the shipwreck. This is a small sample of what would have been aboard a 17th-century vessel, as indicated by the 3000 pieces recovered from the Kennemerland, a 17th-century Dutch vessel (Price and Muckelroy 1974:263). With the relatively small size of the Port Royal shot sample in mind, it nevertheless seems possible to suggest the presence of particular types of guns on board the wreck, as indicated by the size distribution of the shot.

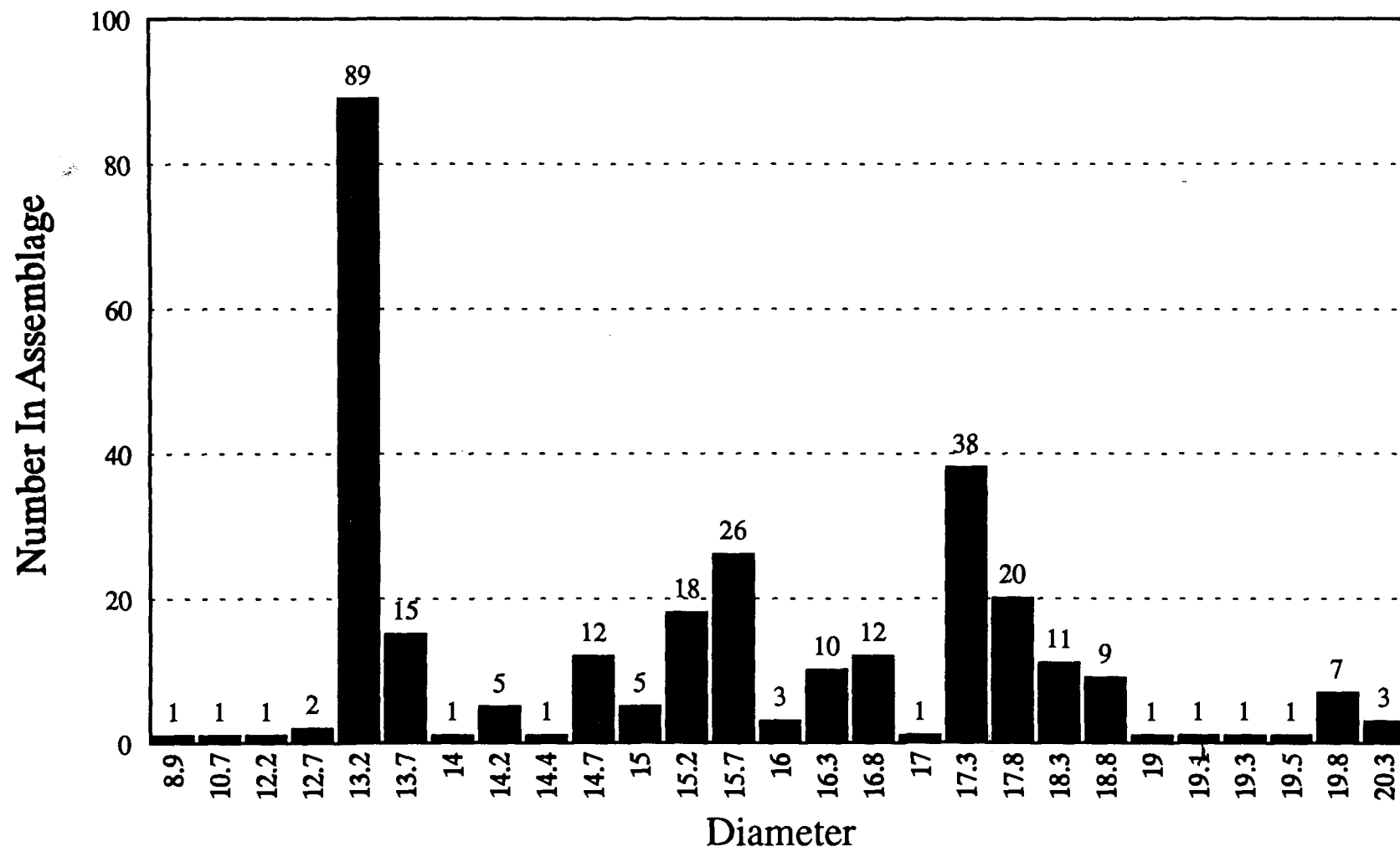
Small arms were not made specifically for use at sea until the 18th century (May and Kennard 1962:13); therefore, the types of firearms represented by the shot are the same as those recovered from other 17th-century contexts. Some of these firearm types and the size of shot appropriate for use with each type is presented below as listed by McBride, Larn and Davis (1975:248) and McBride (1976:194):

Blunderbuss	31mm
Musketoons	18mm
Musket	17mm
Carbine, Caliver	16mm
Pistol	13mm
Pistol, Blunderbuss and Case shot	10mm

The association of a particular size of shot with a particular type of firearm is not, however, as clear as it may seem. First, in the 17th and 18th centuries, firearms were not manufactured according to strict specifications. Instead, their caliber could vary according to the inclination of the manufacturer or client. Secondly, when blackpowder firearms are discharged, the barrel becomes fouled with powder residue. It was necessary, therefore, for the user of the firearm to be equipped with lead shot smaller than the optimum size for the weapon. Present-day firings of 17th- and 18th- century firearms have demonstrated that shot of two bore sizes less than the optimum size could be used in a repeatedly discharged (and thus fouled) firearm (Perkins 1983:340).

With these factors in mind, one should consider Chart 1, in which the size distribution of the Port Royal Shipwreck's shot is presented. Working with the list of firearms presented above, it would seem that the clustering of shot at 14.7-15.7 mm, 16-16.8 mm and 17.3-18.3 mm, suggests the presence of carbines and calivers, muskets and musketoons respectively. The smallest shot sizes and the cluster at 13.2-13.7 mm may suggest pistols that varied from the observations of McBride et al.

Chart 1. Size Distribution of the Small Lead Shot
Recovered from the Port Royal Shipwreck



sized in millimeters

While similar size shot has been recovered from many contemporary wrecks including the Lastdrager (Sténuit 1974), Dartmouth (McBride 1976), Santo Christo de Castello (McBride, Larn and Davis 1975), and Campen (Larn 1985), it is necessary to note that shot size is nearly useless in terms of dating a wreck because the sizes the shot used in the 17th century continued to be used into the 19th century (McBride 1976:198).

Personal Effects/Shipboard Life (Figure 34 and Appendix 7)

Stemware

Despite the chaotic nature of a shipwrecking, intact stemware items are, amazingly, recoverable from such archaeological sites, as exemplified by the crystal wine goblets brought up from the wrecks of the Guadeloupe and Tolosa, two Spanish galleons that wrecked in 1724 (Smith 1988:100, Figure 21). Unfortunately, this is a rare occurrence, and few intact drinking glasses have been recovered from any archaeological sites. While spectacular pieces were not retrieved from the Port Royal Shipwreck, two significant drinking glass stem fragments were recovered: PR90 1036-5 and PR90 2074-14.

After the restoration of the Monarchy in 1660 the English, heretofore dependent upon Venetian craftsmen for their fine glassware, took deliberate steps to develop a glass making industry of their own. One firm that joined in the endeavor was Measey and Greene who developed relatively elaborately styled glasses with a variety of such decorative features as balusters, inverted balusters, knops (ribbed and plain), and a variety of collars (Noël-Hume 1991:187-189). PR90 1036-5 with its

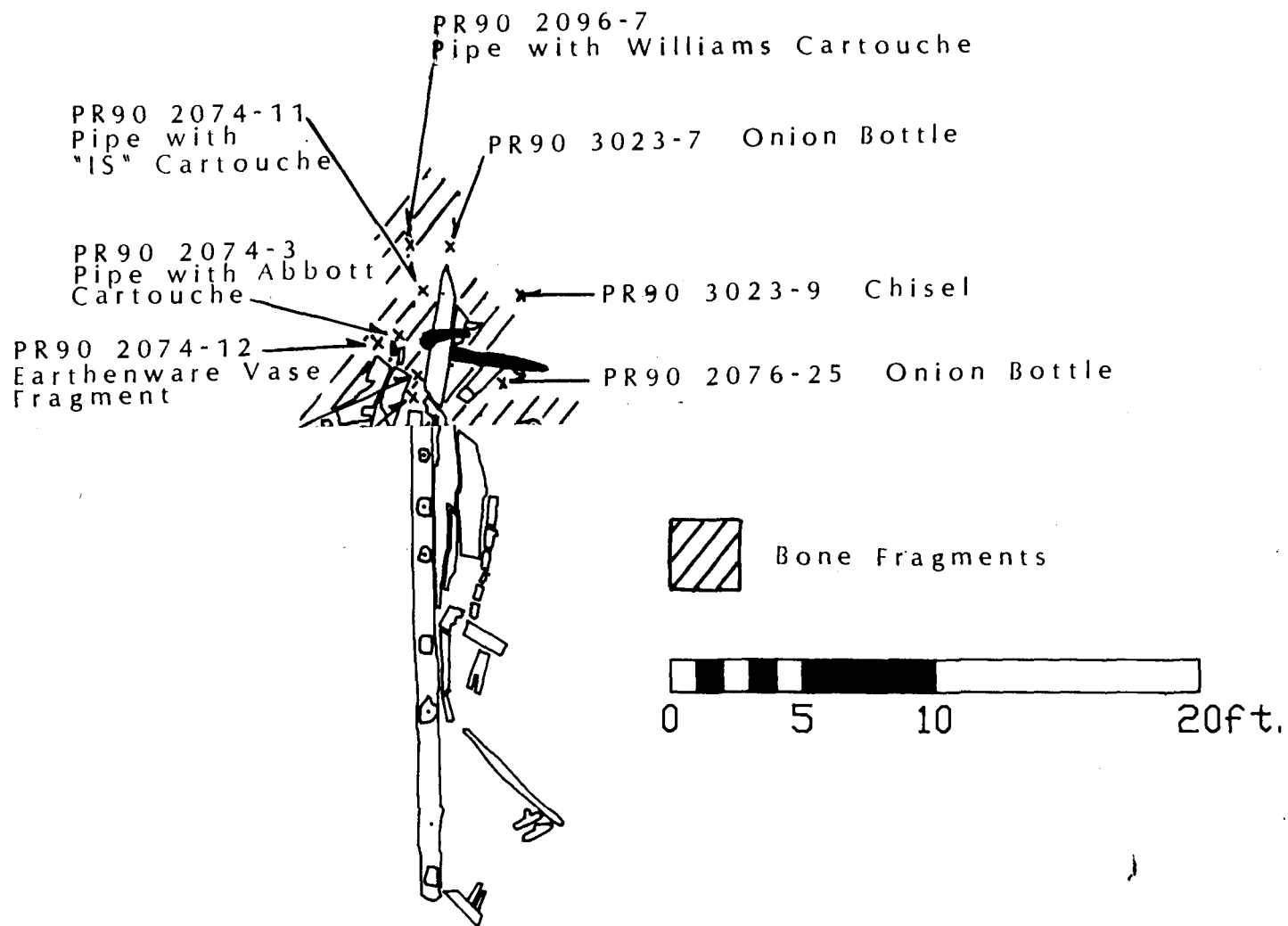


Figure 34. Distribution Map of "Personal Effects/Shipboard Life" Artifacts

globular knop and decided transition points at top and bottom seems to fit nicely into this stylistic period. This piece bears a strong resemblance to Noël-Hume's type IV (1991:191, Figure 64), which he dates from 1665 to 1675, and to a number of examples presented by McClenaghan (1988:54, Figure 8), a group which she dates from 1666 to 1672.

Another prominent individual in the 17th-century English glass manufacturing business was George Ravenscroft who produced some of the finest "flint glass" or leaded crystal of the period. A design popular with Ravenscroft, as well as with Hawley Bishop and other glassmakers of the 1680s and 1690s incorporated a "quatrefoil" stem like PR90 2074-14. This example is very similar to Noël-Hume's type VI (1991:191, Figure 64) and to examples presented by McClenaghan (1988:59, Figure 11). Furthermore, Noël-Hume (1991:186) notes that Ravenscroft marked his work with a glass seal placed on the stems. It would appear that PR90 2074-14 bears just such a circular seal, particularly when compared to McClenaghan's (1988:57, Figure 10) examples.

Pestle

PR 2076-23 is a wooden pestle recovered from the stern area of the Port Royal shipwreck. A mortar and pestle would have been very useful within the realm of food preparation, to grind peppercorns and other such spices; however, these tools were also required by the ship's doctor to grind and mix medicines, and were perhaps even used by gunners to mix fine powder (Crisman 1992:pers. comm.).

Most crews, particularly those onboard vessels operated by the government, included barber/surgeons. The presence of such an individual within the crew of the Mary Rose, Henry VIII's flagship which sank in 1545, was evident upon the excavation, from within the vessel, of a surgeon's chest. This wooden chest contained, among other items, steel surgical tools such as a syringe, and razors. A chafing dish and a heavy mortar were also recovered from within the surgeon's cabin, the latter tool having obviously been used for grinding drug powders (Rule 1984:192-193; Watt 1983:6-7). Now it would seem logical to conclude that the presence of a mortar suggests the presence of a pestle, although one has yet to be identified on the Mary Rose.

A stone pestle was, however, recovered from the Santo Antonio de Tanna, a 42-gun Portuguese frigate which sank in Mombasa Harbor in 1697 (Piercy 1977:338).

Chisel

Hysol cast PR90 3023-9 bears a very strong resemblance to chisel NS2.A5b.1d as presented by Franklin (1992:87, Figure 66). This tool, recovered from the 17th-century stratum of a land excavation at Port Royal, is described as a woodworking chisel with a solid iron shank and handle attached to a deteriorated chisel blade (Franklin 1992:87). Interestingly, Franklin (1992:75) notes the difficulty in distinguishing between chisels and caulking irons and, due to the reuse of valuable tools, a particular example could have functioned in both capacities.

This is an intriguing point in light of the possibility that the Port Royal Shipwreck might be the wreck of H.M.S. Swan, which was being careened and repaired at the time of the earthquake. PR90 3023-9 with its bent tip may have been a woodworking tool turned caulking iron that was being used to recaulk the Swan on that fateful day in 1692.

Lead Punch Back

PR90 845-6, is a lead disk with numerous small circular holes punched in its two faces. The function of this artifact is not quite clear, although it would have provided a relatively soft yet firm backing behind an item into which small circles were being punched. The soft nature of the lead would have dulled the punch to a lesser degree than would a harder surface.

Pipes

Several fragments of tobacco smoking pipes were recovered, the majority of which were kaolin, or white clay, pipes. Tobacco was introduced to Europe in the 16th century and led to the manufacture of the first clay pipes in Europe in 1590 (Jobling 1992:4). At this time and throughout the early 17th century, however, tobacco was quite expensive, and the small bowls of the early 17th century reflect this fact.

As tobacco became increasingly affordable throughout the 17th century, the size of pipe bowls was increased. This affordability also enabled a large portion of the populace - men, women and children alike - to take up smoking. Consequently,

in historical records. Again, this does not mean that this pipe maker was not placing his mark on pipes before this time.

PR90 1054-1 bears the cartouche of Isaac Evans. The bowl of this pipe, while similar to several late 17th-, early 18th-century varieties, was peculiar in shape. The bulbous nature of the face away from the smoker coupled with the straight side facing the smoker together keep this pipe from being easily categorized. It most closely resembles Noël-Hume's number 15 (1991:303) which he dates from 1700 to 1770. Walker (1977a:1130) dates Isaac Evan's anchor and shield cartouche to the years from 1696 to 1700/1. The year 1696 is simply the first time Isaac Evans is mentioned in contemporary documents. Therefore, it seems probable that he could have produced this pipe in 1691.

PR90 1083-2 appears to have been made by Devereaux Jones I who is present in contemporary records from 1684 to 1713 (Walker 1977a:1186,1454). The bowl itself closely resembles Walker's number 15 (1977b:1549) dating from 1700 to 1770. As described above, it is reasonable to place this pipe in a 1692 context.

PR90 2074-3 bears the cartouche of James Abbot, whose name occurs in the records from 1676 to 1715/6 (Walker 1977a:1046). This pipe bowl is a near perfect match to that presented in Walker's Figure C (1977a:1405) and closely resembles Noël-Hume's number 13 dating from 1680 to 1710 (1991:303).

PR90 2074-11 is difficult to identify. The cartouche has not been associated with a particular pipemaker but only to "...many possible Bristol makers (Oswald in Marx 1968:47)." One possible maker could be John Sinderling who appears in the

records from 1653 to 1699 (Walker 1977a:1296). The bowl itself closely matches that presented by Walker (1977b:1545) in Figure 6a-3, dated from 1700 to 1730.

PR90 2074-16 also bears the anchor and shield cartouche of Isaac Evans as did PR90 1054-1. In this instance, however, the bowl is very similar to Walker's (1977b:1531) number 23 in Figure 4b, dated from 1690 to 1720.

Finally, PR90 2096-7 bears the cartouche "R/WILLIAMS" which is attributable either to Roger Williams (in the records from 1668 to 1677) or to Robert Williams I (in the records from 1685 to 1714). The bowl, however, is very similar to Oswald's (1961:59) number 5b, which he dates from 1640 to 1670. While this fact would seem to rule out Robert Williams I as the pipe maker, Oswald does note that a giant pipe in this style, dating to 1698, "...may represent a survival of tradition (Oswald 1961:58)."

Ceramics

Several sherds of 17th-century African and European ceramics were recovered from the wreck site. These sherds included examples of coarse earthenware, slipware, tin-enameled delftware, and Westerwald stoneware. None of the fragments was large enough to indicate the type of vessel of which it was a part. The most complete ceramic artifact recovered from the wreck was the rim and a portion of the neck of a wheel-thrown vase or jug. While this piece has been identified as earthenware, the specific type of earthenware can not be discerned.

Onion Bottles

These globular green glass bottles with concave bottoms were found in significant quantities throughout all of the INA excavation sites along Lime Street. This underlines the fact that these bottles were the ubiquitous "jerry can" of the 17th century, and were used to hold a variety of substances from liquor to seal oil (R. McClure, pers. comm.).

Faunal Remains

Fragments of bovine, pig and turtle bones were found along the wreck in random pockets with the greatest concentration at the stern.

CONCLUSIONS

This study has served to underline the cosmopolitan, multi-faceted nature of seaborne trade and enterprise based in 17th-century Port Royal, Jamaica. A consistently high level of shipping traffic was maintained throughout the year in the spacious, clear harbor. The largest of merchant vessels from Europe appeared at regular intervals, discharging their cargoes of fine furniture, cloth and foodstuffs, and loading up with sugar, tobacco, and dyestuffs. Smaller ketches and pinks appeared throughout the year, unloading salt cod and wood before slipping off in hopes of making a quick fortune with a load of logwood. While these vessels filled the harbor, an entire fleet of smaller vessels - shallops and sloops based in Chocolata Hole (Figure 9) - conducted trade throughout the Caribbean Islands and around Jamaica itself.

How did the vessel wrecked in Building 4 fit into this maritime context? The intermingling of the dwelling-related and ship-related artifacts, the relatively small artifact assemblage recovered from the ship, and the high degree of damage to both the building and the vessel, all have resulted in a confused archaeological record.

I do believe that the question of whether this vessel was wrecked during the 1692 earthquake, or was instead an 18th century intrusion, has been answered. A sample of gudgeon canvas was sent to the University of Texas' Radiocarbon Lab for Carbon-14 testing. A Libby date of 284 ± 53 , -27 (TX 7747) was acquired, which,

This information, together with the vessel's construction features and artifact assemblage, as well as the degree of destruction the vessel inflicted upon the building, solidly place the vessel in the 17th century.

What is the nationality of this vessel? The frames of the ship were not transversely fastened with Iberian dovetail mortise and tennon joints; however, as discussed previously, it is not known if this construction characteristic was utilized in the 17th century. Eliminating France as a nation of origin is also difficult given the sparse information available concerning 17th-century French hulls. If one uses H.M.S. Hazardous (originally French) as a model, however, the Port Royal wreck does not appear to be as heavily framed and fastened as this French-built vessel. A colonial North American port of origin is possible. It is likely that colonial shipwrights followed the construction practices of their homeland, particularly in the 17th century when the colonies were still young. While the presence of North American species of wood in the vessel's structure might indicate Dutch or English colonial origin, European shipyards did begin to import North American timber soon after colonies were founded, and European-built ships were frequently repaired in the Americas.

Given all of these considerations, it seems most likely that the Port Royal vessel was of English or Dutch origin. The vessel's floor/futtock arrangement, the lack of transverse fasteners between these elements, and the style of keel scarf are characteristic of English shipbuilding practices but Dutch construction can not be ruled out.

The "Northern" Dutch method of ship construction yielded distinctive products. These vessels had wooden patches or plugs fitted into areas where wooden clamps were used during the construction of the hull. No such patches were noted on the Port Royal shipwreck. The "Southern" Dutch method, however, much more closely approximated contemporary English ship construction practices. Furthermore, it is well documented that despite the long term hostilities between England and the Netherlands in the 17th century, there was a high degree of interaction between the citizens of both nations. This was particularly true in the shipping and shipbuilding industries. English and Dutch shipwrights found employment on either side of the channel and it is highly likely that the vessels of each nation had similar characteristics. It is Martin's contention (1978:54) that aspects of the hull of H.M.S. Dartmouth, such as her substantial bottom construction and lighter upper works demonstrate influence from the Low Countries.

The single characteristic that may have most obviously differentiated English and Dutch hulls was the draft of the vessels. The shallow nature of Dutch harbors necessitated that Dutch hulls be of markedly shallow draft. In terms of the Port Royal vessel, however, the traumatized nature of the hull makes it impossible to analyze her draft relative to that of other vessels.

Could this be the wreck of H.M.S. Swan, the English 5th Rate warship washed from a carenage wharf into the sinking town during the earthquake? The Swan was captured by the English from the Dutch in 1672. When the earthquake ended her career in 1692 she was, therefore, at least 20 years old. In that time she

had been converted to a fireship and reconverted to a man-of-war. How would the wreckage of the lower hull of a Dutch vessel appear after she had spent her last 20 years in English hands? While the vertical keel scarf with stopwater may be taken as a characteristic of English shipbuilding, it is highly possible that at some time during the Swan's 20 years of service and two refits she was re-keeled by the English. No other aspect of this hull precludes it from being of Dutch origin. Furthermore, the principal dimensions of H.M.S. Swan compare favorably with those of the Port Royal vessel - particularly the length of keel.

Artifacts were recovered primarily from the bow and stern areas of the wreck while the main body of the vessel was markedly devoid of artifactual material. This would seem in keeping with a vessel that was being careened. It would be far easier to clean out the body of a vessel as opposed to the cramped areas of the bow and stern. Spilled shot and dropped tools may have remained in these areas throughout the cleaning and refitting of the vessel. Finally, the shot gauge and cannon balls found around the bow of the wreck suggest the presence of sizes of guns that were typical for a 5th Rate English warship.

A strong argument can therefore be made for the Port Royal shipwreck being the wreck of H.M.S. Swan. From the reconstruction map presented in Figure 9, one can see how the Swan could have been ripped from a careenage wharf on the northern side of the spit, lifted over the sinking houses between the shore and Queen Street, and then washed westerly down Queen Street and into Building 4, which was

right at the western end of Queen Street. Prudence clearly dictates, however, that I stop short of declaring this scenario a fact.

Regardless, the excavation of this vessel has added significant information to the small body of available knowledge concerning 17th-century ship construction. This study has also served to highlight the fact that generalizations about ship construction practices are tenuous at best. Few defining characteristics such as "Iberian" dovetail mortise and tennon joinery exist. Furthermore, characteristics such as the presence or absence of lateral fastening of frame elements, and the distance between the keel and first futtocks, are not, by themselves, reliable indicators of the date of a vessel's construction.

It is clear then, that despite the wealth of documentation that exists regarding post-medieval ship construction, there is much that still eludes us. Primary source material such as shipbuilding treatises and Admiralty records are undeniably valuable, but it is clear that during the 16th, 17th, and 18th centuries, the whims or judgements of individual shipwrights influenced the construction of the vessels they built. It is only through archaeological excavation of shipwrecks that an accurate reconstruction of post-medieval ship construction practices can be achieved - a reconstruction that will take into account the modifications that shipwrights made in the construction of vessels in order to address the real-world challenges, such as time limitations and shortage of supplies, that they inevitably faced.

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APPENDIX 1

ENGLISH VESSELS TRADING AT JAMAICA

APPENDIX 1

ENGLISH VESSELS TRADING AT JAMAICA

(Pawson and Buisseret 1975:72-74)

Richard and Sarah - 200 tons

1683 - Jamaica to London:

Cargo - 429 hogsheads sugar
 28 hogsheads cocoa
 28 bags cotton
 24 barrels indigo
 20 tons logwood
 20 hogsheads pimento
 86 hides

1686 - London to Jamaica:

Cargo - 46 "'passengers and
 servants'"
 25 tons beer
 12 casks mum (a type of
 beer)
 4 hogsheads cider
 40 whole and 20 half
 cases spirits
 3 tons flour
 60 firkins butter
 2,500 pounds cheese
 "'90 tons of dry goods as
 per cocketts'"

- Jamaica to London:

Cargo - 43 hogsheads sugar
 63 bags cotton
 32 barrels indigo
 15 tons ginger
 30 tons logwood
 2 tons fustick
 23 hogsheads pimento
 41 puncheons lime-juice

1687 - London to Jamaica:

Cargo - beer and mum
 Rhenish and Canary
 wines
 butter
 cheese
 candles
 flour
 soap

1688 - Jamaica to London:

Cargo - sugar and other staples
 231 "'elephant teeth'"
 10 tons ebony

- London to Jamaica

Cargo - food and drink
 "'45 tuns provisions
 50 tuns ammunition

- Jamaica to London:

Cargo - 574 hogsheads sugar
 53 hogsheads pimento
 7 hogsheads indigo
 37 bags cotton
 50 tons logwood

Lambe - 80 tons (Claypole 1972:130)

1682-1691 - seven trips from Jamaica to
Bristol

Average Cargo - 230 hogsheads sugar
50 bags cotton
2 bars indigo
15 tons fustick

Susannah

1688 - Hispaniola to Jamaica
Cargo - hides

Greyhound

1688 - Rio de Hacha to Jamaica
Cargo - cocoa

John and Mary

1688 - Rio de Hacha to Jamaica
Cargo - mules and horses

Charles

1689 - Cuba to Jamaica
Cargo- hogs

APPENDIX 2**NEW ENGLAND VESSELS TRADING AT JAMAICA**

APPENDIX 2

NEW ENGLAND VESSELS TRADING AT JAMAICA
(Pawson and Buisseret 1975:74-75)

James - 70 tons

1687-1689 - five trips between
New England and Jamaica

Import Cargos - lumber
fish
foodstuff
horses

Export Cargos - 12-20 hogsheads sugar
2 bags cotton
2,260 lbs tanned leather

1689 - Jamaica to London
Cargo - 209 hogsheads sugar
11 barrels indigo
8 bags cotton

Sara and Abigail - 25 tons

1686-1689 - four trips between
New England and Jamaica
Export Cargos - 12 hogsheads sugar
12 hogsheads molasses

1687 - "'Providence'" to Jamaica
Cargo - Braziletta wood

1688 - Ireland to Jamaica
Cargo - general foodstuffs and
commodities
2 barrels neats' tongues
5 firkins salmon

APPENDIX 3

MERCHANT VESSELS BASED IN JAMAICA

APPENDIX 3

MERCHANT VESSELS BASED IN JAMAICA
(Pawson and Buisseret 1975:75-76)

Loyal Factor - 130 tons

- 1689 - Africa to Jamaica
Cargo - 286 slaves
- Jamaica to London
Cargo - 142 hogsheads sugar
other tropical products

Bonadventure - 25 tons

- 1691 - Bristol to Jamaica
Cargo - food
drink
dry goods
- Africa to Jamaica
Cargo - 59 slaves

John and Joseph

- | | |
|---|---|
| <p>1687 - Curaçao to Jamaica
 Cargo - 30 tons salt
 one passenger</p> <p>- Boston to Jamaica
 Cargo - fish
 tobacco
 wood candles</p> <p>1688 - Campeche to Jamaica
 Cargo - 30 tons logwood</p> | <p>1690 - New York to Jamaica
 Cargo - flour
 beef
 pork
 staves</p> |
|---|---|

Sarah - 20 tons

1687- New England to Jamaica

Cargo - fish
staves

1688 - Campeche to Jamaica

Cargo - 25 tons logwood

1688-1689 - two trips between Madeira
and Jamaica

Cargo - Madeira wine

APPENDIX 4**A TRANSCRIPTION OF THE WILL OF MR. ISAACK WINSLOW
(VOL.1, FOL.48)**

APPENDIX 4

A TRANSCRIPTION OF THE WILL OF MR. ISAACK WINSLOW
(VOL.1, FOL.48)

In the name of God Amen I Isaack Windslow of New England in ye County of Middlesex being sick of body but of sound and pfect memory praised be to God for it and calling to mind the uncertainty of this transitory life and that all flesh must die and yeald unto death when it pleaseth God to call for them, and first being penitent for my Sinns past desireing forgiveness for the same, doe make this my last will and Testament revocking and Annulling every will and will Testament or Testaments theretofore by me made or declared and this for to be taken for my last will and Testament and none other first I give and Bequeath unto my wife Mary Winslow ye house and land she now.... at Charlestowne in New England Item I give piece of land joyning to it, to my daughter Parnill Windslow.... ly I give my parte of the Ketch Pellican to ye child my wife..... all when I left her upon the twelfth of July in case it I give it to my loving wife aforesaid In Wittnesse whereof I have hereunto Sett my hand seale dated at Port Royall in Jamaica this Twenty Sixth day of August in the yeare of the Lord one thousand six hundred and seaventy

Isaack Winslow
his mark

Sealed signed @ delivered in the presence of John Turell, Thomas B Banfield John Turell appeared before me this 29th day of August 1670 and made oath that he saw the above named Isaack Windslow signe and seale ye above written will @ did heare him publish it to be his last will and Testament he being then in sound @ perfect memory

Tho Modyford

Thomas Banfield appeared before mee this 30th day of August 1670 and made oath that hee saw ye above named Isaack Winslow signe and seale the above written will and did heare him publish ye same to be his last will and testament hee being their of sound and pfect memory T Modyford

APPENDIX 5

SHIP RELATED ARTIFACTS: Gudgeons, Deadeye, Fasteners, Lead Strips

SHIP RELATED ARTIFACTS

Gudgeons

2074-17: pp.174-175
 2074-17A, B, and C: pp.175-176
 2075-8: pp.177-178
 2075-9: pp.178-179
 2075-9A: pp.178,180
 2076-7: pp.181-182

Deadeye

2076-19: pp.183-184

Fasteners

Bolts

1065-7: pp.185-186
 1083-5: pp.187-188
 1083-7: pp.189-190
 1083-10: pp.191-192
 1085-5: pp.193-194
 1096-6: pp.195-196
 1096-10: pp.197-198
 2075-5: pp.199-200
 2076-12: pp.201-202
 3023-7: pp.203-204

Drift Pin

1083-11: pp.205-206

Ring Bolt

2076-21: pp.207-208

Forelock Bolt

2075-12: pp.209-210

Spikes

1083-6: pp.211-212
 1084-5: pp.213-214
 2074-7: pp.215-216
 2075-10: pp.217-218
 2075-11: pp.219-220
 2076-2: pp.221-222
 2076-2: pp.223-224
 2076-9: pp.225-226
 2076-10: pp.227-228
 3023-1: pp.229-230
 3023-1: pp.231-232
 3023-8: pp.233-234

Nail

3023-11: pp.235-236

Eyehook

1052: pp.237-238

Washer

1080DP: pp.239-240

Pintle

2006-5: pp.241-242

Lead Patching Strips

Varied: pp.243-244

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2074-17

IDENTIFICATION: Iron gudgeon

PRINCIPAL DIMENSIONS: Maximum preserved length from circular end - Strap 1: 37-1/4 in. (93.5 cm), Strap 2: 22 in. (56 cm); Maximum preserved width of straps: 3-1/4 in. (18.3 cm); Maximum preserved thickness of straps: 1-1/8 in. (2.5 cm); Outer diameter of eye for pintle: 5-9/16 in. (14 cm); Inner diameter of eye for pintle: 2-7/16 in. (5.9 cm); Fastened with square-shanked spikes spaced along straps at 4-1/2 in. (11 cm) intervals

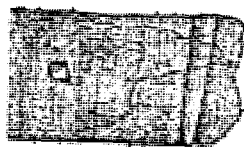
****** Separation of gudgeon straps indicates that the sternpost had a sided dimension of 5-5/8 in. (14.5 cm) at this point

DESCRIPTION: Wrought iron gudgeon with canvas lining; canvas retained evidence of pitch and hair (believed to be cow or horse hair), that were used as sealing material

ARCHAEOLOGICAL PROVENIENCE: Recovered from the stern area of the shipwreck, lying just off the port side, associated with dislocated timbers, presumably of the stern assembly

PARALLELS: PR90 2075-8 and PR90 2075-9 - epoxy cast of fragments of a second gudgeon that was concreted to the stern assembly

COMMENTS / CONSERVATION NOTES: This was a composite artifact - iron with canvas lining its interior. The canvas was removed and treated separately (see Artifact Record PR90 2074-17A, B, and C for conservation routine). Iron gudgeon underwent electrolytic reduction and was then sealed.



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2074-17A, B and C

IDENTIFICATION: Three sections of canvas recovered from the iron gudgeon, PR90 2074-17

PRINCIPAL DIMENSIONS: Average width of strips: 3 in. (7.6 cm); Average thickness of strips: 1/16 in. (.15 cm); Strands average .1 cm in width

DESCRIPTION: These strips of canvas were used on the interior of the gudgeon to hold sealing material such as pitch hair, and to help better seat the gudgeon against the wood of the stern assembly.

ARCHAEOLOGICAL PROVENIENCE: Canvas was recovered from the interior face of the iron gudgeon, PR90 2074-17, which was lying just off the port side the wreck's stern.

PARALLELS: Canvas was also recovered from the encrusted mold of gudgeon strap fragment PR90 2075-9.

COMMENTS / CONSERVATION NOTES: (SEE FIGURE 35: PR90 2074-17 FOR COMPOSITE ILLUSTRATION OF GUDGEON AND CANVAS)

Treatment followed the procedures of the Conservation Division of the Western Australia Museum as outlined by Hamilton (1992:40-41) as follows:

- 1) Immerse in 10% hydrochloric acid to remove encrustation, iron corrosion and stains.
- 2) Rinse in running water.
- 3) Soak in acetone to remove tar, pitch, tallow, and any other acetone-soluble compounds.
- 4) Soak in 5% oxalic acid to remove iron stains - treatment time depends upon degree of staining: it may take a couple of hours to a couple of days
- 5) Immerse in 5% EDTA disodium to remove any remaining iron stains - variable treatment time
- 6) Bleach in a hydrogen peroxide solution (5%-20% depending upon degree of staining); DO NOT USE ON HAIR FIBERS
- 7) Rinse thoroughly in DI water
- 8) Dehydrate in acetone and slowly air dry
- 9) Consolidate if necessary

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2075-8

IDENTIFICATION: Gudgeon strap fragment with associated spikes

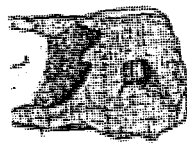
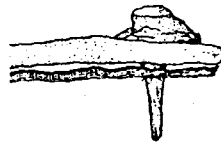
PRINCIPAL DIMENSIONS: Length: 13-1/2 in. (34.5 cm); Maximum preserved width: 3 in. (7.7 cm); Thickness: 5/8 in. (1.5 cm); Maximum preserved length of spikes: 3-1/8 in. (8.5 cm); Shaft of spike: 5/8-x-1/2 in. (1.7-x-1.4 cm)

DESCRIPTION: Hysol cast of portion of gudgeon strap from starboard side of wreck; casting captured the pattern of associated canvas and retained chunks of pitch used to seal the gudgeon and canvas against the stern assembly

ARCHAEOLOGICAL PROVENIENCE: Recovered from the starboard side of the stern of the wreck

PARALLELS: PR90 2075-9 and PR90 2074-17

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



ed Spikes

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2075-9

IDENTIFICATION: Gudgeon strap

PRINCIPAL DIMENSIONS: Length: 32-1/4 in. (82.3 cm); Width: 3-1/2 in. (8.5 cm); Thickness: 5/8 in. (1.5 cm); Seven associated square or rectangular shafted spikes piercing thickness at an average spacing of 5 in. (12.6 cm); Spikes were driven through the center of the width of the strap; The preserved length of the spikes averaged 3 in. (7.6 cm)

DESCRIPTION: A large portion of a gudgeon strap recovered from the port side of the stern assembly; this strap had canvas, pitch and hair associated with its inner surface; seven spikes held this portion of the strap to the vessel

ARCHAEOLOGICAL PROVENIENCE: Strap was recovered from the port side of the stern assembly

PARALLELS: PR90 2075-8; PR90 2074-17

COMMENTS / CONSERVATION NOTES: Hysol cast of mold

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2075-9A

IDENTIFICATION: Canvas from the inner face of gudgeon strap PR90 2075-9

PRINCIPAL DIMENSIONS: Length: 34 in.; Average width: 3 in. (7.6 cm); Thickness: 1/16 in. (.15 cm)

DESCRIPTION: Strip of canvas used on the interior of a gudgeon to hold sealing material such as pitch and hair and to help better seat the gudgeon against the wood of the stern assembly

ARCHAEOLOGICAL PROVENIENCE: Recovered from the interior face of the encrusted mold of a port side gudgeon strap

PARALLELS: Canvas was also recovered from the iron gudgeon PR90 2074-17, recovered from just off the port side of the stern

COMMENTS / CONSERVATION NOTES: (SEE FIGURE 36. PR90 2075-8 AND PR90 2075-9 FOR COMPOSITE ILLUSTRATION OF GUDGEON STRAPS AND CANVAS)

Treatment followed the procedures of the Conservation Division of the Western Australia Museum as outlined by Hamilton (1992:40-41) as follows:

- 1) Immerse in 10% hydrochloric acid to remove encrustation, iron corrosion and stains.
- 2) Rinse in running water.
- 3) Soak in acetone to remove tar, pitch, tallow, and any other acetone-soluble compounds.
- 4) Soak in 5% oxalic acid to remove iron stains - treatment time depends upon degree of staining: it may take a couple of hours to a couple of days
- 5) Immerse in 5% EDTA disodium to remove any remaining iron stains - variable treatment time
- 6) Bleach in a hydrogen peroxide solution (5%-20% depending upon degree of staining); DO NOT USE ON HAIR FIBERS
- 7) Rinse thoroughly in DI water
- 8) Dehydrate in acetone and slowly air dry
- 9) Consolidate if necessary

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-7

IDENTIFICATION: Gudgeon strap fragment

PRINCIPAL DIMENSIONS: Length: 5-1/2 in. (14 cm); Width: 2-5/8 in. (6.2 cm); Average thickness: 9/16 in. (1.5 cm)

DESCRIPTION: Fragment of gudgeon strap with half of a spike hole in one end, midway through the strap's width

ARCHAEOLOGICAL PROVENIENCE: Directly aft of the stern assembly

PARALLELS: PR90 2074-17, PR90 2075-8 and PR90 2075-9

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant

PR90 2076-7

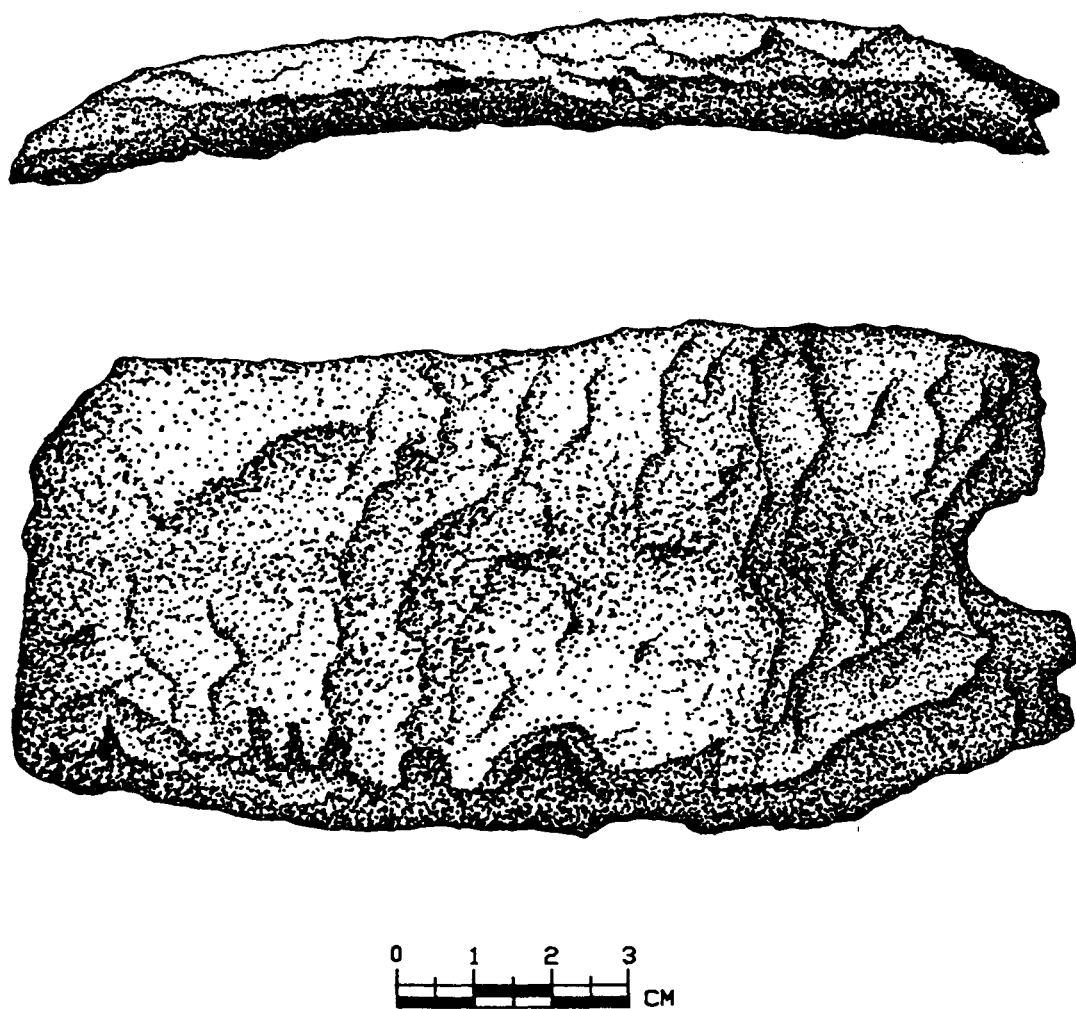


Figure 37. PR90 2076-7: Gudgeon Strap Fragment

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-19

IDENTIFICATION: Wooden deadeye

PRINCIPAL DIMENSIONS: Diameter: 4 in. (10.2 cm); Average thickness: 1-7/8 in. (4.8 cm); Average diameter of the three holes through thickness: 7/16 in. (1.15 cm); Groove running along circumference: 1/4 to 5/16 in. deep

DESCRIPTION: Circular wooden deadeye with three holes through thickness, perpendicular to diameter in triangular pattern to accept rope; a groove runs along the circumference of the deadeye also to accept rope

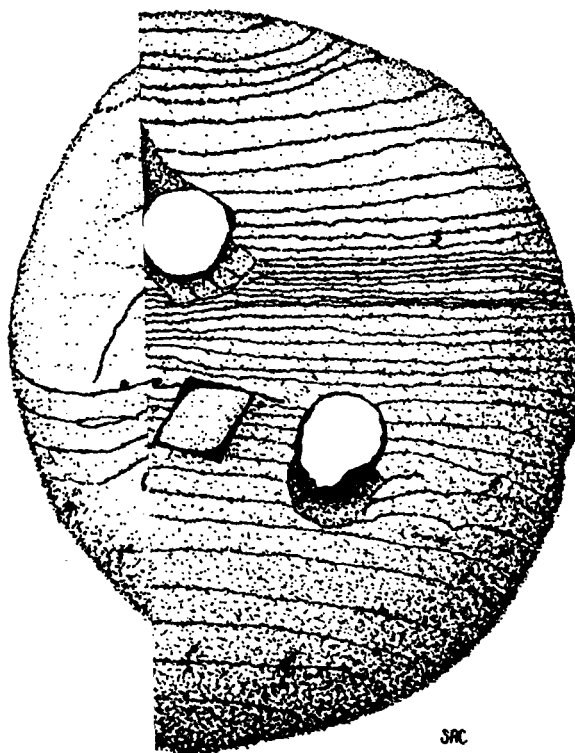
ARCHAEOLOGICAL PROVENIENCE: Lying off the port side of the stern end of the vessel

PARALLELS:

COMMENTS / CONSERVATION NOTES:

- 1) Dehydrated in sequential baths of 100% isopropyl alcohol, 50/50 isopropyl alcohol/acetone, and 100% acetone
- 2) Placed in heated (approximately 120° F), saturated acetone/rosin solution for eight weeks; in this case, saturation means a 66% solution, or one in which there is always a sludge of resin on the bottom of the treatment container

This piece came out of treatment with a crack in one face. While this can happen along a wood grain, I noted that the oven in which the treatment was run was inadvertently shut off on occasion. I think the alternating heating and cooling of this artifact stressed the wood and encouraged the crack along the grain.



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1065-7

IDENTIFICATION: Iron Bolt

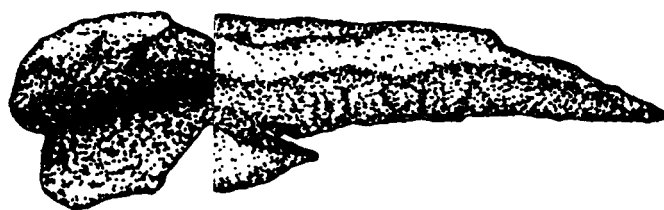
PRINCIPAL DIMENSIONS: Length: 10-7/16 in. (26.5 cm); Greatest surviving diameter: 15/16 in. (2.4 cm); Head not recovered

DESCRIPTION: Section of iron bolt, neither head nor tip was recovered

ARCHAEOLOGICAL PROVENIENCE: Found laying across starboard strakes 2 and 3, just fore of the starboard end of Frame 17.

PARALLELS: PR90 1083-5, PR90 1083-7, PR90 1083-10, PR90 1085-5, PR90 1096-6, PR90 1096-10, PR90 2075-5, PR90 2076-12, PR90 3023-7

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1083-5

IDENTIFICATION: Bent bolt fragment

PRINCIPAL DIMENSIONS: Length of longest section 7-1/8 in. (18.2 cm);
Length of shorter section: 3 in. (7.5 cm); Overall length: 10-1/8 in. (25.7 cm);
Average thickness 1-13/16 in. (2.1 cm)

DESCRIPTION: Portion of an iron bolt bent at a 90° angle

ARCHAEOLOGICAL PROVENIENCE: Located just off the outer edge of the
port side planking strakes, slightly fore of Frame 31.

PARALLELS: Very similar to PR90 3023-7

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant

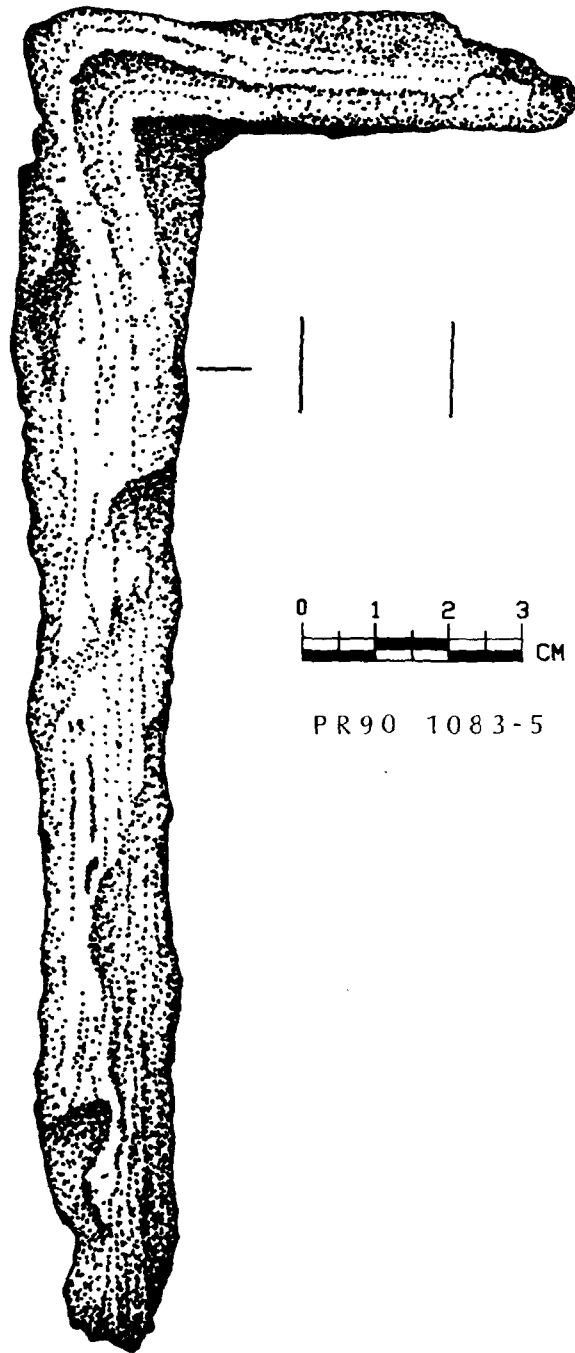


Figure 40. PR90 1083-5: Bent Bolt Fragment

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1083-7

IDENTIFICATION: Section of bolt

PRINCIPAL DIMENSIONS: Length: 4-1/8 in. (10.5 cm); Diameter 15/16 in. (2.35 cm)

DESCRIPTION: Short section of an iron bolt

ARCHAEOLOGICAL PROVENIENCE: Just off the starboard planks in the stern, opposite Frame 32

PARALLELS:

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant

Fragment of Iron Spike

PR90 1083-7

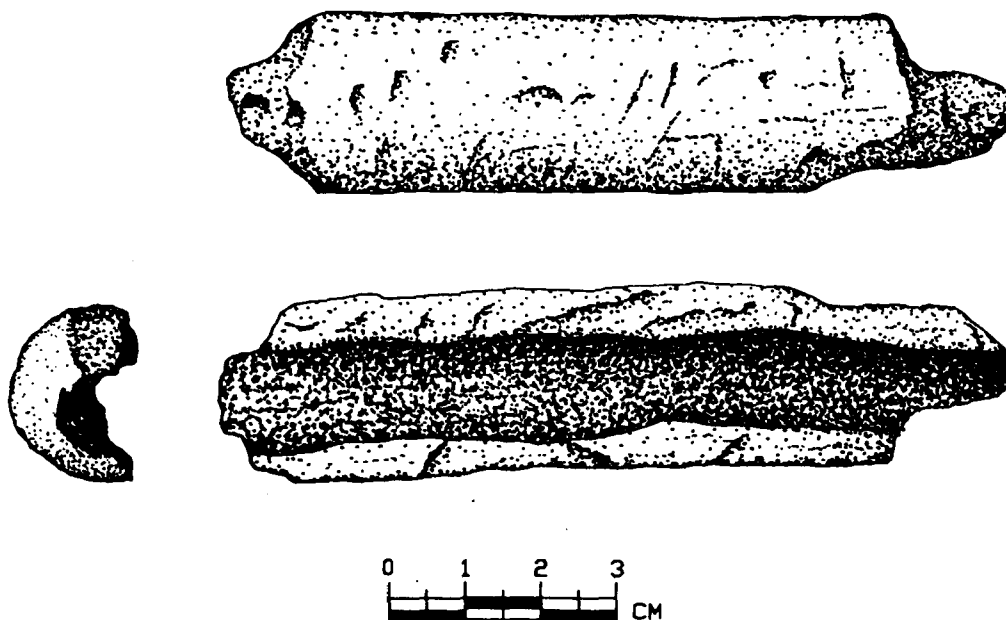


Figure 41. PR90 1083-7: Bolt Fragment

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1083-10

IDENTIFICATION: Bolt

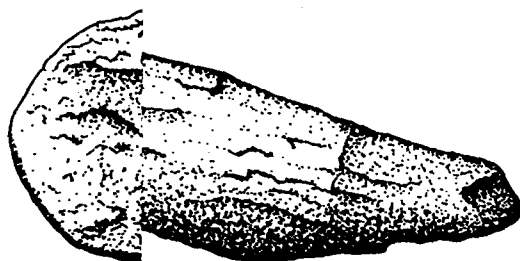
PRINCIPAL DIMENSIONS: Length: 9-9/16 in. (24.3 cm); Diameter of head: 1-1/4 in. (3.2 cm); Maximum diameter of shaft: 1 in. (2.54 cm) - slow taper to a point, it is not clear if this is the original end

DESCRIPTION: Round-headed iron bolt

ARCHAEOLOGICAL PROVENIENCE: Recovered off the port side of the wreck, just forward of Frame 32.

PARALLELS: PR90 1083-5, PR90 1083-7, PR90 1085-5, PR90 1096-6, PR90 1096-10, PR90 2075-5, PR90 2076-12, PR90 3023-7

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1085-5

IDENTIFICATION: Iron bolt

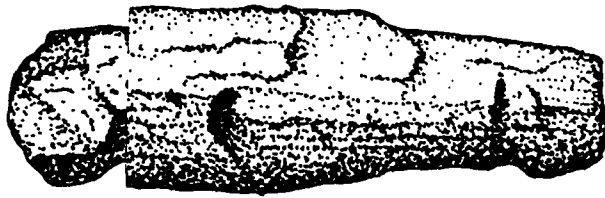
PRINCIPAL DIMENSIONS: Length: 10-11/16 in. (27 cm); Maximum diameter: 15/16 in. (2.4 cm)

DESCRIPTION: Section of an iron bolt; neither head nor tip was recovered

ARCHAEOLOGICAL PROVENIENCE: This bolt lay across the deadwood, and port garboard and second plank, just fore of Frame 30.

PARALLELS: PR90 1065-7, PR90 1083-7, PR90 1096-6, PR90 1096-10

COMMENTS / CONSERVATION NOTES: Electrolytic reduction



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1096-6

IDENTIFICATION: Iron bolt

PRINCIPAL DIMENSIONS: Length: 7-7/16 in. (18.8 cm); Head: 1-7/16-x-15/16 in. (3.2-x-2.4 cm); Maximum diameter of shaft 15/16 in. (2.4 cm)

DESCRIPTION: Section of iron bolt including head, but short of the tip

ARCHAEOLOGICAL PROVENIENCE: Found lying just to starboard of the center of Frame 27; was actually on top of the deadwood because of the degraded condition of the frame.

PARALLELS: PR90 1065-7, PR90 1083-7, PR90 1085-5, PR90 1096-10

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1096-10

IDENTIFICATION: Bent section of an iron bolt

PRINCIPAL DIMENSIONS: Length: 10-13/16 in. (28.0 cm); Average width (too degraded for estimation of diameter): 3/4 in. (1.9 cm)

DESCRIPTION: Section of iron bolt bent at roughly a 145° angle; neither the head nor the tip was recovered

ARCHAEOLOGICAL PROVENIENCE: Laying on deadwood, just off the forward starboard end of Frame 28.

PARALLELS: PR90 1065-7, PR90 1083-7, PR90 1085-5, PR90 1096-6

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2075-5

IDENTIFICATION: Two sections of a bolt

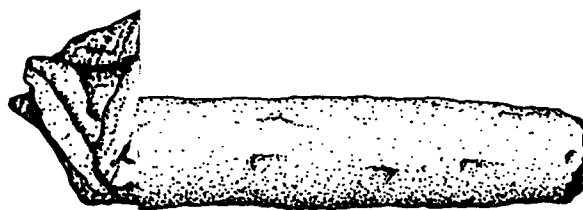
PRINCIPAL DIMENSIONS: Lengths - Section 1: 9-9/16 in. (24.4 cm), Section 2: 8-7/16 in. (21.4 cm), Overall: 18 in. (45.8 cm); Bolt diameter: 7/8 in. (2.3 cm)

DESCRIPTION: Section of an iron bolt broken into two pieces; fragments of wood remain around the bolt

ARCHAEOLOGICAL PROVENIENCE: This bolt lay just off the starboard side of the very end of the stern

PARALLELS: PR90 1065-7, PR90 1083-7, PR90 1085-5, PR90 1096-6, PR90 1096-10

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-12

IDENTIFICATION: Bent bolt

PRINCIPAL DIMENSIONS: Head: 1-11/16-x-1-7/16 in. (4.3-x-3.3 cm); Length from head to bend: 9-1/8 in. (23 cm); Length from bend to end: 10-1/2 in. (26.5 cm); Overall length: 19-5/8 in. (49.5 cm); Average diameter: 1 in. (2.54 cm)

DESCRIPTION: Large segment of an iron bolt, bent at a 90° angle midway along its length; a fragment of wood remained affixed to the bolt

ARCHAEOLOGICAL PROVENIENCE: Lying off the port side of the end of the stern

PARALLELS: PR90 2075-5

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant

Figure 47. PR90 2076-12: Bent Bolt

202

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 3023-7

IDENTIFICATION: Bent bolt

PRINCIPAL DIMENSIONS: Length - Segment 1: 2-11/16 in. (6.8 cm), Segment 2: 6-1/4 in. (15.3 cm); Average diameter 7/8 in. (2.2 cm)

DESCRIPTION: Fragment of a iron bolt bent at a 90° angle

ARCHAEOLOGICAL PROVENIENCE: Found directly out from the jumbled timbers at the stern of the vessel

PARALLELS: PR90 1083-5 and PR90 2076-12

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant

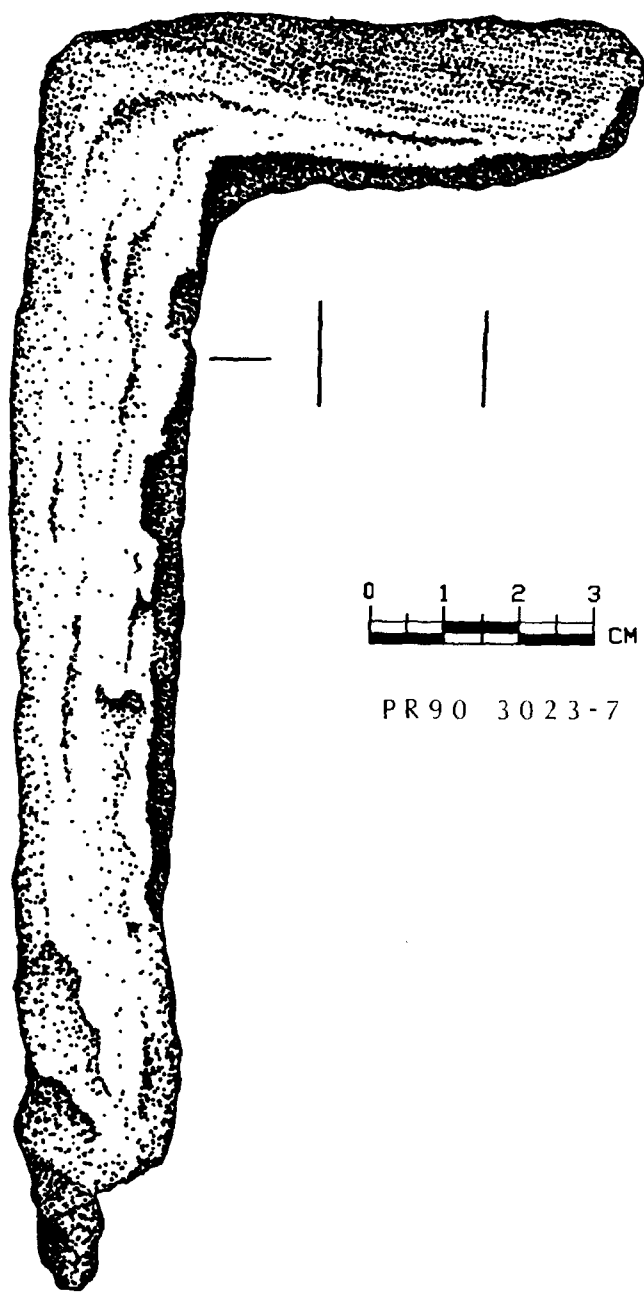


Figure 48. PR90 3023-7: Bent Bolt

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1083-11

IDENTIFICATION: Portion of large square-shanked bolt

PRINCIPAL DIMENSIONS: Length: 7-15/16 in. (20.1 cm); Cross-sectional widths:
1-1/8-x-1 in. (2.85-x-2.6 cm)

DESCRIPTION: Hysol cast of a section of a square shanked spike

ARCHAEOLOGICAL PROVENIENCE: Found just off port side of wreck, directly outward from Frame 32.

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-21

IDENTIFICATION: Fragment of iron ring bolt

PRINCIPAL DIMENSIONS: Outer diameter of ring: 4 in. (10.1 cm); Inner diameter of ring: 2-15/16 in. (7.4 cm)

DESCRIPTION: Portion of an iron ring with a fragment of metal crossing over one end, perpendicular to the ring; believed to be the remains of a ring bolt

ARCHAEOLOGICAL PROVENIENCE: Lying close to the wreck, just off the port side of the end of the stern

PARALLELS:

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant

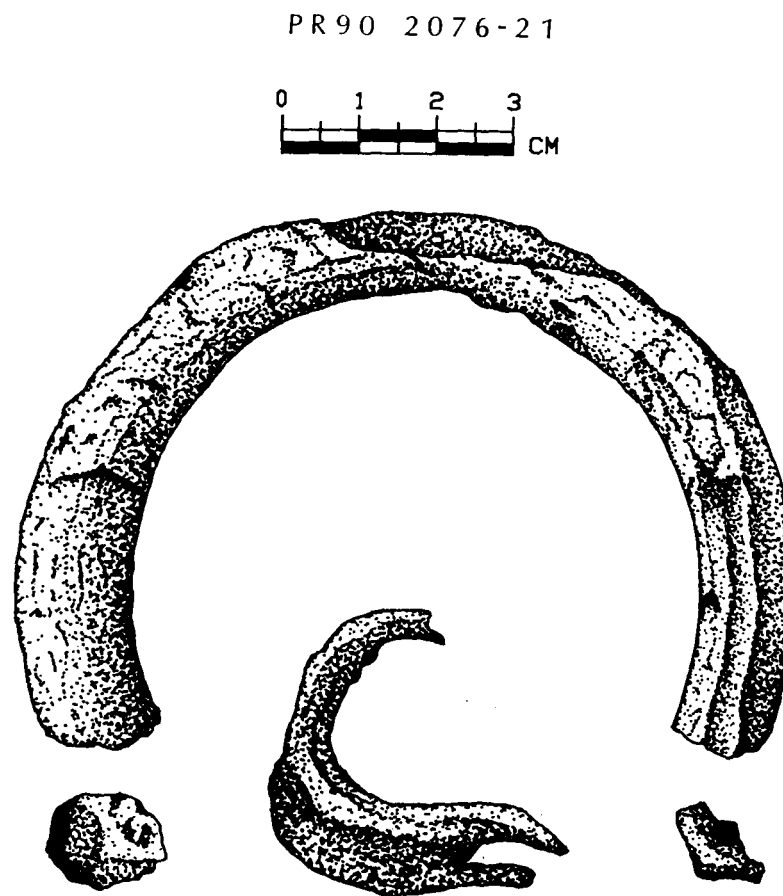


Figure 50. PR90 2076-21: Fragments of an Iron Ring Bolt

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2075-12

IDENTIFICATION: Forelock Bolt

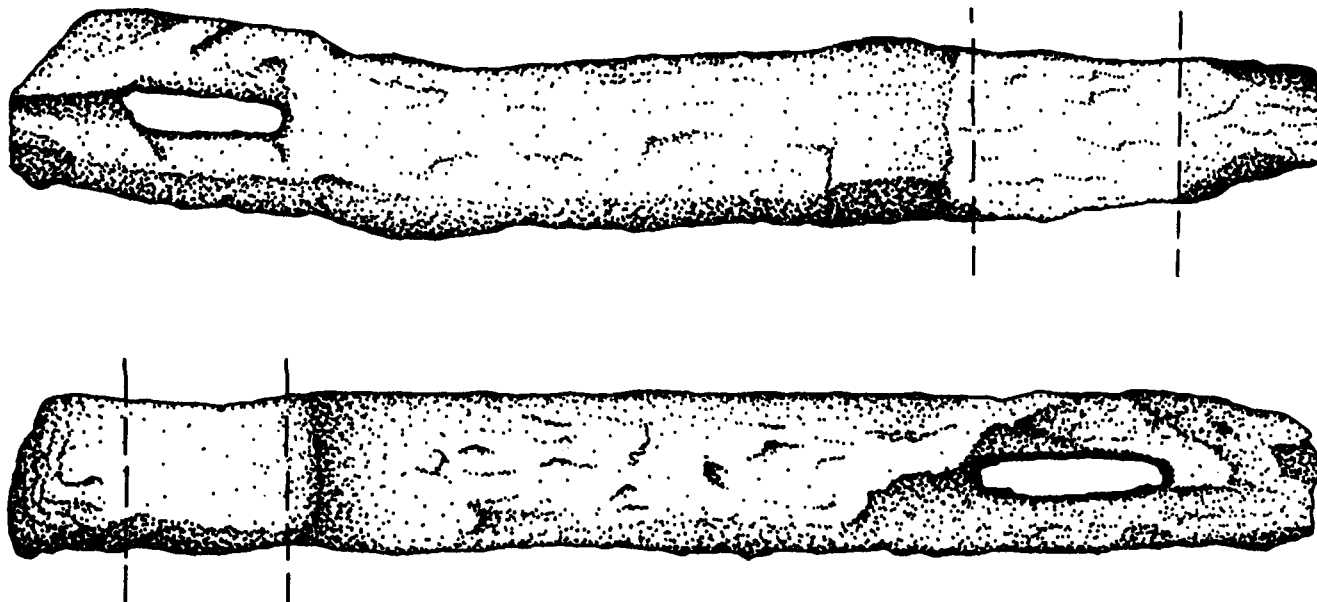
PRINCIPAL DIMENSIONS: Shaft length: 6-13/16 in. (17.2 cm); Diameter: 7/8 in. (2.2 cm); Length of slots: 1 in. (2.54 cm); Width of slots: 3/16 in. (6 cm); Center to center distance between slots: 4-1/2 in.

DESCRIPTION: Hysol cast of a circular shafted bolt or pin with slots through its thickness, perpendicular to its length; slots are also perpendicular to each other

ARCHAEOLOGICAL PROVENIENCE: Just off starboard side of stern, associated with two spikes

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



PR 90 2075-12

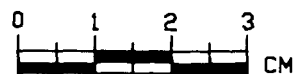


Figure 51. PR 90 2075-12: Forelock Bolt

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1083-6

IDENTIFICATION: Spike fragment

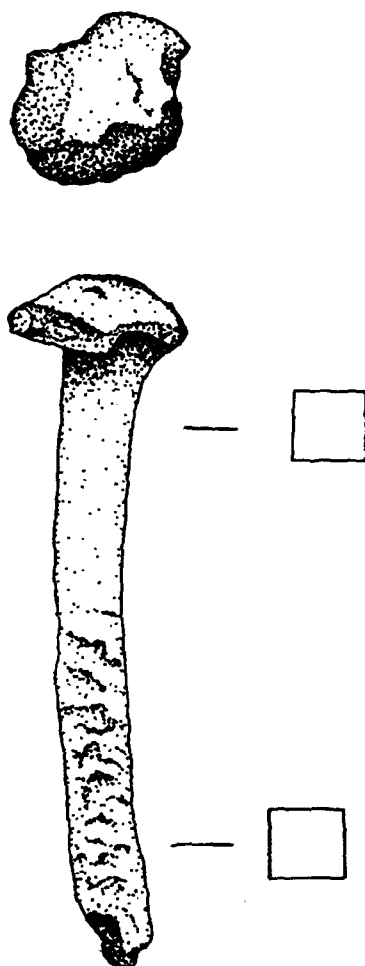
PRINCIPAL DIMENSIONS: Head: approximately 7/8 in. (2.2 cm) wide; Shaft 3/8 in. (.9 cm) square; Overall length: 3-11/16 in. (9.4 cm)

DESCRIPTION: Hysol cast of a portion of a square shafted spike

ARCHAEOLOGICAL PROVENIENCE: From starboard side of wreck, just to the side of the deadwood, lying atop a treenail.

PARALLELS: PR90 2075-11

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



PR90 1083-6

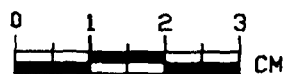


Figure 52. PR90 1083-6: Spike Fragment

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1084-5

IDENTIFICATION: Square head spike

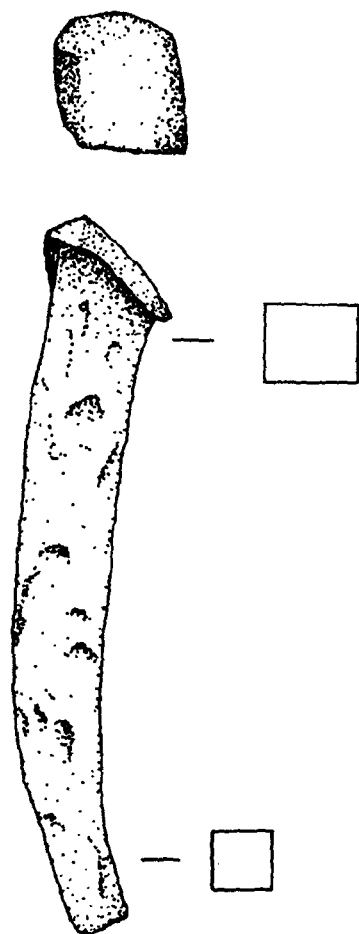
PRINCIPAL DIMENSIONS: Head: 3/4-x-11/16 in. (1.9-x-1.7 cm); Semi-rectangular shank 1/2-x-7/16 in. (1.3-x-1 cm) tapering to 5/16 in. square (.8 cm square); Length: 3-7/8 in. (9.9 cm)

DESCRIPTION: Hysol cast of a square headed spike with rectangular shank near head that tapers and squares up before tapering sharply to a thin finished end

ARCHAEOLOGICAL PROVENIENCE: Found off port side of wreck, outward from Frame 33.

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



PR 90 1084-5
0 1 2 3 CM

Figure 53. PR90 1084-5: Square Head Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2074-7

IDENTIFICATION: Rectangular shafted spike

PRINCIPAL DIMENSIONS: Head: 7/8-x-13/16 in. (2.4-x-2.1 cm); Shank: 9/16-x-7/16 in. (1.5-x-1.2 cm) tapering to 7/16-x-3/8 in. (1.2-x-1 cm); Overall length: 5-7/8 in. (15 cm)

DESCRIPTION: Hysol cast of a rectangular shanked spike

ARCHAEOLOGICAL PROVENIENCE: Found directly off stern of vessel, amidst the jumble of timbers

PARALLELS: PR90 2075-11

COMMENTS / CONSERVATION NOTES: Hysol cast of mold

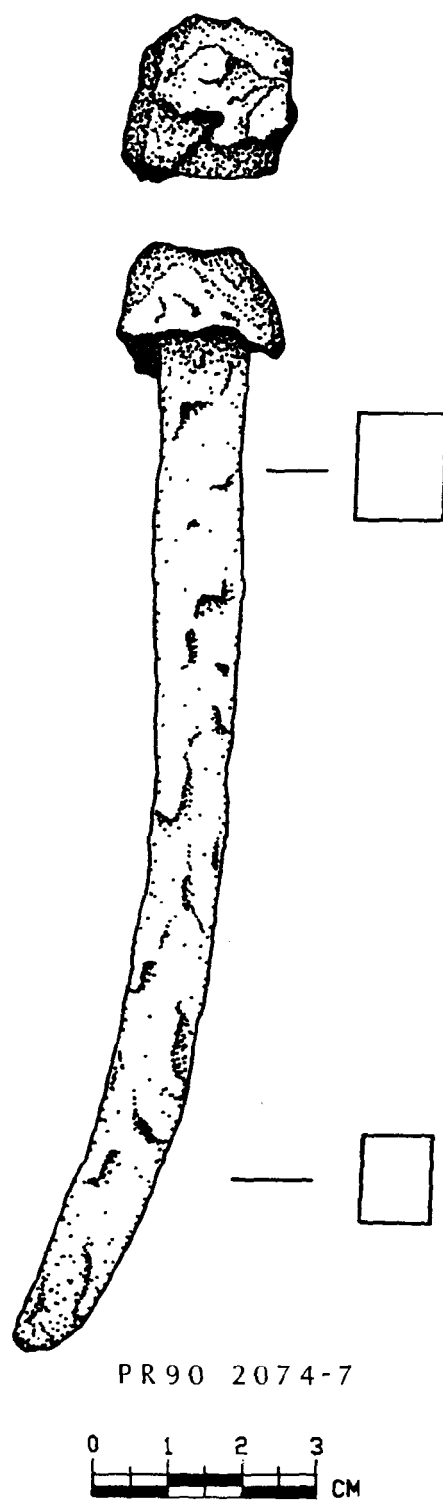


Figure 54. PR90 2074-7: Rectangular Shafted Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2075-10

IDENTIFICATION: Bent spike

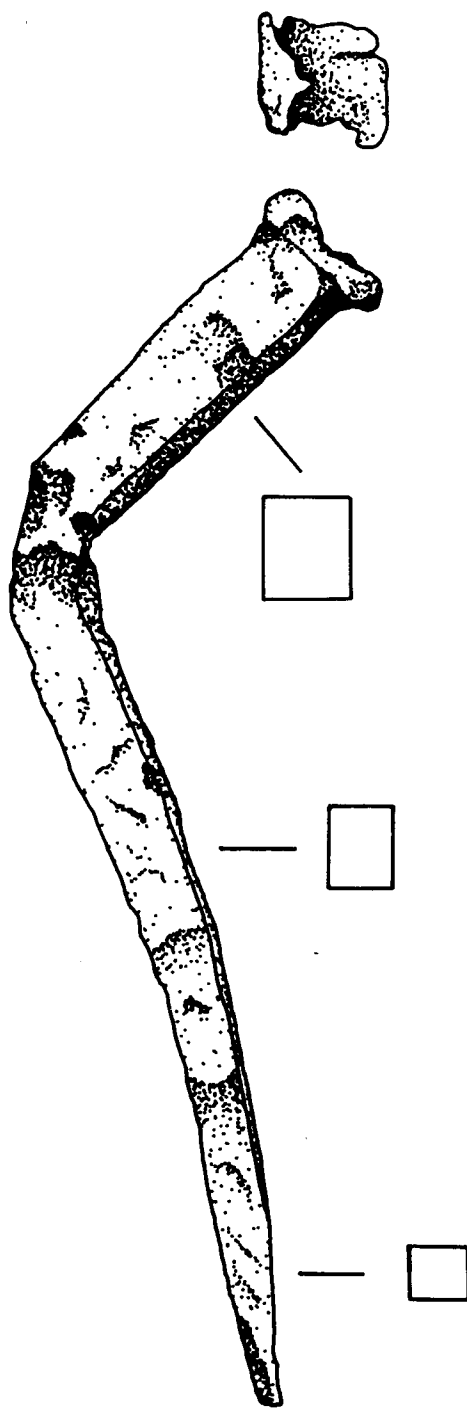
PRINCIPAL DIMENSIONS: Length - Head to bend: 2-1/8 in. (5.5 cm), Bend to tip: 4-5/8 in. (11.2 cm), Overall: 6-3/4 in. (16.7 cm); Width: 1/2-x-7/16 in. (1.4-x-1.1 cm) tapering to 1/4-x-5/16 in. (.7-x-.8 cm) before tapering quickly to a thin finished edge

DESCRIPTION: Hysol cast of a square headed spike bent at roughly a 90° angle

ARCHAEOLOGICAL PROVENIENCE: Just off starboard side of stern, forward of gudgeon

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



PR 90 2075-10

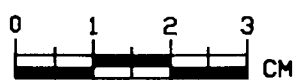


Figure 55. PR90 2075-10: Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2075-11

IDENTIFICATION: Spike

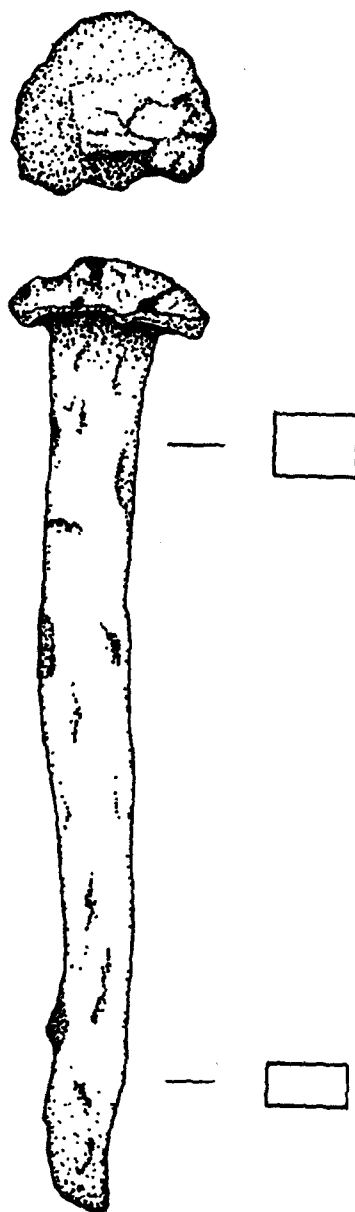
PRINCIPAL DIMENSIONS: Head: 1-x-1-1/8 in. (2.54-x-2.8 cm); Overall length: 5-3/16 in. (13.2 cm); Shaft width: 7/16-x-5/16 in. (1.2-x-.9 cm) tapering to 7/16-x-3/16 in. (1.2-x-.5 cm) before coming to a thin finished end

DESCRIPTION: Hysol cast of spike with rectangular shaft

ARCHAEOLOGICAL PROVENIENCE: Just off starboard side of stern, forward of gudgeon

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



PR90 2075-11

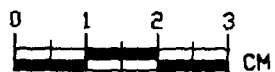


Figure 56. PR90 2075-11: Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-2

IDENTIFICATION: Portion of spike

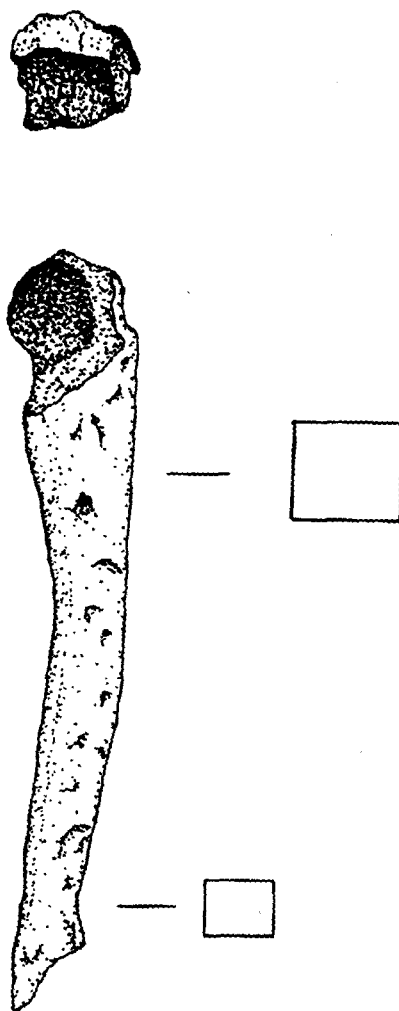
PRINCIPAL DIMENSIONS: Length: 4-1/4 in. (10.9 cm); Width: 5/8 in. square (1.5 cm square) tapering to 3/8-x-1/4 in. (.7-x-.5 cm) before tapering sharply to a thin end

DESCRIPTION: Rectangular shanked spike; head was not recovered

ARCHAEOLOGICAL PROVENIENCE: Off port side of stern, just forward of the gudgeon lying free of the wreck

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



PR90 2076-2

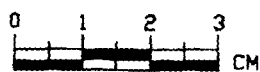


Figure 57. PR90 2076-2: Portion of a Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-2

IDENTIFICATION: Square headed, square-shanked spike

PRINCIPAL DIMENSIONS: Length: 7-3/16 in. (18.6 cm); Head: 3/4-x-7/8 in. (2-x-2.1 cm); Shank: 9/16-x-4/9 in. (1.4-x-1.3 cm) tapering to 3/8-x-3/16 in. (.9-x-.5 cm) before tapering quickly to a thin, flat end

DESCRIPTION: Hysol cast of a relatively square spike

ARCHAEOLOGICAL PROVENIENCE: Off port side of stern, just forward of the gudgeon lying free of the wreck

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold

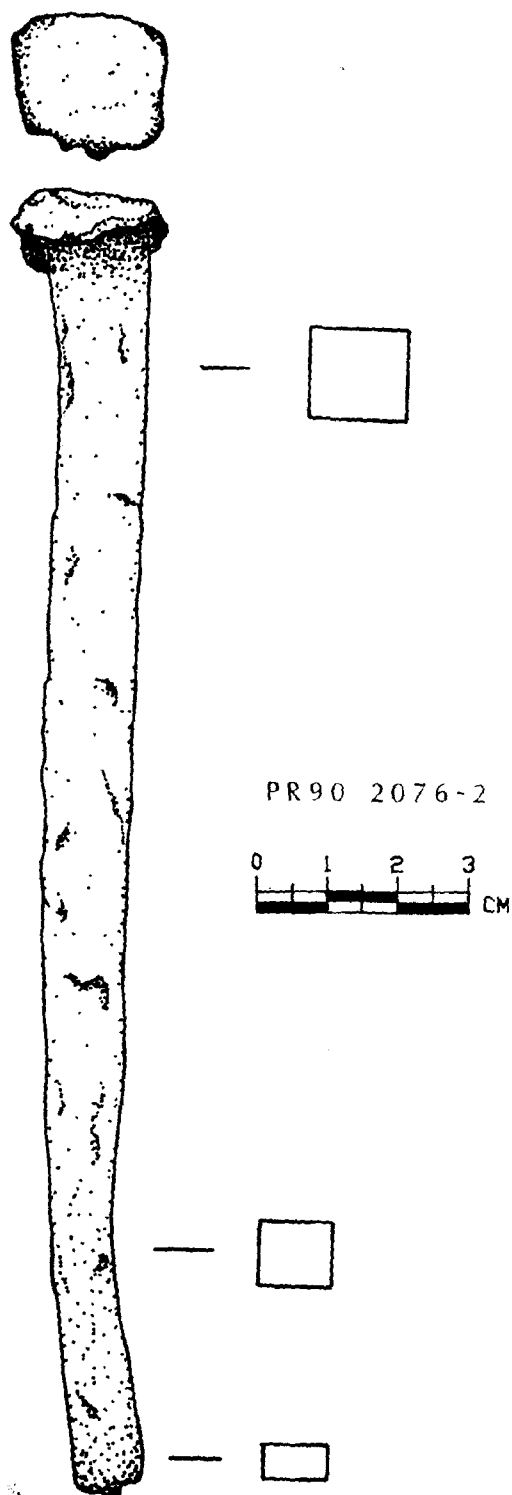


Figure 58. PR90 2076-2: Square Shank Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-9

IDENTIFICATION: Spike

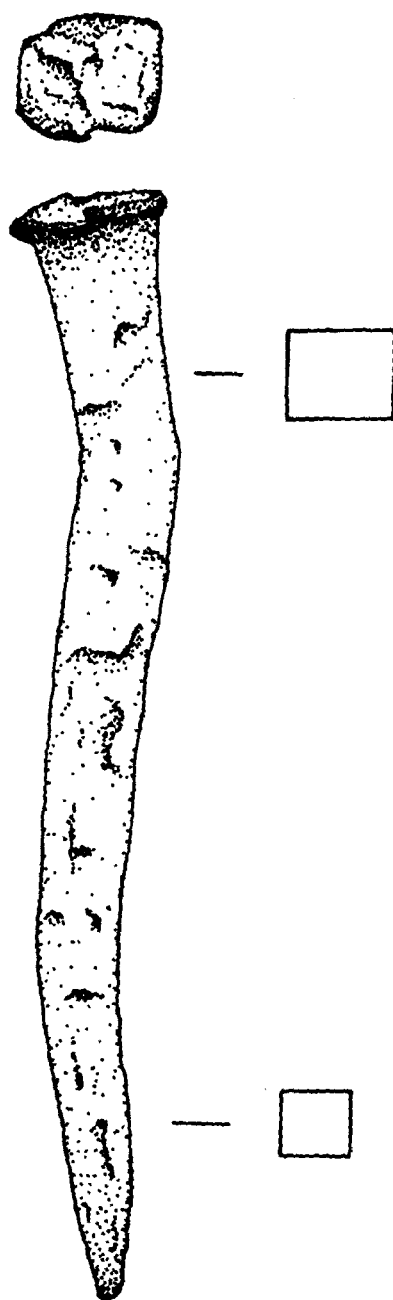
PRINCIPAL DIMENSIONS: Length: 6 in. (15.2 cm); Head: 13/16-x-11/16 in. (2.1-x-1.8 cm); Shank width: 9/16-x-7/16 in. (1.5-x-1.2 cm) tapering to 3/8-x-5/16 in. (1-x-.9 cm)

DESCRIPTION: Hysol cast of a square headed spike with a square to rectangular shank

ARCHAEOLOGICAL PROVENIENCE: Off port side of stern assembly

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



PR90 2076-9

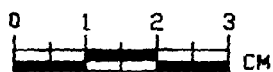


Figure 59. PR90 2076-9: Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-10

IDENTIFICATION: Spike

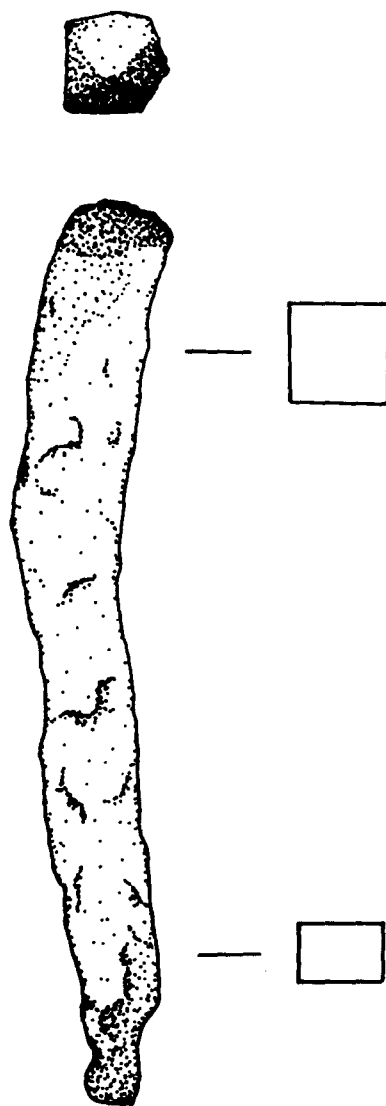
PRINCIPAL DIMENSIONS: Length: 11/16 in. (11.9 cm); Width: 1/2 in. square (1.3 cm square) tapering to 7/16-x-5/16 in. (1.1-x-.75 cm)

DESCRIPTION: Hysol cast of a segment of a spike; neither the head nor the tip was recovered

ARCHAEOLOGICAL PROVENIENCE: Laying a short distance out from the port side of the end of the stern

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold



PR 90 2076-10

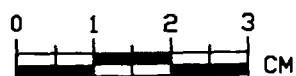


Figure 60. PR90 2076-10: Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 3023-1

IDENTIFICATION: Spike

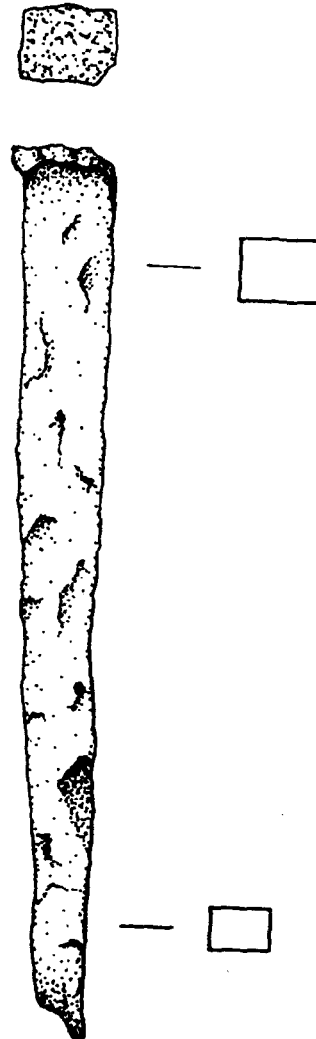
PRINCIPAL DIMENSIONS: Length: 4-3/4 in. (12.1 cm); Head: 1/2-x-3/8 in. (1.3-x-1 cm); Shank: 7/16-x-5/16 in. (1.1-x-.8 cm) tapering to 5/16-x-1/4 in. (.8-x-.6 cm)

DESCRIPTION: Hysol cast of a rectangular shanked spike, possibly with rectangular head

ARCHAEOLOGICAL PROVENIENCE: Located off wreck's stern end, on port side; fore of unattached gudgeon

PARALLELS:

COMMENTS / CONSERVATION NOTES: Encrustation also included a fragment of a white kaolin pipe stem and a saltglazed stoneware sherd



PR90 3023-1

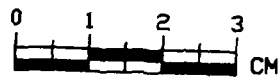


Figure 61. PR90 3023-1: Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 3023-1

IDENTIFICATION: Spike Fragment

PRINCIPAL DIMENSIONS: Length: 2-1/16 in. (5.3 cm); Head: average diameter - 5/8 in. (1.6 cm); Shank width: 3/8 in. (1 cm) square tapering to 3/8-x-1/4 in. (.9-x-.7 cm) before tapering quickly to a point

DESCRIPTION: Spike fragment with head

ARCHAEOLOGICAL PROVENIENCE: Found off the port side of the stern assembly, near unattached gudgeon

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold

PR90 3023-1

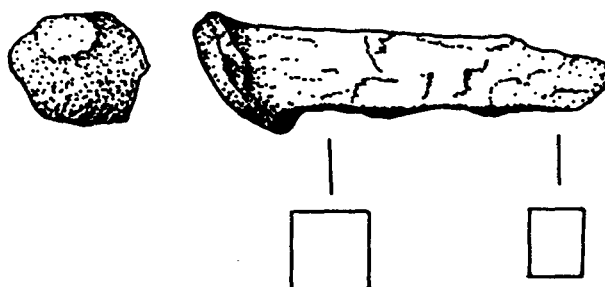
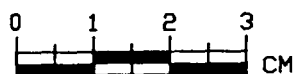


Figure 62. PR90 3023-1: Spike Fragment

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 3023-8

IDENTIFICATION: Spike

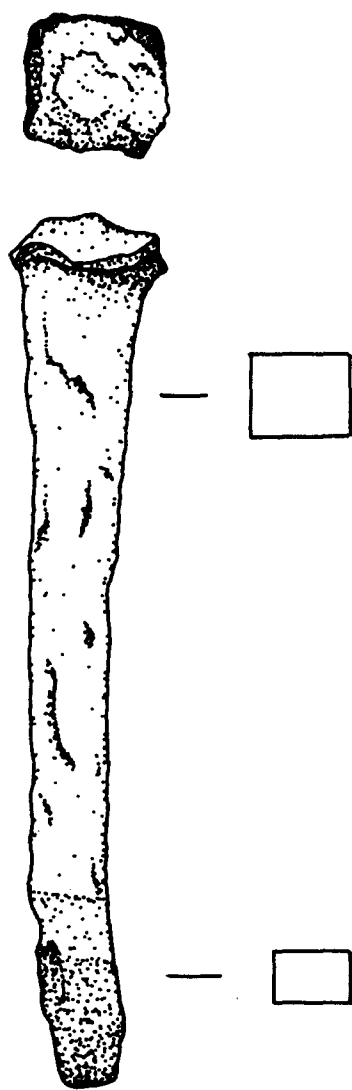
PRINCIPAL DIMENSIONS: Length: 4-9/16 in. (11.5 cm); Head: 3/4-x-11/16 in. (1.9-x-1.7 cm); Shank: 1/2-x-7/16 in. (1.3-x-1.1 cm) tapering to 3/8-x-1/4 in. (1-x-.7 cm)

DESCRIPTION: Hysol cast of a square headed spike

ARCHAEOLOGICAL PROVENIENCE: Located directly out from the jumbled timbers of the stern assembly, slightly off to the port side

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of a mold



PR 90 3023-8

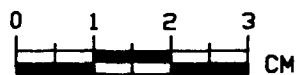


Figure 63. PR90 3023-8: Spike

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 3023-11

IDENTIFICATION: Nail

PRINCIPAL DIMENSIONS: Length: 2-7/16 in. (6.2 cm); Head: 1/2-x-3/8 in. (1.2-x-1 cm); Shaft: 5/16 in. (.75 cm) square tapering to 1/4 in. (.7 cm) square; Tip was not recovered

DESCRIPTION: Hysol cast of a relatively fine, thin shafted nail, perhaps from some of the finer woodwork on the vessel

ARCHAEOLOGICAL PROVENIENCE: Found slightly aft of the unattached gudgeon, PR90 2074-17

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold

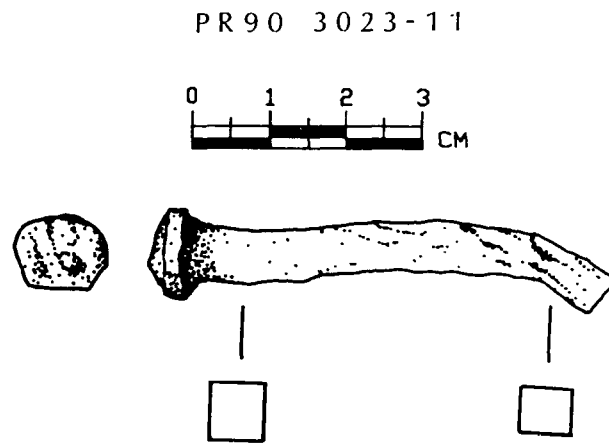


Figure 64. PR90 3023-11: Nail

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1052

IDENTIFICATION: Eyehook

PRINCIPAL DIMENSIONS: Length: 5-5/8 in. (15 cm); Maximum outer diameter of ring: 3-1/2 in. (9.2 cm); Maximum inner diameter of ring: 2-1/8 in. (5.5 cm); Width of hook: 1-3/8 in. (3.5 cm); Thickness: 7/8 in. (2.2 cm)

DESCRIPTION: Hysol cast of iron hook with eye

ARCHAEOLOGICAL PROVENIENCE: Found lying atop the port end of Frame 13

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1080 DP

IDENTIFICATION: Washer

PRINCIPAL DIMENSIONS: Outer diameter: 2 in. (5 cm); Inner diameter: 1 in. (2.54 cm); Thickness: 5/16 in. (.8 cm)

DESCRIPTION: Hysol cast of metal washer

ARCHAEOLOGICAL PROVENIENCE: Recovered from the very top of the dredge pile after a day's work; highly likely that it came from grid location 1083 or 1084

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold

Epoxy Cast of Washer

PR90 1080(DP)

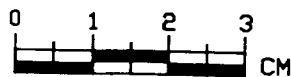
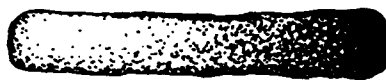
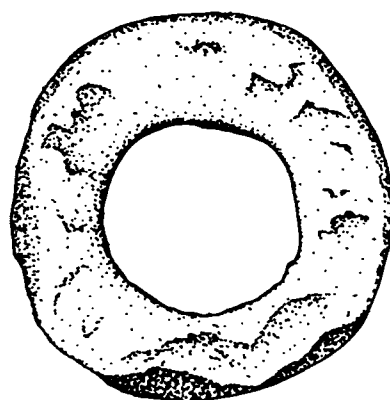


Figure 66. PR90 1080DP: Washer

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2006-5

IDENTIFICATION: Iron pintle

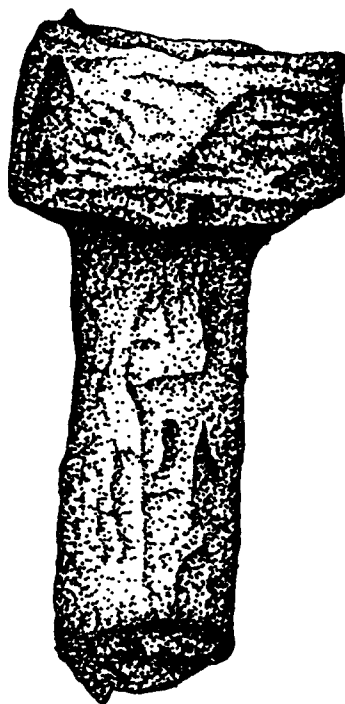
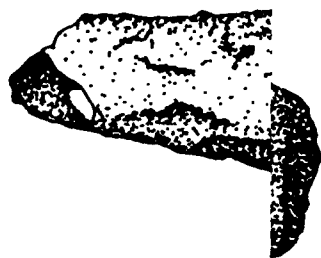
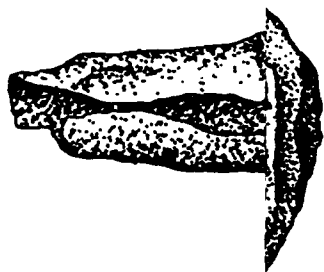
PRINCIPAL DIMENSIONS: Length of pin (from top of arm): 3-1/8 in. (9.1 cm);
Maximum diameter of pin: 1 in. (2.45 cm); Length of arm: 10-1/8 in. (25.8 cm);
Maximum diameter of arm 15/16 in. (2.4 cm) tapering to 5/16 in. (.75 cm)

DESCRIPTION: Iron pintle with thick rounded arm; it would appear that this arm would have been driven into the thickness of a wooden frame of some sort and perhaps pinned at the end; this pintle is too small to be associated with the gudgeons

ARCHAEOLOGICAL PROVENIENCE: Several feet of the starboard side of the wreck at the level of the beginning of the stern deadwood

PARALLELS:

COMMENTS / CONSERVATION NOTES: Electrolytic reduction / sealant



ARTIFACT RECORD**ARTIFACT NUMBER: VARIED****IDENTIFICATION:** Lead Patching Strips**PRINCIPAL DIMENSIONS:** Thickness: 1/16 in. (.2 cm); Width: 2-3/4 in. (7cm) to 6-1/2 in. (16 cm)**DESCRIPTION:** Strips of lead sheeting with small tack holes and impressions around their edges**ARCHAEOLOGICAL PROVENIENCE:** Various locations around the wreck**PARALLELS:****COMMENTS / CONSERVATION NOTES:**

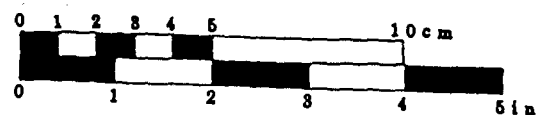
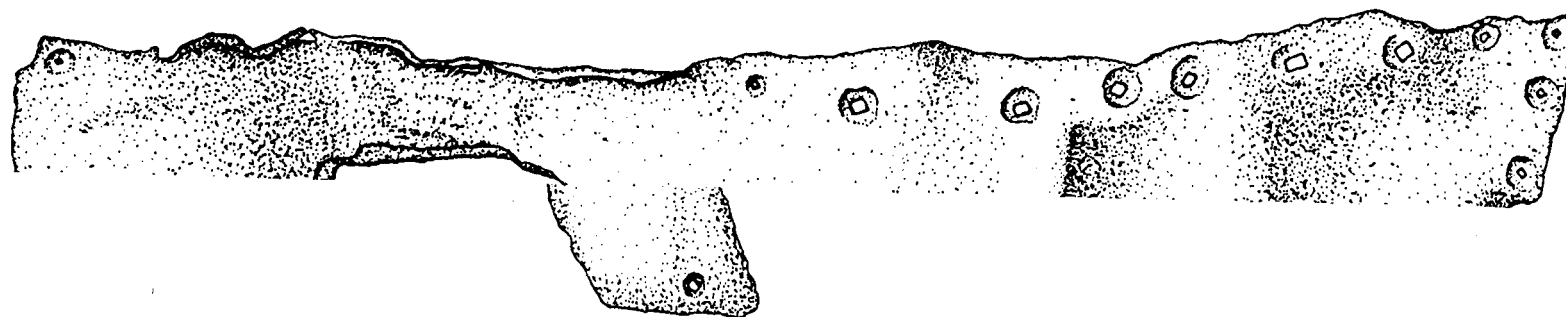


Figure 68. Varied Lots: Representative Examples of Lead Strips Recovered from the Port Royal Shipwreck Site

APPENDIX 6

**ARMAMENT: Cannon Ball Gauge, Barshot,
Cannon Balls, Small Lead Shot**

ARMAMENT**Brass Shotgauge**

PR89 884-7: pp.247-249

Cannon Balls

PR89 738-10: pp.250-251

PR89 7310-5: pp.252-253

PR89 867-8: pp.254-255

Iron Barshot

PR89 885-5.3: pp.256-257

PR90 2012-11: pp.258-259

Small Lead Shot

Varied: pp.260-261

ARTIFACT RECORD

ARTIFACT NUMBER: PR89 884-7

IDENTIFICATION: Brass Shotgauge

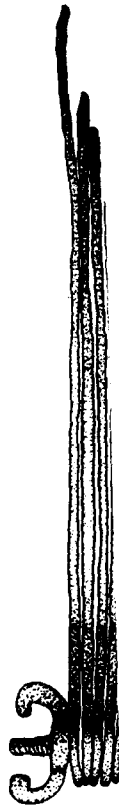
PRINCIPAL DIMENSIONS: Five rings; Interior diameters (in.) -
Demi-Culverin: 4-1/8; Saker: 3/8; Minion: 3-1/8; Falcon: 2-1/2; Falconet: 2

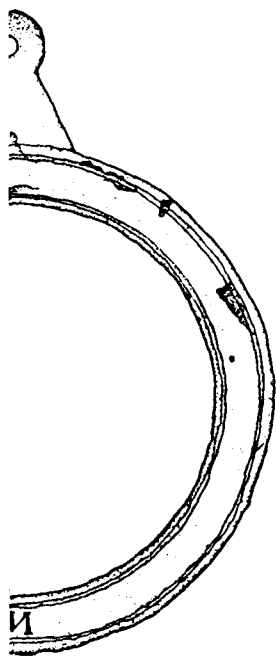
DESCRIPTION: Brass shotgauge consisting of 5 rings fastened together with a wing nut; each ring bears decorative inscribed bands as well as a single or double letter abbreviation which coincides with the name of a piece of 17th-century ordnance

ARCHAEOLOGICAL PROVENIENCE: In the upper stratum over the Hearth 7

PARALLELS:

COMMENTS / CONSERVATION NOTES:





ARTIFACT RECORD

ARTIFACT NUMBER: PR89 738-10

IDENTIFICATION: Cannon ball

PRINCIPAL DIMENSIONS: Diameter: 2-3/8 in.

DESCRIPTION: Cast iron cannon ball; its diameter makes it suitable for use with a Falcon, an English gun, with a bore diameter of 2-1/2 in.; evidence of mold and sprue remain

ARCHAEOLOGICAL PROVENIENCE: On the floor in the top right quadrant of Room 3 of Building 5

PARALLELS: PR89 867-8; PR89 7310-5

COMMENTS / CONSERVATION NOTES:

PR 89 738-10

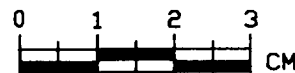
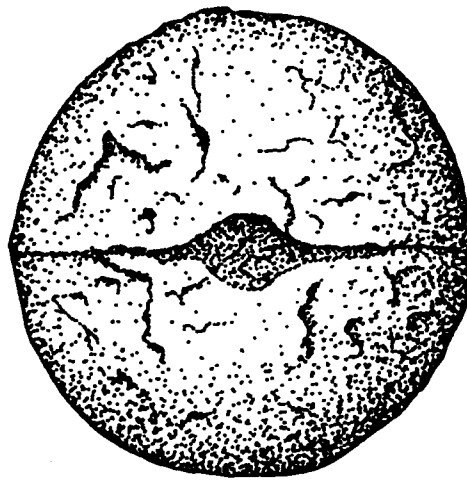


Figure 71. PR89 738-10: Cannon Ball Suitable for a Falcon

ARTIFACT RECORD

ARTIFACT NUMBER: PR89 7310-5

IDENTIFICATION: Cannon ball

PRINCIPAL DIMENSIONS: Diameter: 2-3/4 in.

DESCRIPTION: Cast iron cannon ball, the diameter of which suggests that it was used in a Dutch gun, the 3-pounder, with a diameter of 2-3/4 in. ; evidence of mold and sprue remain

ARCHAEOLOGICAL PROVENIENCE: In the doorway between Rooms 3 and 4 of Building 5

PARALLELS: PR89 867-8; PR89 738-10

COMMENTS / CONSERVATION NOTES:

PR89 7310-5

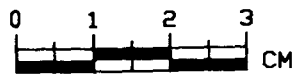
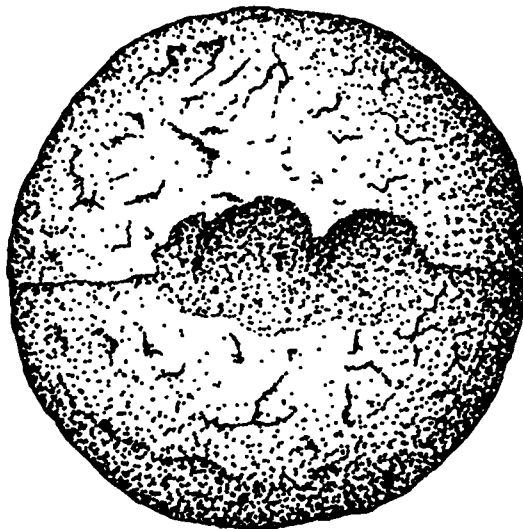


Figure 72. PR89 7310-5: Cannon Ball Suitable for a Dutch 3-Pounder

ARTIFACT RECORD

ARTIFACT NUMBER: PR89 867-8

IDENTIFICATION: Cannon ball

PRINCIPAL DIMENSIONS: Diameter: 3-1/4 in.

DESCRIPTION: Cast iron cannon ball with a diameter suitable for use in a Saker, an English gun with a bore diameter of 3-3/8 in.; evidence of a mold line and sprue hole remained

ARCHAEOLOGICAL PROVENIENCE: In Yard 4A, near the eastern wall of Room 4 of Building 5

PARALLELS: PR89 738-10; PR89 7310-5

COMMENTS / CONSERVATION NOTES:

ARTIFACT RECORD

ARTIFACT NUMBER: PR89 885-5.3

IDENTIFICATION: Iron Barshot

PRINCIPAL DIMENSIONS:

DESCRIPTION: Wrought iron bar with an iron disk fastened at either end

ARCHAEOLOGICAL PROVENIENCE: In Yard 7 just outside of the hearth

PARALLELS: PR90 2012-11; while this is an entirely different style, it functioned in the same manner

COMMENTS / CONSERVATION NOTES:

PR 89 867-8

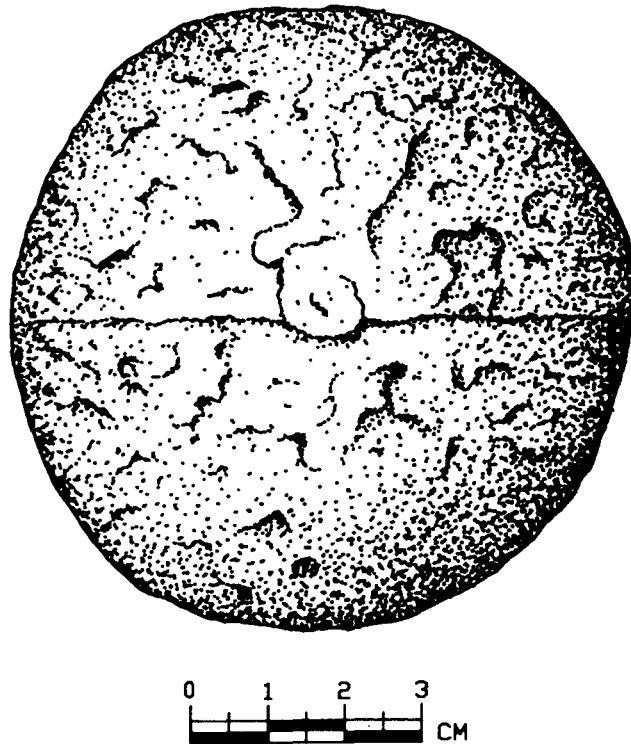
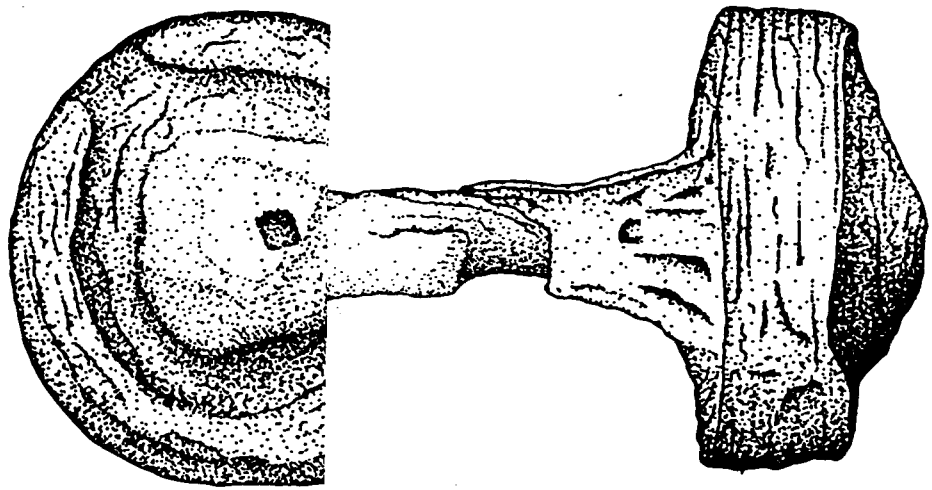


Figure 73. PR89 867-8: Cannon Ball Suitable for a Saker



ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2012-11

IDENTIFICATION: Iron barshot

PRINCIPAL DIMENSIONS: Length of visible portion of shaft: 5-5/8 in. (14.4 cm); Cross sectional width of extant shaft: 3/4 in. square (1.9 cm square); Cross sectional width of shaft hole in cannon ball: 1-x-15/16 in. (2.5-x-2.4 cm); Diameter of half cannon balls at ends of shaft: 3-5/16 in. (8.4 cm)

DESCRIPTION: Iron barshot with wrought iron shaft with cast iron half cannon balls at either end; note that both halves exhibit sprue holes and mold lines; the shaft appears to be sunk into the cannon ball halves as opposed to being welded to their outer surfaces

ARCHAEOLOGICAL PROVENIENCE: Roughly 15 ft. off the starboard side of the wreck at the stern

PARALLELS: PR89 885-5.3 is another example of barshot, though of a different style

COMMENTS / CONSERVATION NOTES: This barshot is of an unusual design. Several archaeological examples exist of barshot with half cannon ball ends, but in these examples, the shaft is welded to the flat faces of the cannon ball halves. In this example from Port Royal, the shaft is imbedded within the cannon ball halves, indicating that the halves were either cast around the shaft, or that the shaft was driven into a hole cut into the rounded surface of the cannon balls.

Evidence of sprue holes on both cannon ball halves in this example seems to suggest that these halves were from two different cannon balls. Also, mold lines suggest that the cannon balls were cast first and then cut in half, although saw marks are not readily visible on the faces of the halves. It is interesting to note, however, that the sprue holes and mold lines on each cannon ball half are lined up. Is this coincidence, or could there actually have been half cannon ball molds for bar shot? - molds that would have had two openings: one opening being sealed with the shaft, and the other opening being the sprue into which the molten metal was poured?

ARTIFACT RECORD

ARTIFACT NUMBER: VARIED

IDENTIFICATION: Two hundred ninety-five pieces of lead shot

PRINCIPAL DIMENSIONS: Diameters represented (in mm): 8.9, 10.7, 12.2, 12.7, 13.2, 13.7, 14, 14.2, 14.4, 14.7, 15, 15.2, 15.3, 15.7, 16, 16.3, 16.8, 17, 17.3, 17.8, 18.3, 18.8, 19, 19.1, 19.3, 19.5, 19.8, 20.3

DESCRIPTION: Small lead shot, the sizes of which suggest that carbines, calivers, muskets and musketoons may have been used on the vessel

ARCHAEOLOGICAL PROVENIENCE: Individual pieces of shot were found all along the wreck, but particularly large conglomerations of shot were found in 1060, on the port side of the deadwood, around the inner ends of Frames 22-25; the greatest number was recovered from 2076, all along the port side of the stern assembly and extending outward from it

PARALLELS:

COMMENTS / CONSERVATION NOTES:

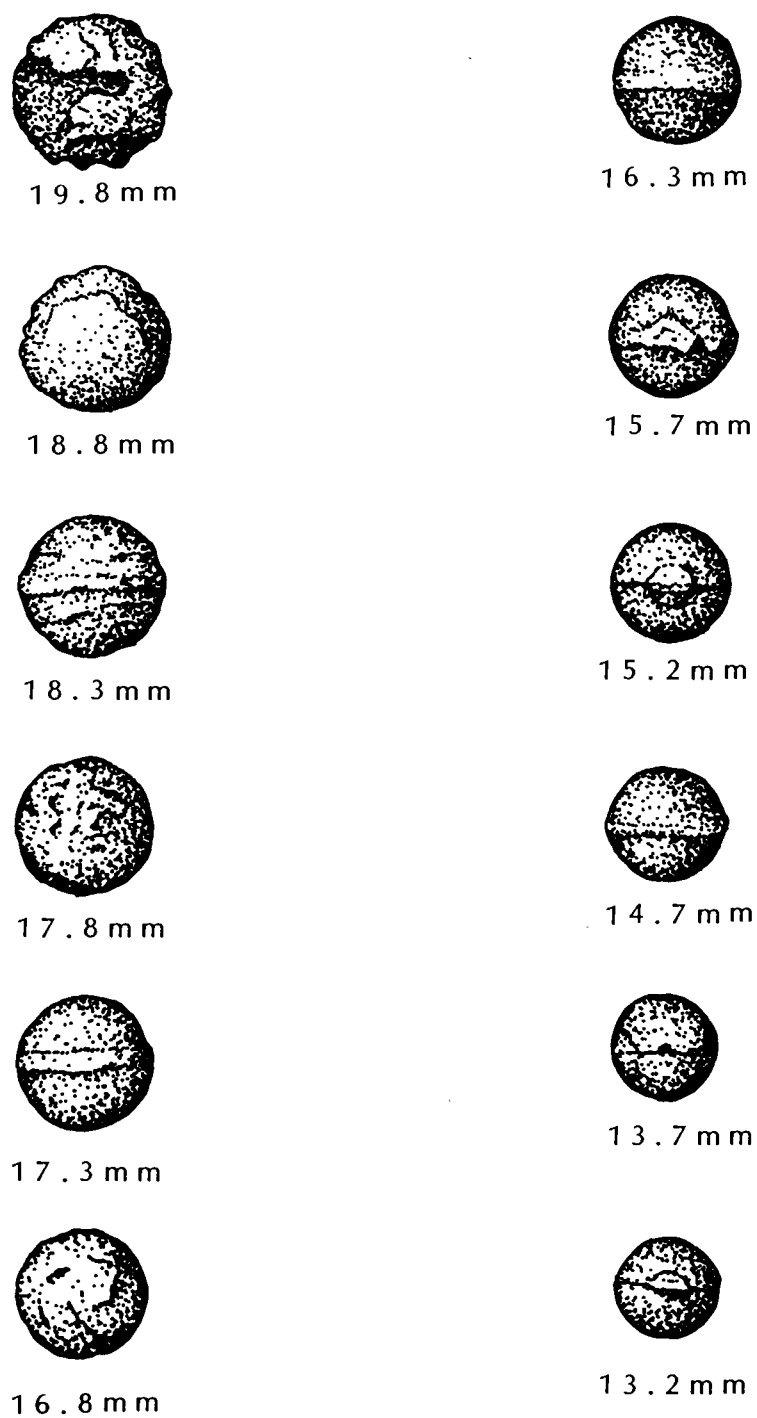


Figure 76. VARIED LOTS: Representative Examples of the Diameters of Shot Recovered from the Port Royal Shipwreck

APPENDIX 7

**PERSONAL EFFECTS/SHIPBOARD LIFE: Stemware, Pestle, Chisel,
Lead Punch Back, Tobacco Pipes, Ceramic Sherds, Onion Bottles**

PERSONAL EFFECTS/SHIPBOARD LIFE**Stemware**

1036-5: pp.264-265

2074-14: pp.266-267

Wooden Pestle

2076-23: pp.268-269

Chisel or Caulking Tool

3023-9: pp.270-271

Lead Punch Back

845-6: pp.272-273

Tobacco Pipes

1054-1: pp.274-275

1083-2: pp.276-277

2074-3: pp.278-279

2074-11: pp.280-281

2074-16: pp.282-283

2096-7: pp.284-285

Ceramic Vase

2074-12: pp.286-287

Onion Bottle

1054-5: pp.288-289

1055-5: pp.290

1056-5: pp.291-292

1056-6: pp.293-294

1056-9: pp.295-296

2076-25: pp.297-298

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1036-5

IDENTIFICATION: Glass stemware fragment

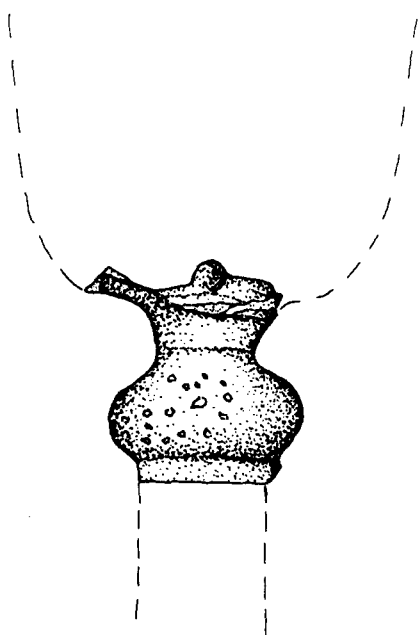
PRINCIPAL DIMENSIONS: Length: 1-5/32 in. (2.4 cm); Widest Breadth (diameter): 1 in. (2.54 cm)

DESCRIPTION: Slightly asymmetrical globular knob decorative piece that falls between the cup and stem on fine glassware; Anglo/Venetian

ARCHAEOLOGICAL PROVENIENCE: Located just abaft the starboard end of Frame 3

PARALLELS: See PR90 2074-14. While the style is different, this is another example of 17th-century stemware design.

COMMENTS / CONSERVATION NOTES:



PR 90 1036-5

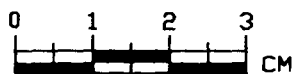


Figure 77. PR90 1036-5: Glass Stemware Fragment - Globular Knob

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2074-14

IDENTIFICATION: Quatrefoil stemware fragment

PRINCIPAL DIMENSIONS: Length: 1-15/16 in. (4.9 cm); Maximum diameter: 1-5/16 in. (3.4 cm)

DESCRIPTION: Ravenscroft style of quatrefoil stemware decoration, apparently bearing his trademark circular seal; clear glass

ARCHAEOLOGICAL PROVENIENCE: Found directly off stempost

PARALLELS: PR90 1036-5, while of a different style, is another example of 17th-century stemware

COMMENTS / CONSERVATION NOTES:

PR 90 2074-14

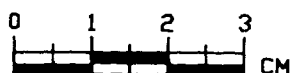
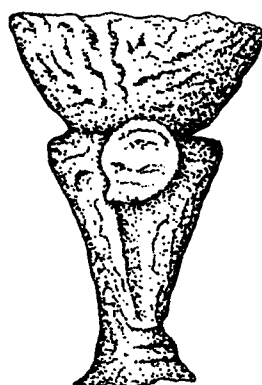


Figure 78. PR90 2074-14: Quatrefoil Stemware Fragment

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-23

IDENTIFICATION: Wooden pestle

PRINCIPAL DIMENSIONS: Length: 9-7/16 in. (24 cm); Diameter of handle: 1-1/4 in. (3.2 cm); Maximum diameter of the working end of the pestle: 2-13/16 in. (7.1 cm)

DESCRIPTION: Wooden pestle with several simple, yet decorative, turns and ridges

ARCHAEOLOGICAL PROVENIENCE: Found right next to the wreck, on the port side of the stern assembly, underneath the gudgeon strap, PR90 2075-9

PARALLELS:

COMMENTS / CONSERVATION NOTES:

- 1) Dehydration in sequential baths: 100% isopropyl alcohol to 50/50 isopropyl alcohol/acetone to 100% acetone
- 2) Placed in a heated (approximately 120° F), saturated (66% or with sludge on bottom of container) acetone/rosin solution
- 3) Removed after eight weeks

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 3023-9

IDENTIFICATION: Chisel or Caulking tool

PRINCIPAL DIMENSIONS: Length: 4-5/8 in. (11.8 cm); Shaft: 1/2 in. (1.3 cm) square, however, all four corners of shaft were beveled; "Blade": width at shaft end: 5/8 in. (1.6 cm), widest point: 1-1/16 in. (2.8 cm), thickness at shaft: 7/16 in. (1.2 cm), thickness at blade end: 1/8 in. (.2 cm)

DESCRIPTION: This appears to be a fragment of a tool including a rounded blade and a portion of the square shaft into which the blade fits. The tapering nature of the blade suggests a chisel of some sort; however, the crumpled tip suggests that it may have been reused as a caulking tool

ARCHAEOLOGICAL PROVENIENCE: Found off the port side of the very end of the timber jumble off the stern

PARALLELS:

COMMENTS / CONSERVATION NOTES: Hysol cast of mold; encrustation also contained a mold of what appeared to be a spike, but this was not recoverable due to the crumbly nature of the encrustation

PR90 3023-9

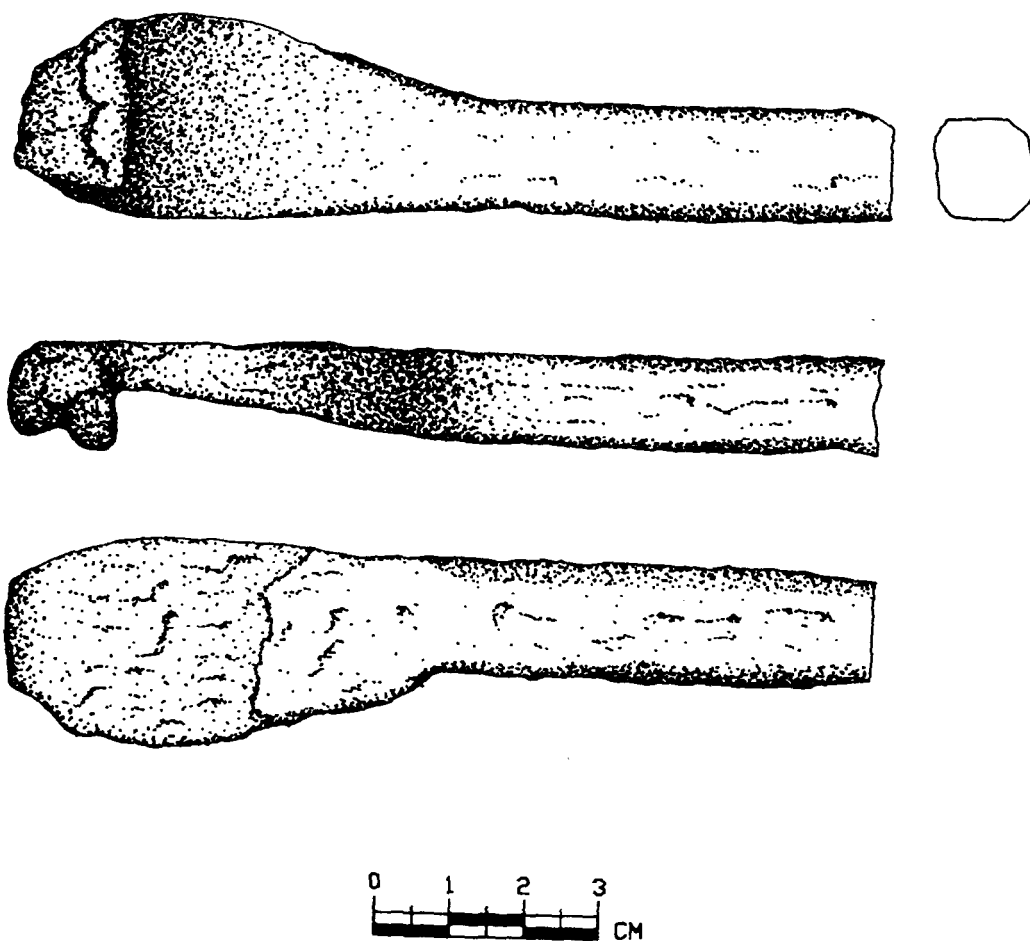


Figure 80. PR90 3023-9: Chisel or Caulking Tool

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 845-6

IDENTIFICATION: Lead punch back

PRINCIPAL DIMENSIONS: 6-7/8 in. (17.5 cm) average diameter; 11/16 in. (1.7 cm) thick

DESCRIPTION: A disc of lead with numerous circular punch dents in both of the faces of the disc; the diameter of the majority of punch circles is 2-1/5 in. (5.6 mm); there is a jagged "S" shaped tear in the middle of the disk.

ARCHAEOLOGICAL PROVENIENCE: Below the very bow end of the port garboard strake, level with the bottom of the keel

PARALLELS:

COMMENTS / CONSERVATION NOTES: It is not quite clear what purpose this artifact served. It has been suggested that it provided a relatively soft yet firm backing behind an item into which small circles were being punched. The soft nature of the lead would have dulled the punch to a lesser degree than a harder surface would have.

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1054-1

IDENTIFICATION: White kaolin pipe with Isaac Evans cartouche on right hand side

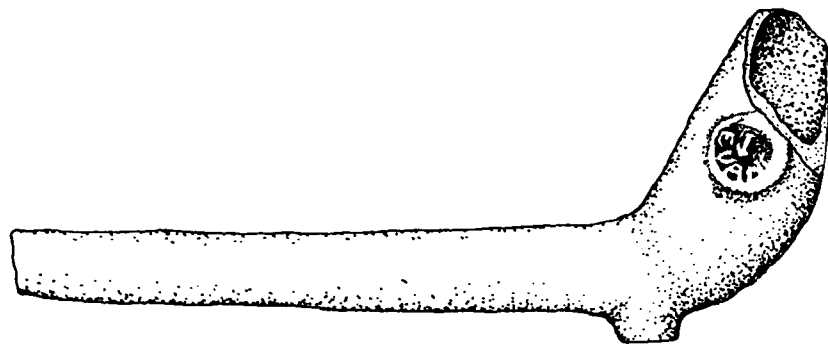
PRINCIPAL DIMENSIONS: Bore Diameter: 5/64 in.

DESCRIPTION: This is a partial bowl and stem fragment; the bowl bears the anchor and shield Evans cartouche; This pipe has a slightly peculiar shape but bears a strong resemblance to Hume's number 15 (1991:303).

ARCHAEOLOGICAL PROVENIENCE: Lying atop the keel off the starboard end of Frame 8

PARALLELS: PR90 2074-16

COMMENTS / CONSERVATION NOTES:



PR 90 1054-1

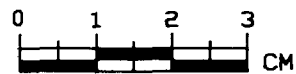


Figure 82. PR90 1054-1: White Pipe with Isaac Evans Cartouche

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1083-2

IDENTIFICATION: White pipe with Devereaux Jones cartouche

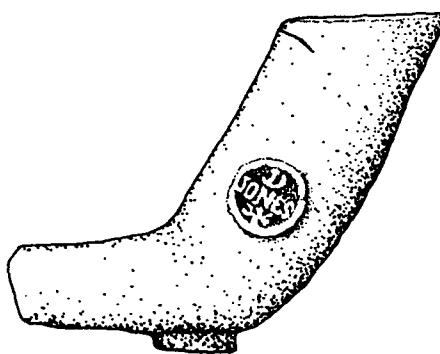
PRINCIPAL DIMENSIONS: Bore Diameter 5/64 in.

DESCRIPTION: White pipe bowl and stem fragment; bowl bears the cartouche of Devereaux Jones I on its right hand side; Walker (1977a:1186,1454) dates Devereaux Jones I from 1684-1713; bowl resembles Walker's number 15 (1977b:1549)

ARCHAEOLOGICAL PROVENIENCE: Lying atop the deadwood in the stern

PARALLELS:

COMMENTS / CONSERVATION NOTES:



PR90 1083-2

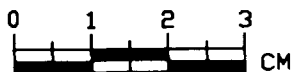


Figure 83. PR90 1083-2: White Pipe with Devereaux Jones I Cartouche

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2074-3

IDENTIFICATION: White pipe bowl with cartouche of James Abbot on its right hand side

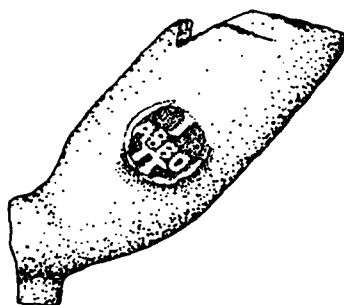
PRINCIPAL DIMENSIONS: Bore Diameter: 6/64 in.

DESCRIPTION: White pipe bowl; James Abbot dates from 1676 to 1715/6 (Walker 1977a:1046); Bowl closely matches Walker's Figure C (1977a:1405) and Hume's number 13 (1991:303)

ARCHAEOLOGICAL PROVENIENCE: Directly off the sternpost

PARALLELS:

COMMENTS / CONSERVATION NOTES:



PR 90 2074-3

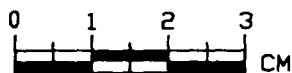


Figure 84. PR90 2074-3: White Pipe Bowl with James Abbot Cartouche

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2074-11

IDENTIFICATION: White pipe bowl with "IS" cartouche on its right hand side

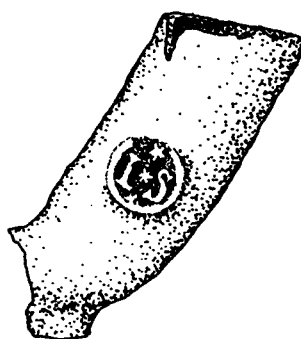
PRINCIPAL DIMENSIONS: Bore Diameter: 6/64 in.

DESCRIPTION: White pipe bowl bearing a cartouche that is difficult, if not impossible, to identify at this time; one possible maker was John Sinderling, 1653-1699 (Walker 1977a:1296); the bowl closely matches the style dating from 1700-1730 presented in Walker's Figure 6a-3 (1977b:1545)

ARCHAEOLOGICAL PROVENIENCE: Off the port edge of the stern assembly timber associated with gudgeon PR90 2074-17

PARALLELS:

COMMENTS / CONSERVATION NOTES:



PR 90 2074-11

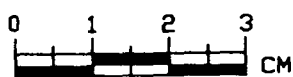


Figure 85. PR90 2074-11: White Pipe Bowl Bearing the Cartouche "IS"

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2074-16

IDENTIFICATION: White kaolin pipe with Isaac Evans cartouche

PRINCIPAL DIMENSIONS: Bore Diameter: 5/64 in

DESCRIPTION: Pipe bowl and portion of stem; Isaac Evans anchor and shield cartouche on right hand side of bowl; roulette around half of bowl rim, only on the half that faces the smoker; thin spur; bowl is similar to Walker's (1977b:1531) number 23.

ARCHAEOLOGICAL PROVENIENCE: Directly off the sternpost

PARALLELS: PR90 1054-1

COMMENTS / CONSERVATION NOTES:

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2096-7

IDENTIFICATION: White pipe bowl with Robert Williams I cartouche on its right side

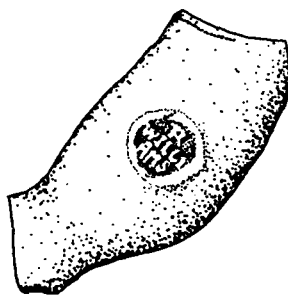
PRINCIPAL DIMENSIONS: Bore Diameter: 5/64 in.

DESCRIPTION: White pipe bowl; Robert Williams I dates from 1685 to 1714; the bowl is very similar to Oswald's number 5b (1961:59), which dates from 1640-1670

ARCHAEOLOGICAL PROVENIENCE: Off the stern of the vessel, slightly to starboard

PARALLELS:

COMMENTS / CONSERVATION NOTES:



PR 90 2096-7

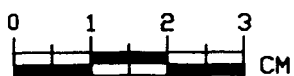


Figure 87. PR90 2096-7: White Pipe Bowl with Robert Williams I Cartouche

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2074-12

IDENTIFICATION: Vase fragment

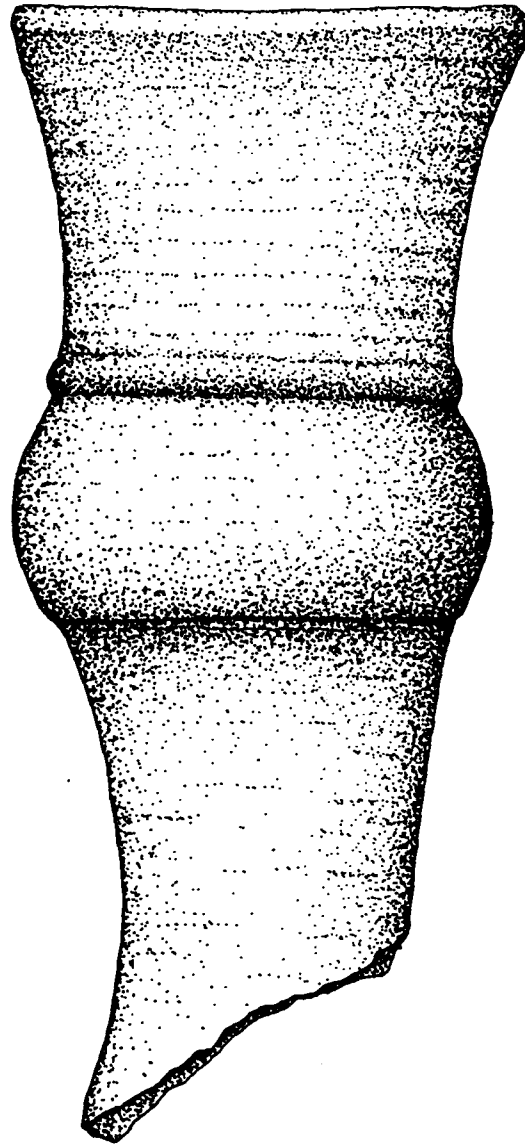
PRINCIPAL DIMENSIONS: Greatest length: 5-7/8 in. (15 cm); Rim diameter: 2-11/16 in. (16.8 cm)

DESCRIPTION: This appears to be a portion of the neck of an earthenware vase or jar. The specific type of earthenware is unknown. The piece appears to have been wheel thrown, as evidenced by smooth, regular, slightly indented rings in the outer surface of the piece

ARCHAEOLOGICAL PROVENIENCE: Found directly off the stern of the vessel, slightly off to starboard

PARALLELS:

COMMENTS / CONSERVATION NOTES:



PR 90 2074-12

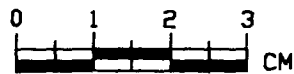


Figure 88. PR90 2074-12: Earthenware Vase Fragment

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1054-5

IDENTIFICATION: Onion Bottle

PRINCIPAL DIMENSIONS: Height: 5-1/10 in. (13 cm); Base Diameter: 4-3/10 in. (11 cm); PR variety number 4.74

DESCRIPTION: Typical squat style of onion bottle

ARCHAEOLOGICAL PROVENIENCE: Off the starboard side of the wreck, between Frames 18 and 19

PARALLELS: PR90 1055-5, PR90 1056-5, PR90 1056-6, PR90 1065-9, PR90 2076-25

COMMENTS / CONSERVATION NOTES:

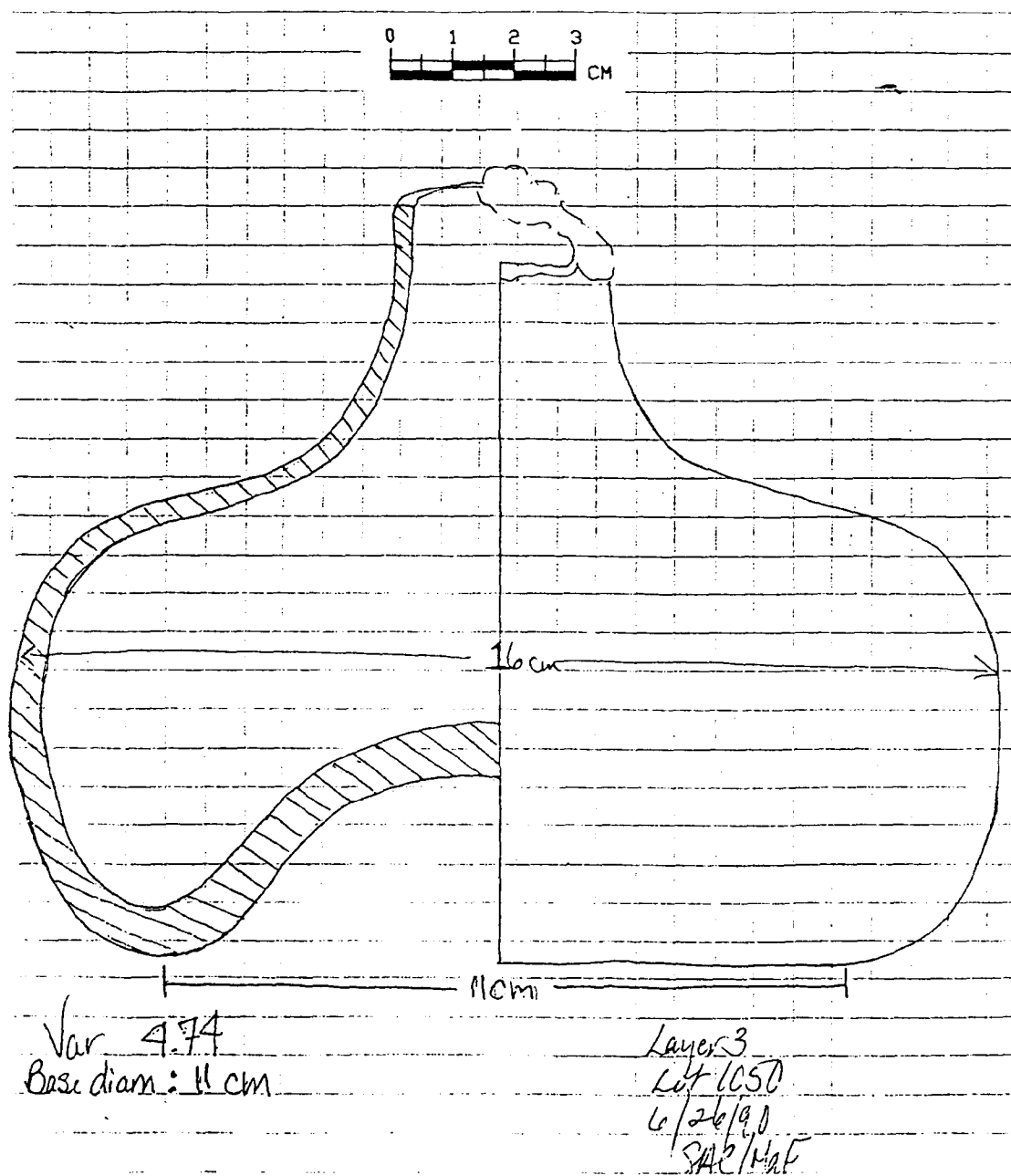


Figure 89. PR90 1054-5: Onion Bottle

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1055-5

IDENTIFICATION: Onion Bottle

PRINCIPAL DIMENSIONS:

DESCRIPTION:

ARCHAEOLOGICAL PROVENIENCE: On the port garboard off the port end of Frame 8

PARALLELS: PR90 1054-5, PR90 1056-5, PR90 1056-6, PR90 1065-9, PR90 2076-25

COMMENTS / CONSERVATION NOTES: No field drawing available

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1056-5

IDENTIFICATION: Onion Bottle

PRINCIPAL DIMENSIONS: Base Diameter: 4-3/10 in. (11 cm); Variety number 76 or 4.76

DESCRIPTION: Typical squat style of onion bottle

ARCHAEOLOGICAL PROVENIENCE: Off the port side of the wreck, between Frames 9 and 10

PARALLELS: PR90 1054-5, PR90 1055-5, PR90 1056-6, PR90 1065-9, PR90 2076-25

COMMENTS / CONSERVATION NOTES:

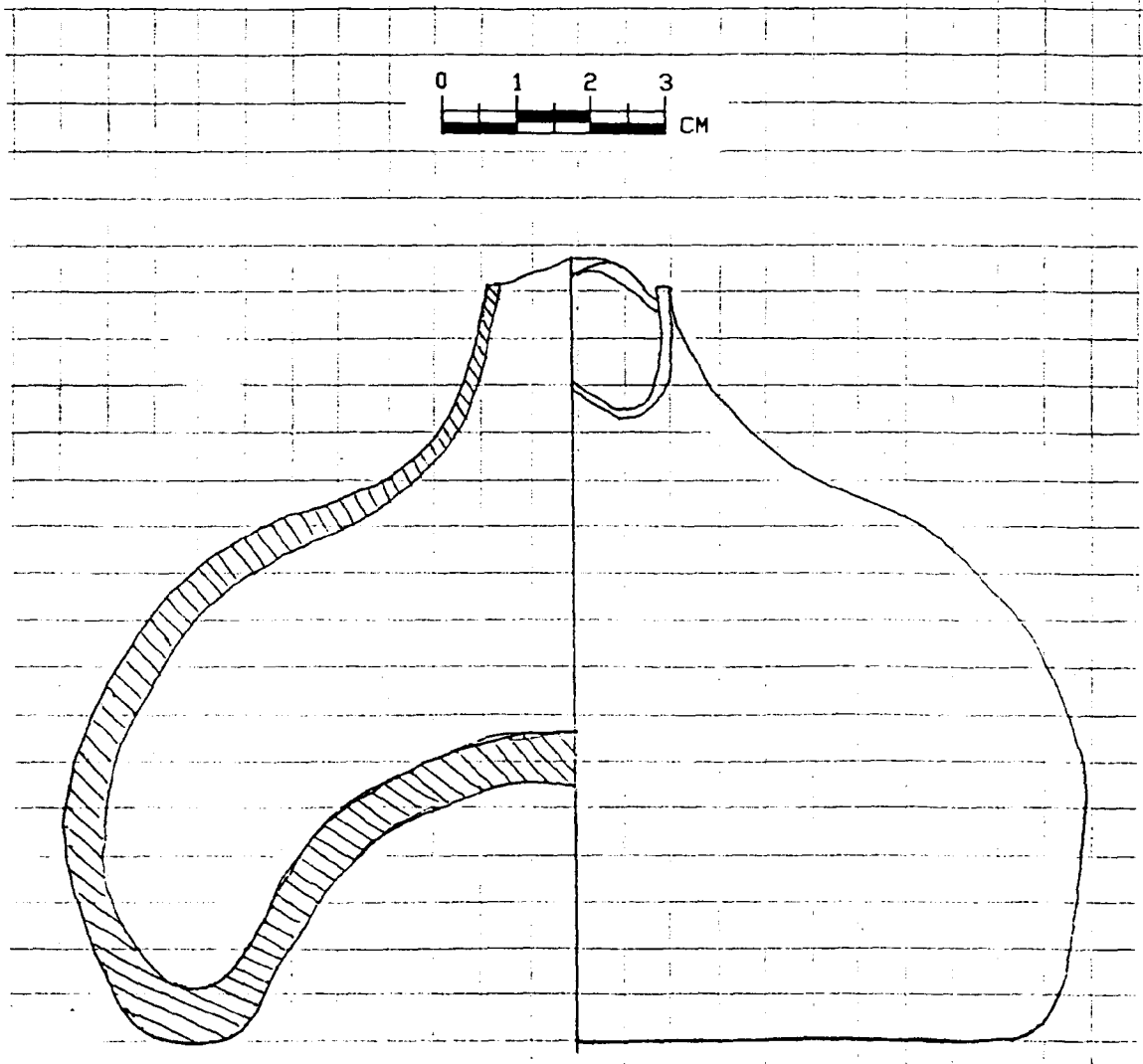


Figure 90. PR90 1056-5: Onion Bottle

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1056-6

IDENTIFICATION: Onion Bottle

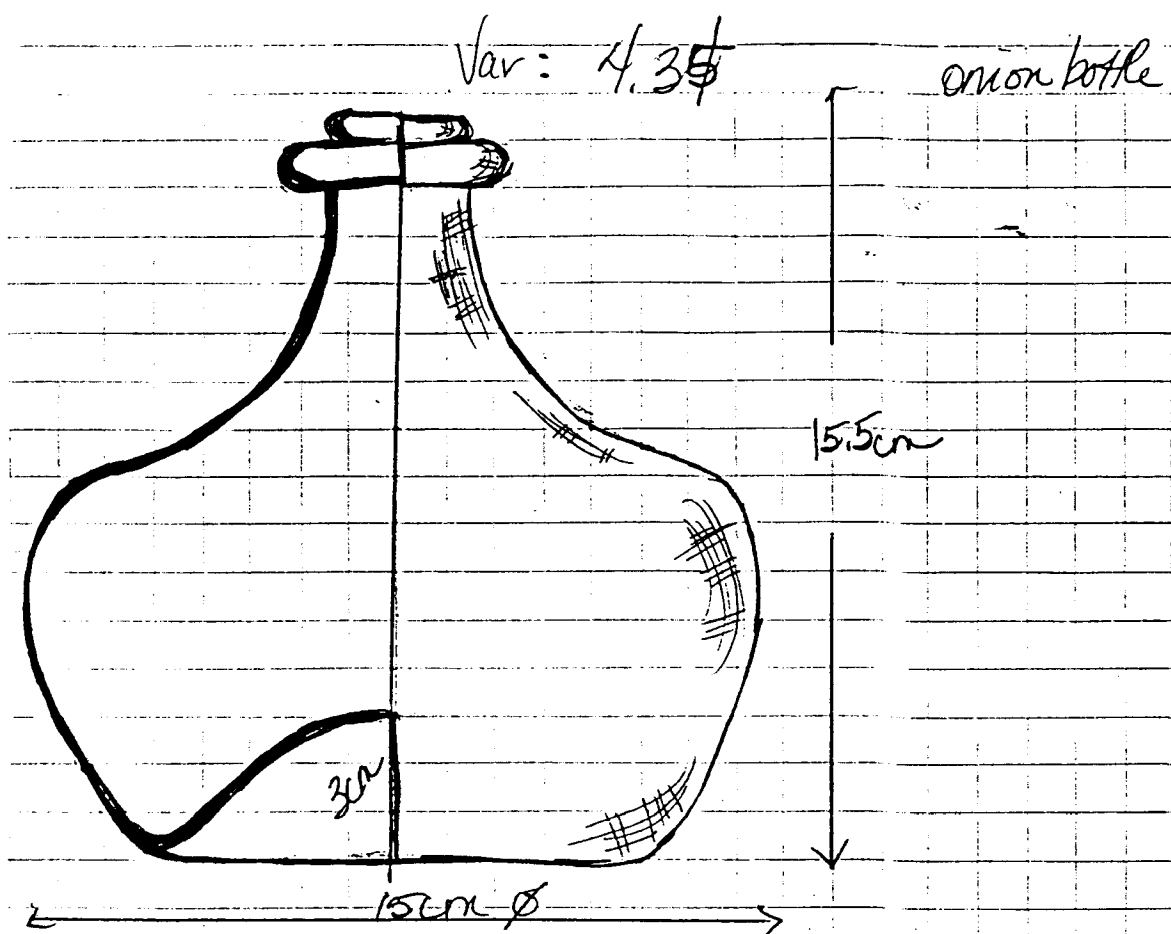
PRINCIPAL DIMENSIONS: Base Diameter: 4 in. (10 cm); Height: 6-1/10 in. (15.5 cm); Variety 4.35

DESCRIPTION: Onion bottle with slightly steeper sides than on the typical squat variety

ARCHAEOLOGICAL PROVENIENCE: Off the port side of the wreck, off Frame 11

PARALLELS: PR90 1054-5, PR90 1055-5, PR90 1056-5, PR90 1065-9, PR90 2076-25

COMMENTS / CONSERVATION NOTES:



Recorder: Tuna

Scale 1:40

0 5

Figure 91. PR90 1056-6: Onion Bottle

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 1056-9

IDENTIFICATION: Onion Bottle

PRINCIPAL DIMENSIONS: Base Diameter: 4-3/10 in. (11 cm); Height: 7-4/5 in. (20 cm); Variety 3.17

DESCRIPTION: Later style of onion bottle with very steep, slightly concave sides and a fairly long neck

ARCHAEOLOGICAL PROVENIENCE: Off the starboard side of the wreck, off Frame 17

PARALLELS:

COMMENTS / CONSERVATION NOTES:

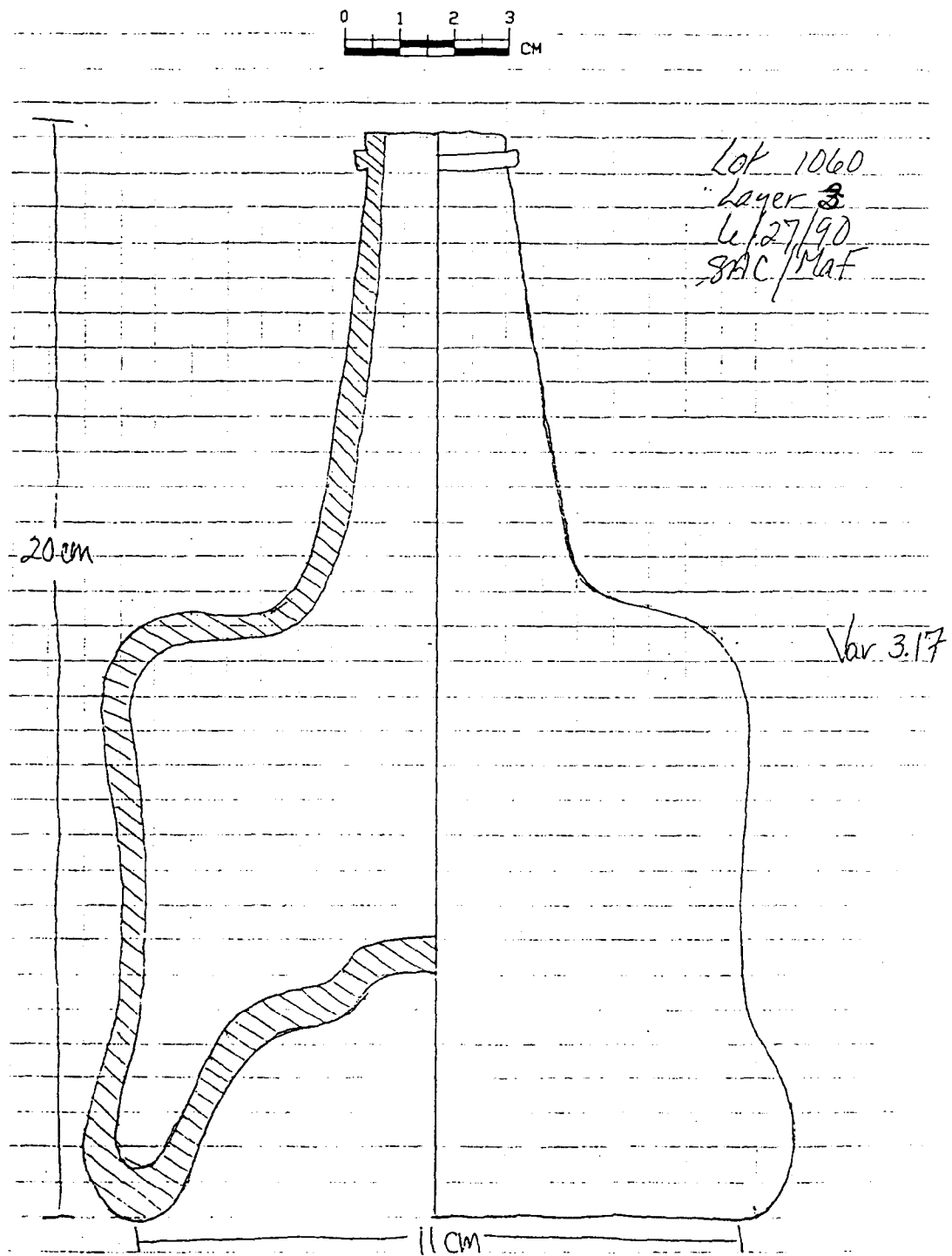


Figure 92. PR90 1065-9: Onion Bottle

ARTIFACT RECORD

ARTIFACT NUMBER: PR90 2076-25

IDENTIFICATION: Onion Bottle

PRINCIPAL DIMENSIONS: Base Diameter: 4-7/10 in. (12 cm); Height: 6 in. (15 cm); Variety number 64

DESCRIPTION: Onion bottle with slightly steeper sides than on the typical squat variety

ARCHAEOLOGICAL PROVENIENCE: Lying next to gudgeon PR90 2074-17

PARALLELS: PR90 1054-5, PR90 1055-5, PR90 1056-5, PR90 1065-9,

COMMENTS / CONSERVATION NOTES:

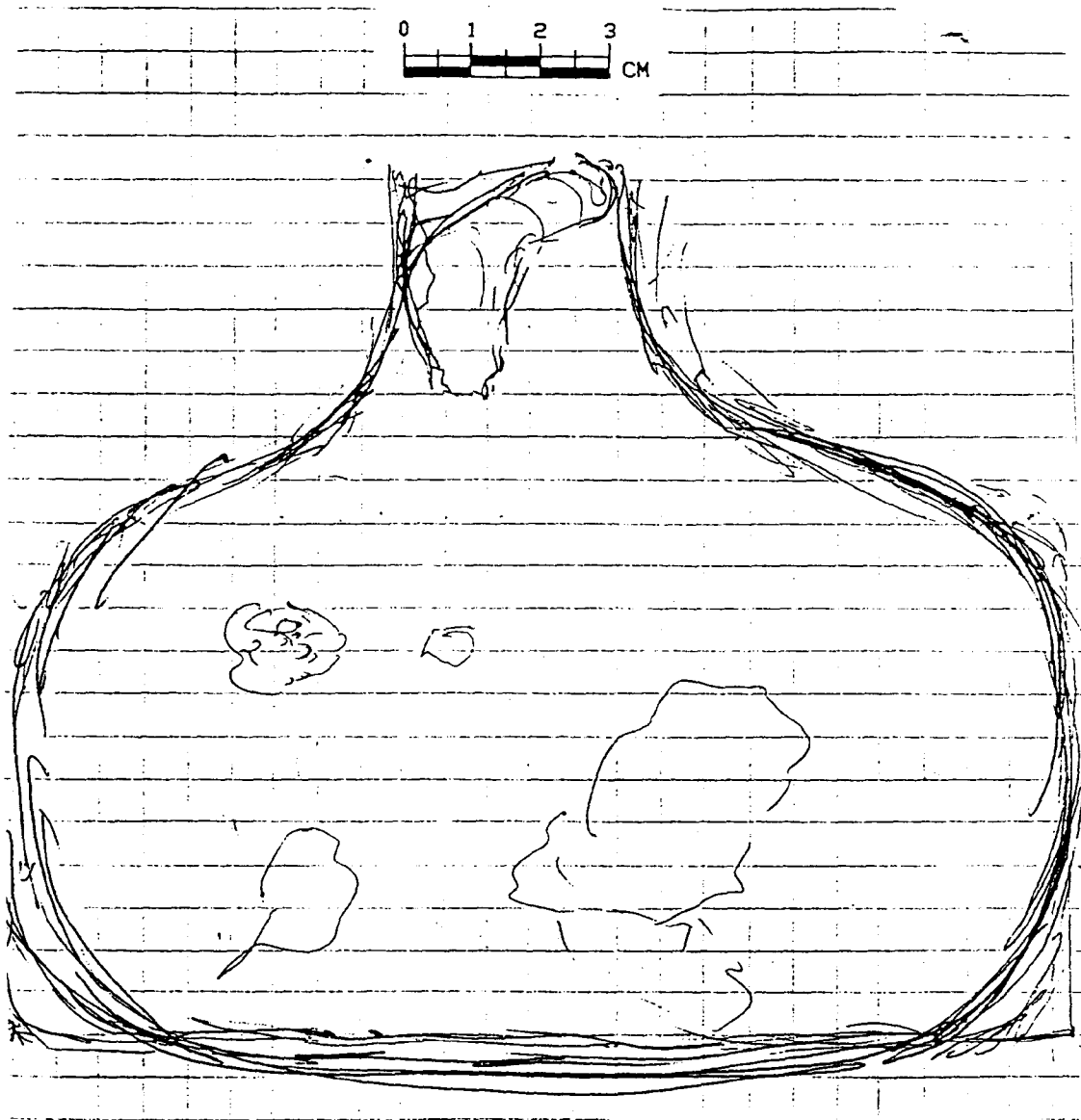


Figure 93. PR90 2076-25: Onion Bottle

APPENDIX 8

LETTERS OF PERMISSION

30-SEP-1992 09:56

ASDAL 071 485 6742

071 485 6742 P.01

To: Sheila A Clifford, Dept. Anthropology, Texas A & M University,
College Station, Texas 77843 - 4352 FAX 409 845 6399

OLIVER COX CBE AADip(Hons) RIBA Dist TP

22 Grove Terrace Highgate Road London NW5 1PL 071-485 6929

FAX 071-485 6742
30th Spt. 1992

Dear Sheila Clifford,

Port Royal, Jamaica.

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I am very happy to agree this. Perhaps you would let me have a copy of the relevant page showing how this will be used.

You mention that this will not be published prior to Dr. Hamilton's publication of the site, and I would appreciate information as to when this later publication date might be, as I have not heard from him since our meeting at the S.H.A. Conference in January.

Yours sincerely,



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28 September 1992

Sheila A Clifford
Nautical Archaeology Program
Texas A & M University
College Station
TX 77843-4352
USA

Dear Ms Clifford

BARLOW'S JOURNAL

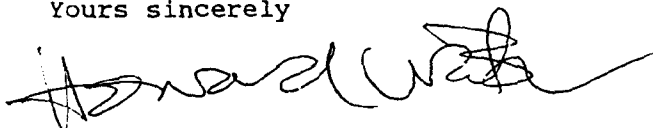
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Please acknowledge the author, source and Hurst & Blackett as publisher.

Yours sincerely



Howard Watson
Permissions Controller

VITA

Sheila Alicia Clifford

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Nautical Archaeology/Jamaica National Heritage Trust

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Dr. D.L. Hamilton, Director, Port Royal
Project

Summer, 1989 Archaeological Diver, Port Royal Project, Jamaica; Texas
A&M University/Institute of Nautical Archaeology/Jamaica
National Heritage Trust

Summer, 1987 Earthwatch volunteer, The Vixen Project, Bermuda;
Dr. Richard Gould, Director