

YORKTOWN SHIPWRECK 44YO88:
STORES AND CARGO FROM A
BRITISH NAVAL SUPPLY VESSEL
FROM THE AMERICAN WAR FOR INDEPENDENCE

A Thesis

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John D. Broadwater

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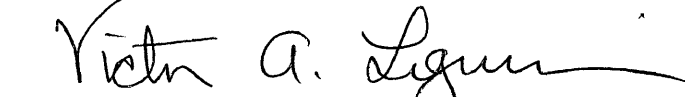
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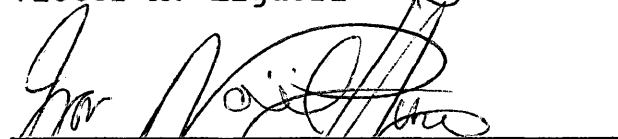
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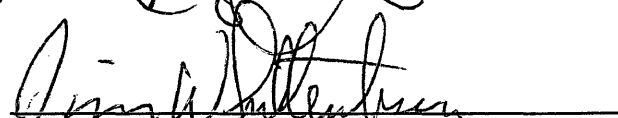
Master of Arts


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This paper
is dedicated to

William M. Kelso,
Ivor Noël Hume
and
John O. Sands

whose vision, initiative,
faith and support
made the Yorktown Project possible.

TABLE OF CONTENTS

ACKNOWLEDGMENTS.....	v
LIST OF TABLES.....	vii
LIST OF FIGURES	viii
ABSTRACT	ix
INTRODUCTION	2
CHAPTER 1. THE ROLE OF ENGLISH MERCHANT VESSELS AS MILITARY TRANSPORTS	6
CHAPTER 2. THE SUNKEN FLEET AT YORKTOWN	15
CHAPTER 3. RESEARCH PLAN AND SITE DESCRIPTION	36
CHAPTER 4. SHIP'S STORES	49
CHAPTER 5. CARGO AND BALLAST	86
CHAPTER 6. A PARTIAL RECONSTRUCTION OF SHIPWRECK 44Y088	91
CHAPTER 7. ANALYSIS AND CONCLUSIONS	100
APPENDICES: A. EXCERPTS FROM INVENTORIES OF SHIPS' STORES	112
B. RIGGING AND CORDAGE FOR A 160-TON MERCHANT BRIG	120
GLOSSARY.....	121
BIBLIOGRAPHY.....	126
VITA.....	135

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LIST OF TABLES

Table:	Page:
1. Classes of ships' stores	51
2. Carpenter's stores from site 44Y088	55
3. Boatswain's stores from site 44Y088	66
4. Summary of stores from site 44Y088	85
5. Dimensions of vessel 44Y088	93

LIST OF FIGURES

Figure:	Page:
1. Map of Yorktown, 1781, indicating the sunken ships	22
2. National Register district and site locations	34
3. Artist's depiction of Yorktown Cofferdam	39
4. Site 44Y088: archaeological grid designations	41
5. Site 44Y088: archaeological zone designations	42
6. Site 44Y088: preliminary site plan	47
7. Distribution of casks	58
8. Distribution of standing and running rigging hardware	69
9. Deadeye and Thimble	70
10. Block	71
11. Trestletree Assembly	72
12. Project Rope Form	76
13. Knots and Surface Treatments	77
14. Distribution of miscellaneous boatswain's stores	79
15. Lever, with sketch of possible operation	82
16. Spun-Yarn Winch	83
17. Profile of vessel 44Y088 showing hypothetical stowage plan	94
18. Flow Diagram of the Formation of Shipwreck Site 44Y088	102

ABSTRACT

The Yorktown Shipwreck Archaeological Project has shed new light not only on merchant vessels from the latter half of the eighteenth century but also on the Battle of Yorktown, 1781, the last major conflict of the American Revolution. The project culminated in the complete excavation of a British supply ship, known by its site designation 44Y088 and now believed to be the brig Betsy. This vessel has provided significant information on hull and rigging configuration, merchant vessel technology, cargo and ship's stores.

Research to date indicates that vessel 44Y088 is a brig of approximately 180 tons, well built and heavily constructed. It is very full-bodied, with a bluff bow, to accommodate maximum cargo. Data suggest that the vessel was built in the north of England as a collier, or coal-carrier, then leased by the Navy Board as a British Transport during the American Revolution.

Only a small portion of the expected shipboard stores necessary for support of the vessel and crew were recovered, probably due to a combination of prior removal, salvage and natural forces. However, almost all categories of stores were represented in the assemblage of material culture from the site, thus providing an excellent opportunity to study a wide range of objects.

The extremely well-preserved hull and contents have provided significant information on vessel configuration, including deck and compartment locations. Ship's stores, which include all equipment and provisions required for operating the vessel, are well represented among the recovered material. Analysis of the stores, cargo and ballast provide a unique look at a typical eighteenth-century merchant brig, information poorly represented in surviving contemporary documents.

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INTRODUCTION

Detailed documentation on merchant sailing vessels is scarce. Until the 18th century, no means had been developed for accurately and completely describing the complex form of a ship's hull. Even then, however, in spite of several valuable sources from that period, including Chapman (1768), Murray (1765), Steel (1794, 1805) and Sutherland (1755), there are many gaps in the information, especially concerning merchant vessels. Almost all surviving plans and models are of warships, as are most data in contemporary shipbuilding and rigging manuals.

Not only is there a general paucity of data on merchant ship construction, there are few recorded details on interior configuration, stores and equipment, command and social structure, or daily life. As a result, even though the world's merchant marine has always vastly outnumbered its naval forces, our knowledge of these workhorses of commerce is sadly lacking.

In Archaeology of the Boat (1976: 202) Basil Greenhill complained, "We know today more about the evolution of the ship within 250 miles of the Skaw between A.D. 800-1200 than about the development of almost any other kind of ships and boats until modern times." Greenhill's remark may seem facetious, but the Viking practice of burying important

personages in ships has provided terrestrial archaeologists with sufficient numbers of Norse ships to justify his statement.

In his excellent book, The Rise of the English Shipping Industry, Ralph Davis offered a similar lament:

No expert on ship design has ever examined in any detail the ordinary merchant ship of the seventeenth and eighteenth centuries, and, apart from East Indiamen, only the types that developed at the very end of the 1790's are at all well known (1962: 71).

Davis not only recognized the scarcity of information on early merchant vessels, but he also saw in the emerging field of underwater archaeology the partial bridging of this knowledge gap. He went on to say, "It is to be hoped that nautical archaeologists will one day investigate these matters..." (Ibid.: 74).

Since Davis offered that invitation, several important studies, both archival and archaeological, which have begun to fill the gaps in current knowledge of merchant ship construction and evolution, from early vessels of the Bronze Age to nineteenth-century ships of steel and steam (Bass 1972, 1988; Muckelroy 1980). Although the evolution of these vessels is becoming increasingly clear, not as much attention has been paid to the stores and equipment necessary for operating such vessels.

Lists of stores and equipment have been published for numerous warships, and several important shipwreck

excavations including the Vasa and Mary Rose have yielded significant archaeological information on warship equipment and stores (Bass 1972, 1988; Muckelroy 1980). However, there is still little published information on the stores and equipment carried aboard merchant ships in the days of sail.

The sunken British ships at Yorktown, Virginia, have provided archaeologists with an opportunity to answer a variety of questions concerning eighteenth-century merchant vessels, particularly those serving as naval transports and victuallers during the American Revolution.

During the period 1978-1988, the Yorktown Shipwreck Archaeological Project located and investigated the remains of nine British vessels sunk during the Battle of Yorktown, 1781. Of these, seven are believed to be the remains of merchant ships leased as military transports, while two appear to be the hulls of warships. The eleven-year investigation of the Yorktown shipwrecks has contributed new information on merchant ship construction, interior details, stores and equipment, maritime technology and wartime strategies.

The project was conducted by the Virginia Division of Historic Landmarks, Department of Conservation and Historic Resources, with funding from the National Endowment for the Humanities, U. S. Department of the Interior, the Commonwealth of Virginia, the County of York, numerous private and corporate sources and individuals.

This study concentrates on Yorktown shipwreck site 44Y088, the remains of a well-preserved merchant vessel which was completely excavated during 1983-88. An attempt has been made to reconstruct an accurate picture of the vessel's interior configuration and to present a detailed description of the types, quantities and locations of its stores and equipment. Details of hull construction will not be covered, as they are beyond the scope of this paper and are the subject of a separate study. Likewise, archaeological methodology is covered only in general terms.

It is hoped that this study will provide useful information for historians and archaeologists, and will, therefore, prove useful to future researchers endeavoring to develop an accurate general model of eighteenth-century merchant vessels, their stores, cargoes and their crews.

CHAPTER 1
THE ROLE OF ENGLISH MERCHANT VESSELS
AS MILITARY TRANSPORTS

The importance of merchant shipping in the American War for Independence was summed up by David Syrett: "The success of the British war effort depended to a considerable degree on the ability of the Navy Board to charter sufficient shipping on a long-term basis" (Syrett 1970: 77). Although merchant vessels often provided essential support to naval operations, the American War marked the first instance in which British land forces depended almost entirely upon supply by sea.

Procurement of Merchant Shipping

Merchants willing to accept the risk could reap enormous profits during wartime, but the chance of capture or sinking often made the gamble unwise. Travelling in protected convoys afforded some protection against enemy ships, but delays and price fluctuations frequently led to lost profits. One solution, often chosen by shipowners as being the best of several unattractive options, was to lease their vessels to the government. Once it chartered a vessel, the government began paying freight and assumed all responsibility for loss or damage (Ibid.: 78-9).

From 1776 to 1783 the Navy Board chartered shipping under long-term agreement through ship brokers, underwriters and London merchants. Vessels obtained in this manner served as transports for general supplies, war materials and troops (Ibid.: 249-50). After 1779, the Navy Board assumed responsibility for chartering victuallers as well (Baker 1971: 241).

The mechanism for leasing vessels was the charter-party, described by David Steel in the 1792 edition of The Ship-Master's Assistant and Owner's Manual:

The taking of a ship to freight is the hiring her of her master or owners; either in part or the whole, and either by the month, for an entire voyage, or by the ton: and the contract, reduced into writing, commonly called a charter-party, executed between the freighter and the person who lets the ship, must express the different particulars agreed on (Steel 1792: 103).

So immense was the task of obtaining the necessary tonnage that Syrett writes: "During the American War the Navy Board was undoubtedly the largest single operator of merchant ships under long-term time charters in the world." To support this assertion, Syrett points out that at any time during the war, an average of 323.5 merchant ships, representing an average total tonnage of 96,637 tons was under charter-party to the Navy Board (Syrett 1987: 5).

The British Merchant Marine

The British merchant marine was second to none at the outbreak of the American Revolution. It is estimated that

in 1775 approximately 7,700 ships comprising some 608,000 tons were engaged in maritime commerce under English ownership (Davis 1962: 27). In that year, nearly 300,000 tons of shipping were engaged in the three most important foreign trades: America and the East and West Indies (Ibid.: 41). These figures can be compared to those for the warships in Royal Navy at that time. In 1778 the Royal Navy consisted of 416 ships, including both warships and auxiliaries, of which only 270 were ships-of-the-line (Montaine 1778: 24). By January 1, 1781 the Navy listed 538 vessels, of which 329 were ships-of-the-line (PRO, ADM/7/567: 29). These statistics verify that at the time of the American Revolution, there were approximately 14-18 times as many British merchant vessels as warships.

Most merchant vessels were relatively small. As late as 1788, when compulsory vessel registration resulted in more complete data, nearly all ships were smaller than 200 tons burden. Of 9,355 ships owned in English ports, fully 7,756 (83%) were under 200 tons (Davis 1962: 79). Of the 1,156 ships built in England during 1790-91, only 150 (13%) were over 200 tons, with the average tonnage being 90 (Ibid.: 70). During this period, a majority of vessels in the under-200-ton range were two-masted vessels: brigs, brigantines, snows or schooners.

Several estimates agree that by 1774, approximately one-third of all British-owned merchant ships were actually built in the American colonies. R. Champion (quoted in

Davis 1962: 68) places the number of American-built vessels at 2,342 of 7,694 (30%). There was disagreement as to the quality of American-built ships, but no one questioned the economic advantage. A British merchant could have a ship built in the American colonies for one-third to one-half less than in England--a total cost of three to four pounds sterling per ton for a Colonial vessel compared to five to seven pounds for a British one (Hutchins 1969: 153; Goldenburg 1976: 95; Fairburn 1945: 295).

Growth of the Transport Service

In addition to providing the means for commercially expanding and developing the Empire, Britain's merchant marine served a vital function during the years 1775-1783, when Britain was engaged in wars in both Europe and North America. During that time, vast numbers of merchant vessels were chartered for use as victuallers and transports.

With trade in the American colonies and West Indies severely curtailed by the war, many British merchants were willing to charter their vessels to the Navy Board. As of December 31, 1775, 132 ships totalling 49,997 tons were under charter to the Navy Board. By December 31, 1780, the figures had more than doubled, to 346 ships totalling 104,747 tons. A year later, the figure had increased to 369 ships totalling 113,140 tons, at a cost of £433,650 for transports and £478,913 for victuallers (Syrett 1970: 89, 100, 249-50).

Merchant vessels chartered by the Navy Board were used as troop and horse transports, victuallers, and store ships. They carried a wide assortment of food, beverages, fuel, and military items, the latter including tents, clothing, cannon, small arms, powder and ammunition, as well as other supplies necessary for supporting a large fighting force on foreign soil where very few needs could be met locally.

The logistics of conducting a foreign campaign are always immense. This was especially true in the American war, which marked the first British effort requiring that virtually all war materials and supplies be provided from England (Sands 1983: 5, 174; Syrett 1970: 78). Before merchant ships could be employed in this duty, however, they first had to be processed, preferably at a Royal Dockyard.

Processing of Transports and Victuallers

Once a merchant vessel was offered to the Navy Board for use in the transport service, it was thoroughly inspected before acceptance. Whenever possible, all such vessels entering the transport service were inspected, surveyed, measured and appraised at a Royal Dockyard. Following these essential preliminary activities, the vessels were then fitted-out for their new service (Syrett 1970: 100).

Serious discrepancies in the computation of tonnage, or carrying capacity, were common in the eighteenth century.

The Navy Board complained that Deptford surveyors "seldom find the Tonnage by measurement equal to what transports are tender'd for" (PRO,ADM/106/3404: 106). This complaint was common, resulting in orders for all transports to be measured in Royal Dockyards whenever possible or to be remeasured at a Royal yard when the opportunity arose (PRO, ADM/106/2606, Sept. 26,1781). The problems, however, were likely ones of implementation rather than of written procedure. For instance, certain shortcuts were taken in determining length on keel for vessels in the water, as opposed to those in dry dock. Other practices may have affected the determination of tonnage for warships, which would have been the more familiar type in Royal Dockyards.

The ambiguity of tonnage measurements has caused significant confusion concerning the measurement of transports. Various historians have accused the Navy Board of altering the accepted tonnage formula, reducing by approximately one-fifth the amount of freight it was obliged to pay for each vessel (see Syrett 1970: 112). In fact, however, the Navy Board was utilizing the standard formula of the day and, therefore, was paying market rates for its shipping.

Eighteenth-century nautical references confirm that the Navy Board applied the standard formula for determination of tonnage, as follows:

$$T = \frac{L \times B \times (B/2)}{94}$$

where L is length on keel for tonnage and B is extreme breadth. Extreme breadth was understood to be the width of the ship at its widest point, measured to the outer edge of the outer planking; determination of the keel length, however, was more difficult and has been the cause of much of the confusion. Instead of attempting to actually measure the length of the keel, the length was generally estimated by subtracting three-fifths of the extreme breadth from the length of the vessel at the lower deck. This estimate has caused some researchers to assume that actual keel length was diminished for purposes of reducing lease rates. As verified by eighteenth-century sources, however, such was not the case (Sutherland 1755: 71; Steel 1805: 120).

Therefore, all future references to tonnage in this paper will assume the use of the standard formula, above, which was given force of law by an Act of Parliament in 1773 and was in general use at the time of the American Revolution (Kemp 1976: 876).

Fitting-Out and Preparation for Sea Duty

Once approved by the dockyard, a vessel chartered by the Navy Board had to be fitted-out, armed, provisioned and manned before it began to earn freight and to take on its first cargo. The shipowner was required to make the ship seaworthy in all respects by supplying crew, provisions and all equipment, including sails, rigging, anchors, and even cannon (Syrett 1970: 114).

When vessels were inspected and measured, a complete inventory was made of their masts, yards, rigging, stores, equipment and furniture, and each item was assigned a value. Reports on these surveys and assessments, which can be found in Navy Board documents, help form a general model for typical merchant vessels (PRO,ADM/106/3318, 3402-4). However, these documents are only available for examination in London and, since they are not indexed, are very difficult to utilize.

Ship owners seem to have generally leased their vessels with the same equipment and crew as employed for commercial trade since, as has been explained, owners were responsible for offering ships completely ready for sea. There seem to be no provisions for "hazardous duty pay" for crews of these ships, possibly since eighteenth-century seamen always faced the hazards of the sea, whether from natural causes or from the guns of hostile forces or pirates.

Contract requirements were modified throughout the war, and by May 24, 1780, transports were required to be manned at the rate of six men per 100 tons of measured burden, and to be supplied with at least three anchor cables of 120 fathoms each, anchors, and at least six carriage guns of 6 pounds or less, with 20 rounds of ammunition per gun. This was in addition to all other necessary furniture (equipment) required for efficient operation of the vessel. The freight rate by this time had been increased to 12 shillings 9 pence per ton (Syrett 1970: 114-5).

The above discussion demonstrates that historical documents are vague on the construction and equipage of eighteenth-century merchant vessels, even those chartered and documented by the Navy Board. The sunken British vessels at Yorktown, Virginia, have provided an opportunity to build on prior knowledge of merchant vessels and to test theories on the appearance, function, stores and equipment of such vessels. The following chapter provides a brief history of the British fleet at Yorktown as well as of subsequent salvage efforts and archaeological investigations.

CHAPTER 2

THE SUNKEN FLEET AT YORKTOWN

The Problems of Supply

The success of the British war effort in North America during the American Revolution depended heavily upon maintaining a continual flow of troops and supplies from home ports. Superior sea power was necessary for keeping shipping lanes open. As late as 1781, in spite of a French naval presence in Rhode Island, the British had been successful in maintaining the Atlantic lines of supply and communication. However, the British strategic plan of blockading New England ports while seeking to rally Loyalist support in the Southern Colonies was not as successful, largely due to the difficulty of opposing nebulous Colonial forces in the South, scattered over a vast and largely unpopulated terrain.

The Establishment of a British Post at Yorktown

By the spring of 1781, Sir Henry Clinton, commander of all British forces in North America, had become frustrated by unsuccessful campaigns in the Carolinas. Fearing an Allied assault on his positions in New York, Clinton ordered several units of the Southern British Army, Major General

Charles Earl Cornwallis commanding, to retire north to strengthen his defenses.

On May 20, Cornwallis' army joined forces with British troops under General Benedict Arnold, already in Virginia. This combined force, under Cornwallis' command, arrived in Portsmouth, Virginia after a series of minor engagements with rebel forces in the area. Once in Portsmouth, Cornwallis began embarking the requested troops for the voyage to New York aboard Navy transport vessels.

However, before these troops sailed, Clinton received a letter dated May 2, 1781 from Lord George Germain, the British secretary of state for American affairs, which stated in stern language,

. . . I am commanded by His Majesty to acquaint you, that the Recovery of the Southern Provinces, and the Prosecution of the War by pushing our Conquests from South to North, is to be considered as the chief and principal Object for the Employment of all Forces under your Command . . . (Quoted in Sands 1983: 35).

As a result of Germain's clear directive, Clinton wrote to Cornwallis on July 8,

By a letter I received this Instant from the Commander in Chief it is necessary to stop the sailing of the Expedition, which you will be pleased to do & remain with the Transports in Hampton Road untill you hear futher from me (Quoted in Sands 1983: 36).

Cornwallis was further notified of the need to establish a post in Virginia with a fortified harbor which could serve as an ice-free winter port for the British Fleet, then in

New York. Cornwallis anticipated utilizing this new post as a base for further operations in the Chesapeake the following year.

Cornwallis responded to Clinton on July 27:

. . . I shall, in obedience to the spirit of your Excellency's orders, take measures with as much dispatch as possible, to seize and fortify York and Gloucester, being the only harbour in which we can hope to be able to give effectual protection to line of battle ships (quoted in Sands 1983: 38).

On August 1, Cornwallis took possession of Yorktown, transporting his troops and equipment by sea using the naval transports and local vessels at his disposal. Here, Cornwallis was to prepare fortifications and await reinforcements from New York in the form of troops and warships.

Four weeks later, however, on August 29, a major British setback occurred. A fleet of 26 French warships, under the command of Admiral Francois Joseph Paul de Grasse, arrived at the mouth of the Chesapeake Bay. This force had sailed north from the Caribbean to either assist in an assault on New York or, if the opportunity arose, to entrap the Southern British Army in the Chesapeake.

This strategy had been decided on May 21 at a meeting in Connecticut between Washington, Rochambeau and Admiral deBarras. De Grasse had been persuaded to sail to Virginia by General George Washington, who knew that an Allied victory would depend upon possessing adequate sea power to

repel British reinforcements at the mouth of the Chesapeake, thereby trapping Cornwallis at Yorktown.

At Yorktown, Cornwallis had at his disposal a large fleet consisting of five relatively small naval vessels, approximately fifty transports and armed merchantmen, at least seven captured prizes and a variety of small sloops, schooners and rowing craft (Sands 1983: 59). Since his small warships were no match for the large French ships-of-the-line, Cornwallis could only await the arrival of the expected reinforcements from New York.

The Battle of the Chesapeake Capes

When the main British fleet, commanded by Rear Admiral Thomas Graves, arrived off the Virginia Capes on September 5, it was confronted by de Grasse's fleet at anchor near Lynnhaven Bay, guarding Hampton Roads and keeping a watchful eye on Cornwallis' escape route at the mouth of the York River.

Following an accepted, if conservative, doctrine of naval warfare, Graves forfeited his advantageous position and allowed the French fleet to sail out and form a line of battle. The ensuing engagement was tactically indecisive, with neither side losing any vessels during the battle. However, the British fleet suffered sufficient damage that Graves elected to return to New York to repair and refurbish his ships, and to consider the new French naval threat more carefully (Tilley 1987: 254-64).

This decision left the Chesapeake Bay under French control, trapping Cornwallis at Yorktown; thus the Battle of the Capes became a strategic victory for the Allies.

The Siege of Yorktown

At this point, Allied forces on the peninsula were not sufficient to attack Cornwallis' fortifications at Yorktown and Gloucester Point. The Marquis de Lafayette had under his command a small force of militia and 800 continentals. These had been augmented by the arrival of the Marquis de St. Simon and 3000 troops from de Grasse's fleet. After feinting an attack on New York, however, Washington and Rochambeau led a forced march south, bringing 4000 French regulars and 2500 continentals. These reinforcements brought the total Allied force to 16,645 effectives, including militia, a three-to-one advantage over Cornwallis' Southern British Army at Yorktown, who could field only 5953 troops.

Washington met with de Grasse aboard the latter's flagship Ville de Paris on September 18, eliciting a promise from the Admiral to maintain his control over the Chesapeake until the end of October, by which time both men hoped an Allied victory would be assured.

Barely a week later, when de Grasse sent word that the threat of arrival of additional British ships made it necessary for his fleet to depart to cruise offshore, Washington replied with a confident and determined summary

of the critical need for continuation of the French blockade:

Give me leave in the first place to repeat to Yr Excellency that the enterprise against York under the protection of your Ships, is as certain as any military operation can be rendered by a decisive superiority of strength and means; that it is in fact reducible to calculation, and that the surrender of the british Garrison will be so important in itself and in its consequences, that it must necessarily go a great way towards terminating the war, and securing the invaluable objects of it to the Allies (Quoted in Sands 1983: 59).

Yielding to the logic of Washington's argument, de Grasse agreed to remain.

In the meantime, Cornwallis continued his efforts to establish a secure post at Yorktown. Here, his fleet of supply vessels played a major role. On August 31, a Hessian soldier, J. C. Doehla, wrote in his journal:

I was on unloading duty. All the munitions and provisions were unloaded from the ships riding in the harbour, the lower tiers of guns from the warships and frigates brought into the earthworks and all the ships completely emptied (Doehla 1781: 251).

By mid-September, realizing that he was trapped at Yorktown and that an attack on his army was imminent, Cornwallis shortened his lines to strengthen his position and evacuated all non-combatants. He also ordered a line of his transport vessels to be scuttled, that is, purposefully sunk, along the Yorktown beach to hinder an anticipated French amphibious landing. Hessian Captian Ewald of the

Field Jäger Corps recorded that "on the 16th [of September] we began to sink ten transport ships between York and Gloucester to obstruct the entrance" (Quoted in Sands: 63).

A Williamsburg resident, St. George Tucker, recorded in his journal on October 2 that "the British had sunk several square rigged Vessels near the Shore and at the distance of one hundred and fifty, or two hundred yards from it . . ." (Tucker 1781: 382).

Two days later, a man leaving Yorktown by boat was interrogated and the following report was made to Washington: "Ten or twelve large merchant ships have been sunk before York, and piles have been driven in front of these vessels, to prevent our ships from approaching the Town sufficiently to debark Troops . . ." (Washington Papers, quoted in Sands: 63).

Reports and maps prepared at the time of the siege suggest that the ships were anchored bow-to-stern in shallow water and sunk to form a continuous obstruction along the Yorktown shoreline (Figure 1). Apparently, some of the ships were scuttled very close to shore, leaving their upper decks above water and allowing pickets to be stationed aboard as a rear guard. Hessian soldier Doehla reported on October 11 that he was on "ship watch on the water" (Doehla 1781: 251).

Although the sinking of so many ships might be interpreted as an act of desperation, it had become, in fact, a standard defensive tactic for the British army in

America. For instance, ships were scuttled in a similar manner at the defense of Savannah, where the tactic proved effective (Sands 1983: 63).

Following Washington's meeting with de Grasse, the French took a more aggressive posture at Yorktown, dispatching several warships into the mouth of the York River, probably within sight of Cornwallis' fleet. The French were watching for an opportunity to pass upriver of Cornwallis' position at Yorktown, thereby cutting off another possible avenue of British escape.

On September 22, the British attempted to break through the blockade using fireships, vessels fitted out to be ignited in close proximity to enemy vessels with the intent of destroying them by fire. Late that night, Captain Palmer, of H.M.S. Vulcan, led his group of four fireships down to the French ships anchored near the mouth of the York.

One of the fireships was ignited too early by a nervous captain, thereby alerting the French, who acted quickly to save their ships. Although two French warships ran aground attempting to avoid the fireships, they were refloated on the next high tide, apparently without serious damage. The French warships returned immediately to their blockading stations within sight of British troops at Yorktown (Tucker 1781: 382). Thus, one of the last remaining British options was executed poorly, and the British fireships were lost to no avail.

While these minor skirmishes were taking place on the river, Allied troops were preparing for the much-anticipated siege against Cornwallis' position. On September 30 the first approach trenches were dug and on October 6 the first parallel trench was opened, thereby closing all avenues of British escape.

Apparently, the British realized that the situation at Yorktown was becoming less tenable. Recently-discovered excerpts from a log kept by the mate of the Transport Emerald reported that on October 9, Captain Todrock of the transport Andrew sent orders for them to sink their ship. They obediently scuttled the Emerald that same day in 22 feet of water (Buckley 1952: 106).

The bombardment opened that same day, October 9, with much of the early fire directed at the British ships anchored near shore. On the following evening, H.M.S. Charon was set afire by red-hot shot from the French batteries. The loss of Charon, Cornwallis' largest warship, must have been devastating to British morale. The power of this event was captured by an American surgeon, Dr. Thatcher, who watched from shore:

A red-hot shell from the French battery set fire to the Charon, a British 44-gun ship, and two or three smaller vessels at anchor in the river, which were consumed in the night. From the bank of the river, I had a fine view of this splendid conflagration. The ships were enwrapped in a torrent of fire, which spreading with vivid brightness among the combustible rigging, and running with amazing rapidity to the tops of the several masts, while all around was thunder and

lightning from our numerous cannons and mortars, and in the darkness of night, presented one of the most sublime and magnificent spectacles which can be imagined (Thatcher 1781: 283).

The British prudently withdrew their remaining vessels to Gloucester almost immediately. Even there, however, they were not safe, as the Hessian Doehla explained in his diary entry of October 11:

These ships were miserably ruined and shot to pieces I saw with astonishment today on my watch how the enemy cannon balls of 24 and more pounds flew over our whole line and the city into the river, where they often struck through 1 and 2 ships, and indeed even struck 10-12 times in the water; yes, some even went clear across the river to Gloucester, where they even injured some soldiers on the beach (Doehla 1781: 251).

Realizing that reinforcements from New York were not likely to arrive in time, the British began destroying equipment which might fall into enemy hands. On October 13, the Master's log of H.M.S. Fowey recorded matter-of-factly: "P.M. bored holes under the Starboard fore chains to sink the Ship pr. order from Captain Symonds" (Quoted in Sands 1983: 82). Two days later, Guadeloupe and most of the remaining supply ships were also scuttled.

On the night of October 16, the British made a last desperate attempt to escape in small boats across the river to Gloucester Point. The attempt was thwarted by a sudden severe storm, which drove several of the small boats downstream and others ashore. Following this demoralizing and damaging setback, Cornwallis recognized that further

resistance was futile; he asked for terms of surrender on October 17.

On October 19, 1781, the Southern British Army laid down arms, ending the siege which proved to be the last major conflict of the American Revolution.

At the time of the surrender, nearly all of Cornwallis' ships lay on the bottom of the York River. In his journal, St. George Tucker described the condition of the British fleet at that time:

Thursday 18th . . . At a small distance from the Shore were seen ships sunk down to the Waters Edge --further out in the Channel the Masts, Yards & even the top gallant Masts of some might be seen, without any vestige of the hulls. On the opposite of the river the remainder of the shipping drawn off as to a place of security. Even here the Guadeloupe sunk to the Waters Edge shew'd how vain the hope of such a place....A painter need not to have wish'd for a more compleat subject to imploy his pencil without any experience of Genius (Tucker 1781: 391).

Disposition of Cornwallis' Shipping

The actual number of vessels and their respective fates are difficult to ascertain from documentary sources. In his briefing to the Continental Congress, Washington's aide-de-camp, Colonel Tench Tilghman reported,

. . . the vessels amount to about 100 sail, fifty of which may be called transports: that among the shipping, are the Guadaloupe, a frigate of 28 guns, and Bonetta Sloop of War, with two or three other armed vessels: that most of them are sunk, but can easily be raised (quoted in Sands 1983: 93).

A similar report was made by Captain Thomas Symonds to Admiral Graves, stating that of the five naval vessels, only the Bonetta was afloat; and of the thirty-two transports and victuallers listed, all but two were sunk (Ibid.: 86).

The Articles of Capitulation at Yorktown dealt directly with the disposition of the captured British fleet:

Article XIII--The shipping and boats in the two harbours, with all their stores, guns, tackling and apparel, shall be delivered up in their present state to an officer of the navy appointed to take possession of them, previously unloading the private property, part of which had been put on board for security during the siege (quoted in Fleming 1963: 349).

Therefore, the French took possession of all shipping, a dubious award in light of Colonel Tilghman's report that most of the vessels lay on the bottom of the river. De Grasse assigned the task of dealing with the newly-acquired shipping to Captain Guillaume-Jacques-Constant de Liberge de Granchain, chief administrative officer under Admiral de Barras.

Accounts following the battle suggest that the British assessment of shipping losses may have been overly pessimistic. The Articles of Capitulation required that all private property be unloaded prior to delivering up the ships to the French. This suggests that the vessels carrying this property remained afloat. There were also reports that numerous large ships were offered by the French for sale during the winter of 1781/82.

No satisfactory account of all the shipping has been located. Granchain's detailed reports to de Grasse have not been found, and some of the most detailed British records were lost shortly after the battle in an unfortunate incident. On January 14, 1782, Cornwallis was aboard the transport Greyhound, commanded by Thomas Tonken, former agent for all transports on the North American coast.

What occurred was described by Tonken in his report to the Commissioners of His Majesty's Navy: "We were taken off Scilly by a french privateer of St. Malo All my papers about Transports are destroy'd as well as the letters . . . (quoted in Sands 1983: 108). Cornwallis convinced the captain of the privateer to release the crew and passengers at an English port, in exchange for a guarantee of free passage for his prize, but the papers concerning his sunken Yorktown fleet were lost.

Following the British surrender at Yorktown, the armies departed, leaving a small French naval force to deal with the newly-acquired shipping. At least twenty-six vessels from the decimated British fleet were unaccounted for in the records and are presumed to have been abandoned on the bottom of the York River.

Two Centuries of Salvage Attempts

When the French left Yorktown, the duty of salvaging the British fleet was assigned to Captain La Villebrune, of the Romulus. For this task, La Villebrune was given four

ships but virtually no salvage equipment for raising the British vessels.

La Villebrune's report of January 30, 1782 suggests strongly that many of the British vessels survived the battle:

I have sold [many of] the boats and sloops which are of use in the navigation of the rivers The large vessels, on the other hand, have had little demand . . . (La Villebrune to unknown, quoted in Sands 1983: 111).

It is unlikely that the large vessels to which he refers had been previously salvaged, as implied by La Villebrune in the same report:

I have raised very few of the vessels; the apparatus necessary for these operations . . . has not been given to me . . .; my first attentions will be given to the Guadeloupe, as soon as good weather permits (Ibid.).

In another report of the same date, La Villebrune complains, "The prizes taken in York [were] plundered before my arrival . . ." (Ibid.: 112). It is not clear if he refers to removal of equipment from only the floating vessels or whether there may already have been some salvage of the sunken ships. The moderate temperature of the water in October and the shallow depths would have made such salvage quite attractive to local residents as well as military personnel.

Unfortunately, detailed records of the French salvage operations have not been located, but a description of

Yorktown in 1783 by Johann David Schoepf makes it clear that prior salvage had been less than complete:

The ships sunk in the river for the protection of the garrison were still in their places, and it is thought not worth while to be at the trouble of raising them, for there is every reason to believe that after two years they will be found so eaten by the worms, (which do much damage in these waters), as to be no longer usable (Schoepf 1783: 85).

Later Salvage Attempts

Although no other eighteenth-century references to the salvage of sunken vessels at Yorktown have been located, later evidence reveals that the fleet had not been forgotten. Several poorly-documented salvage attempts apparently occurred in the 19th century, followed by an extensive and well-publicized effort in 1934-35.

At that time, the National Park Service, The Mariners' Museum and Newport News Shipbuilding and Dry Dock Company conducted recovery operations at several sites on both sides of the river near Yorktown. Hundreds of objects, ranging from timbers to bottles to cannon, were recovered and documented, and some have been preserved. In spite of good intentions, however, no detailed records of artifact provenience or precise site locations were made, thereby greatly limiting the value of the project (Ferguson 1939; files of Colonial National Historical Park).

As the availability of modern scuba equipment increased in the 1950s, so did diving activity in the York River.

The river bottom near Yorktown became widely known as a good location for relic hunting. With few exceptions, the extent of these sport diving activities is impossible to assess.

Interest in the Yorktown fleet also increased within Virginia's scholarly community in the early 1970's. John O. Sands, following a suggestion by Ivor Noël Hume, began research into Cornwallis' fleet. Sands' investigation soon became the foundation from which all subsequent research was built.

Official interest in the wrecks was also kindled and, in 1973, the Yorktown Shipwrecks became the first submerged archaeological site to be placed on the Virginia Historic Landmarks Register. That same year, the site was added to the National Register of Historic Places, one of the first underwater sites in the nation to be so designated. Although there were periodic discussions and suggestions for archaeological excavations in the York River, only a growing awareness of increased site destruction in 1975 finally prompted action.

Assessing the Sunken Fleet

In the mid-1970s, a group of divers from Richmond, Virginia began systematically removing large quantities of artifacts from a site just offshore from the Cornwallis Cave. John Sands and the author became aware of this activity in the summer of 1975 and as a result, with the assistance of Gordon P. Watts, Jr., underwater archaeologist

for the state of North Carolina, the three conducted a brief archaeological survey in the York River in October, 1975. The survey revealed extensive damage and artifact removal from the bow of a large wooden shipwreck, believed to belong to Cornwallis' fleet (Broadwater, Sands and Watts 1975).

As a response to this initial survey, a series of events was rapidly triggered: The Commonwealth of Virginia, in April, 1976, passed the Virginia Underwater Historic Properties Act to protect historic shipwrecks in state waters; two magnetometer surveys were conducted; and an intensive archaeological investigation of the shipwreck near Cornwallis Cave was initiated.

The "Cornwallis Cave Wreck" investigation was conducted by a team from The American Institute of Nautical Archaeology (now the Institute of Nautical Archaeology), under the direction of Dr. George F. Bass and his assistant, Paul F. Johnston. The adverse diving conditions encountered during the investigation prompted Bass and his team to develop a "floating cofferdam" to be anchored over the excavation area, with the enclosed water clarified by a filtration system. This was an adaptation of the cofferdam concept originally proposed by Norman Scott (Bass 1976: 6).

Due to limitations of time and funds, and the strength of river currents, the cofferdam was not successful; however, the investigation confirmed that the "Cornwallis Cave Wreck" was probably a large transport from the British fleet of 1781 (Ibid.; Johnston, et. al. 1978).

Research continued intermittently until 1978, when the Historic Landmarks Commission, later the Division of Historic Landmarks, received a one-year grant from the National Endowment for the Humanities. By providing necessary survey funds, this grant initiated, under direction of the author, the full-scale research effort designated the Yorktown Shipwreck Archaeological Project.

The 1978 survey, followed by subsequent surveys in 1979-80, combined remote-sensing surveys with bottom assessments by diving archaeologists to investigate the area designated as a National Register site, 2550 acres of river bed between Yorktown and Gloucester Point.

These surveys resulted in the location and assessment of nine shipwrecks from the Battle of Yorktown, 1781. Site 44GL136 was identified in 1980 as the remains of H.M.S. Charon, and another, 44Y086, was tentatively identified as H.M.S. Fowey; the other seven are thought to be transports (Broadwater 1980; Sands 1983; Steffy, et.al. 1981). Figure 2 shows the locations of the wrecks in relation to the National Register district between Yorktown and Gloucester Point.

The deep river channel and the constriction between Yorktown and Gloucester Point create a dynamic river environment which has scoured the upriver area to the northwest, while depositing silt downriver in the vicinity of sites 44Y088, 44Y089 and 44Y094. The surveys during 1978-1980 verified that the three downriver sites were the best

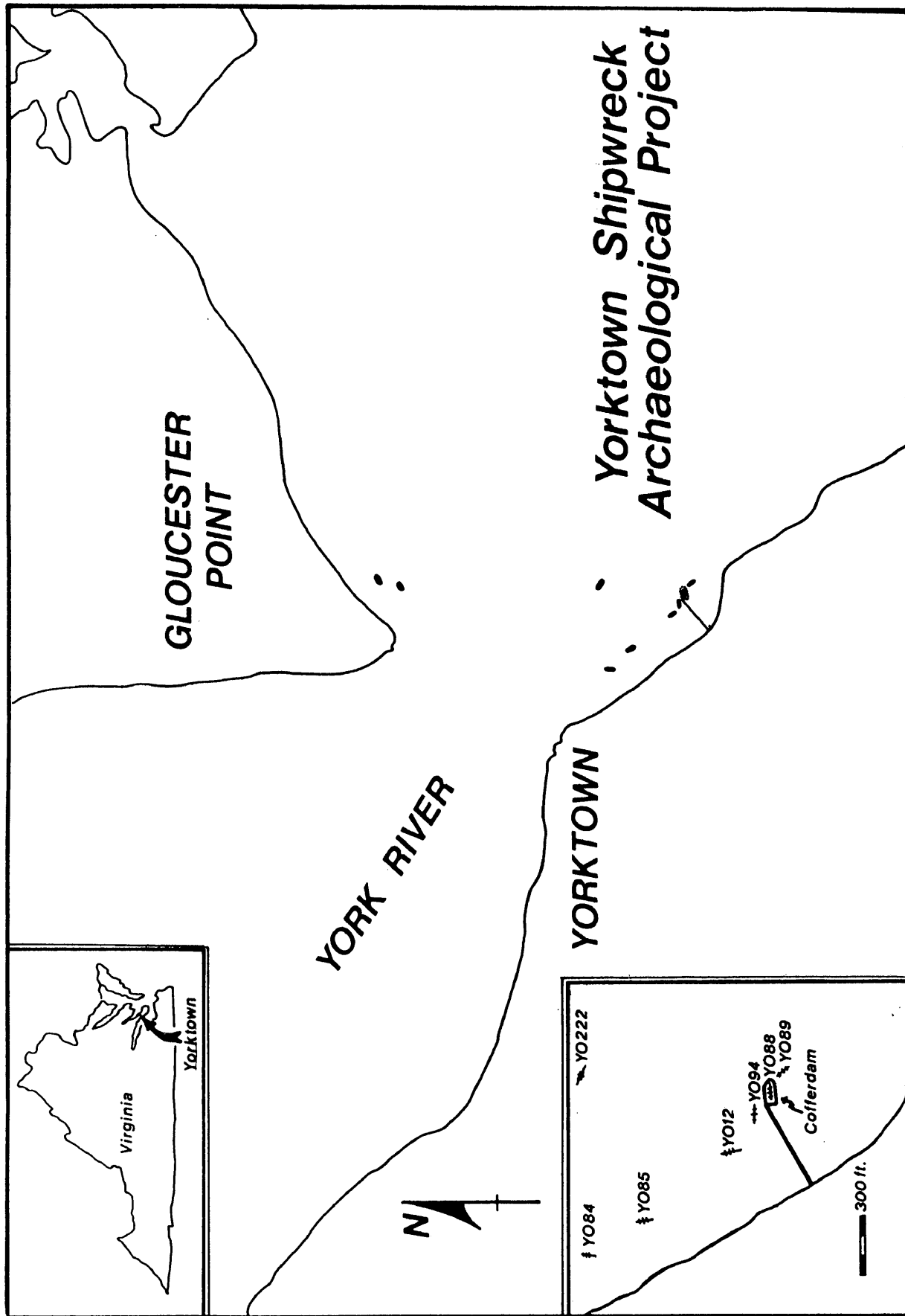


Figure 2: National Register district and site locations

preserved and that one, 44Y088, offered exceptional research potential (Broadwater 1980, 1981; Sands 1983).

During the latter phase of the survey period, a research design for the complete excavation of the best-preserved of the shipwrecks, 44Y088, was prepared. A major problem was how to employ exacting archaeological standards in the York River environment of mud, poor visibility, currents and jellyfish.

Building upon the ideas of Bass and Scott, described above, a plan was developed for the construction of a rigid steel cofferdam. The structure would completely isolate the site from the surrounding river, allowing the enclosed water to be clarified, thus greatly facilitating excavation.

Funding was obtained from a variety of federal, state and local governmental sources as well as private corporations, foundations and individuals. Principal funding was provided by a Maritime Preservation Grant from the U. S. Department of Interior, National Park Service, with matching funds from the Commonwealth of Virginia and the National Endowment for the Humanities. Detailed engineering design was initiated in 1980, along with extensive archaeological planning.

CHAPTER 3

RESEARCH PLAN AND SITE DESCRIPTION

The final phase of the Yorktown Shipwreck Archaeological Project was the complete excavation and documentation of shipwreck site 44Y088. This site was chosen for excavation after initial surveys determined that it was the best-preserved of the nine shipwrecks located. The extant hull, mast stumps, decking and bulkheads promised to reveal significant information on hull construction, rigging and internal layout of the vessel.

Excavation included removal of all contents of the vessel, along with exterior trenching, but did not include recovery of the hull itself. Although an optional plan for hull recovery was developed, it was not adopted by the state. The current plan calls for back-filling the site and removing the cofferdam in 1990.

PROJECT RESEARCH DESIGN

Research Goals

Two primary goals of the project were to interpret the site within the context of existing knowledge of the people and events of the American Revolution and to expand knowledge of merchant ship construction, technology, maritime commerce and shipboard life. A secondary goal was

evaluation of the cofferdam and associated methodology as a means for improving the quality and rate of archaeological data recovery.

Overall project research focused on four general levels of inquiry, derived in part from the excellent text, Maritime Archaeology, by Keith Muckelroy (1978: 216-25):

1. The vessel as an artifact: Details of eighteenth-century merchant ship construction and equipment are scarce. A comparison of hull remains, construction details and equipment from 44Y088 with those of other vessels, both at Yorktown and elsewhere, will contribute to the development of a baseline for merchant vessel technology and configuration in the late eighteenth century.

2. The vessel as a vehicle of commerce and a transport of war materials: Compartmentalization, cargoes and stores should yield evidence of the former (commercial) and modified (naval) service of the Yorktown vessels.

3. The vessel as a closed community of integrated social units: The distribution of material culture within the various compartments can be expected to provide expressions of status differences between the officers in the stern and the seamen in the bow. There should also be evidence of living conditions for officers and seamen in a closed, working community which was essentially viable and self-sufficient.

4. The site as a tightly-dated repository for material culture: Since archaeological research verified that the

vessel sank in October of 1781, intact eighteenth-century layers will provide a tightly-dated "time capsule" to assist other researchers in refining the dating of material culture from this period.

The above topics served as a framework from which comprehensive research was conducted and interpretation was formulated.

Methodology

Underwater archaeology is a relatively new scientific sub-discipline. Methodology varies considerably from project to project and there is sometimes disagreement regarding even such basic techniques as measurement and recording. Because of such variability, and since the Yorktown Shipwreck Archaeological Project employed unique techniques and equipment, a brief description of project methodology has been presented.

Facilities: The water-filled cofferdam is the most innovative feature of the project. Such a structure had not previously been employed for the excavation of a submerged archaeological site.

The cofferdam is a steel enclosure which completely surrounds the shipwreck, isolating it from the York River (Figure 3). The cofferdam is connected to the shore, approximately 500 feet away, by a wooden pier, permitting access to archaeologists and visitors alike. A water filtration system, consisting of pumps and filters, was

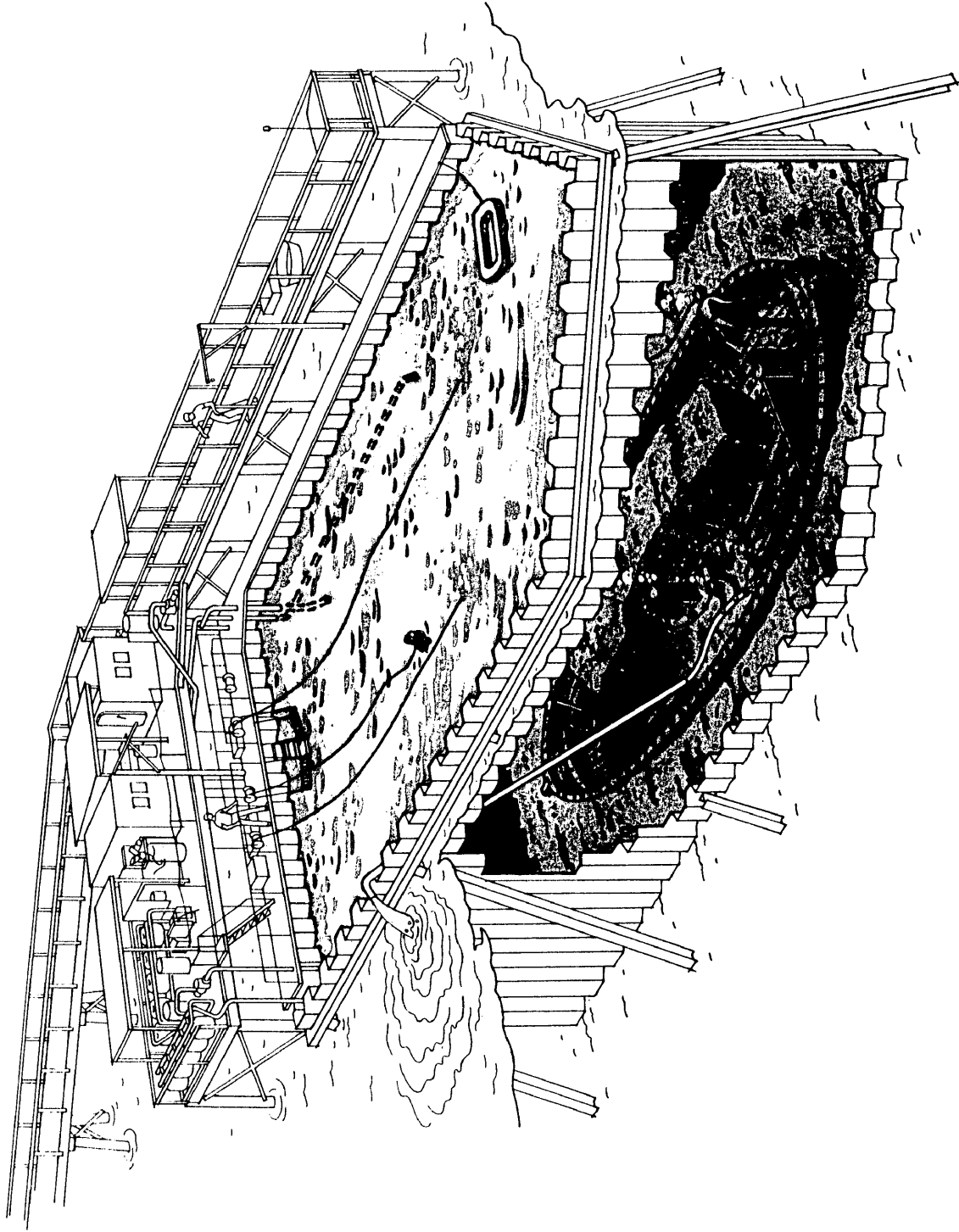


Figure 3: Artist's depiction of Yorktown cofferdam
(Pierre Mion, © 1988 National Geographic)

installed to clarify the water. The system dramatically improved visibility at the site.

The facility was completed and initially tested in October, 1982. Since a cofferdam had never before been utilized in this manner, the project faced numerous technical problems associated with the construction and operation of the facility. In spite of these developmental problems, however, strong currents and persistent jellyfish were eliminated and visibility eventually improved from a few inches to as much as 30 feet, thus enhancing diving conditions, opportunities for photographic recording of the site and, consequently, the quality of the resulting data. A separate report is being prepared on the cofferdam.

Excavation: The site was excavated and documented by teams of archaeologists assisted by supervised students and volunteers.

Archaeological control was provided by a three-dimensional measurement system which utilized the rigid cofferdam structure itself as a reference. The site was divided into squares five feet on a side; moveable grids made of plastic pipe were used both for reference and as scaffolds to support excavators at work. Sediments were removed utilizing airlifts, suction devices powered by compressed air.

Excavation followed natural stratigraphic layers and divisions within the hull, all termed zones. Within the zones, excavation in arbitrary four-inch levels was used

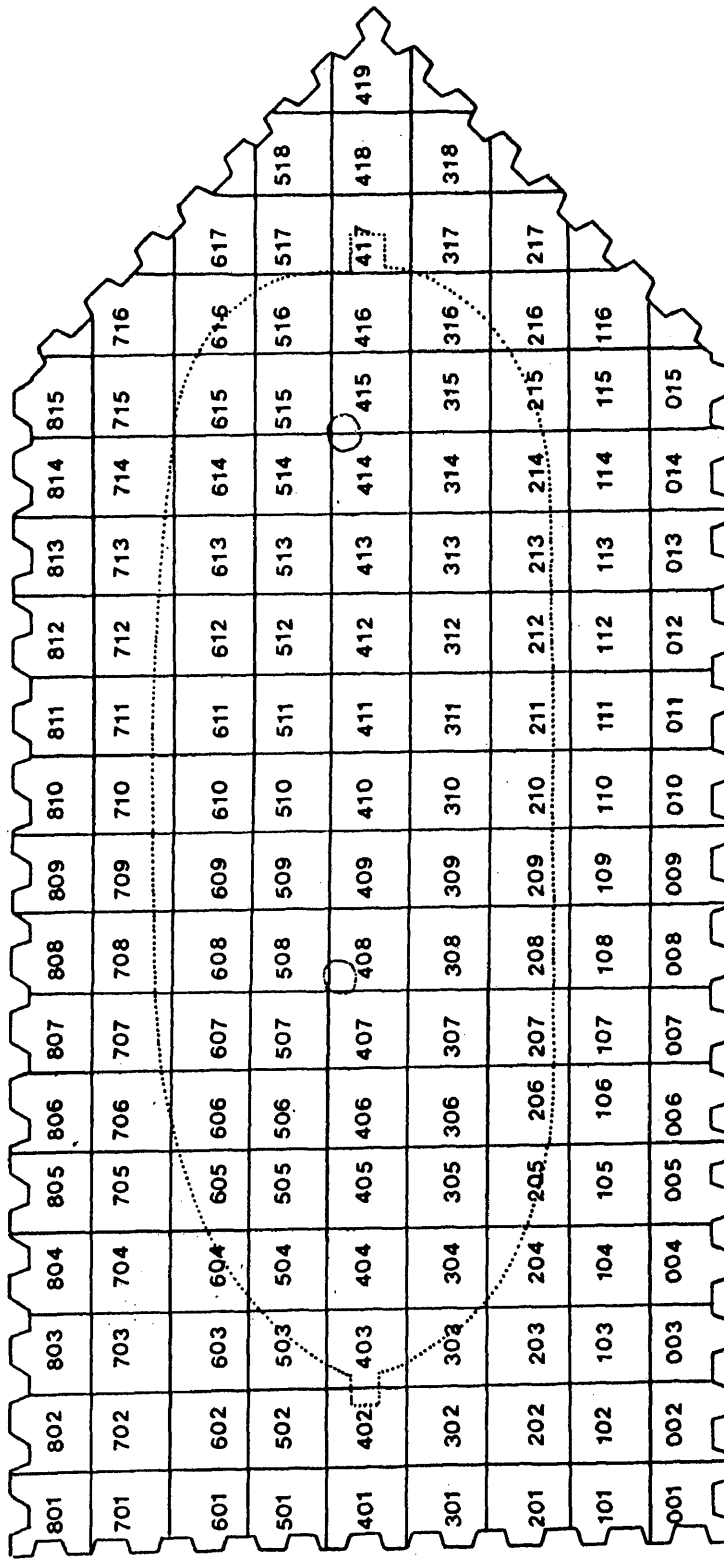


Figure 4: Site 44Y088: archaeological grid designations

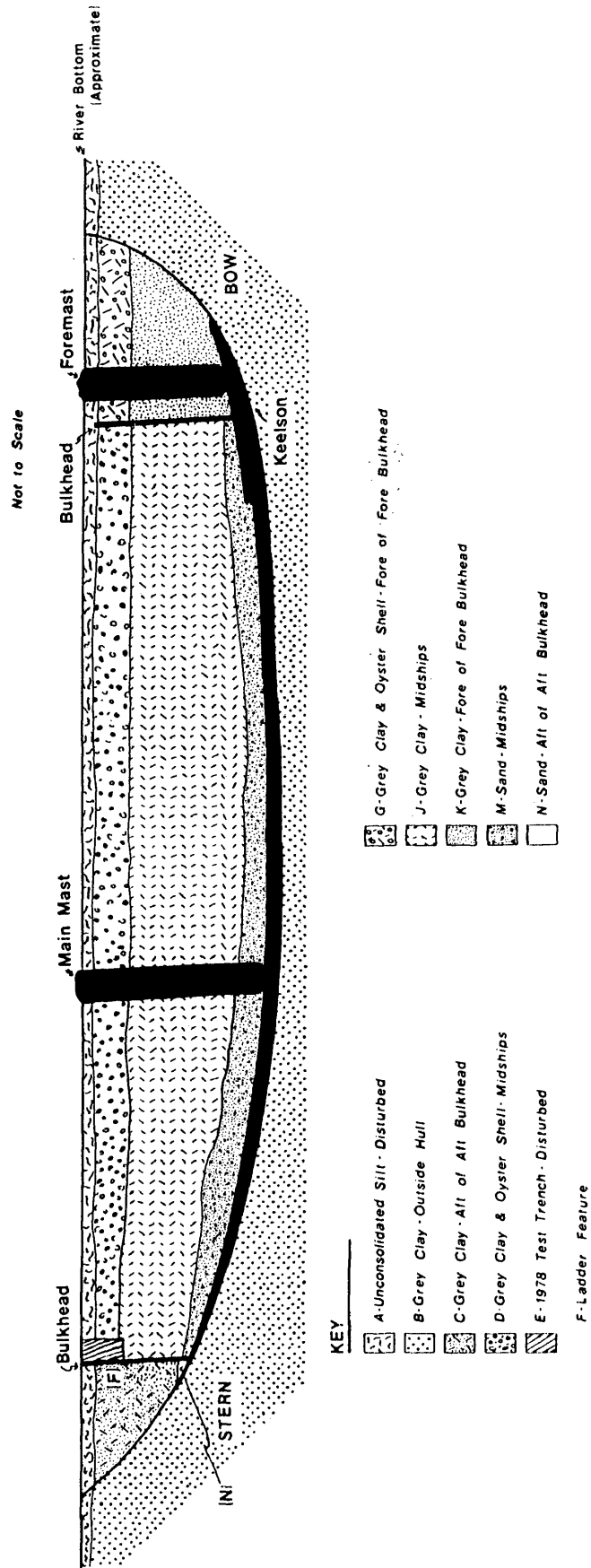


Figure 5: Site 44Y088: archaeological zone designations

for evaluating progress. As hull features and artifacts were exposed, they were recorded on mylar drawings referenced to grid square number, zone and four-inch level (Figures 4 and 5). Selected objects and features were located and mapped using the aforementioned three-dimensional measurement system.

Analysis of hull remains: The hull was fully documented and a complete set of drawings and specifications for the hull and decks was generated, along with hypothetical deck and sail plans. Lines drawings of the hull and other analytical drawings were generated on a computer-aided design and drafting system (CADD), which provided high accuracy, increased analytical capabilities and flexibility.

The hull of site 44Y088 is being described with reference to available information on merchant vessels, especially colliers, or coal-carriers. A separate report will contrast and compare construction and layout details, and identify transitional characteristics, possible modifications and repairs.

Analysis of material culture: The various assemblages of material culture and ancillary samples from the excavation are being studied by categories which reflect their useage, with the resulting analyses to be utilized in the final interpretation of the site. Staff and volunteer consultants are currently involved in these analyses.

The major studies include stores, masting and rigging, furnishings and furniture, cooperage, ceramics, bottles, military and personal items, botanical and faunal remains, and ballast.

Conservation and Curation: Conservation and curation have been conducted simultaneously with excavation, so most artifacts from pre-1987 excavations have already been conserved. Treatment methods have been established and refined over the past five years.

Very little ferrous metal survived; a vast majority of the recovered artifacts are organic in nature, primarily wood, leather and hemp. The bulk of the organic material is being treated in polyethylene glycol, although acetone-resin, sucrose and other methods are also employed. Other materials are treated by appropriate methods, descriptions of which are beyond the scope of this report. All objects are drawn and photographed, and detailed written treatment records are maintained.

All material from the excavation will eventually be placed on exhibit or stored in the collections of the Virginia Department of Historic Resources, where they will be available for continued analysis and inspection.

Reporting Objectives

Several reports are being produced from the Yorktown Shipwreck Archaeological Project. This report concentrates

on a description and interpretation of the stores and cargo from vessel 44Y088.

A major objective is to define the interior configuration and equipment stowage patterns of this vessel, and to compare findings to existing knowledge of eighteenth-century merchant vessels. A similar examination of ship's cargo is made, comparing military cargo to that from a commercial venture.

Finally, results are analyzed in an attempt to reconstruct the original appearance, layout and stowage patterns of the vessel at the time it was scuttled.

THE EXCAVATION OF SHIPWRECK 44Y088

Schedule of Excavation

Excavation began in 1983, concentrating on the stern and starboard frame line (Figure 6). Efforts during 1984 and 1985 concentrated on the bow and midships areas. Progress became more rapid during that period and was excellent in 1986, despite the need to repair extensive storm damage caused by Hurricane Juan in November, 1985. Excavation was conducted simultaneously in bow and stern in 1986, during which time the bow was completely excavated and preliminary hull lines recorded. In 1987, excavation within the hull was completed, leaving undisturbed a single balk, or section of silt, to port and forward of the mainmast. This balk may prove useful to future archaeologists who may have more advanced equipment. Additional hull details were

exposed and recorded during 1988 before the site was officially closed.

Description of Site 44Y088

Referring to Figure 6, a plan view of the site, excavation of site 44Y088 revealed a hull preserved to the approximate level of its load waterline, with bulkheads, two mast stumps and portions of the lower deck still in situ. The hull, lying in approximately 20 feet of water, was almost completely buried in river silts when discovered.

The hull, which measures approximately 74 feet in length and 24 feet in breadth, is almost box-shaped, with heavy oak frames and planking. The capacity of the hull is estimated to be 176 tons burthen. *

Certain aspects of bow and stern construction represent techniques for which no historical references have been found. These may be representative of a particular shipyard or could be relatively common, but undocumented, techniques for shipbuilding. It is hoped that additional research will settle this question.

Excavation revealed valuable information on the interior layout of the vessel. There were two decks, upper

* NOTE: The English system of measurement was used throughout the project in order to remain consistent with the system employed in the nation where the vessel and its stores were manufactured.

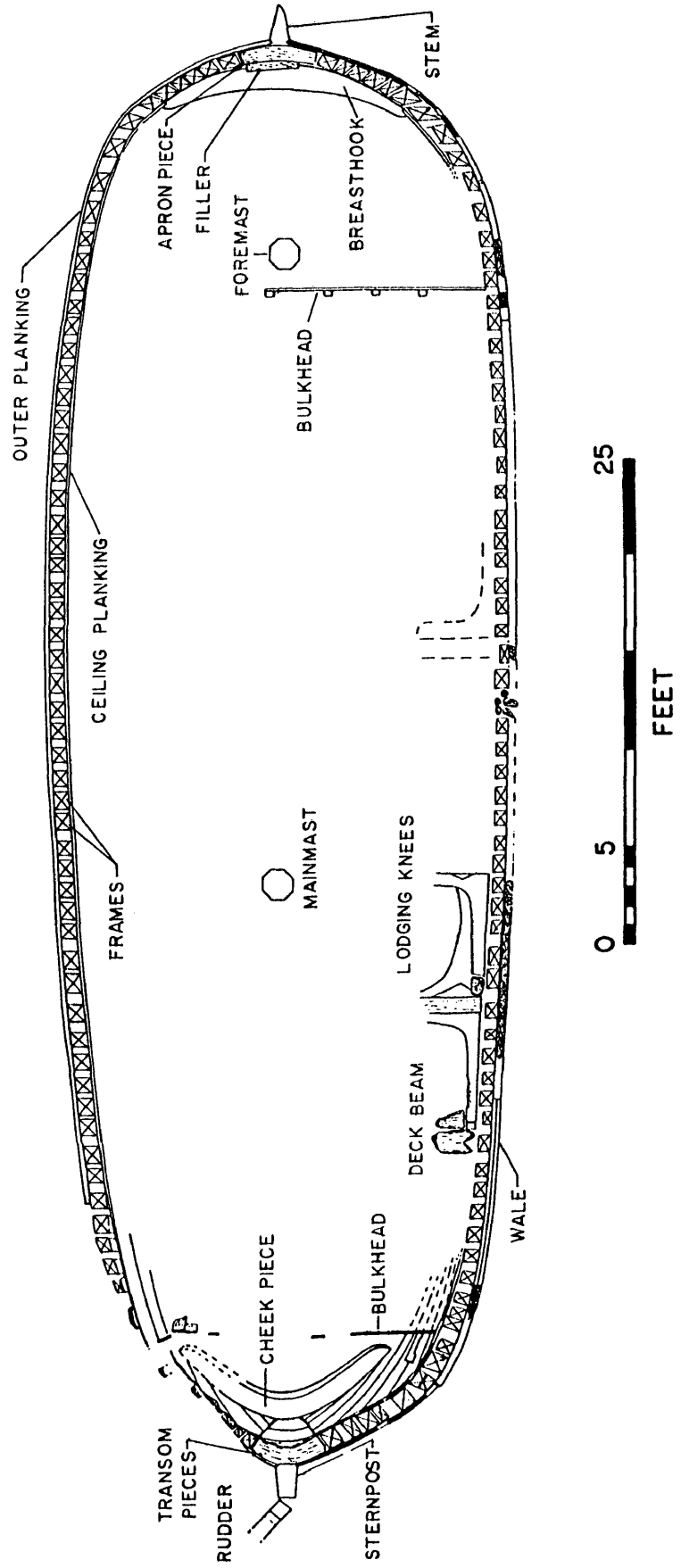


Figure 6: Site 44Y088: preliminary site plan

and lower. The depth of the hold beneath the lower deck was approximately eight feet. The hold was segregated into three compartments by bulkheads which were somewhat crudely made, of American yellow pine.

Panelling, furniture and furniture hardware was recovered from the stern. The hold was empty except for scattered casks, boatswain's stores, and logs and timbers.

Just beneath the lower deck, to starboard of the mainmast, was evidence of the cause of sinking. A neat, rectangular hole had been chiselled through the inner planking; then a second, irregular hole had been cut through the outer planking in order to scuttle the ship. The skill and time-consuming means by which the hole was cut contrasts with written descriptions of the scuttling of other Yorktown ships by boring holes through their hulls.

As stated earlier, preservation of organic materials, including wood, rope, leather, textiles, bone, and botanical material, was excellent. Most ferrous objects were reduced completely to unidentifiable masses of concretion. A wide range of other materials, including glass, ceramics, brass and pewter, were recovered in good condition.

In summary, site 44Y088 produced a wealth of information on eighteenth-century merchant vessels and contents, some of which will require many years for complete analysis and interpretation. This report offers a description and interpretation of ship's stores and cargo from vessel 44Y088.

CHAPTER 4
SHIP'S STORES

GENERAL DISCUSSION

As vital as ships' stores have always been to all vessels, the terms "stores" and "ships' stores" are not listed in Falconer's nautical dictionary of 1780, nor are they explicitly defined in the major eighteenth-century nautical treatises. Reference to modern works is no more helpful (Bradford 1952; Harland 1984; Kemp 1976). Apparently, "stores" has always been considered too common a term to warrant definition.

Fortunately, however, "stores" is found in definitions of other terms and is discussed in several treatises. From those sources, "ships' stores" can be defined as those materials required for self-sufficient operation, maintenance, communication, protection and repairs of the vessel, and care and sustenance of crew and passengers.

Information on the types and locations of stores is even more elusive. As late as the mid-nineteenth century, a book on stowage began with the statement:

. . . while our libraries are replete with works upon naval architecture, and steam, and navigation, and seamanship, we may search in vain for a treatise on stowage . . . (Murphy and Jeffers 1864: 1).

The book continued with the caution, "Stability, floatation and speed depend upon proper stowage, so it should not be neglected (Ibid). The authors then proceeded, however, to define stowage only in terms of cargo and some provisions, without regard to the stowage of ship's equipment or other stores.

That stowage was not always well managed is graphically illustrated by Richard Henry Dana in his description of accommodations aboard the brig Pilgrim in 1834:

The steerage in which I lived was filled with coils of rigging, spare sails, old junk and ship stores, which had not been stowed away.

The above passage appeared in Dana's classic account of the shipboard life of a common seaman, Two Years Before the Mast (Dana 1840: 44-5). Coincidentally, the Pilgrim was a brig of 180 tons, the same rig and tonnage as 44Y088.

For the purposes of this study, it is assumed that there are seven major classes of ships' stores, all of which would generally be represented both on merchant ships and warships. In addition, there are six other classes of stores which are almost always represented on warships and are often found on merchant vessels as well (Table 1).

Ships' stores are generally grouped according to the principal functional specializations aboard ship. As noted in Table 1, cargo is not considered part of ships' stores and will be discussed separately in the following chapter. A glossary of nautical terms is appended to aid the reader.

TABLE 1
CLASSES OF SHIPS' STORES

Major classes:

- * Masters' stores -- navigational/command items
- * Boatswains' stores -- tools, rigging, boats, etc.
- * Carpenters' stores -- tools, spare wood
- * Pursers' stores -- provisions, "slops"
- * Sailmakers' stores -- tools, spare sails, cloth
- * Cooks' stores -- galley implements
- * Cabin stores -- furniture, personal items

Additional classes:

- * Armorer/black-smiths' stores -- metalworking tools, etc.
- * Coopers' stores -- tools, spare staves, hoops
- * Ecclesiastical stores -- chapel vestments, books, etc.
- * Gunners' stores -- powder, shot, implements, etc.
- * Sailing Masters' stores -- navigational items, etc.
- * Surgeons' stores -- instruments, medical supplies

- NOTES:
1. Major classes of stores listed roughly in order of shipboard status
 2. Additional classes of stores listed in alphabetical order
 3. Cargo is not considered part of ships' stores

On large merchantmen and almost all warships, one or more crew members would have been assigned to each of the functional categories indicated by the table. On small commercial vessels, however, economy did not permit the luxury of employing specialists for all shipboard tasks. Therefore, skilled personnel filled essential positions, while other necessary functions undoubtedly were divided among available crew members as effectively as possible.

Although not much has been written about apportionment of specialized duties aboard merchant vessels, it is not difficult to imagine the captain performing the duties of master, sailing master and purser as well as providing basic medical services in lieu of a surgeon; the boatswain may have taken charge of sail repairs and even gunnery for the few small carriage guns likely to be aboard.

On very small vessels, even the duties of carpenter, blacksmith/armorer and sailmaker may have been performed by skilled seamen who received neither the title nor pay due the positions. The muster rolls from small merchant vessels registered in the port of Whitby, North Yorkshire, during the eighteenth century list only Captain, Mate, Carpenter, Cook, Seamen and Servants (Whitby Muster Rolls). Sometimes the seamen are designated by the categories of able-bodied and ordinary seamen.

On such vessels it seems obvious that mixing and sharing of duties was the norm. Therefore, it should be kept in mind throughout the remainder of the discussions

that for a small vessel such as 44Y088, the categories referred to in this study represent useful descriptive groupings rather than verified responsibilities of specific individuals.

The next section discusses each category of ship's stores, describing the respective material culture assemblage from shipwreck 44Y088. Because boatswain's stores are represented by the most numerous and varied assemblage of material, those stores are discussed separately in the following section. Material associated with ship's stores from 44Y088 reveals important information on the technologies available and the individual skills and practices of some of the crew.

CATEGORIES OF SHIP'S STORES

Master's Stores

In a small merchant ship, the captain, master and sailing master were usually one and the same person. Masters' stores primarily relate to command and navigational equipment, although various other items may be under the master's charge.

An inventory of 1776 of the Pennsylvania ship Montgomery listed the following items under master's stores: sand glasses, brass and wood compasses, sounding lines, lanterns, candlesticks, log book paper, speaking trumpets, and log reels (Hazard 1970: 125). The inventory also assigned anchors, cables, rigging and boats to the

master but, as will be shown below, these items almost always fell under the care of the boatswain.

A 1781 inventory of master's stores of the Continental frigate Alliance lists water casks, a variety of speaking trumpets, lanterns, compasses, sand glasses, binnacles, a lightning rod, 10 gallons of "oyl," and "2 Balls Cottom Wick" (Brewington 1966: 143). Although both of these vessels were larger than 44Y088, the types of items should be typical. For reference, a partial list of stores from the Montgomery and Alliance will be found in Appendix A.

The only artifacts which can be definitely assigned to this category are a small sand glass vial and a wooden object thought to be a telescope eyepiece. This paucity of master's stores is discussed in Chapter 7.

Carpenter's Stores

Of this crewman, Ralph Davis says:

The most senior specialist, the carpenter, was carried by most ships going far beyond the confines of the Channel and North Sea The carpenter often had a mate in ships of quite moderate size . . . (Davis 1962: 111-13).

As seen in Table 2, only a few of the carpenter's tools remained. Additionally, it is possible that some of the listed tools could have belonged to the boatswain.

Spare materials were a major component of a carpenter's stores. The hull of 44Y088 contained a vast assortment of logs, some still bark-covered, along with partially-worked

TABLE 2

CARPENTER'S STORES FROM SITE 44Y088

- 1 - tool box, with interior compartment
- 1 - bevel (for measuring angles)
- 1 - adz, with handle
- 1 - mallet head
- 3 - gimlet handles
- 1 - shovel handle
- 4 - tool handles, unidentified

timbers and finished planks and beams. Some of this wood undoubtedly represented raw materials and unfinished projects under the supervision of the ship's carpenter or a skilled crewman serving as carpenter. These materials are discussed more fully in the following chapters.

Purser's Stores

Montaine states that the purser of a warship

is to provide the Ship with Coals, Wood, Turney Ware, Candles, Lanthorns, &c. to enable him to do which, he is allowed Twelve-pence a Man per Month . . . [and] is to be careful to inspect the good Order, Stowage and Preservation of Provisions, and the oldest be expended first (Montaine 1778: 60).

The purser was also in charge of the "slops." Masefield explains that "'slops' were the sailor's clothes and sea-bedding, supplied by the naval storekeeper to every ship in commission" (Masefield 1905: 47). Among the items normally carried as "slops" in a man-of-war, Masefield lists:

white canvas kit-bags, scarlet marine tunics, blue coats, waistcoats, and trousers, checkered blue-and-white shirts, black silk wrappers, Dutch fur and worsted caps, straw mattresses, blue or brown blankets, thick woolen stockings, heavy weather trousers, and usual seamen's frocks and shoes (Ibid.).

In all likelihood, the captain of the vessel under study would have assumed these responsibilities, along with those of the military cargo aboard.

Provisions: The most significant category of purser's stores from 44Y088 was provisions, represented by the

largest collection of precisely-dated eighteenth-century cooperage ever recovered. Cooperage from the site consists of 21 intact containers and loose staves representing at least 17 additional casks. Of these, six are thought to have held beef, while five contained peas, and five carried musket balls; six were puncheons, five were wine hogsheads, while the use of nine is unknown.

Most of the casks were found in the bow, in the vicinity of the forward bulkhead (Figure 7). Rather than constituting part of the cargo, these casks appear to have been provisions for the crew. They were stored well forward, where provisions were normally stored; in addition, many of the casks had one head removed, indicating that the contents had been consumed. Since cooperage was in short supply, empty casks were apparently routinely retained for reuse.

Evidence of recycling of casks was abundant: many containers showed evidence of repairs in the form of plugs, patches and re-cut grooves; several clearly had new content markings branded over old ones; caulking was found between staves, etc. A separate study of the cooperage is revealing new information on cooperage (Shackelford 1988).

Research by the author has revealed the sources of some of these provisions. During the American Revolution, forty-six men held contracts for the supply of provisions, rum, coal and specie (Baker 1971: 216). Many of these contractors were London gentlemen who sub-contracted to

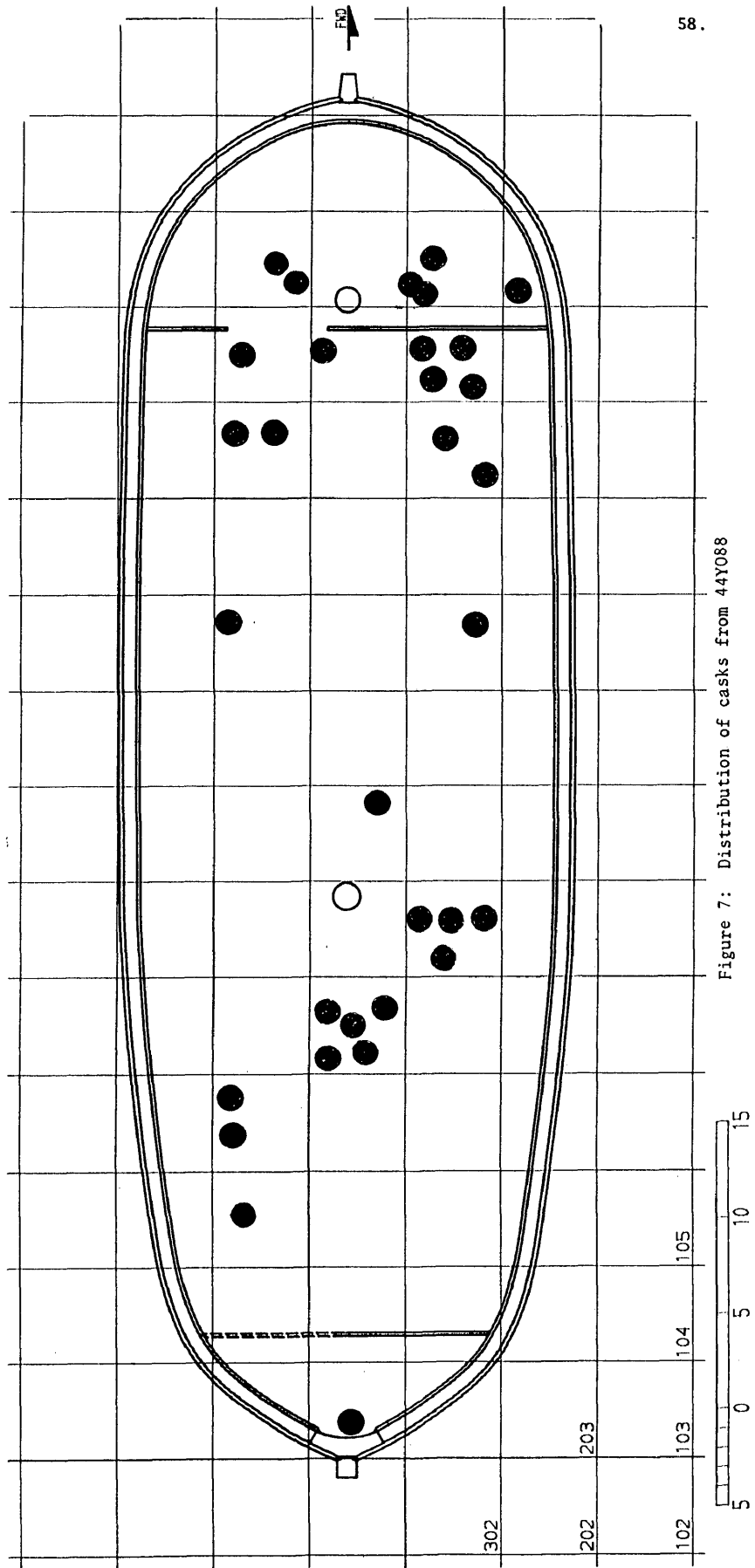


Figure 7: Distribution of casks from 44Y088

others the actual responsibility for supplying goods to the assigned ports (Ibid: 230).

Most wet provisions--beef, pork, suet, vinegar, rum, lime juice--were shipped from Cork, Ireland, while dry provisions--peas, oatmeal, chocolate, tea, flour, raisins, sugar--were generally loaded at Cowes, on the Isle of Wight (Ibid.: 64, 89).

Recovered cask staves and head pieces often bore some type of grafitti in the form of branded or incised markings. One cask head was branded "G&C PEAS." Treasury Board records reveal that a large contract for the supply of peas and flour was held by Gooch and Cotton, "Merchants and Millers of Bungay in Suffolk" (Ibid.: 83).

Other heads were branded "P R LONG, WATERFORD," and "LIMERIC." Waterford and Limerick were Irish ports near Cork. Treasury records show that Waterford was used sporadically as a loading port. In 1779, contractors Durand & Bacon changed their agent to a "Mr. Long" of Waterford, undoubtedly the same agent who supplied the cask from 44Y088 (Ibid.: 66). Research should eventually illucidate specific supply patterns for Cornwallis' transports.

In attempting to determine the make-up of the crew, observations of cask workmanship provided an essential clue: some of the repairs were crude, such as lead patches nailed over holes gnawed by rats. This suggests that the repairs were made by a carpenter or crewman, not a skilled cooper. Such evidence is consistent with the theory that a

small merchant vessel would not have carried all the craftsmen for performance of such specialized tasks.

Fuel: In addition to casks, 1870 pounds of coal was recovered from the forward hold, on the starboard side. The coal was in large chunks, the largest of which weighed 34.5 pounds. The chunks of coal, averaging 8.5 pounds each, occupied approximately 34 cubic feet of space in the bow. These figures yield a density of 55.6 pounds per cubic feet, which is very nearly that of broken, loose Anthracite coal. Since the coal was stored well forward, in an area not normally associated with cargo, it is assumed to be part of shipboard provisions, to be used for cooking and heating.

As mentioned above, a large number of whole and split logs were found in the bow and midships areas; some of this wood, especially amidships, was probably stored for fuel.

Sailmaker's Stores

The duties of sailmaker were undoubtedly performed by the boatswain or mate. No sailmaker's tools were found, but several large sections of folded material were recovered from the bow compartment. The cloth is badly deteriorated, making analysis difficult. The surviving sections are too small to represent whole sails, and do not contain visible grommets or bolt ropes, but could be spare sailcloth.

An analysis of one sample revealed that it was made of bast. To date, it has not been possible to determine if the cloth belonged to the sailmaker's stores.

A grommet, made of rope yarn and having a 1/2-inch diameter hole, was recovered in the bow. This grommet may well be the remnant of a sail.

Cook's stores

No galley stove was located, nor were any implements for food preparation. Although it is possible that the galley stove was salvaged, a large stove, such as the one found on the remains of the privateer Defense (Switzer 1978) was not anticipated. This vessel carried only a small crew, for which meals most likely were prepared in a small hearth on deck or in a "camboose," a small structure containing a stove which fit over a hatchway on the weather deck.

Seamen's accounts in the nineteenth century stated that merchant ship crewmen ate in the forecastle or on deck, with no utensils other than a tin pot and pan and an iron spoon. Each was fed in a wooden tub called a "kid." Each crewman was normally responsible for these items, which were sometimes stored in the galley (Dana 1871: 133). At the time of the American Revolution, seamen probably ate from a kid with only a spoon and seaman's knife for implements.

The only items of food consumption recovered were six pewter spoons, two wooden spoons and a small wooden bowl.

Cabin stores

A rich variety of cabin furnishings and stores were recovered from the stern of the vessel, providing a unique

glimpse into officers' accommodations aboard a small merchantman. Tongue-and-groove paneling, panel doors, two windows and a companionway ladder offered clues to the appearance of the captain's cabin. Among the recovered cabin stores are portions of a variety of furniture items including a custom-built china cupboard, a chair, a table and a bookcase. Other cabin stores were decorative hardware, such as brass coathooks and keyhole escutcheons, and personal items (Renner 1987).

Most of the recovered cabin stores were items which would have been difficult or impossible to remove when the vessel was abandoned. As a result, this group of stores remained, relatively intact, to provide a unique glimpse of a cabin interior and furnishings.

Armorer/Blacksmith's Stores

No items associated with metalworking were found. Evidence of small arms included: a brass pistol handle guard, a trigger guard from a sea-service musket, a Land pattern musket side plate, a badly-deteriorated bayonet, a cartridge box, a sword hand guard from an officer's sword and approximately 10,000 rounds of musket ammunition, most of which was stored in three casks near the mainmast.

Cooper's stores

No tools associated with cooperage were recovered, nor were any of the recovered barrel components thought to be

spare parts. Such a small ship would not be expected to carry a skilled cooper (see section on purser's stores).

Ecclesiastical stores

No religious objects were found.

Gunner's stores

The principal item associated with gunner's stores was a wooden cannon carriage, intact except for one missing truck (wheel). No cannon tube was found at the site. No evidence of a shot locker or powder magazine was found.

Only one badly-deteriorated cannon shot of 3 or 4 pounds was recovered. A tompion, or muzzle plug, for a 4-pounder cannon, was recovered, along with iron grape shot.

Since almost all the transport vessels were armed with at least a few small carriage guns, it seems strange that no other evidence survives. Even if all cannons, carriages and ammunition were taken ashore, it seems likely that a few shot and the remains of a shot locker and magazine would be evident. This vessel may not have been armed, since the carriage was found in the hold and thus could have been stored for repairs and possible future use. Another possibility is that all gunner's stores were taken ashore.

Sailing Master's Stores

As discussed earlier, it is hypothesized that the captain of 44Y088 also served as sailing master; therefore,

the few fragments of navigational instruments recovered are assumed to have belonged to the master's stores.

Surgeon's Stores

No medical instruments or containers were found.

Boatswain's Stores

Mountaine states in his Seaman's Vade-Mecum that:

The Boatswain is to receive into his Charge the Rigging, Cables, Cordage, Anchors, Sails, Boats, &c. by Indenture from the Surveyor of the Navy, and to use great Care in the Disposition of the same (Mountaine 1778: 53).

In other words, the boatswain, or bosun, as it is sometimes written and always pronounced, was in charge of almost all major equipment associated with the maintenance and operation of a vessel.

On naval vessels, the boatswain was also the warrant officer in charge of administering punishment. John Masefield wrote, "A boatswain always carried a cane, the end of which was waxed and 'tip'd with simple twine-thread' (Masefield 1905: 44). Concerning the cane, Masefield added,

"This small stick of his," says Edward Ward, ". . . seems little inferior to the rod of Moses . . .; it has cured more Scurvy than the Doctor, and made many a cripple take up his Bed, and walk; sometimes it makes the Lame to skip, and run up the Shrouds like a Monkey" (Ibid.: 45).

The heavy responsibility placed on the boatswain for all ship's equipment is reflected in the inventory of the

Montgomery, mentioned above, which specifically lists a diverse variety of items under the heading "Boat'ns Stores" (see Appendix A for a complete listing). Site 44Y088 yeilded numerous items associated with boatswain's stores, as summarized in Table 3.

Boatswain's Chest: No items associated with a boatswain's chest (e.g., fids, sail palms, needles, etc.) were recovered, except for two small balls of spun-yarn, which were probably used for rigging maintenance.

Rigging Hardware: Steel's Elements of Mastng and Rigging (1794: 131-8) provides a table of all standing and running rigging required for a 160-ton merchant brig. Since shipwreck 44Y088 is thought to be a merchant brig of approximately 176 tons burthen, Steel's table can be used to estimate the rigging hardware and cordage required for this vessel. The list, summarized in Appendix B, indicates that a total of 415 blocks and deadeyes and over eight miles of cordage are required to rig a brig of this size. This is considerably more than the 171 blocks specified for "a Brig of about 11 Keels, 1760" (approximately 230 tons) from the Smales masting book (Smales 1959: 8). However, the Smales list does not include blocks, deadeyes or thimbles for standing rigging, nor other miscellaneous rigging items.

No list of recommended spares has been found, but several contemporary inventories are helpful: a 1776 inventory of the Pennsylvania naval vessel Montgomery listed 80 spare blocks (Hazard 1970), while those of the

TABLE 3

BOATSWAIN'S STORES FROM SITE 44Y088

Hardware, standing rigging

- 6 - deadeyes, rope-bound
- 2 - deadeyes, iron-bound
- 1 - thimble, wood
- 1 - trestletree assembly
- 2 - bibs
- 1 - flagpole (?)

Hardware, running rigging

- 3 - blocks
- 2 - blocks, shoulder
- 1 - thimble, iron
- 43 - sheaves and/or sheave pins
- 2 - block straps
- 12 - parrel trucks

Ship's Boat

- 2 - oars
- 1 - paddle
- 1 - oarlock
- 1 - rudder

Cordage

A wide assortment of sizes, knots, etc.

Miscellaneous Items

- 1 - spun-yarn winch
- 2 - balls, spun-yarn
- 2 - handspikes
- 1 - lever (?)
- 2 - yokes (?), cross-set (?)
- 1 - chafing mat
- 1 - fid
- 1 - belaying pin
- 2 - tar buckets
- leather, poss. sailcloth

Continental frigates Raleigh (1778) and Alliance (1781) listed 97 and 183 spares, respectively (Brewington 1966).

These quantities can be compared with the 88 blocks and block parts recovered from the boatswain's locker of another of the Yorktown shipwrecks, 44Y012 (Inventory by J. Sands, in Broadwater, Sands and Watts 1975; Bass 1976). However, since that site had been partially looted by sport divers, it can be assumed that some of the recovered material was missing.

All of the aforementioned vessels were full-rigged, three-masted ships, requiring over 900 blocks for their rigging. Vessel 44Y088, with only two masts, may have carried approximately 50 spare blocks.

Rigging items recovered from 44Y088 are included in Table 3 and the site distribution of these items is shown in Figure 8. No evidence of standing rigging (mast supports) was found in situ, although several blocks were recovered, along with numerous blocks and block parts associated with running rigging (blocks and ropes for manipulating sails and yards).

Three items associated with the vessel's active standing rigging were recovered: a 7-inch deadeye in poor condition, with a segment of line wrapped around it, an 8-inch deadeye, and a 4-inch wooden thimble with fragments of rope around its perimeter and through its hole (Figure 9).

The deadeye, located in the upper strata just aft of the foremast, probably held a fore-topmast shroud; the

thimble, also found near the surface in the starboard bow, probably supported an upper shroud or stay on the foremast.

Six examples of stored standing rigging hardware were recovered: five deadeyes and two iron-bound deadeyes showing signs of extensive wear and weathering, which evidently caused them to be removed from service.

None of the blocks, active or stored, were stamped or marked in any way, indicating that they belonged to a non-military vessel on which almost all hardware would have been stamped "->", which is the "Broad Arrow," the mark of the Board of Ordnance.

Referring again to Figure 8, running rigging is represented primarily by five blocks, a dozen parrel trucks, and numerous sheaves and sheave pins. The majority of these seem to have been part of the active rigging of the mainmast which fell into the hull as the ropes deteriorated. The softer oak or elm block shells were probably destroyed by shipworms, leaving only the sheaves and pins, which are made of lignum vitae, a very durable hardwood.

Among the blocks were two 8-inch shoulder blocks (Figure 10), one missing its sheave, the other without sheave or pin. These blocks functioned as sheet blocks, strapped to a yardarm where the projection, or shoulder, prevented the block from rolling and binding the sheet (rope). Their size indicates that they are topgallant sail sheet blocks, which could have been used on either mast. From their condition, these blocks were being stored as

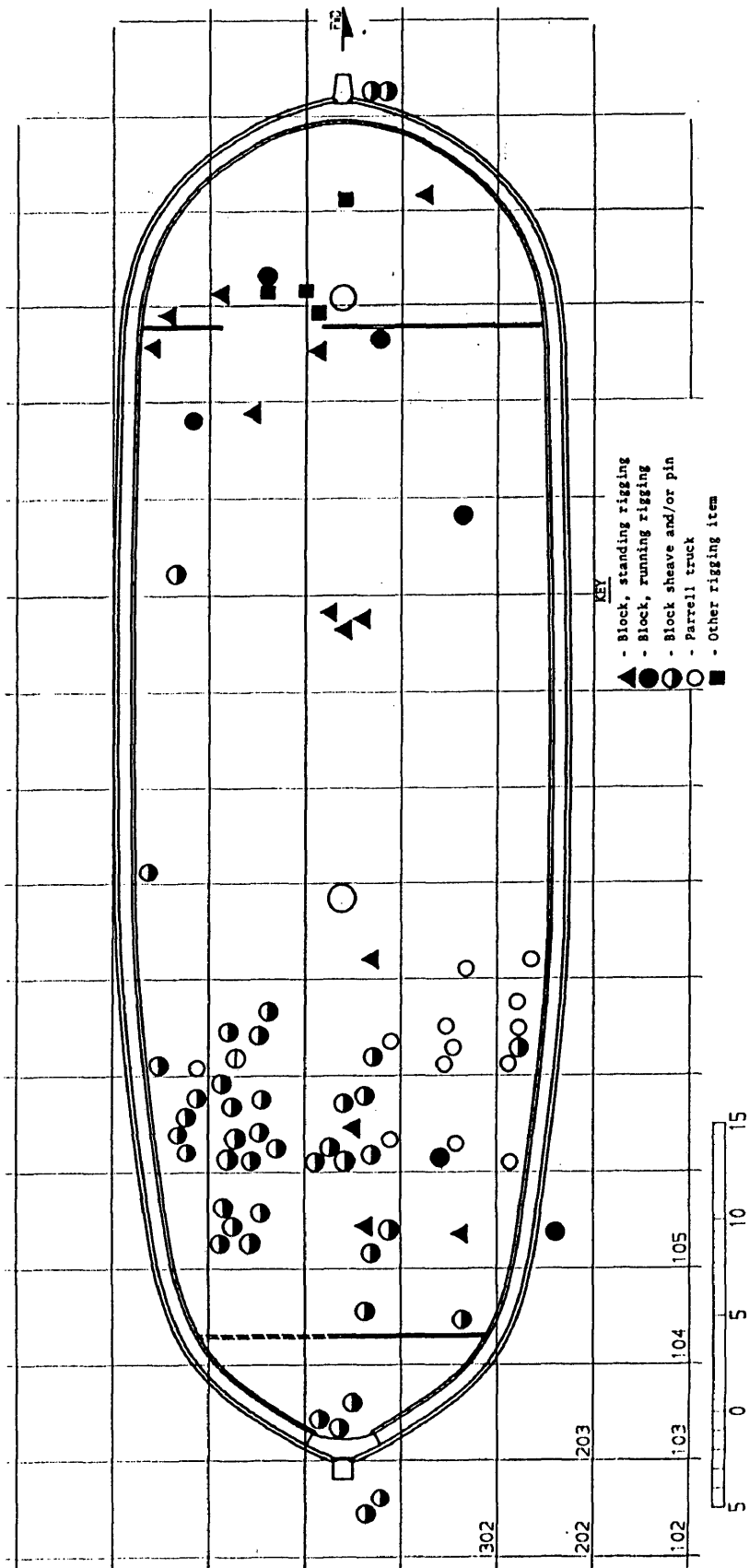
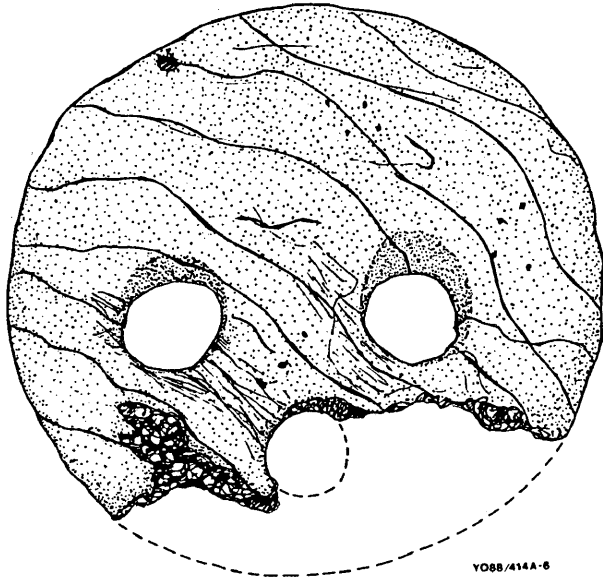
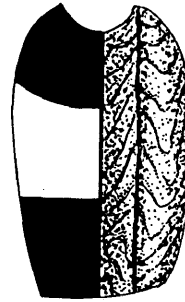
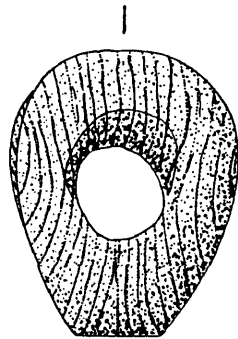
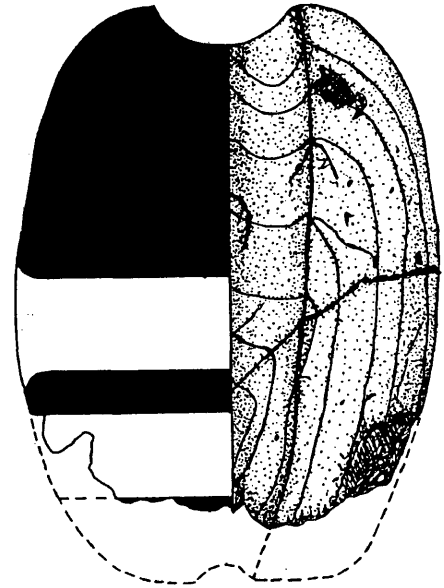


Figure 8: Distribution of standing and running rigging hardware



(a)



(b)

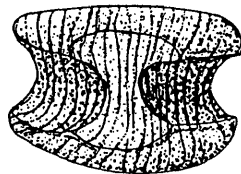


Figure 9: Deadeye (a) and thimble (b)

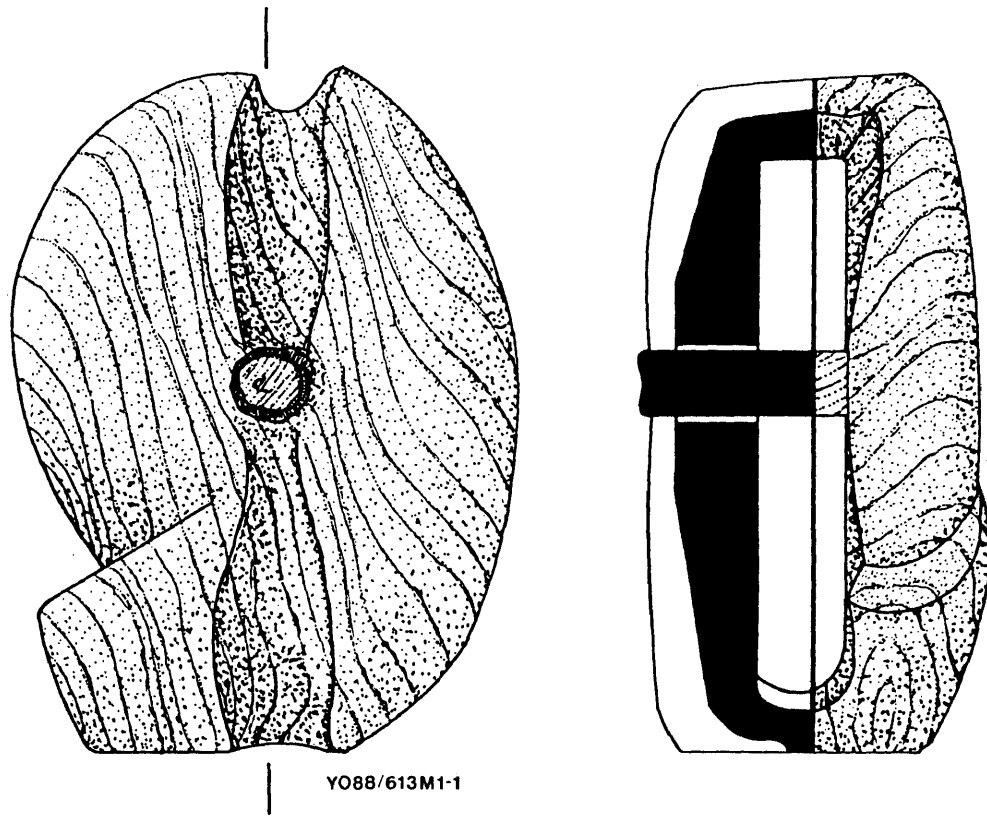
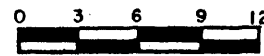
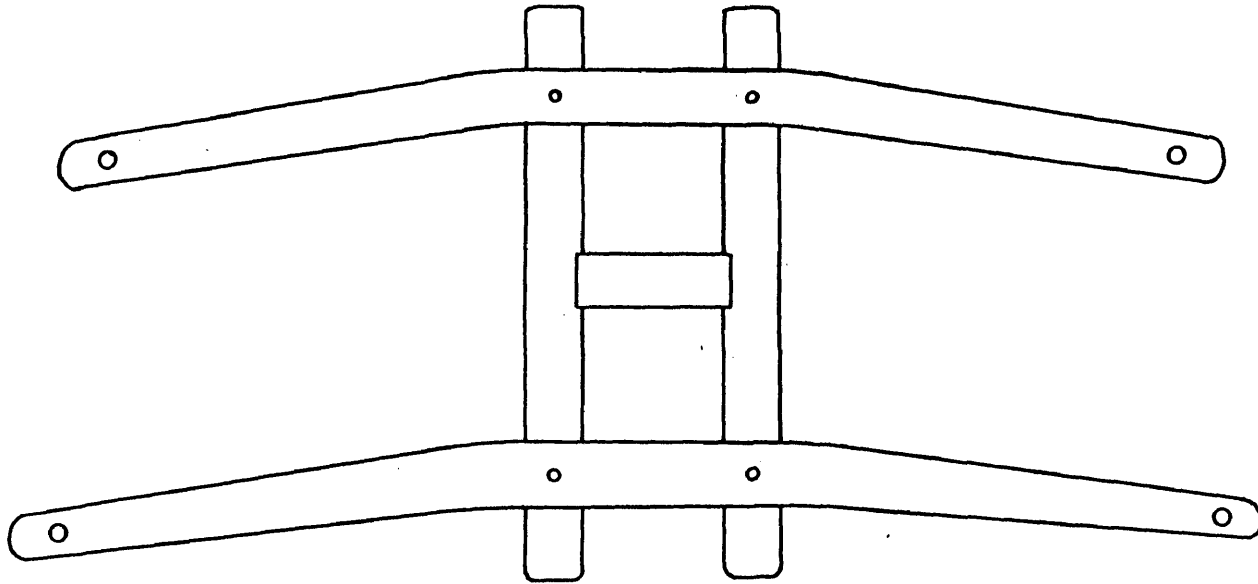


Figure 10: Shoulder Block



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Fore Topmast & Toppail Yard

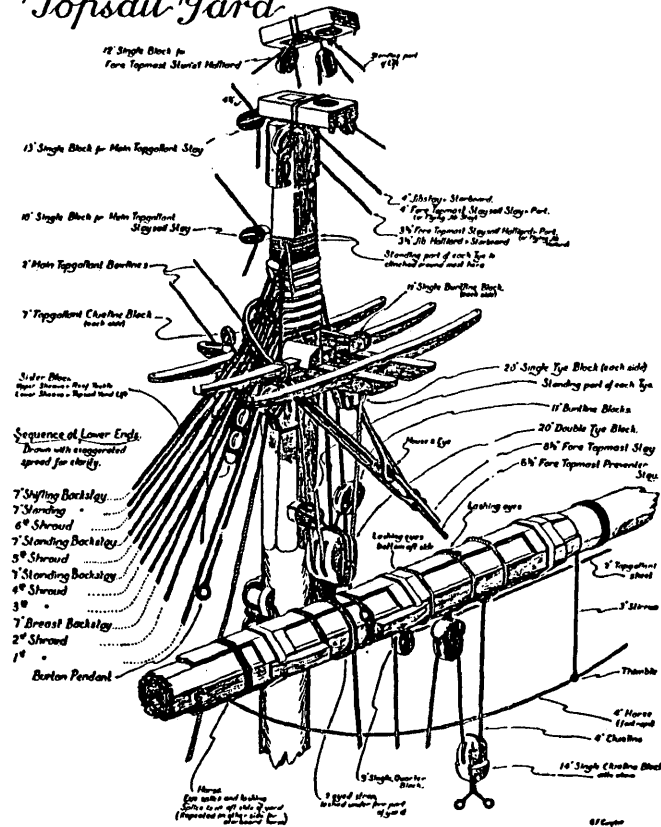


Figure 11: Trestletree assembly (a) from 44Y088, (b) illustration of usage (Longridge 1981)

spares. A rope block strap, which had apparently been seized around a 9-inch block, was also among the stores.

Outside the starboard bow, two sheaves were found connected by a common pin. This combination was from a double-sheave block, and its location suggests that it may have been from the cat block, used to recover the anchor.

In addition to the blocks, a trestletree assembly, consisting of crossed pairs of trestletrees and crosstrees (Figure 11), was found lying against the forward bulkhead, just to port of the foremast. Its dimensions indicate that the assembly was mounted atop one of the topmasts to support a topgallant mast and shrouds.

Reference to naval specifications (Lees 1984; Steel 1794) reveals that the crosstrees on this assembly are much longer, with respect to the trestletree length, than was recommended. This indicates that the shrouds were spread further than normal, probably to support a longer-than-normal topgallant mast or mast pole.

In a review of illustrations of colliers (coal-carriers) from the eighteenth century, Charles McDonald found evidence to support this conclusion. McDonald determined that colliers were heavily sparred and seemed to carry relatively long topgallant mast poles (1984: 115-16).

Such a deviation from naval specifications is not surprising; in fact, a cursory review of merchant vessel spar dimensions suggests a wide diversity, probably necessitated by the diversity of functions for which

merchant vessels were built, individual preferences of shipbuilders and the availability of material.

Two bibs, large timber cheeks which support the trestletrees, were found adjacent to the trestletree assembly, strongly suggesting that they had once supported the assembly.

A tapered spar, 4-1/2 feet long, was found with an immobile 2-1/2 inch half-sheave set into the tapered end. This spar is thought to be a flagpole, which sat atop a mast. The half-sheave could not have borne much of a load, but could have served as a fairlead for a flag halliard. At the very tip is an iron concretion which is probably the remains of a truck (flagpole cap).

One common characteristic shared by the trestletree assembly, bibs, flagpole and shoulder blocks is probable association with a topgallant mast. Both blocks appear to have been damaged in use, suggesting that the ship may have been caught in a gale which damaged the upper rigging. October gales can be very destructive on the Chesapeake, and vessel 44Y088 may have suffered damage which required sending down the topgallant yard, mast and fittings.

The rigging components recovered from site 44Y088 represent only a fraction of the items required for adequate boatswain's stores, and an even smaller percentage of the necessary active rigging elements. Possible reasons for this shortage are discussed in later chapters.

Cordage: Adjusting, altering and repairing rigging constituted a large portion of the average seaman's duties. Rope was made from vegetable fiber, usually hemp, which was twisted into yarn. The yarn was then turned into strands and three strands formed a right-hand, or hawser-laid rope, which made up the majority of cordage aboard any class of vessel. Three of these ropes can be twisted left-handed to form a cable. Figure 12, the form used for recording rope from the site, illustrates the make-up and terminology of cordage.

Although the cordage from 44Y088 has not been fully analyzed, a basic inventory and study has revealed some interesting objects. Approximately 300 feet of rope of various sizes and types were found at site 44Y088. The plotted distribution of rope indicated that intact coils were found exclusively in the bow area, but ropes of various sizes were to be found throughout the hull. The resulting distribution pattern was not considered diagnostic, so was not included.

A total of nine knots were recorded, along with several types of exterior treatments (Figure 13). Among the interesting finds are a coil of braided rope, several eye splices, two pairs of wall-and-crown knots, forming two short beackets, and a possible bucket handle.

As with the rigging items discussed above, the cordage recovered is insufficient for maintenance of a sailing vessel. This topic will be taken up in later chapters.

Figure 12: Project rope form
 VIRGINIA DIVISION OF HISTORIC LANDMARKS
 YORKTOWN SHIPWRECK ARCHAEOLOGICAL PROJECT

ROPE FORM

CONSERVATION # _____

PROVENIENCE _____

LENGTH _____

DRAWING ON BACK _____

	ROLL	FRAME	DEV?
COLOR			
B&W			

COMMENTS:

BRAIDED _____

WORMED _____

SERVED _____

PARCELLED _____

SEIZED _____

SPLICES _____

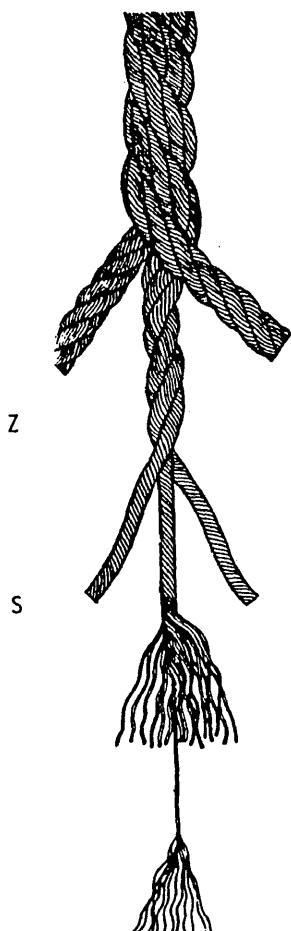
KNOTS _____

TAPERED _____

WEATHER-PROOFED _____
 (Pitch or Tar)

DATE _____

RECORDER _____



CABLE number of hawsers/cable: _____
 lay: Z S
 cable diameter: _____

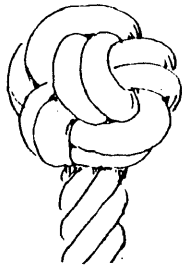
HAWSER number of strands/hawser: _____
 lay: Z S
 hawser diameter: _____

STRAND number of yarns/strand: _____
 lay: Z S
 strand diameter: _____

YARN number of fibers/yarn: _____
 lay: Z S
 yarn diameter: _____

FIBER type: _____ diameter: _____

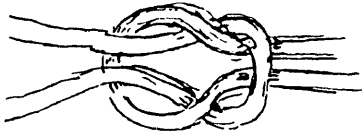




Wall and crown knot



Stopper knot

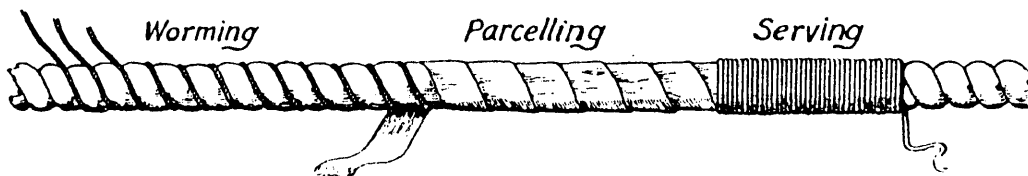


Reef (square) knot



Figure-8 knot

(a) Illustrations of the types of knots found on 44Y088



(b) Surface treatments represented on rope from 44Y088

Figure 13: Knots and surface treatments

Distribution of the following classes of miscellaneous boatswain's stores is illustrated in Figure 14.

Ground Tackle: A vessel the size of 44Y088 should have carried at least three large anchors, three smaller anchors, a grapnel, 360 fathoms (2160 feet) of large cable and 240 fathoms (1440 feet) of smaller cable (Syrett 1970).

No anchors were found inside the hull; nor were large ferrous masses located during a magnetometer survey of the site in 1980. However, approximately 25 feet of 12-inch circumference anchor cable was found, two fragments of which have served ends. Neither of the servings is the type of termination normally used to secure the bitter end to a stationary point within the vessel or to another section of cable. Therefore, these ends may have bent directly onto an anchor chain shackle. All cable fragments are short and are likely old line stored as a supply of fiber for spun-yarn and oakum, used for rigging and caulking, respectively.

A lead hawse pipe was found outside the port bow, with a parcelled hawser passing through it and out toward another sunken vessel, 44Y089. This line could be attached to an anchor or could have secured the two vessels together before scuttling. No other evidence of ground tackle was found.

Tar, Pitch, Oakum: Based upon contemporary inventories, even a small ocean-going vessel should have carried several casks and buckets of tar and pitch, as well as a supply of oakum for caulking seams. Two pitch-lined buckets were recovered from the bow; the bucket from the

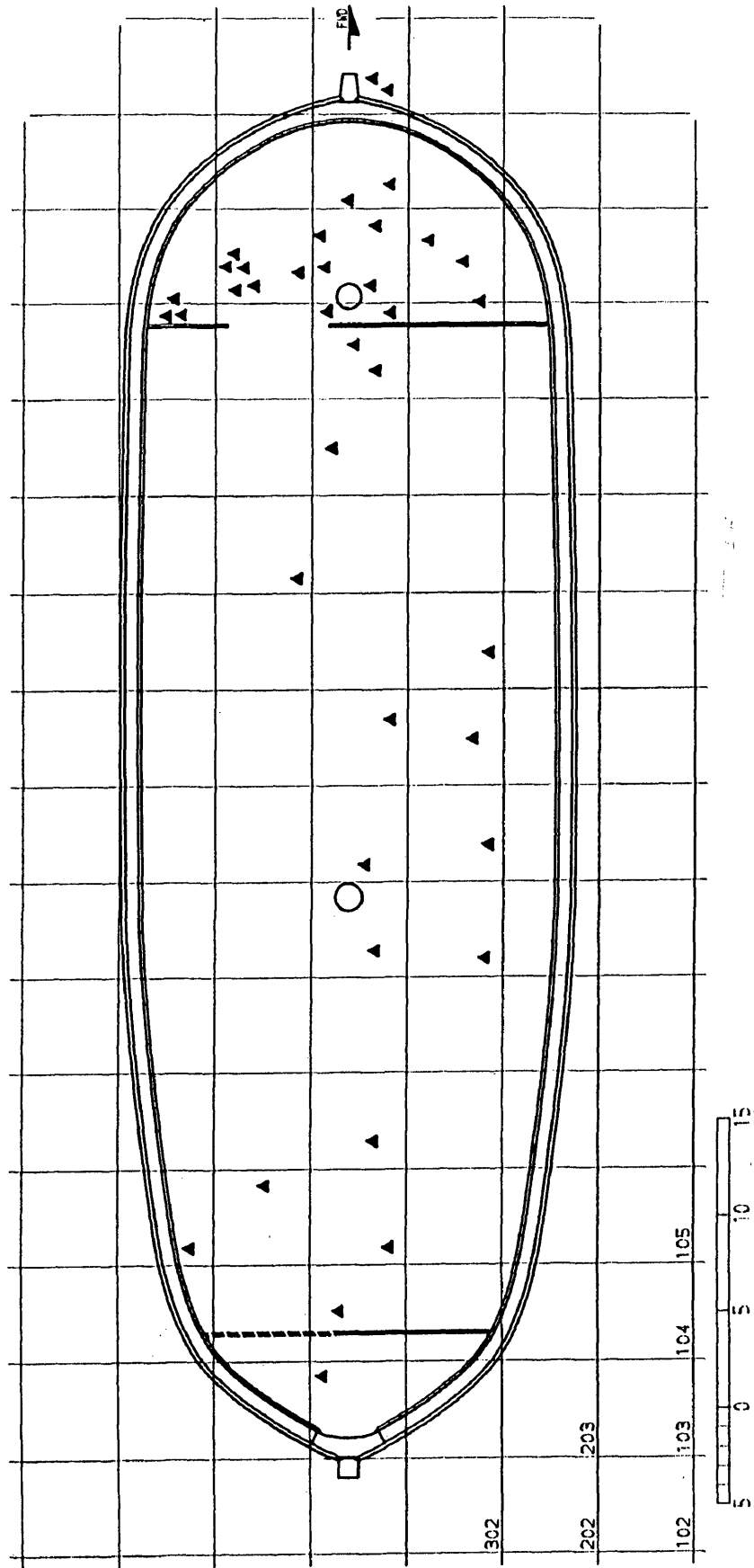


Figure 14: Distribution of miscellaneous boatswain's stores

port side appeared to have tipped over, spilling a quantity of pitch onto the ceiling.

Equipment for Ship's Boats: A merchant vessel of the size of 44Y088 would have probably carried only one boat, most likely secured to the deck between the two masts. Probable evidence of the ship's boat were two short oars or paddles, and a 10-foot-long oar recovered from the bow. All are in poor condition and seem to have been retained for scrap wood or emergency use. A rudder from a small boat was found near the surface of the sediments amidships, and may indicate that the ship's boat was secured to the deck in that location.

Other Boatswain's Items: Two handspikes (windlass bars) were recovered from the bow. Both were broken and one, stamped in three places with the letters "BF", had been repaired with marline. In writing about nineteenth-century collier brigs, Runciman related that "Many of the coaster's windlasses were worked with handspikes. Each of the sailors had their own . . . (1926: 84). Sutherland specified that windlass handspikes were usually 3-1/2 times the diameter of the barrel in length. This formula gives a windlass barrel diameter of approximately 19 inches, which is within one-half inch of the actual diameter of the windlass barrel from 44Y088.

The object illustrated in Figure 15 has a bar with tapered ends set into one end of the main bar and supported by knees. A sheave is set into the opposite end of the main

bar. This device appears to be a type of lever, such as a cargo-loading davit.

Two shaped wooden bars, one with rope still attached, may be part of a cross-set, a type of clamp, or could be part of a lifting yoke.

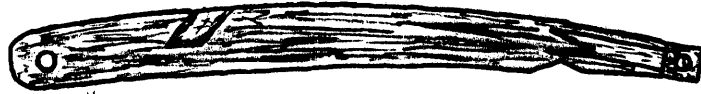
A reel with a barrel length of 16-1/2 inches was recovered virtually intact from the boatswain's locker in the bow (Figure 16). Reels were used for log lines and lead lines, but this reel is a "winch" used for making spun-yarn. Steel describes the device as follows:

WINCH, to make or twist spunyarn with, is made of 8 spokes, 4 at each end, and 4 wooden pins 15 inches long driven through the end of them. Through the centre of the spokes is bored a hole for an iron bolt to pass through, that serves for an axis. The motion is given to the winch by the hand; on the edges of the spokes is a small hook to stop the yarn when twisting, after which the spunyarn is wound round the body of the winch (Steel 1794: 66).

The winch from 44Y088 is nearly identical in size and shape to that described above by Steel.

Richard Henry Dana, in his classic account of a sea voyage, provides a graphic description of the winch's use:

These "rope-yarns" [made by pulling apart old rope] are constantly used for various purposes, but the greater part is manufactured into spun-yarn. For this purpose every vessel is furnished with a "spun-yarn winch;" which is very simple, consisting of a wheel and spindle. This may be heard constantly going on deck in pleasant weather; and we had employment . . . for three hands in drawing and knotting yarns, and making spun-yarn (Dana 1840: 54).



0 3 6 9 12



INCHES

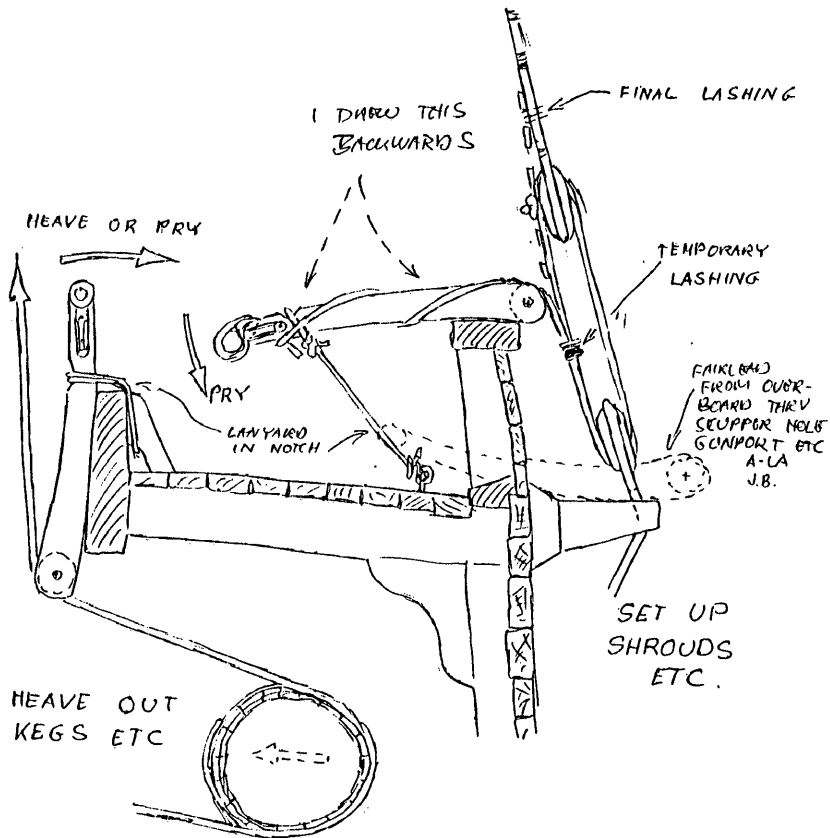
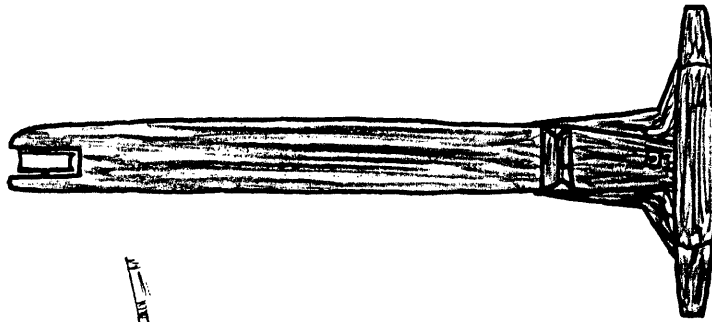


Figure 15: Lever, with sketch of possible operation (sketch by Norman Cubberly)

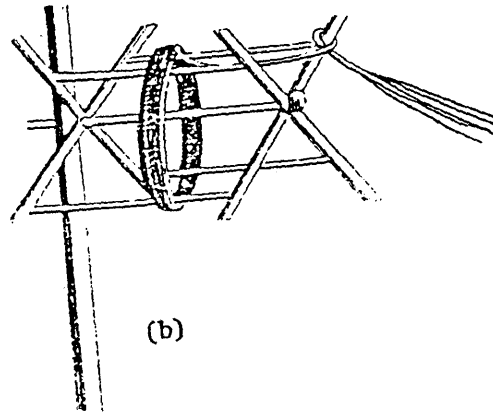
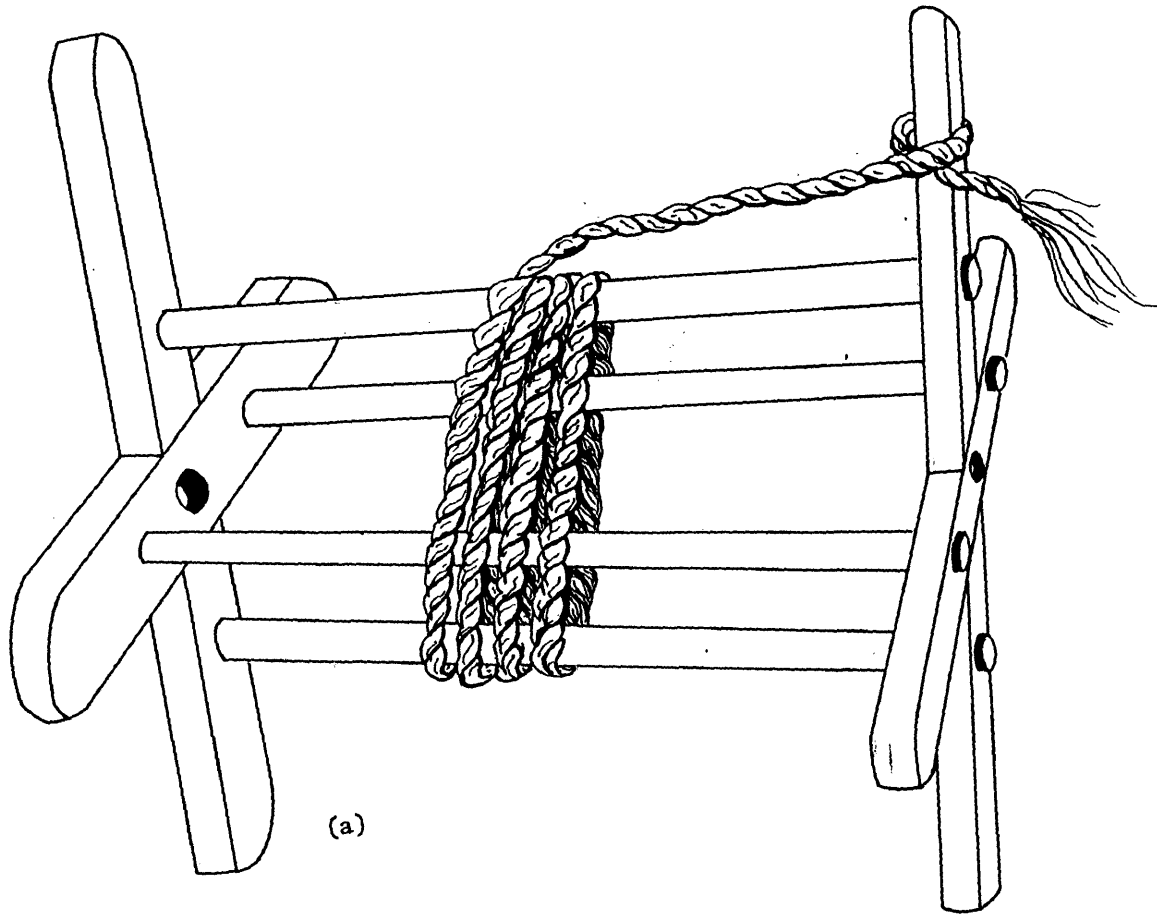


Figure 16: Spun-yarn winch (a) from 44Y088, (b) from Lever 1819: 2

A woven mat measuring 5 inches wide by 6-1/2 feet long was found near a section of anchor cable in the bow. Its size and shape suggests that it may have been used for "plattling the cable," in which case it would have been wrapped around the anchor cable to prevent the cable from chafing on the hawse pipe (Harland 1984: 233).

Summary of Stores from Site 44Y088

As can be determined from the above discussion and from Table 4, site 44Y088 produced artifacts from all categories of ship's stores except cook's, surgeon's and ecclesiastical stores. The evidence of some categories was minimal or even questionable; however, a study of eleven other shipwreck sites and ships' inventories verifies that no category of stores was found on all of the vessels studied, and none of the inventories contained listings for all 13 categories. In fact, of the eleven vessels examined, only five provided evidence of four or more categories of stores. Of those five, only two were shipwrecks--the other three were contemporary inventories of floating vessels (Spencer 1984: 122).

This brief comparison indicates that the stores recovered from 44Y088 offer a useful, if incomplete, selection of supplies and equipment from an eighteenth-century merchant vessel. This topic is discussed further in the following chapters.

TABLE 4

A COMPARISON OF SHIPS' STORES

		Pres. on <u>44Y088</u>	Present in the inventories of other <u>Vessels (Note 1)</u>
Major Classes:			
* Masters' stores	--	yes	3
* Boatswains' stores	--	yes	4
* Carpenters' stores	--	yes	4
* Pursers' stores	--	yes	5
* Sailmakers' stores	--	yes?	1
* Cooks' stores	--	no	6
* Cabin stores	--	yes	4
Additional Classes:			
* Armorer/black smith's stores	--	yes	4
* Coopers' stores	--	yes	3
* Ecclesiastical stores	--	no	2
* Gunners' stores	--	yes	6
* Sailing Master's stores	--	yes (Note 2)	3
* Surgeons' stores	--	no	2

NOTES: 1. The value represents the number of 18th-century vessels or shipwreck sites from the list of eleven below for which artifacts from the indicated category were present:

The 11 vessels are: Alliance (1781), Amsterdam (1748), Charming Sally (1758), HMS Charon (1781), Defence (1779), Joseph & John (1723), Montgomery (1776), Le Machault (1760), Raleigh (1778), Relief (1755), HMS Winchester (1695)

2. Included with Master's stores

CHAPTER 5
CARGO AND BALLAST

SHIPS' CARGO

Falconer's nautical dictionary of 1780 defines cargo as:

the whole lading, or quantity of whatever species of merchandise a ship is freighted with, in order to proceed from port to port.

In the case of the Yorktown supply ships, which were merchant vessels leased as military transports, cargo took the form of all types of supplies and equipment required to support and sustain the British Army in a remote location.

Some of the transports were fitted out for carrying troops or horses; some, called victuallers, carried food and water; others carried weapons, ammunition and general supplies. Many of the transports carried a wide variety of cargoes, depending upon current needs. Navy Board records indicate that transports were often dispatched as they became available and as needs arose (NMM, ADM/N/248-50).

It was hoped that a study of cargo from vessel 44Y088 would reveal the precise function for which the vessel had been utilized. Its cargo hold was nearly empty, however, except for a variety of casks and other items which could be

cargo, or could be part of the ship's stores and provisions. In addition to cargo items, the hold contained a jumble of logs and partially-worked timbers which could have been military cargo, or could have been stores of firewood. This possibility is discussed further in the following chapters.

SHIP'S BALLAST

Ballast is material, usually, but not always, iron or stone, carried in a vessel to provide stability and trim. Ballast is carried deep in the hold of the vessel and often covered with a temporary deck or with cargo.

The ballast in vessel 44Y088 was sand mixed with stones of various sizes. The sand ballast was contained in the hold between the fore and aft bulkheads, and virtually no sand was found on the opposite sides of the bulkheads (Figure 5).

An analysis of the sand and stone from the hold of 44Y088 offers evidence that the material was beach sand which was not deposited in the vessel from the York River but, instead, was carried to Yorktown as ship's ballast (Webber 1988: 21). Archaeological evidence supported this conclusion even more strongly: numerous artifacts, including casks and rope, were found lying directly on top of the sand layer, and stones were found suspended within the layer. In addition, sand was found only between the two major bulkheads in the lower hold.

Sand was not considered a desirable material for ballast. A nineteenth-century book on stowage cautions:

Sand, as ballast, should never be employed, if it be possible to avoid it, on account of the liability to work through the ceiling, and choke the pumps. When other ballast cannot be obtained . . . , a careful, considerate seaman would take the precaution to cover the ceiling of his vessel with mats or old sails (Murphy and Jeffers 1864: 17).

The book goes on to advise:

the only means by which the pumps can be cleared, and kept cleared, is to have the well made sufficiently large to admit of sending a man down for that purpose (Ibid.).

There was no bilge lining in 44Y088; the sand lay directly against the ceiling planking. Nor was the pump well sufficiently large to permit a man to enter it. The vessel was, however, planked inside very carefully, which may have been sufficient for preventing sand from entering the bilge. Ceiling planking was extremely tightly fitted, although there was no indication that it had been caulked.

The tight ceiling was probably an original feature of the vessel since if, as hypothesized, the vessel was a collier, it was important to prevent coal dust from entering the bilge and clogging the pumps. Inspection of the bilge produced small quantities of coal, possibly from previous cargoes, but no indication of excessive sand infiltration.

As described in the previous chapter, approximately a ton of coal was piled on the starboard side of the bow,

forward of the forward bulkhead. Lying on the ceiling in the bow, primarily on the port side, were stones and a few brickbats. These were apparently removed from the ballast by hand and stowed forward as a means of trimming the vessel.

The required ballast for men-of-war was calculated as follows:

$$\text{Tons ballast} = T/8 - (T/8)/5,$$

where T is the tonnage of the vessel (Murphy and Jeffers 1864: 16; Harland 1984: 49). In the case of a merchant vessel, T is the tonnage, burthen. The equation reduces to:

$$\text{Tons ballast} = T/10.$$

For 44Y088, the required ballast, by this formula, is:

$$\text{Tons ballast} = 176/10 = 17.6 \text{ tons.}$$

For merchant vessels, however, Murphy and Jeffers state that as a general rule, 30 tons of ballast for every 100 tons of "custom-house" measurement is sufficient (Murphy and Jeffers 1894: 18). This rule yields an entirely different figure:

$$\text{Tons ballast} = 30 \text{ tons} \times 176 \text{ tons}/100 \text{ tons} = 52.8 \text{ tons.}$$

From estimates of the volume of the ballast mound in 44Y088 and the average dry weight of ballast samples, the actual ballast carried was estimated as follows:

$$\begin{aligned} \text{Tons ballast} &= 934 \text{ cu.ft.} \times 113.38 \text{ lbs./cu.ft.} \\ &= 105,897 \text{ lbs.} = 52.9 \text{ tons.} \end{aligned}$$

These last two figures are remarkably close. Although the estimate of the volume of ballast is only a first approximation, it seems sufficient to indicate that 44Y088 was ballasted with the requisite amount of weight, if not the most preferred material.

Although the lack of significant evidence of cargo was disappointing, it was not surprising. Historical references reported that most of the cargo had been removed from the transports. The remaining material in the hold of 44Y088 offers clues to the original cargo carried by the vessel. This information is discussed in the following chapters.

Geological analysis of coal and ballast samples is still underway and may eventually reveal countries of origin which, in turn, will help reconstruct the final voyage of vessel 44Y088.

CHAPTER 6

A PARTIAL RECONSTRUCTION OF SHIPWRECK 44Y088

Excavation and analysis of site 44Y088 confirmed that the hull is preserved approximately to the level of the waterline, with bulkheads, mast stumps and portions of the lower deck still intact. The hull is very box-shaped, with heavy oak frames and planking. The excellent condition of the hull suggests that the vessel was probably less than 15 years old when it sank.

Hull Reconstruction

From the evidence described in previous chapters, from other site data and analysis, and from contemporary information on shipbuilding, a partial reconstruction of vessel 44Y088 has been generated.

Measurements recorded at the site during 1987-88 formed the basis for development of a set of descriptive hull lines, following the procedures employed by naval architects. The lines were generated by John William Morris III, Yorktown Shipwreck Project, Robert Caverly, computer operator, Advanced Marine Enterprises (AME), Virginia Beach, and the author. A series of diagnostic drawings were produced throughout the developmental phase, utilizing AME's computer-aided design and drafting system (CADD).

The lines and detailed plans reveal a bluff-bowed, flat-bottomed hull shape, typical of colliers, or coal-carriers, built in the north of England in the eighteenth century. The positions of the masts indicates that the vessel was probably rigged as a brig, a two-masted vessel with square sails on both masts. Hull measurements are summarized in Table 5 and a hull and stowage plan is illustrated in Figure 17.

Details of hull construction and rigging are being analyzed and described elsewhere (Morris, in progress; Broadwater and Morris, in progress), and are beyond the scope of this study. However, a brief description of the hull shape and layout are essential to an analysis of the distribution of stores and equipment within the vessel.

Interior Reconstruction

Excavation revealed significant information on the interior layout of the vessel. Referring again to Figure 17, there were two decks, upper and lower. The lowest stowage area was the hold; the space between the lower and upper decks was generally referred to as "the 'tween decks."

The hold: The depth of the hold beneath the lower deck was nearly ten feet. The hold was segregated into three compartments by two wooden bulkheads. The forward bulkhead, located just aft of the foremast, was constructed of horizontal planks nailed into vertical studs or stanchions.

TABLE 5
 DIMENSIONS OF VESSEL 44YO88

Length between stem and stern perpendiculars --	73 feet 1-5/8 inches
Maximum Breadth --	23 feet 7-1/4 inches
Depth of Hold --	9 feet 10 inches
Estimated length on keel for tonnage --	58 feet 10-11/16 inches
Estimated Tonnage --	176 32/94 tons, burthen

(NOTE: Tonnage was calculated from the standard Navy Board formula, as shown below. See page 12 for explanation of the formula).

$$\text{Tonnage, burthen} = \frac{L \times B \times (B/2)}{94}$$

FIGURE 17
PROFILE OF VESSEL 44Y088,
SHOWING HYPOTHETICAL STOWAGE PLAN

KEY to the plan shown on the following page:

- A - Sand ballast in hold
- B - Main cargo hold (stowage)
- C - Lower ('tween) deck (stowage)
- D - Upper (weather) deck
- E - Tiller
- F - Stern companionway
- G - Bilge pump
- H - Mainmast
- I - Main hatch
- J - Fore hatch
- K - Windlass
- L - Foremast
- M - Forward scuttle
- N - Bowsprit
- O - Lazarette (stowage)
- P - Boatswain's locker (port) / coal bunker (stbd)
- Q - Captain's cabin / (officers' cabins?)
- R - Forecastle (crew's quarters?) / stowage
- S - Ship's boat stowage

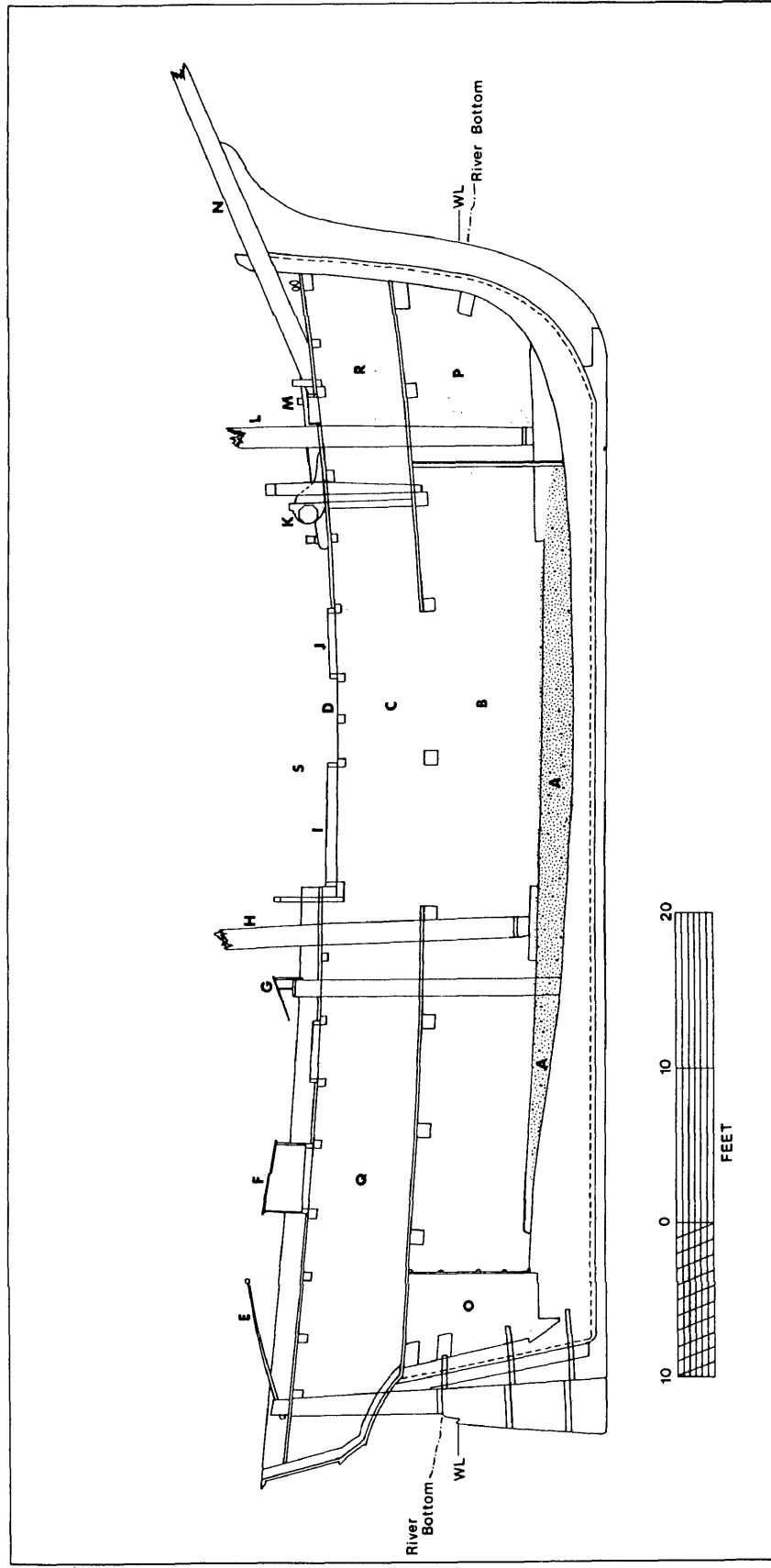


Figure 17: Profile of vessel 44Y088, showing a hypothetical stowage plan

The stern one, which partitioned off a very small space aft, generally referred to as the lazarette, was made of vertical planks with horizontal supports. These bulkheads were somewhat crudely made, of American yellow pine, and so may have been added after the vessel reached North America.

The casks found in the hold, primarily in the bow, provide a varied (and quite rare) assemblage of precisely-dated 18th-century cooperage. Evidence, including location and missing cask heads and contents, suggests that some, if not all, of the casks represent ship's stores rather than cargo.

The presence of a large quantity of bark-covered logs and partially-worked timbers found within the hull has remained a mystery. Many of the logs found in the bow measured three to six inches in diameter and up to ten feet long. Many of them had saddle notches cut near the ends. Most were of pine, which was probably locally cut.

One theory is that the logs found in the bow had been originally assembled on the foredeck as chevaux-de-frise, pyramidal barriers against the encroachment of enemy vessels. Archaeological evidence, however, refutes this theory.

Deterioration of the vessel after sinking would almost certainly have resulted in the destruction of the logs by shipworms and strong currents. Lashings would have decayed, allowing currents to carry away the logs. If, for some reason, the logs had remained on the deck, the deck

structure would have eventually collapsed, thus being pressed into the hull beneath the water-saturated logs. Such was not the case, however, strongly implying that the logs had been stowed below deck at the time of sinking.

The whole and split logs found in the hold are, therefore, assumed to have been a combination of fortification materials (cargo) and firewood (stores). Further interpretation of this material will be found in the next chapter.

Rigging blocks, line, and other boatswain's stores were found deep in the forward compartment of the hold, mostly on the port side. Most of the items were found just inside the compartment, in front of what appears to be an opening into the main hold. This area must have served as a boatswain's storeroom, possibly shared with other crewmen such as the carpenter.

The lower deck: The bulkheads provide a clear picture of compartmentalization in the hold. Although reconstruction of the lower ('tween) deck was not so straightforward, some deductions were possible.

A companionway ladder found in the stern suggests that the space between decks in the stern cabin was at least five and a half feet. From the stern came panelling with raised molding, panel doors, brass hardware, and remains of furniture including a table, a chair, a bookshelf and even a custom china cupboard. Undoubtedly, these were from the captain's cabin, a location which was almost universal. The

captain also usually had a small stowage area called the lazarette, in the hold beneath his cabin. This area also often served as a bread storage room.

Distribution of personal and military items suggests that there could have been additional officers' cabins along the sides of the lower deck, but there is no other evidence to support this theory.

In sharp contrast with the stern, the bow produced no evidence of furniture or furnishings. Typically, crewmen slept on straw-filled mattresses in the bow, with no cabins or bunks. Crew quarters and equipment storage could have been in the hold or 'tween decks. Archaeological evidence did not contribute to the definition of crew's quarters.

The lower deck beams were probably planked over in bow and stern, with an open section forward of the mainmast, beneath the main hold. Cargo and stores were arranged on the decked portions of the 'tween decks, except for cabin areas and access ways. The large hemp anchor cables were probably coiled along the sides of the lower deck, leaving the lower hold free for cargo.

Upper deck: The upper, or "weather," deck was completely missing except for a few collapsed fragments of pine decking, so this deck was reconstructed almost entirely from plans and information on contemporary vessels.

The upper deck was generally on one level except at the quarterdeck in the stern, where it was slightly raised above rest of the upper deck to provide additional headroom in the

stern cabin. On the quarterdeck was the tiller and binnacle for steering and navigating the vessel. Also, there was often a skylight, for light and ventillation, and an entrance to the captain's cabin.

The weather deck then ran forward to the bow. Main and secondary hatches were located on this deck, along with the bilge pump and the windlass. The pin and fife rails, where the numerous ropes for controlling the yards and sails were secured, were also at this deck level.

The weather deck normally carried no cargo; however, spare spars, a ship's boat and other such equipment was often stowed on this deck.

Stowage Plan

An analysis of archaeological evidence resulted in the generation of the hypothetical stowage plan illustrated in Figure 17. A key to the letter designations on the illustration immediately preceeds it on page 93.

CHAPTER 7

ANALYSIS AND CONCLUSIONS

The Yorktown Shipwreck Archaeological Project has produced valuable data concerning one of the largest groups of associated sunken vessels known to exist in North America. At Yorktown, Virginia, the complete excavation of a British supply ship, identified by the site designation 44Y088, has shed new light on merchant vessels from the latter half of the eighteenth century.

Although research and analysis will continue for many years, preliminary results have provided significant information on hull construction and technology, rigging, stores and cargo. In addition, research has produced a more complete picture of the events of the Battle of Yorktown, 1781.

Before proceeding with a summary of shipwreck site 44Y088, it seems appropriate to briefly describe the analytical framework employed. Of particular importance is the development of a model describing the major processes influencing shipwreck site formation.

The Process of Shipwreck Site Formation

Keith Muckelroy, in his definitive text, Maritime Archaeology, offers the following definition:

a shipwreck is the event by which a highly organised and dynamic assemblage of artefacts are transformed into a static and disorganised state with long-term stability (Muckelroy 1978: 157).

In the present case, the precipitating event was the purposeful sinking, or scuttling, of vessel 44Y088. Based upon historical information and knowledge of site formation sequences, a useful model for 44Y088 can be developed.

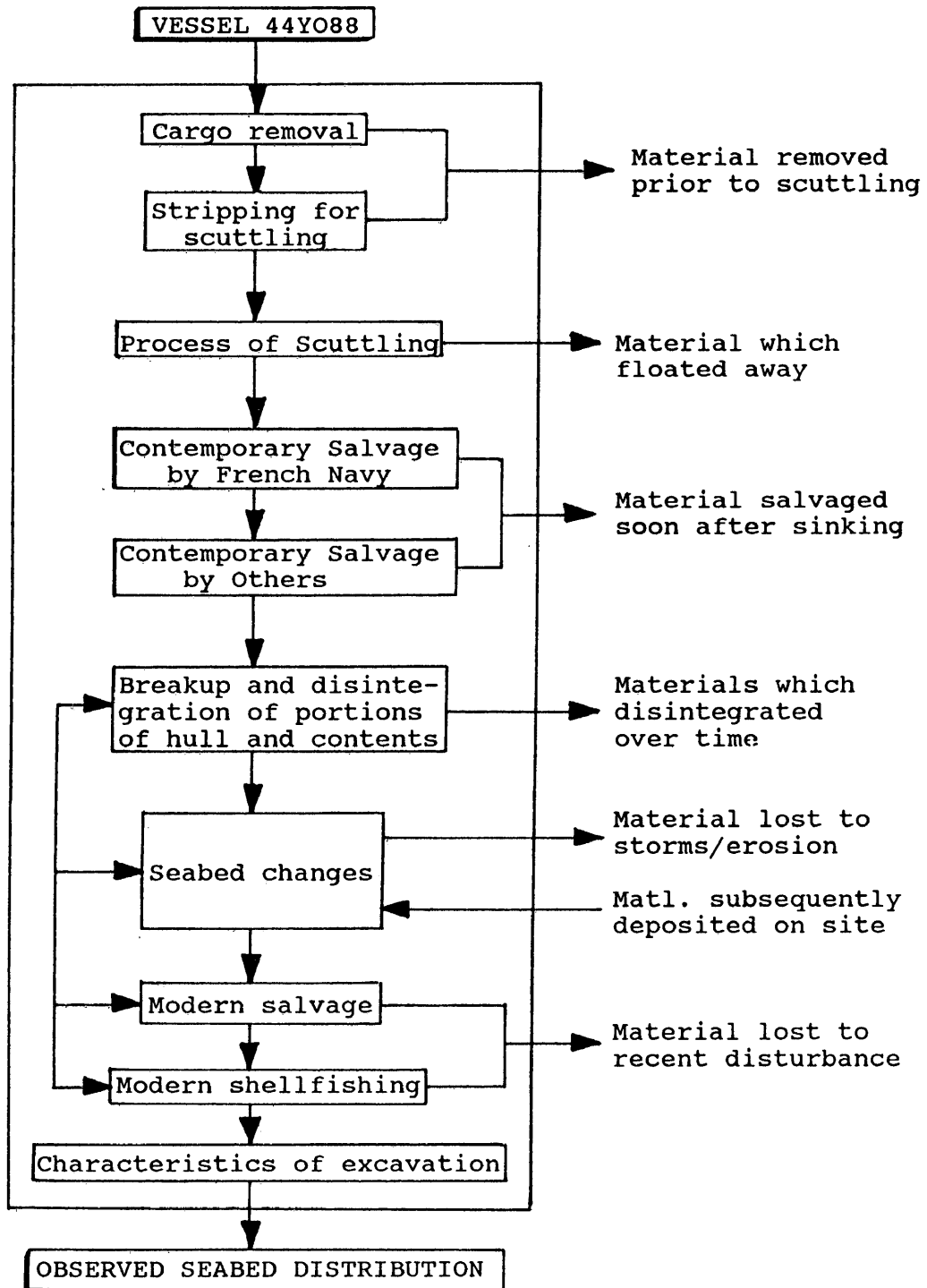
Figure 18 is a flow diagram of the major factors and processes leading to the observed seabed distribution of material culture at site 44Y088.

The first group of factors, which Muckelroy refers to as extracting filters, resulted in removal of material before the vessel sank. Although it is impossible to determine the extent of material removal at that stage, certain assumptions are possible.

The second group of factors, involving eighteenth-century salvage, comprise additional extracting filters for which only limited quantification is possible.

The third group of factors represent long-term and recent effects on the site. Breakup and disintegration of portions of the hull and contents appears to have taken place over two to three years, resulting in loss of some material and displacement of others. Storms and recent salvage have exposed additional portions of the site to deterioration and loss. Muckelroy refers to such processes as scrambling devices. Seabed changes also represent scrambling devices, further displacing material and causing

FIGURE 18
 FLOW DIAGRAM REPRESENTING THE FORMATION
 OF SHIPWRECK SITE 44Y088
 (After Muckelroy 1978: 158)



additional material to be lost. Seabed movement may result from storms and from long- and short-term erosion.

The final influencing factor is the process of archaeological excavation itself. The characteristics of excavation and recording determine the nature and quality of the archaeological data, which make up the only permanent record of the seabed distribution of cultural material. This factor was tightly controlled for 44Y088.

Although this flow diagram does not provide a complete model of the predicted site configuration, it does illustrate the factors to be taken into account in analyzing site data. Ultimately, the task facing the archaeologist is to follow the flow chart in the reverse direction, examining the seabed distribution of material in light of all influencing factors in an effort to accurately reconstruct the original configuration of the vessel and its contents. This analytical process is difficult, at best, but the model was found to be a useful tool for attempting to reconstruct the site.

A major goal of the research at Yorktown was to define the behavior associated with wartime abandonment of vessels. Another goal was the determination of which shipboard items were considered the least expendable, by comparing the catalog of recovered material with a predicted shipboard inventory, and by utilizing the above model. These goals were not fully met. The paucity of shipboard equipment recovered from the site was most likely due to a

combination of several unrelated and unquantifiable factors, including contemporary salvage, the wrecking process, disintegration, storms and erosion, as well as removal prior to sinking.

Since the vessel was easily accessible for salvage following the British surrender, and since relatively little material was recovered from the site, it would be scientifically unsound to formulate generalizations on vessel abandonment behavior or equipment removal priorities. Therefore, the model was used as a reference for the following site interpretation which is based upon more supportable evidence.

General Interpretation of the Site

As described in the preceeding chapter, vessel 44Y088 is a brig of approximately 176 tons, burthen. Current research suggests that the vessel was built in the north of England as a collier, or coal-carrier, then was chartered by the Navy Board as a victualler. It was probably loaded in Cork, Ireland, with general food supplies before travelling in convoy with other transports and possibly a few warships to North America. The vessel may have joined Cornwallis in the Carolinas or, later, in the Chesapeake.

According to historical documents, the cargo, guns and essential stores were removed from most of the transports. This appears to have been the case with 44Y088, as evidenced by its nearly empty hold. Even if the vessel had been

salvaged, more material should have been found in the lowest recesses of the hull unless it had been unloaded.

After being off-loaded at Yorktown, the ship may have served as workshop ship. The presence of cut logs and partially-worked timbers in the bow, along with tools and wood chips, strongly suggests that the ship's carpenter and crew were kept busy fabricating items for the vessels of the fleet and, possibly, the army ashore. Split logs found further aft were more likely stored for firewood.

Little has been written about fleet workshop ships; however, it is known that such a function was sometimes performed. British ships and their crews were used in this capacity in Havanna and Charleston (Syrett 1987: pers. comm.). Reinforcement for this theory was provided by Captain Thomas Symonds, commander of Cornwallis' fleet, who reported in a letter to Admiral Graves that "the Seamen work with the greatest spirits and exertion in cutting down wood for redoubts . . ." (quoted in Sands, 1983).

Many of the cut logs found in the hold appear to be of an appropriate size for use in constructing land fortifications. After its cargo was removed, 44Y088 may have been dispatched upriver, where its crew could have cut trees for transport to the fortifications at Yorktown. The partially-worked and notched timbers may be indicative of pre-fabrication by the vessel's crew.

Other evidence also suggests that 44Y088 served as a floating workshop: partially-repaired shoes and a shoe

last; timbers and planks which are partially trimmed at one end, yet bark-covered at the other; repaired casks; a gun carriage missing a wheel; and a partially-worked timber lying next to an adze and surrounded by wood chips, pressed down into the sand ballast and preserved. Although repair and fabrication operations were an everyday occurrence aboard ships, evidence on 44Y088 suggests an increased intensity of activity.

A wormed and served hawser still passes through the port hawse pipe and trails away in the direction of the adjacent shipwreck, offering evidence that the vessels were cabled together, with anchors set, to hold them in a defensive line.

The vessel was scuttled by cutting a hole just beneath the lower deck, on the starboard side just aft of the mainmast. Hull measurements and the distribution of artifacts indicates that the ship heeled to starboard, then sank in 15-20 feet of water, settling to the bottom with only a slight starboard list.

Analysis of stratigraphy and oyster shells attached to artifacts and timbers verified that the hull was exposed to storms and continued salvage by local wreckers for two to three years, during which time the upper portions of the hull and many artifacts deteriorated before the remainder silted in. Except for disturbance in the upper silt layer, little additional disturbance appears to have taken place until the ship was rediscovered in 1978.

Discussion of Ship's Stores

In addition to cargo, the vessel carried a wide assortment of stores necessary for support of the vessel and crew. A comparison of the stores and rigging items found at the site with the total range and quantity of items required for operation of such a vessel verifies that most of the expected material is missing. However, examples from almost all categories of stores are present in the assemblage, providing an excellent opportunity to study a variety of ship's equipment and stores.

Several general conclusions can be drawn concerning the abandonment of the vessel. Undoubtedly, since the vessel was purposely scuttled, most of the ship's cargo, instruments and officer's personal items were removed prior to sinking. Galley implements were almost certainly removed to provide for the men while ashore as were medical supplies. The remaining equipment and stores, however, may not have been taken ashore, due to limitations on time, manpower or storage space.

The easy accessibility of the sunken vessels at Yorktown--lying near shore, most still visible, lying in shallow water--left them very vulnerable to salvage. Material not salvaged by the French was undoubtedly sought energetically by local residents who could have reused or sold almost any items recovered from the wreckage. Therefore, it is impossible to determine which materials were taken by the British as opposed to those lost during

the wrecking process or due to subsequent salvage and other factors.

The absence of some items can be accounted for from the historical record. Several documents attest to the fact that the transports had been relieved of their cargo and cannon. Other references are also informative. The absence of spare sails may be explained by the testimony presented after the battle by Captain Pinder, of the Quartermaster General's Department:

. . . during the Siege of York the Sails of all vessels private as well as Publick were ordered to be taken to make tents for the sick and wounded Soldiers of Lord Cornwallis's Army at Gloster Point . . . (quoted in Sands 1983: 83).

Although furnishings and personal effects are relatively few in number, their distribution reveals a clear social stratification aboard ship. In the stern were found items of tableware, 24 glass beverage containers, buttons, cufflinks, a brass pocket knife and a ceramic whistle in the shape of a monkey. In the bow were only homemade gaming pieces, a die made from a musket ball, and a single fragment of a silk hat decoration.

Historical sources make clear that segregation of officers and crew was common aboard naval vessels in all European cultures. Evidence at Yorktown was inadequate for positive verification, but does suggest that such social stratification was probably maintained in merchant vessels as well.

Officers and crew alike may have suffered from a relatively poor diet. Cask markings announce the standard nautical fare: beef, pork and peas. Although they had to endure poor or spoiled provisions, the crew was apparently able to supplement shipboard stores with some fresh meats and produce from shore, as evidenced from recovered food remains. Botanical samples have revealed various grains, along with an assortment of nuts and fruits and corn. An array of faunal material, currently under study, contains fowl and fish bones, many of which probably represent additional fresh provisions (Weinstein, 1988: pers. comm.).

Also present with food remains were vermin including grain weevils and rats. Black Rats which stowed away on Cornwallis' ships may have been the first of their species to immigrate to Virginia (Armitage 1988: pers. comm.).

A rudder from a small boat was found near the surface of the sediments amidships, and may indicate that the ship's boat was secured to the deck in that location. It seems unlikely, however, that so useful an item as the ship's boat would have been scuttled along with the vessel. Therefore, the rudder could be a spare or, since it was recovered from near the surface, could have been deposited on the site at a later time.

Along with an array of ship's equipment, the forward hold contained a ton of coal for heating and cooking. Merchant vessels generally attempted to maximize profits by carrying cargo as ballast. In the American Colonial period,

ships often arrived in the Colonies with paving stones, building stones, bricks and coal as ballast, as well as heavy manufactured goods (Middleton 1953). English collier brigs routinely discharged their coal in London, then proceeded to Northfleet where they took in chalk ballast to be sold in the coal-loading port (Runciman 1926: 77).

The Navy Board was no less inventive in its efforts to provide efficient transport service to the British Army. After 1779, all the coal required for troops in North America was transported as ballast in the transports (Baker 1971: 198).

Identity of the Site

It was military items which provided the essential clue to the identity of site 44Y088. Four buttons from the 43rd Regiment of Foot were found, thus launching an investigation into the movement of this unit. Recently-obtained regimental order books for 1781 show that on July 16, troops from the 43rd Regiment were transported from Portsmouth to Yorktown aboard the ships Diana, Providence Increase and the 150-ton brig Betsy.

Reference to Lloyd's Register of Shipping verified that a brig Betsy of 180 tons was converted to a transport in 1780. This vessel, built in Whitehaven in 1772, disappears from the Register following the American Revolution. The captain listed in the Register is John Younghusband, the same as listed on the accounts of the Yorktown transports.

Apparently, this is the same vessel, and the tonnage in the order book was incorrectly given. The tonnage computed for 44Y088, just over 176 tons, matches perfectly.

Adding credibility to this identification are two barrel heads found on 44Y088 bearing the initials "FY" which seem likely to be those of John Younghusband. Although additional research must be conducted, it seems very likely that Yorktown shipwreck 44Y088 is the English brig Betsy.

Summary

In the final analysis, evidence of stores and rigging from vessel 44Y088 has presented the opportunity to study a relatively significant sampling of ship's equipment and supplies from an English merchant brig from the late eighteenth century. Since little attention has been paid to merchant vessels from that period, the Yorktown Shipwreck Archaeological Project has increased our understanding of these common, yet little-known workhorses of commerce.

APPENDIX A
EXERPTS FROM INVENTORIES OF SHIPS' STORES

APPENDIX A
 PORTIONS OF AN INVENTORY OF THE
 PENNSYLVANIA SHIP MONTGOMERY, 300 tons, 1776
 (Hazard 1856)

Inventory of Cabin Stores.

2 pewter Dishes.	6 Brass Candlesticks.
1 doz. pewter Plates.	6 half pint bowls and sawsers.
22 knives and 22 Forks.	2 White Quart Mugs.
2 frying Pans.	2 doz. Cups and sawsers.
1 Grid Iron.	1 Peper Pot.
1 Iron Ladle.	1 doz. Soup plates.
1 pair Tormenters.	2 doz. wine Glasses.
2 Iron Tea Kettles.	1 Dutch Oven.
2 pair Snuffers.	1 Sugar Canaster and Lock.
2 Coffee Potts.	1 Drudging Box
1 doz Chairs.	1 Peper Box.
5 Tables.	6 Canvis Bottom Chairs.
3 Punch Bowls.	1 Egg Slice.
6 Yellow Dishes.	1 Nutmeg Grater.
4 Tumblers.	1 Candle Box.
24 Yellow Plates.	1 Bread Greater.
2 Salts.	1 Dripping Pan.
1 Vinegar Crewet.	3 Copper Sauspans.
2 Jugs.	1 Coffee Mill.
2 Decanters.	2 Chamber Potts.
1 Tyrene.	1 Cheese Toaster.
1 Mustard Pot.	1 Dust Pan.
1 doz. Pewter Spoons.	2 Cullanders.
2 Mugs.	3 Blacks Jacks.
2 Bowls.	1 Brass Ladle
4 White Pine Tables	1 Copper Coffee Pott.
6 China Cups and sawsers.	2 Wash hand Basins & Bottles.

Inventory of Masters' Stores.

2 half hour glasses.	2 Speaking Trumpets.
1 half Minute glasses.	4 Hand do.
1 Quarter Minute glasses.	6 Log Lines.
1 Brass Compass.	2 Log Reels.
1 Wood do.	4 hand Leads and Lines.
1 Depsey Lead and Line.	4 Anchors.
12 Sticking Candlesticks	3 Cables.
4 horn Lanterns.	3 Towlings.
4 Tinn Lanterns.	1 Barg with 8 Oars.
12 Signal do	2 Shoulder Mitten Sales and Masts with aurning.
1 Quire Log Book Paper, Masts yards Stand'g & Running Rigon Compleat.	1 Yawl with 6 do.
	1 Jolley Boat 4 do.

MONTGOMERY Stores (Continued)

Inventory of the Boat's Stores

148 Hammocks.	4 doz Thimbles & Hooks.
2 Lanthorns.	2 Coyles 2 Inch Rope.
12 Marlin Spikes.	2 do 2 1/2 do.
6 Fidges.	1 doz. Shovells.
10 lbs Sowing Twine.	1 doz. Painting Brushes.
8 Scrapers without handles.	6 Long Tar Brushes.
1/2 yd. read & green Baze.	12 Hickery Brooms.
7 doz. of Points.	1/2 Hundred wt. of Tallow.
3 1/2 doz Robins 2 1/2 Inch.	6 Caggs Lamblack
4 Love Tackles.	9 Balm Irons.
80 Spare Blocks.	18 Sail Hooks.
4 doz. Gaskets	18 Bolt Rope Needles.
2 doz. Scrapers.	30 Sowing do.
6 Mellats.	1 Coyle Virmin
3 Coyls 3 Inch Rope.	12 Buckets.
12 Fatham of 5 1/2 Inch Rope.	8 Mops without handles.
3 Coyles of 12 Thread Rattling.	1 Pott White Lead.
3 Coyles of 3 yarn Spunyarn.	

Inventory of the Carpenter's Stores

29 lb Spikes.	13 p hand Sheakle.
34 lb 2/ & 2/6d Nails.	2 Pump Gallises.
10 lb 10d & 20d do.	3 Set Pump Geers.
162 lb Bolts.	3 Case Bottles.
5 1/2 doz Large & Small Steples.	1 Iron Brace with 2 Square bitts.
1 Boat Hook.	450 Willding Nails.
4000 Pump Nails.	1 doz Willding Hooks.
2500 Sprigs.	4 1/2 doz. Ring & fore locks.
36 feet 3 Inch plank, pine	18 do 2 do. do.
18 feet 2 Inch do.	24 Leader Bolts.
27 feet 4 Inch Oak Plank	1 Iron Pitch pot & Ladle.
10 do 2 1/2 do. do.	2 Spare Topmasts.
1 Lower Yard.	

APPENDIX A (continued)

PORTIONS OF AN INVENTORY OF THE
CONTINENTAL FRIGATE RALEIGH, 1778
(Brewington 1966)

CAPTAIN'S CABBIN

2 Bulk heads	Wine Glasses
1 Pantry	Muggs
1 Pine Table for the Steward	Punch Bowls
1 Mahogany Table	Table Cloth
1 Looking glass	Towels
12 Canvas Bottomed Stools	Copper Kettles
1 Copper Stove Compleat	Stewpans
1 Cott	Sauce Pans
2 Globe Lamps	Frying pans
1 Hanging [tell tale] Brass Compass	Candle Sticks & Snuffers
Dishes	Spoons
Plates	Salt Mustard & pepper Box
Knives & Forks	Tea Kettle
Tumbler Glasses	

Wood work, Blocks &c. Occasional & Spare

15 Spare Oars	4 Trucks for Mast Heads
10 Large Dead Eyes	4 Iron Straped Snatch Blocks
10 Small Do	1 Vial Block
36 [Single Blocks]	40 Sheaves
34 [Double Blocks]	50 Pins
2 [Triple Blocks]	

Ship Chandlery & small Stores Occasional

2 Log Reels	12 Ballast Shovels
1 Deep sea line reel	6 Ballast . Basketts
28 Scrubbing Brushes	17 Half Hour glasses
8 long handled Tar Brushes	28 Half & Quarter minute Do
12 Short Ditto	3 Four hours Do
8 Handspikes	3 Two hour Do
3 Splicing Fids	1 Azamuth Compass
2 Commanders	1 Amplitude Do
3 Mizen Hoops	2 Sailing--Brass Do
12 Seizing Trucks	4 Sailing--wood Do
1 Chest for Colours	20 Fishing Leads
1 Do for Compass & Glasses	5 Deep Sea Do
144 Brooms	5 Hand do
12 Bucketts--wood	2 Hanging [tell tale] Compasses
12 Ditto--Leather painted	

APPENDIX A (continued)

PORTIONS OF AN INVENTORY OF THE
CONTINENTAL FRIGATE ALLIANCE, 1781
(Brewington, 1966)

Partial list of "Sundries under the Care of the Boatswain"

4 Coils 4 1/2 Inch Rigging	4 Small Lanthorns
4 Coils 3 3/4 Inch Rigging	4 Signall ditto
1 ditto 3	6 Cod Leads
4 ditto 3 1/2	3 Dep Sea Leads
15 do Ratline	24 Cod Lines
1 Sheet Anchor	4 Hook Stoppers
1 Sheet Cable 18 Inches	2 Bitt Stoppers
1 Best Bower Anchor	12 Keggs Lampblack
1 Best Cable 17 1/2 Inches	20 Scrubbing Brushes
1 Small Bower Anchor	210 Hammocks
2 Small ditto Cables	36 Nippers
1 Stream Anchor	12 Swabs
1 Stream Cable	72 Lignum Vitae Pins
2 Cage [Kedge] Anchors	16 Hand Leads
1 9 Inch Hauser	4 Hand Lines
1 7 Inch do	1 Deep Sea line
1 Grappling for the Boat	20 Sides of Leather
2 Fire Grapplings	24 Hickery Brooms
36 Scrapers	6 Log Lines
68 Iron Hooks Assorted	7 Yards Red Baize
108 Needles do	50 wt Marlines
33 Palm Irons	50 wt Whiping Twine
11 Shovels	13 Tar Brushes
18 Marling Spikes	1 Cagg Hogs Lard
2 Top Mauls	3 Feeds [Fids]
2 Iron Fides	7 Water Bucketts
2 Top Chains	14 Gauskets [Gaskets]
2 Fish Hooks	48 Robins [Robbands]
45 Cod Hooks	24 Points
170 Spare Blocks of Diff. Sizes	1 Spare wheel Rope
4 Cat Blocks	1 Bolt Oznobrakes
4 Top Blocks	6 do Russia Ducks
1 Sett of Top Takle Blocks	3 do ravens Duck
14 Serving Mallets	25 wt Sewing Twine
4 Snatch Blocks	1 New main Sail
3 Buoys	1 old main Sail
30 Shieves	3 main top Sails
4 Top Gallt Trucks	3 fore Sails
2 Messengers	3 fore top Sails
2 1/2-Barrels Tar	2 mizen top Sails
4 wt [pounds] of Bees Wax	2 mizen
& Tallow	1 mizen Stay Sail

ALLIANCE Stores (continued)

Boatswain's Stores (continued)

2 Jibbs	1 Driver
4 fore topmast Stay Sails	1 Ringtail
1 Main Staysail	1 Boom Mizzen
2 main topmast Stay Sails	1 main topgallant Stay Sail
1 Top Sail, old	1 Spritsail Topsail
1 Top gallt Sail	1 Jibb of Jibbs
5 Top gallt Steering Sails	1 Mizzen topgallt Stay Sail
2 middle Stay Sails	2 main Topgallt Sail
6 topmast steering sails	1 fore topgallt Sail
3 lower steering Sails	1 mizen topmast Stay Sail
1 Top gallt Stay Sail	1 Sprit Sail
3 Royals	2 Barges Sails
1 Boat sail	1 old main Sail to be made use of for old Canvass
4 1/2 Coils 2 Inch Rope	25 lb Twine
1 Coil 2 1/2 Inch do	2 Coils 3 Inch Rope
2 Coils 3 Inch do	9 Coil Ratline
100 lb of Worming	9 Small Coils Rope [2-3 Inches]
2 Blew Flags	1 Suit of French Collors
1 Red do	1 dutch Ensign and Pendant
2 Blew and Yellow do	2 English Ensigns. 1 Pendant
2 Yellow do	1 Jack
2 red & white do	2 America Pendant 1 Jack
2 Blew & white do	2 America Ensigns
2 red & yellow do	1 Engine [pump or fire engine]
2 Blew and white pendants	12 Buckets
1 red do	3 Tons of old Jounk
2 Blew and yellow do	1 Barge
2 red and white do	1 Pinnacle
1 yellow ditto	1 Cutter
	1 Jawl

Provisions and Stores under the Care of the Purser

29000 wt Bread	2500 wt of Cheese
103 Barrels Salt Beef	1 Hoghead Molasses--102 Galls
10 Tierces ditto	2000 wt of Fresh Bread
33 Barrels Pork	921 wt Soft Bread
8 Tierces ditto	9091 wt of Biscuit
20 Barrels Flour	15984 wt of Fresh Beef
15 Hogsheads N. E. Rum	2 Tierces Brandy 115 galls
3 ditto WI ditto	1 do do 100 do
8 Firkins Butter	11 Boxes Candles
19 Boxes Candles	7 Casks pease
2 Barrels Coffee	108 wt Raisins
3 Barrels Sugar	24 cords Wood
2 Bushels Salt	10185 wt Vegetables
2 Casks Pease--62 Gall	510 wt ditto
70 Bushels Vegetables	[307 Galls Rum]

ALLIANCE Stores (continued)

Partial List of "Sundries under the Care of the Carpenter"

36 Oars for Boats	2 Sounding Rods
1 Set of Chain Pumps	6 Pump Breaks
2 Wooden Pumps	6 Boat Hooks
3 Axes	1 Haser Gauge
3 Adds [adzes]	4 small Guages
3 Mauls	3 Drawing Knifes
3 Handsaws	2 Starting Hammers
12 Chizels	14 Scupper Nails
10 Spike Gimblets	4 Pump Tacks
10 Decknail do	39 wt 6d Nails
24 small do	3 m Clapper Nails
1 Pr Cannippers	6 Padlocks
4 Compasses	2 Barlls Pitch
4 Rules	2 do Turpentine
4 Chalk Lines	3 do Tarr
1 Iron Square	3 qrs Tallow
1 Whip Saw	10 gallon Oyl
1 Cross Cut Saw	30 wt Putty
1 Key hole Saw	60 wt Chalk
1 Pannel Saw	6 Ringbolts
6 Hand saw files	12 Eyebolts
6 Cross cut do	2 Sets spar Hatch Barr for
2 Whip Saw do	Lower Deck
1 Handsaw Sett	1 set spare Chains for ye
2 Caulking Mallets	Chain Pump
12 Caulking irons	2 Grind Stones
1 Jointer	1 Rat tale file
2 Bead plaines	2 drift Bolts
2 smoothing Plaines	6 wood Axes
1 fore plain	4 2/ nail Gimblets
6 Hammers	2 tin Lanthorns
6 Cold Chizels	200 feet Oak Boards
2 qr Bolts	600 feet pine boards
1 qr Spikes	300 feet Oak Planck
50 wt deck nails	12 Boat Hook poles
50 do 2/ nails	1 Main Cap
50 wt double Tens	1 Topmast Cap
6 m Board nails	10 yds woolen Cloth for Ports
3 m 4d do	4 Spoon bladed 16 feet Oars
3 Crows	for Pinnice
72 Fore locks	5 Common do 14 do
12 Sticking Candlesticks	for yawl
6 Iron Wedges	8 ditto 18 do
72 Rings	for Cutter
96 Staples	1 Spare Jibb boom
12 Spare Chain Bolts	1 do fore Topmast
12 Augers	1 do fore Topgallnt Mast
6 Foothook plates	1 do fore top gallt yard
14 spare dead Eyes & Chain plates	1 do royal yard

ALLIANCE Stores (continued)

Carpenter's Stores (continued)

28 wt Brimstone	1 do main yard
1 gr Sheet Lead	1 do main Topsail yard
4 Hide Pump Leather	1 do main Top gallt yard
6 Pump Speares	1 do royall yard
6 Lower Pump Boxes	4 Upper Deck Hatch Barrs
2 Pump Hooks	6 Spare Studden Sail Yards
25 wt of 2/ Nails	Sundry fishes made up on Board
50 wt Double Tenns	last Cruise fit for use again
2000 10d nails	3000 6d Nails
3000 Clapper Nails	2200 pump Nails
20 wt Nails 5 inches Long	3 Lower Dead Eyes
3000 Scupper Nails	100 wt Oakum
2 Topmasts	

Return of Captain Steward Stores

4 doz Plates	1 Mustard Pott
2 Bowls	1 Oyl Cruet
2 Turins [tureens]	2 Large Copper Kettle
1 Teapot	1 Stew pan
18 Knives & Forks	1 fish Kettle
18 wine glasses	1 Ragout Kettle
2 Muggs	1 frying Pan
1 Jugg	4 Candle Sticks
Several Cups & Saucers	1 gridiron
2 sauce pans	1 Wash pan Bason
1 Tea Cannister	1 stove
2 Tea Kettle	1 Shovel & Tongues [tongs]
2 white point [pint] mug	1 Table
6 Tumblers	9 Table Cloaths
2 Salt Sellars	12 Towels
12 half point Muggs	1 Collonder

Sundries under the Care of the Cook

2 Leadles	1 Shovel
2 Bellows	1 pr Tongs
4 pr Tormenters [large forks]	

Sundries under the Care of the Captains Clerck

4 Blank Books	50 Quills
6 Quire Letter Paper	3 Sticks Sealing Wax
6 do Writing Paper	1 Paper ink powder
1 Pen Knife	6 Sticks Sealing Wax
1 ink stand	1 Bottle Ink
1 Box of Wafors [seals]	

APPENDIX B
A LIST OF THE BLOCKS REQUIRED FOR A
BRIG OF 160 TONS (STEEL, 1794)

BLOCKS	BOWSPRIT	SPRITSL	JIB	FOREMAST	FORETOPM	FORETGAL	MAINMAST	MAINTOPM	MAINTGAL	MISC	TOTALS	%
14 SINGLE				2			1				3	1
14 DOUBLE					2			2			4	1
13 S				2	1		6	1			10	2
13 D							1				1	0
12 S					3			3		2	8	2
12 D					2			2			4	1
11 S				4	1		8	1			14	3
11 D					2		4	2		2	10	2
10 S				4	1		5	1		2	13	3
10 D				4	1		7	1			13	3
9 S				4	1		17	1		2	25	6
9 D				4			1				5	1
8 S			2	14	2		3				21	5
8 D							1				1	0
7 S			1	16	31		15	35	1	4	103	25
7 D		4						1			5	1
6 S		6	3	14	14		4	13	10		64	15
6 D				6	1		4	3			14	3
5 S				1	5	10	2	4	13		35	8
5 D											0	0
4 S									2		2	0
EUPHRD 14							1				1	0
EUPHRD 12				1							1	0
DEADEYE 8				8			10				18	4
DEADEYE 7							2				2	0
DEADEYE 6					16			16			32	8
HEART 12							2				2	0
HEART 10				2							2	0
HEART 8				2							2	0
TOTALS	0	10	6	88	83	10	94	86	26	12	415	100

A LIST OF THE CORDAGE REQUIRED FOR A
BRIG OF 160 TONS (STEEL, 1794)

CORDAGE	BOWSPRIT	SPRITSL	JIB	FOREMAST	FORETPM	FORETGL	MAINMAST	MAINTPM	MAINTGL	MISC	TOTAL-FM	%
8 IN CIRC							12				12	0
7-1/2				8							8	0
7											0	0
6				6			4			12	22	0
5-1/2				8							8	0
5				57			77				134	2
4-1/2				6	11		30	12		21	80	1
4	49			57	16		73	16		126	336	5
3-1/2				4	124		18	156		21	321	4
3	3	3		118	12		144	7		80	366	5
2-1/2	9	26	62	231	82	19	467	96	14	291	1296	18
2	18	41	35	227	404	94	228	494	90	50	1679	23
1-1/2		66	31	178	88	116	64	161	131	54	888	12
1	4	14		89	85	137	178	73	217	10	806	11
3/4	11	18		176	142	45	222	137	78	377	1206	17
TAR*LINE	1				4	1		4	1	1	10	0
TOTAL-FM	94	168	128	1163	966	411	1515	1153	530	1043	7169	100
										TOTAL-FI	43011	
										TOTAL-MI	8.15	

GLOSSARY

- Ballast:** Dense material (usually stone, iron or sand) placed in the hold of a vessel to lower its center of gravity, thus increasing its stability.
- Bibs:** Wooden cheeks, or shoulders, bolted to the mast below the masthead to support the trestletrees.
- Block:** A pulley (wheel in a wooden case) through which a rope or ropes are passed to create a mechanical advantage for lifting, controlling sails, etc.
- Block strap:** A rope or iron strap wrapped around a block to allow it to be attached to a fixed point or other block.
- Boatswain:** A warrant officer or senior sailor responsible for all equipment pertaining to the working of a vessel.
- Boltrope:** The rope sewn around the edges of a sail to give it strength and to attach support and control ropes.
- Boom:** A spar used for extending the foot of a fore-and-aft sail.
- Bowsprit:** A mast-sized spar extending forward from the stem of a vessel to permit attachment of headsails.
- Brig:** A two-masted vessel, square-rigged on both masts.
- Brigantine:** A two-masted vessel, square-rigged only on the forward, or foremast
- Bulkhead:** Wooden partition, transverse or longitudinal, which separates portions of a vessel into compartments.
- Cable-laid:** A heavy rope made by twisting three hawser-laid ropes together (see Figure 11); a cable is a heavy rope attached to an anchor.
- Cargo:** Merchandise carried aboard a vessel from port to port, usually for hire or for sale.
- Ceiling:** The long, longitudinal wooden planks which are attached to the inside of the frames on most wooden vessels to form an inner "skin."
- Chain plates:** Iron straps bolted to the outside of a vessel's sides to which the mast supports (shrouds) are attached by rope and deadeyes.

- Collier:** A vessel which carries coal; more generally, a type of merchant vessel which is flat-floored, bluff-bowed and designed to carry a large cargo.
- Cordage:** a general term for rope, hawsers and small stuff; also a general term for the running rigging of a vessel.
- Cringle:** A short loop of rope spliced into the boltrope of a sail to allow lines to be attached.
- Cross trees:** Wooden spreaders attached to masts transversely across the trestletrees to support upper mast sections via shrouds and deadeyes.
- Deadeye:** A circular wooden block with no sheave (pulley), but instead having three holes through a lanyard, used to tighten shrouds and stays is passed.
- Driver:** The gaff-headed sail on the aftermost mast of a ship, bark, brig, snow or brigantine.
- Fathom:** A length used for the measurement of depth (and sometimes, length of rope); a fathom is six feet, originally, the length of the spread of a man's arms.
- Fid:** A tapered wooden shaft used for opening strands of rope for splicing.
- Frame:** The timber structures which give a vessel its form and strength, providing the skeleton upon which the planking is attached; sometimes referred to as "ribs."
- Gaff:** A spar to which the head of a fore-and-aft sail is attached.
- Halliard:** A rope used for hoisting a sail, gaff, yard, flag, etc.
- Handspike:** a bar with one end squared for use in turning capstans and windlasses; in gunnery, a crowbar-like bar used for training a cannon.
- Hawser:** A heavy rope or light cable, generally with a circumference of 5 inches or more, used for anchoring, mooring, etc.; hawser-laid rope is made up of 3 strands twisted counter-clockwise, and is the most common type of rope aboard a ship.
- Head:** The upper end of a mast.
- Heel:** The lower end of a mast.
- Hold:** The lowest space in the hull of a vessel where ballast, cargo and stores are placed.

- Hull:** The main structure of a vessel, consisting of the planked frames and decks, but not including the masts, yards and rigging.
- Hull lines:** A set of related curves in three views which describe the complex three-dimensional shape of a vessel's hull.
- Keel:** The large, longitudinal wooden beam which provides the main support ("backbone") of a vessel; the frames ("ribs") are bolted to the keel.
- Mast:** A round pole, set vertically in a vessel for the purpose of supporting the yards and sails. Ships generally carried three masts: foremast, the mast closest to the bow; mainmast, near the center of the vessel (the aftermost mast on a two-masted vessel); mizenmast, the aftermost mast on a ship (see illustration for details).
- Oakum:** Old hemp or manila rope fibers which have been tarred for use in caulking seams in decks and planking to waterproof the seams.
- Parcelling:** To wrap a rope with long, narrow strips of tar-soaked canvas to protect the rope from weathering and chafing.
- Planking:** The long, longitudinal wooden planks which are attached to the outside of the frames to make up the outer "skin" of a vessel's hull.
- Pole mast:** A mast or mast section made from a single tree, as opposed to a mast built-up of several segments.
- Powder magazine:** A compartment or space, almost always below the waterline in a vessel, for use in stowing gunpowder.
- Provisions:** The supplies of food, beverages and clothing carried aboard ship for the sustenance and support of the crew.
- Purser:** On a warship, a warrant officer in charge of ship's provisions; the captain or a senior officer may serve the function on a merchant vessel.
- Rig:** A term used to indicate the configuration of a vessel's masts and sails (e.g., "brig-rig"); "rigging" is the general term for the ropes, blocks, chains, etc., which support and move masts, spars and sails.
- Rope:** Any type of cordage, above one inch in circumference, used in rigging and other shipboard use; includes hemp, manila, sisal and coir (see Rope Form, Figure 11).

- Running Rigging:** The portion of a vessel's rigging which is moveable and passes through blocks for adjusting spars and sails (e.g., halyards, sheets, etc.)
- Sail:** A configuration of segments of canvas or other material sewn together and suspended on spars to convert wind to motive power for a sailing vessel.
- Schooner:** A two-masted vessel with sails rigged fore-and-aft instead of square, but with often a square fore-topsail (18th century).
- Scuttle:** To purposefully sink a ship, usually to prevent capture in time of war; also an opening in a ship's deck.
- Serving:** To wrap a material such as small lines, leather or canvas around a rope to prevent fraying, weathering and chafing; often the served rope is tarred.
- Sheet:** A rope or tackle used for trimming a sail to the wind; on a squaresail, a sheet is attached to each of the lower corners (clews).
- Ship:** Used in the generic sense, the term refers to sea-going vessels, as opposed to boats; as a description of a type of rig, it refers to a sailing vessel with square sails on all three masts.
- Spar:** A general term for all rigid supports used in the rigging of sailing vessels; it includes masts, yards, gaffs, booms, etc.
- Splice:** A method of joining two ropes together or forming a loop or "eye" in a rope by unlaying the strands and intertwining them in a specified manner.
- Spun-yarn winch:** A small wooden reel used for twisting two or three rope-yarns into spun-yarn, which has many uses on the rigging of a vessel.
- Square-rigged:** A vessel with one or more masts with a sail or sails set on a yard(s) perpendicular ("square") to the mast(s).
- Sheave:** The revolving wheel in a block, generally made of Lignum vitae, a durable hardwood.
- Sheave pin:** The wooden or metal dowel which forms the axle upon which the sheave revolves.
- Shroud:** The heavy ropes used to provide lateral support to masts; shrouds are part of the standing rigging.

- Shroud-laid:** A rope made up of four strands twisted around a central core or heart; used for shrouds because it was less likely to stretch than hawser-laid rope.
- "Slops":** articles of clothing carried on board ships for sale to seamen as needed; the term often included other incidental items as well, such as needles, thread, etc.
- Snow:** A vessel rigged as a brig, but with a small "trysail" mast stepped directly behind the mainmast to carry the driver or spanker, thus allowing a main squaresail to be set; generally the largest European two-masted vessel.
- Standing rigging:** The parts of a vessel's rigging that is fixed and supports the masts, e.g., stays, shrouds, etc.
- Stay:** The heavy ropes used to provide fore-and-aft support to masts; stays are part of the standing rigging.
- Stem (stern) perpendicular:** Imaginary vertical lines drawn at specified points at stem (bow) and stern to assist in defining the length and tonnage of a vessel.
- Stores:** Those materials required for self-sufficient operation, maintenance, communication, protection and repairs, and care and sustenance of crew and passengers.
- Tar (pitch):** The residue after distillation of pine tree gum, used as a protective coating on standing rigging and ropes of all types; pitch is a mixture of tar and coarse resin which is mixed with oakum for caulking seams.
- Thimble:** A circular or heart-shaped ring made of wood or metal around which a rope is spliced to form an "eye."
- Trestle trees:** Wooden timbers attached at right angles to the crosstrees to give them support and to secure mast sections together.
- Trucks:** Spherical pieces of wood with holes drilled through the center which are strung on a rope to form a parrel for securing yards to masts; also, the wooden caps fitted at the top of masts through which signal halyards are often passed over sheaves.
- Worming:** Passing a small line spirally into the lays of a rope or cable for strength and to smooth the rope for serving or parcelling.
- Yard:** A spar upon which a squaresail is set.

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