UNDERWATER ARCHAEOLOGY PROCEEDINGS FROM THE SOCIETY FOR HISTORICAL ARCHAEOLOGY CONFERENCE

PAUL FORSYTHE JOHNSTON, Editor

Society for Historical Archaeology
Washington, D. C. 1995

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FOREWORD

PAUL FORSYTHE JOHNSTON, EDITOR

What is going on in North Dakota? Perhaps the real question should address what is *not* happening there, for it was the only state not represented at the 1995 Annual Conference on Historical and Underwater Archaeology in Washington, D.C. No fewer than 1,213 registrants from 49 states and 19 foreign nations attended what turned out to be the largest annual meeting in the SHA's history.

In the conference's underwater program there were two workshops, seven round table luncheons, 13 sessions, and a total of 91 presentations. Fully one-third (30) of the papers were devoted to foreign sites or issues, with the remainder on North American subjects. These numbers should mitigate the perennial reviews of these *Proceedings* noting the lack of foreign content. Of the 30 papers on international subjects, 11 were submitted and accepted for the 1995 *Proceedings*. Reviewers, take note, and please help encourage our foreign colleagues to submit their presentations! In fact, these figures represent a growing international recognition of the worldwide scope of our annual meetings. Special thanks are due to prior *Proceedings*' editors Toni Carrell and Robyn Woodward for their hard work producing the authors' guidelines and editor's handbook, which made much easier the tasks of writing, editing, and preparing these 33 papers for publication. SHA editor Ronn Michael also deserves thanks for shepherding these papers through the multi-stepped process into printed form.

After six years and two terms as Chair of the Advisory Council on Underwater Archaeology, I stepped down to regular ACUA membership in January 1995. Among the highlights of my tenure were our intense, protracted, and ultimately successful efforts to convert the Abandoned Shipwreck Act of 1987 from a dream into reality, and overseeing the transition of the ACUA into a democratically-elected body of the SHA. We have turned the chair over to Toni Carrell of Ships of Discovery at the Corpus Christi Museum in Corpus Christi, Texas. Toni's contributions to the ACUA and hard work in our field over the years have been outstanding, and we all look forward to her future leadership with great anticipation.

On the legislative front, this past year has been a very active one in our field in both North America and elsewhere. As this goes to press, divers in Maryland are being prosecuted for looting a wreck site, providing the first test case for that state's recently-enacted shipwreck legislation. Virginia salvors were convicted and fined for looting the Civil War wrecks of CSS *Florida* and *Cumberland* and selling the artifacts, and the Confederate Naval Historical Society received a reward for assisting the FBI in bringing these looters to justice. In addition, the American government passed the National Maritime Heritage Act of 1994, wherein 25 percent of the proceeds from scrapping the nation's Ready Reserve Fleet (old freighters mothballed for use in armed conflicts) will offer matching money to maritime heritage projects. The programs will be administered by the National Trust for Historic Preservation (educational and program projects) and the National Park Service's National Maritime Initiative (National Register and Landmark capital projects). An advisory group of maritime preservation professionals will review proposals. Finally, the Abandoned Shipwreck Act survived another legal challenge to its constitutionality in Illinois, which builds upon the body of case law supporting its application.

Overseas, the governments of the Cayman Islands (British West Indies) and Bermuda are currently reviewing tough new legislation that will severely restrict treasure hunting. Elsewhere, the nations of Mozambique and Mauritius in the Indian Ocean have been approached by salvors seeking permits to treasure hunt in their sovereign waters. Rather than issue permits, these governments have sought the assistance of the ACUA in obtaining model legislation to help them draft laws to protect their submerged cultural resources.

These positive developments in the legislative arena are offset somewhat by events in the museum field. Contrary to the advice of its Archaeology Sub-Committee, the International Congress of Maritime Museums (ICMM) elected to do nothing about the National Maritime Museum decision to display recently-salvaged *Titanic* artifacts at Greenwich, London. Finding that the National Maritime Museum decision constituted no fewer than 20 violations of the ICMM's 1993 ethical guidelines, the Sub-Committee recommended expulsion from the organization; Barrie Andrian's seminal paper on British shipwreck legislation in these *Proceedings* may help to explain why the ICMM failed to act in this matter. Two small American museums contacted the ACUA for information on the ethics of treasure hunting exhibitions. One subsequently canceled its exhibit only a few days before the planned opening; the other went ahead with its exhibit over the director's objections but mounted a public debate between salvors and the preservation community at the opening. Despite these particular occurrences, it is clear that knowledge of the existence of museum guidelines for shipwreck treatment is spreading, and it is encouraging to witness the increased level of professional inquiry.

Of equal significance is the decision by the federally-funded National Endowment for the Humanities (NEH) in Washington, DC to partially fund a proposal for a traveling exhibit by the Mel Fisher Maritime Historical Society in Key West, Florida. Only two of the six reviewers gave the proposal strong recommendations, yet the NEH set aside the majority opinion of its expert panel and supported the project. Copies of the grant proposal and reviewers' comments are available from the Humanities Projects in Museums, Division of Public Programs, National Endowment for the Humanities, Washington, DC 20506 USA, tel. 202/606-8284.

In closing, the ACUA would like to acknowledge the passing on 6 January 1995 of one of our field's staunchest supporters, Capt. Ernest W. Peterkin, USN (Ret.). One of the foremost experts on early ironclads, Ernie was an enthusiastic presence at many of our conferences, where his good cheer and lively wit inevitably led to congenial discussions and new insights. We extend our condolences to his wife and family and trust that Fiddlers' Green will be much enriched by his wonderful tales.

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SYMPOSIUM

RICHARD W. LAWRENCE, MODERATOR

Underwater Archaeology in North Carolina: Current Research

Introductory Comments

North Carolina has a long and rich maritime history. With over 300 miles of ocean shoreline, a vast inland sea formed by the coastal sounds, and thousands of miles of navigable rivers and creeks, the people of North Carolina have long relied on the state's waters as a means of transportation and trade and a source of livelihood. Coupled with this active maritime history, the treacherous geography of the North Carolina coast has led to countless shipwrecks. Naval warfare, particularly during the Civil War, has created additional losses.

For the past 30 years, the Underwater Archaeology Unit (UAU) has made steady progress in its efforts to understand and manage the state's submerged cultural resources. The UAU has documented over 600 underwater archaeological sites that include prehistoric dugout canoes, colonial sailing vessels, beached shipwreck remains, dozens of Civil War shipwrecks, and 19th- and 20th-century steamboats. The UAU also maintains extensive files on nearly 4,000 historically documented shipwrecks, as well as on a wide variety of water-related subjects such as bridge and ferry crossings, historic ports, plantation landings, riverine and coastal trade, harbor development, and improvements to navigation.

In its efforts to study the state's submerged sites, the UAU has benefited tremendously from its association with East Carolina University's History Department (ECU). Fifteen years ago, in May and June 1979, the UAU and ECU participated in their first cooperative project—an underwater archaeological survey of the colonial harbor of Bath, North Carolina. Other field schools followed, and in the fall of 1981, thanks to the efforts of Dr. William Still, ECU launched its graduate-level program in maritime history and nautical archeology.

The relationship between the UAU and ECU has been mutually rewarding. In many cases the UAU has been able to suggest sites for thesis research, as well as furnish personnel and equipment to assist in field operations. In return, the students provide the resources of the university including the participation of the program's professors and students, field equipment, and perhaps most importantly, the time and commitment necessary to conduct in-depth historical and archival research, site analysis, and report preparation. Since 1981, 11 theses have been completed that deal with a specific shipwreck site in the state or some aspect of North Carolina maritime history. In addition, field work has been completed on another seven thesis projects—four of which are reported upon in this symposium. Another eight thesis proposals have been submitted by ECU students for future study of other North Carolina shipwrecks.

At the 1989 Baltimore Conference on Historical and Underwater Archaeology, I presented a paper entitled "Current Underwater Archaeological Research In North Carolina." On that day I spoke briefly on a variety of projects with which the Unit had been involved over the preceding two years. It is very gratifying to return today to host an entire session on the same subject.

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The MacKnight Shipyard Wreck: An Interim Report

Introduction

A colonial shipyard owned by Thomas MacKnight came to the attention of the North Carolina Department of Cultural Resources Underwater Archaeology Unit (UAU) in 1992. The shipyard and surrounding waters were surveyed in 1993 by the UAU and students from the Maritime History and Nautical Archaeology Program at East Carolina University (ECU). During remote sensing, vessel remains were discovered in the North River, or Indiantown Creek, as it is known locally. The site (0001NCR) was dubbed the MacKnight Shipyard Wreck (Wilde-Ramsing 1993). In 1993, the author conducted an historical and archaeological investigation of the site for a thesis project. This paper describes the findings and preliminary conclusions.

Historical Background

Thomas MacKnight emigrated to Virginia from Scotland in 1755. In 1757 he moved to the Currituck County area in North Carolina and started a shingle/stave operation with the backing of partners in Norfolk, Virginia (Merrens 1964: 105). He bought large tracts of land along the Pasquotank and North rivers (Snowden 1982: 1). MacKnight's Belville plantation center was located near Indiantown Creek bridge, the head of navigation along the only road from Currituck to Pasquotank counties and the main road from Norfolk to Edenton (Loyalist Papers 1782). The location was a wise choice as shingles, staves, and other local products could be shipped via the river and sound to Norfolk and New Bern for sale or overseas shipment. MacKnight's success was such that the official inspection station for shingles, staves, tar, turpentine, and other goods was at Indiantown Bridge rather than Port Currituck, the port of entry for the area (Saunders 1968 [1886-1890]; Clark 1900 24: 580-586). MacKnight had several valuable slaves trained as ship carpenters who could build a ship by themselves with a master builder as an overseer (Loyalist Papers 1782).

Politics were MacKnight's downfall. A Currituck County representative, he was present at the Second Provincial Congress in New Bern where he refused to sign a resolution calling for non-consumption, importation, or exportation of British goods. His refusal branded him a Tory, and he fled to England in October 1775 (Saunders 1968[1886] XXI:263).

The records are unclear when the next property owner took possession, but by 1787 the sawmill was back in operation, continuing intermittently until the early 20th century (*The State Gazette of North Carolina,* 29 November 1787). MacKnight's store, located next to the bridge, remained in business until the late 1940s or early 1950s (Wilbert Roberts 1994, pers. comm.). A local center of activity, the store was the Indiantown Post Office from 1797 until 1882 (Aloha South 1994, pers. comm.). Since the store closed, the only traffic has been fishermen and sportsmen using the boat ramp at the bridge. There exists no record or local knowledge of sport divers in the area, and the river bottom seems undisturbed since MacKnight's time.

The Work

The vessel remains lie in a typical northeast North Carolina blackwater environment, with a maximum depth of 10 ft. There is minor tidal change and current during normal conditions. During May 1994, a storm changed river conditions, lowering the water table ca. 3 ft., introducing a current of ca. 1.5 knots and reducing visibility to less than 6 in. A transit set up on shore recorded angles, distances, and depths for the stem, stern post, and three futtocks at the bow, amidships, and the stern.

The vessel lies with its bow against the shore and the stern angling into the river. Initial survey revealed an intact lower hull structure including the keel, keelson, floors, futtocks, and planking. Its overall length is 44 ft. 4 in. with a measured beam of 13 ft. 10 in. The beam

measurement was taken at the last set of complete futtocks forward of the midship bend; a projected beam would be ca. 14 ft. 6 in., yielding a beam-to-length ratio of 5/12ths (Rees 1970 [1819-1820]:3). Depth of hold is estimated at 4–4.5 ft.

The keelson is 38 ft. 10 in. long, sided 8 in. and molded 6-1/4 in. It terminates short of both the stem and stern post, like the Rose Hill wreck keelson (Wilde-Ramsing 1992:42). This was a common construction practice until 1750 (Goodwin 1987:28). The keelson changes from a true keelson to a keelson plank just aft of the saddle step at the 25-ft. mark, where it slopes downward before terminating forward of the stern post. A similar keelson-to-plank transition was found on Vessel No. 20 in Savannah, Georgia (John W. Morris III 1995, pers. comm.), and a double keelson plank was found on the *Eagle* (Crisman 1987:Figure 44).

The keelson is notched over the floors like *Charon* (Steffy 1981), the Yorktown "cofferdam wreck" (Broadwater et al. 1985), the British-built *Victory* (Steffy 1981), and a Federal Period vessel near Oriental, North Carolina (Jackson 1992:82). Floors were bolted through the keelson into the keel, using 1-in.-diameter bolts driven through augured holes and clenched on the upper ends without washers. The practice of bolting every floor did not appear in British shipbuilding until around 1800 (Rees 1970 [1819-1820]; Falconer 1815).

The stem appears to be one piece. The broken upper portion measures 5-1/4 in. sided and 4-1/2 in. molded. It expands until the stem/keel junction, where it measures 9-1/2 in. sided and 25 in. molded. There is no visible scarf or joint between stem and keel, indicating one-piece construction or scarfing beyond the first floor (where the keel was inaccessible). The keel measures 10 in. sided and 12-3/4 in. molded, with a 2-in.-molded shoe extending the width of the keel. A 1- x- 1-in. rabbet for the garboard strake is located 3/4 in. below the keel top. It runs the full keel length and extends up the stem for 1 ft. and the stern post for 2 ft. 4 in. The stern post is similar in size to the stem, but complete excavation was hampered by heavy organic matting and timbers. A notch cut from the upper stern post may have accepted the rudder pintel. Like the stem, there were two nails equally spaced on the stern post indicating deadwood, chocks, or knees. The nail location, similarity in post construction, and lack of rising timbers indicate a rounded stern (Broadwater et al 1985; Morris 1991).

Floors are of one-piece construction continuing over the keel and spaced on 18-in. centers. The floors are notched to fit over the keel with notches cut by hand tools, whose scars are clearly evident. The futtocks fit tightly between floors, with their heels ending 9–12 in. short of the keel. The tight fit of the futtocks indicates that room and space are equal. As far as could be determined, floors and futtocks are not attached to each other, with the exception of radial cant frames in the bow. Treenails fasten the after cant frame to the first floor and the forward cant frame to the stem. The cant frames were beveled to fit tightly against the keel and each other at the heels. Although there are no filler pieces, cant frames are similar in construction to ones on the cofferdam wreck (Morris 1991:Figure 8); vessel 20 in Savannah (John W. Morris III 1994, pers. comm.) and the Hilton wreck (Watts 1994). There is no evidence of iron fasteners used for the construction of the floors and futtocks, except for attachment of ceiling and exterior planking.

Exterior planking was accessible at the first floor on the starboard side. This plank measures 2-1/2 in. sided by 2 in. molded and shows signs of charring on the inside portion, suggesting that the "stoving" method was used for bending the plank. Ceiling planking is intact on both sides of the vessel. The port side limberboard was recovered for detailed examination, drawing, and sampling. Partially broken at the forward end, the board is 11-3/4 in. sided, 2 in. molded, and over 6 ft. long. Other ceiling planks average 8 in. sided. Planking is secured to floors and futtocks by treenails and fitted tightly together, indicating a dry hold. Nail holes on ceiling planks are random-patterned and few in number, suggesting they were used to hold planks in position before treenails were installed. The treenails are

polygonal, 1–1-1/4 in. across the flats and ostensibly unwedged.

The rudder is not attached to the stern post. One lower gudgeon strap on the stern post has a sheared-off pintel attached. The bottom of the rudder is 14-1/2 in. below the strap. A notch similar to one on the stern post is located just below the pintel strap. The interior edge of the notch is hollowed-out, and the leading edge of the rudder is beveled. The hollowing and beveling are described by Rees (1970[1819-1820]), Sutherland (1711) and others in works on 18th-century shipbuilding.

Mast step number and placement are unusual. There are three steps located 10 ft. apart, beginning 5 ft. aft of the stem; the first two are mortised into the keelson, while the third is a saddle step. The first step is 7 in. long by 5 in. wide, with a mortise cut completely through the keelson. A floor crosses partially under the step, so the mast would rest on both floor and keel. An augured hole for a drift pin forward of the step angles down through the step to the floor below.

The second step is also 7 x 5 in. but only 3-1/2 in. deep. The saddle step measures 9 in. sided, 12-1/4 in. molded and extends 1 ft. 7 in. beyond the keelson on each side. It rests on the ceiling plank. The 5- x 5- x 5-in. mortise is centered over the keelson. Upper edges of the saddle are beveled and rise 6 in. above the keelson. No fasteners were visible, suggesting fastening from below by treenails or bolts through the keel.

The last feature is a block located 9 in. aft of the saddle step. This block bears on the keelson, rises 6 in. above the keelson, and extends aft for 1 ft. It is fastened to the keelson (and possibly the keel) with three iron bolts spaced equally along its length. This might be a scarf-reinforcing block.

The site of the MacKnight Shipyard and its wreck has a long and varied history. Artifacts included brass shell casings, plastic shotgun shells, and fishing lures disregarded in the dating process. The quantity of older artifacts was small but the ceramics, brass, and pipe stems were dated.

Forty-six ceramic fragments were recovered from the wreck site, including one piece from under the limberboard. Most were creamware or pearlware, with some transfer printed pearlware, stoneware, and glazed redware. The mean date was 1794.

Of 64 glass fragments recovered, most were less than 1-in.-square, flat plate although there was a "mason" jar piece and a Coke™ bottle. Six brass or copper buttons were recovered. Their mean date of 1792.5 is very close to the ceramics' date. Five pipe stems measuring 1/16 in. and one bowl were recovered. Their date is 1750 to 1800, with a mean date of 1775.

A few leather items, including a small leather purse and fragments of two shoes, are undergoing conservation and have not been analyzed. A small number of hand-wrought, rose-headed iron nails, one drift pin, three links of 1/4-in.-wrought-iron chain, and a three-legged cast iron pot were recovered in the vessel. The cast-iron pot dates to between 1750 and 1850 (Tyler 1971:220).

Wood samples taken from the stem, keelson, ceiling planking, outer planking, and treenails were identified as North American white oak. The floors and futtocks were identified as southern red cedar (Newsome 1994, pers. comm.). The wood types suggest the vessel was American-built and probably Southern in origin.

The bluff bow, the framing pattern of the floors with the futtocks stopping short of the keelson, the equal room and space, and the keelson terminating short of the posts all indicate a construction date in the mid-18th century. The bolting pattern and keelson notching are similar to late 18th- and early 19th-century vessels. The key to dating this vessel may be in the cant-framing pattern. The frames appear to be a transition from the arrangement on the mid- to late-18th-century *Charon* (Steffy 1981) and other Yorktown vessels (Broadwater et al. 1971), and the pattern emerging from later vessels such as *Scuppernong* (Turner 1995). A preliminary construction date of 1770-1800 seems appropriate.

The locations of the rabbet, schooner mast steps, and other construction details are similar

to British man-of-war construction. The middle mast step, at one-third the length, is typical of 18th-century sloops. Other details, such as tight ceiling planking, beam-to-length ratio, and depth of hold indicate a merchant vessel. Construction details indicate the builder was familiar with, or perhaps trained by, someone with British Navy construction experience.

The wood types, a shipyard, and an on-site sawmill operation could indicate that the vessel was built locally. The presence of three mast steps confuses vessel identification. Based on the step locations and calculations provided by Marquardt (1986), I believe the MacKnight wreck began as a single-masted sloop but ended as a two-masted schooner. The foremast and the saddle step are the steps for the schooner; the middle step was for the sloop.

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The Cape Fear River Comprehensive Survey: Historical and Cartographic Research in Southeastern North Carolina

Introduction

Between March 1993 and October 1994, the state of North Carolina and the Wilmington District, U.S. Army Corps of Engineers (USACOE) conducted a cooperative project known as the Cape Fear—Northeast Cape Fear Rivers Comprehensive Study. The need for the study arose from USACOE findings that existing channel depths and widths were inadequate for deep-draft vessels at the Port of Wilmington. The Underwater Archaeology Unit (UAU) of the North Carolina Department of Cultural Resources agreed to conduct a historical, cartographic, and submerged cultural resources survey as part of the study.

Wilmington Harbor is a federal navigation project located along the Cape Fear and Northeast Cape Fear Rivers in New Hanover and Brunswick Counties, North Carolina (Figure 1). The navigation project extends from the Cape Fear River ocean bar upstream to a point 1.7 mi. above Wilmington on the Northeast Cape Fear River. Total length of the existing Wilmington Harbor project is ca. 33.8 mi. Over the last 100 years navigable depths and widths within the harbor have increased to their present 38-ft. channel depth up to Wilmington (USACOE 1992:3).

Project Design and Methodology

Investigations began with a review of cartographic references. Examination of over 145 maps provided detailed historical and current information which was added to a computer-generated AutoCad base map of the project area. Information obtained from the historical and cartographic review was used to produce maps that showed historic and current place names, lighthouse and beacon locations, fortifications, and plantation sites. A review of the state historical shipwreck files and map data yielded accounts of over 300 ship losses within the Cape Fear and Northeast Cape Fear Rivers dating from 1526 to 1965 (Jackson 1995).

Based on historical documentation, areas within the rivers were assigned a high, medium, or low potential for containing significant sites. Twelve priority areas were then selected for a remote sensing survey. Criteria used in the selection of the areas were based on the accuracy and frequency of historical documented shipwrecks, and/or the high degree of maritime activity revealed by the historical research.

Historical Research Summary

The first known European exploration of the Carolina coast was in 1524 when Italian Giovanni da Verrazano sighted land in early April probably near Cape Fear. Prior to continuing his exploration northward, Verrazano provided the earliest known written description of the Lower Cape Fear region (Lee 1965:12-15).

Another early exploration occurred in 1525-1526 by Spaniard Lucas Váquez de Ayllón, a Santo Domingo appeals court judge. Based upon earlier promising reports, Ayllón received consent of the Crown to establish a settlement on the mainland. Under his direction six vessels sailed in 1525 and reached the mouth of a large river he called the Jordan (today the Cape Fear River). While attempting to cross the bar into the river the flagship grounded and was lost, and this is the earliest documented shipwreck account on the Cape Fear River. The expedition spent enough time on the river to build a new ship before returning to Santo Domingo (Lee 1965:3-4).

Charles Town Settlement

Almost a century and a half passed before others (the English) tried to settle the Cape Fear River. In fall 1662 William Hilton, commander and agent for a group of people from the Mas-

sachusetts Bay Colony, arrived in the Cape Fear area. He named the prominent cape at the mouth of the river "Cape Fear." In early October he sailed into the river where he spent three weeks exploring the region and purchasing much of it from the Indians. Reaching as far upriver as the fork at present-day Wilmington, Hilton and some of his crew went up the Northeast River. Encouraged by his favorable report, a group of colonists was quickly organized and returned to the Cape Fear that winter. There they briefly established a colony called Charles Town on the western shore of the Cape Fear River at the mouth of Indian, or Town Creek. Inadequate organization contributed to the settlement being abandoned by April 1663 (Sprunt 1992[1916]:30-32; Lee 1965:28-33).

In 1664 the Lord Proprietors granted a Barbadoes colony permission to occupy the former Charles Town settlement. In May the first settlers arrived and later the Proprietors sent recently-knighted John Yeamans as governor. After losing a ship while trying to enter the Cape Fear, Sir John reached the colony in November 1665 and found it in a state of unrest. The colonists soon abandoned their settlement and traveled overland to established colonies in the Albemarle and Virginia (Sprunt 1992[1916]:30-32).

Brunswick Town

The first permanent settlement on the Cape Fear River was in 1725, when Maurice Moore, son of Gov. James Moore of South Carolina, founded Brunswick Town on the western shore of the Cape Fear River 15 mi. below present-day Wilmington. On 3 June 1725, Governor Burrington granted Moore 1,500 acres of land, of which Moore set aside 320 for the town. Important to the survival of the town was a ferry operated between Brunswick Town and the Haulover, a narrow strip of land between the river and the ocean. From the time of its founding until the Revolution, Brunswick Town served as a political, social, and commercial center of the lower Cape Fear region. Port Brunswick became one of the leading shipping points in North Carolina not long after its founding; by 1731 it also served as a legislative center and home to two governors at nearby Russelborough (South 1960:22-23).

In the early evening of 3 September 1748, three Spanish sloops, including the 130-ton *Fortuna*, sailed into the Cape Fear River to attack Brunswick Town. *Fortuna* shelled the town to cover the Spanish retreat during a counterattack mounted by the local militia a couple of days later. During the shelling, one of the ship's cannon ignited a fire that apparently spread to the magazine, causing the vessel to explode and sink. With the growth of a newer port farther upriver known as Wilmington, the importance of Brunswick soon declined. A new foe, the British, burned the then-deserted town in 1776. A few families returned following the war, but by 1830 the town was in total ruin (*Charleston Gazette* [*CG*] 1748; South 1960:51-54; Lee 1965:232-233).

Wilmington and Southport

In 1731 John Maultsby and John Watson were each granted 640 acres of adjoining property near the confluence of the Cape Fear and Northeast Cape Fear Rivers. In April 1733, James Wimble drafted and laid out on the east bank of the Cape Fear a settlement he called New Carthage. Other adjacent property owners joined in enlarging New Carthage and changed the name to New Liverpool. For the most part, however, residents of the area referred to this new community simply as New Town, soon corrupted to Newton. Shortly after, the village's few inhabitants chose to call their community Wilmington, after Spencer Compton, Earl of Wilmington. In 1740 the North Carolina Assembly passed an act formally designating the town as Wilmington. (Lee 1971:12-13; Sprunt 1992[1916]:45-46).

To protect the towns, construction began on Fort Johnston at the river mouth in 1748, continuing with delays and improvements until 1764. In 1792 the General Assembly approved an act to establish a town near Fort Johnston. The town was incorporated as Smithville and

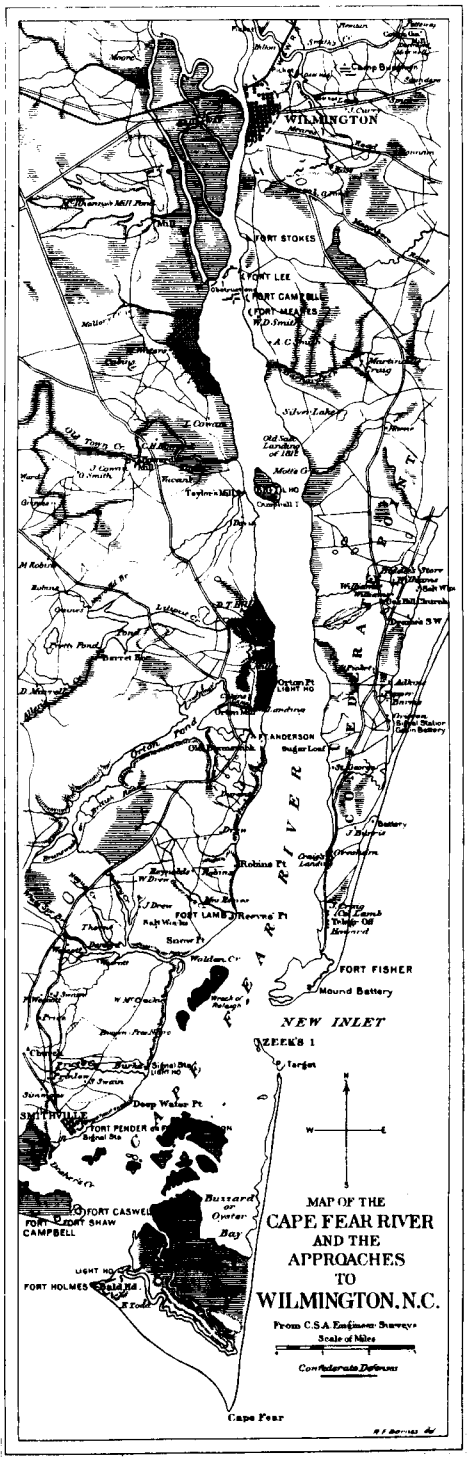

FIGURE 1. Civil War map of the Cape Fear River and approaches to Wilmington, North Carolina (OR/N, Series I, Vol. 12:38).

included 150 acres in addition to the fort and river pilots' residences. Today it is the town of Southport in Brunswick County.

Wilmington's early growth was due in part to the abundant products from the immense pine forests of the North Carolina coastal plain. Naval stores (tar, pitch, and turpentine), shingles, barrel staves and lumber were commonly produced along the river. The majority of shipping and trade on the river passed through either Wilmington or Brunswick Town. The watercraft varied in size, which had an important bearing on the development of the area. Larger ships could not cross the shoals known as The Flats located just above Campbell Island near Brunswick Town. As a result, Brunswick Town became the center of overseas shipping, while smaller vessels (generally those in the coastal and West Indian trade) proceeded over The Flats to Wilmington (Lee 1971:14-17).

By 1764 an oar-propelled ferry transported wagons, coaches, and horse and mule teams across the Cape Fear River at Wilmington. Following the Revolution, Wilmington's inhabitants continued to make their living in trade- and shipping-related occupations. The town economy returned to its pre-war activities—naval stores, lumber and other timber products—with rice the only important commercial crop. Wilmington's growth as a commercial center was recognized when the "Port of Brunswick" name was changed to the "Port of Wilmington" (Lee 1971:14-17).

In 1817 the first steamboat arrived on the Cape Fear River. The stern-wheeler *Prometheus* was built for a Wilmington firm that proposed to run it from Wilmington to Fayetteville and Smithville (Southport). Steamboat traffic was better suited to the Cape Fear than any other North Carolina river since the limited seasonal fluctuation of the river did not seriously impede navigation. In addition, many Piedmont roads already led to Fayetteville at the head of navigation on the Cape Fear. The subsequent arrival of several steamboats on the river marked the beginning of a new era for Wilmington commerce and a call for improvements in river navigation (Logan 1956:82; Lee 1971:37-38).

About 1819 the local Board of Internal Improvement hired a civil engineer to survey and direct improvements to the river below Wilmington. However, the state lacked sufficient funds to continue improving the existing channel from Wilmington to the ocean, and by 1829 the federal government assumed that responsibility (Sprunt 1992[1916]:144).

Wilmington's expansion and trade ended abruptly in 1861 with the beginning of the Civil War. Because the South was predominantly agricultural, the Confederacy had to import much of its needs. Aware of this, President Lincoln ordered a blockade of the southern ports in 1861. To avoid the blockade and bring in vital cargoes, the Confederacy developed blockade-runners—fast, sleek vessels that could slip past Union ships under cover of darkness. At the beginning of the war the South maintained other significant ports, but none proved more important to blockade-running than Wilmington. Blockade-runners had access into the Cape Fear and on to Wilmington through entrances either at the mouth of the river or New Inlet (Figure 1). Union warships found it difficult to blockade these entrances located several miles apart (Lee 1971:61).

Confederate forces constructed two forts in 1861-1862 for the protection of New Inlet. Fort Fisher, the largest fortification along the Cape Fear River, was located on the southern tip of Confederate Point (now Federal Point). Its strategic placement enabled it to guard both New Inlet and the river approach to Wilmington. The other fortification constructed near New Inlet was Fort Anderson on the western shore of the river on the former site of Brunswick Town. Other smaller fortifications and batteries were later placed along the Cape Fear River for the defense of Wilmington and the inlets (South 1960:79; Sprunt 1992[1916]:381-386).

In late December 1864, Fort Fisher, the last remaining Confederate stronghold, came under a massive Union assault. Union control of the fort would seriously hamper the South's ability to fight and possibly bring about an end to the lengthy Civil War. After the first attempt to capture the fort failed, a larger, second effort was undertaken the following month. Fort Fisher finally fell on 15 January 1865. Within weeks, all other forts along the river were subsequently abandoned, and in February 1865 Union forces easily occupied Wilmington. Two months later the war ended (Sprunt 1992[1916]:383-386).

In addition to the fortifications, Wilmington also defended itself by constructing two Confederate ironclad steamers. The Beery family built *North Carolina* at their "Confederate Navy Yard" on Eagles Island, across from Wilmington, in 1862. J. L. Cassidey and Sons built the other ironclad, *Raleigh*, at their shipyard at the foot of Church Street the following year. The Confederates destroyed a third locally-built ironclad, *Wilmington*, to keep it from falling into enemy hands just before the town's occupation in 1865. The ironclads only briefly engaged the Union fleet in battle, but their presence in the river helped keep Wilmington open until late in the war (Shomette 1973:333, 352).

Postwar recovery was gradual as planters and other labor-intensive industries adapted to the new slaveless society. Since the Port of Wilmington remained open for most of the war, it was more able to quickly reestablish trade connections when peace returned. Production and export of naval stores and lumber continued in large quantities, while cotton continued to be an important export of the Cape Fear until 1930. Of the various prewar products, rice alone failed to make a postwar recovery due to insufficient labor (Logan 1956:96-107).

By 1910 Wilmington's cotton exports peaked. The local economy received another boost in 1917 when the U.S. entered World War I and shipbuilding facilities were established at Wilmington. The U.S. Shipping Board in the summer of 1917 selected Wilmington as one of its shipbuilding sites. While the Carolina Shipbuilding Company built fabricated steel ships for World War I, the Liberty Shipbuilding Company began building concrete vessels. During this period the last two wooden four-masted schooners were built in Wilmington (*Wilmington Star* [*WS*] 1916, 1918).

North Carolina commerce, and particularly trade through Wilmington, suffered a setback when the U.S. entered World War II in December 1941. Wilmington's restricted commerce in the early 1940s was partially offset by the city's selection again as a wartime shipbuilding site. The U.S. Maritime Commission chose Wilmington as its cargo vessel construction site. The Newport News Shipbuilding Company built ships at Wilmington under its subsidiary, the North Carolina Shipbuilding Company. This firm produced 126 Liberty ships and 117 Victory Ships at Wilmington during the war (*WS* 1941).

The trade that Wilmington lost during the war began to return in 1945. Foreign imports still exceeded exports. Tobacco remained an important export, while fertilizer still dominated as the leading import. Coastal shipping was entirely petroleum products, accounting for half of Wilmington's total commerce (Logan 1956:130). The town received a boost to its commerce in 1945 with the creation of the North Carolina State Ports Authority with terminals at Wilmington and Morehead City. The state docks in Wilmington opened in 1954. Another boost came to the region in late October 1952, when the USACOE and Transportation Corps began construction of the Sunny Point Army Terminal. This installation opened in 1955 for ammunition handling and is known officially as the Military Ocean Terminal at Sunny Point. By 1970 the USACOE had provided a 38-ft. river channel depth to accommodate deep-draft vessels (Lee 1971:91-93).

Conclusions

Historical and cartographic research was important in determining how and where priority areas were chosen for the Cape Fear River survey. In addition to the accounts of numerous ship losses, data accumulated on six ferry crossings, 23 fortifications, 35 plantations, 54 shipyards, and a wide range of related maritime activities provided researchers with key historical information useful in the selection of the priority areas surveyed. This documentation also contributed to locating and identifying shipwrecks and other significant cultural remains in nine of the 12 priority areas during the remote sensing survey (Jackson 1995). Finally, the publication of historical documentation, such as place names, dredging history and cartographic summaries, will provide the foundation to assess the locating and significance of cultural resources throughout the Cape Fear region for years to come.

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Cape Fear River Comprehensive Study: Methodology and Results of the Field Investigation

Introduction

In fall 1993 the North Carolina Department of Environment, Health, and Natural Resources, the North Carolina Department of Cultural Resources and the U.S. Army Corps of Engineers (USACOE), Wilmington District, conducted a systematic survey of submerged cultural resources in the Cape Fear and Northeast Cape Fear rivers as part of a year-long planning study. According to a 1992 USACOE report, existing channel depths are inadequate for vessels calling at the Port of Wilmington, and additional dredging activities that may affect submerged cultural resources are to begin by 2000 (USACOE 1992:3). The survey was designed to locate and identify submerged cultural resources that might be affected by the deepening project. The survey area extended from the mouth of the Cape Fear River, near the town of Southport, to an area 2 mi. above Wilmington, approximately 33 mi. from the Cape Fear River Inlet.

Methodology

Headed by Richard Lawrence, the Underwater Archaeology Unit (UAU) selected ten areas of historical significance within the rivers according to their potential to yield cultural sites and accessibility. Glenn Overton served as principal investigator for field operations with a crew consisting of Julep Gillman-Bryan, Martin Peebles, and Howard Scott.

Field investigations of the Cape Fear and Northeast Cape Fear Rivers had four objectives. The first was to employ magnetic remote-sensing equipment to identify anomalies in designated areas of the river bottom. The second was to assess targets for characteristics similar to those demonstrably associated with historically-significant submerged cultural resources. The third was to conduct an acoustic and sub-bottom survey of areas where magnetic anomalies warranted further investigation. The fourth was to conduct diver investigations to determine and document the source of the anomalies determined to be potential sites.

Field Investigation

The initial magnetometer survey was carried out by the USACOE using a Geometric G-806M dual-channel, proton precession magnetometer and a Motorola Mini-Ranger Falcon VI Surveyor radar positioning system. During all survey operations 60-ft. lane spacing was maintained, with the magnetometer sensor towed at a depth of 10–12 ft. above the bottom (except in shallow water). The graph recorder strip chart was annotated with the date, survey area, time, lane number, and vessel position.

Upon completion of the magnetic survey, the USACOE used the field data to produce magnetic contour maps of each area. Through analysis of these and the magnetometer strip charts, the UAU was able to pinpoint anomalies warranting further investigation. It was possible to eliminate some anomalies because of their association with buoys and beacons, moored vessels, or shoreline structures.

The UAU target investigation/diver reconnaissance was conducted with a proton precession magnetometer, Mini-Ranger radar positioning system, and high-resolution Klein 500 kHz side-scan sonar. During this project phase 20-ft. lane spacing was maintained and the sonar was towed at a depth of ca. 15 ft. above the bottom, except in shallow water or debris fields that might extend into the water column. Targets were relocated using the Mini-Ranger positioning system. The magnetometer and sonar were then employed to position buoys over the targets. In some cases the sonar images helped identify steel pipes or cables, eliminating further investigation. In most cases, however, it was necessary to manually identify the disturbance. Divers equipped with wireless, single side-band trans-

ceivers surveyed the bottom surface at each site by means of circle searches. Exposed features were measured and sketched, although encrustation often prevented recording specific details. Samples and diagnostic artifacts were recorded and conserved, cataloged, and stored. In areas with strong currents, diving was generally limited to the slack tides; visibility ranged from 3 in. to 3 ft.

During the three-month fieldwork the crew made more than 150 dives at ca. 80 different sites. Most targets proved to be modern debris, but 14 underwater sites and over 20 partially-exposed sites warranted further investigation. Several previously-unrecorded vessels were located during the survey, including the Civil War ironclads *North Carolina* and *Raleigh*, the blockade-runner *Kate*, and the early 20th-century schooner-barge *Belfast*.

Survey Results

In Priority Area I, ten targets were examined on the west and southern portions of Battery Island near Southport. Target 1-C was believed to be the remains of the Civil War ironclad *North Carolina*. Examination of the exposed structure confirmed that the longitudinal axis of the hull lies parallel to the river channel, mostly covered by sand (Figure 1). Neither bow nor stern could be positively identified. Due to heavy marine growth, much of the exposed wreckage was unrecognizable during the survey. Recognizable features of the vessel included the keelson (possibly); frames at the downstream end and amidships; two iron boxes; an iron component at the upstream end; several iron plates on the inshore side; and what appeared to be midships decking. Six artifacts were recovered, including glass and stoneware bottles, a flange, and a brass mounting bracket.

Target 1-E was located only a few hundred yards from *North Carolina*. In contrast to the *North Carolina* site, strong currents hampered work on this target. Examination confirmed the longitudinal axis of a vessel hull perpendicular to the channel and mostly covered by sand and fishing nets, which prevented positive identifica-

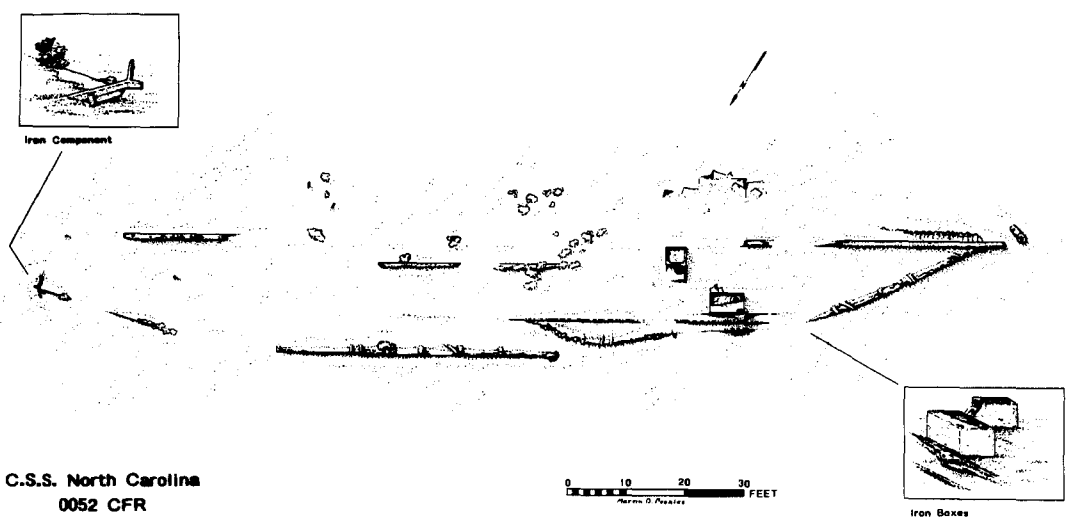

FIGURE 1. Target 1-C, believed to be the remains of the Civil War ironclad *North Carolina*. (Drawing by Martin Peebles.)

FIGURE 2. *Kate* plate emblem. (Drawing by Martin Peebles.)

tion of many of the exposed features. A rudder and steering quadrant were located at the channel end of the vessel, but the stem was not located inshore. The length of the wreck was 181 ft. with double frames exposed over most of the starboard side. A small donkey engine was located 43 ft. from the stern; throughout the wreckage were cut pine logs, some with bark still attached.

A 1939 USACOE map marked the location of *Belfast* at the same spot as Target 1-E. The schooner-barge *Belfast* was damaged in a storm on the Cape Fear shoals and towed to Southport, where she sank in 1929. Historical records confirmed that the vessel was carrying lumber and pilings, and the size of the *Belfast* matched the size of Target 1-E.

Two other targets in Priority Area I proved to be significant. Almost directly across from *Belfast*, on the western shoreline of Battery Island, were the remains of a small boiler. Only ca. 3 ft. were exposed, including a fire-box opening measuring 1 ft. 7 in. wide and 1 ft. 4 in. high. The boiler's small size suggests it was a donkey engine, like those powering windlasses on large sailing vessels. The final wreck in Priority Area I was a 110-ft. wooden barge marked on a NOAA Chart of the Cape Fear River.

The blockade-runner *Kate*, responsible for bringing the yellow fever epidemic to Wilmington in 1862, was located upstream of Southport. The wreckage included a mass of twisted metal and pipe, a boiler, some copper sheathing and a paddlewheel hub, all surrounded by coal scatter. The remains were not identified until divers retrieved a heavily encrusted ironstone plate with a design of a palm tree encircled by a snake (Figure 2). Written beneath the snake was "CAROLINA," *Kate's* original name.

A few miles upstream were the remains of the Civil War ironclad *Raleigh*, lost in May 1863 trying to cross the bar at New Inlet. The historical background and survey results for *Raleigh* are found elsewhere in this symposium.

Located at Campbell Island was a late 19th- to early 20th-century river barge (Figure 3). Positioned on the shoreline, the vessel was partially exposed at low tide. The bow and stern were excavated, as well as a small midship test trench. The total length measured 89 ft. 4 in., with a 19 ft. 3 in. beam. The sides were edge-fastened with 1-in. iron pins. The barge had a cross-planked flat bottom, sharp bow, and square raked stern, with three stringers fastened on each side of a center girder. This barge was the only one of its kind located during the survey.

Near Wilmington over 15 barges and a couple of mid-20th-century powerboats were located on the banks of the Cape Fear and Northeast Cape Fear Rivers. Most of the barges had similar characteristics: a center girder with at least one stringer on each side of the center line; a cross-planked bottom; edge-fastened sides with 3/4- to 1-in. iron fasteners and a raked end. Some of the barges were decked over; most were not. Target 12-C, located on the west bank of the Cape Fear River across from downtown Wilmington, is typical of the barge type found. The 63-ft.-long by 16-ft.-wide barge was cross-planked, framed with 9 x 5-in. frames on 15-ft. centers and raked on the offshore end. The side planks measured 3-1/2 x 7-1/2 in. and were fastened with 3/4-in. iron drift pins. The drift pins were spaced on 18-in. centers along the side and on 3-ft. centers along the center girder. Two stringers measuring 5 x 12 in. were spaced 2 ft. 8 in. on each side of the center girder. A single piece of deadwood supporting the rake timber was located on the offshore end of the down-

stream stringer. The symmetrical timber measured 4 ft. 9 in. long, 8 in. wide, 3 in. thick on each side, and 10 in. thick in the center.

One area demanding attention was at historic Brunswick Town. Documentation indicates that the Spanish vessel *Fortuna* was lost at Brunswick Town in 1748 after a Spanish attack. Previous archaeological investigations of the area revealed a cannon of *Fortuna*'s period near the shoreline of Brunswick Town. The survey revealed several magnetic anomalies, but diver reconnaissance did not produce any cultural material. Additional acoustic data were obtained, but a layer of shell ca. 6 ft. below the bottom at Brunswick Town prevented the acoustic signal from penetrating to the magnetic targets. Continued diving in the vicinity of Brunswick Town located only a late-19th century barge near the shoreline.

Another important area was downstream of Southport, across from Fort Caswell. There, a scatter of wreckage was recorded ca. 200 yd. off the beach. Steam machinery, including an engine and boiler, a few broken frames, and several indistinguishable pieces of metal were noted around the wreckage. Strong currents, low visibility and the deteriorated remains prevented any identification of the engine or hull type, but it is believed to be a 19th-century steamboat.

Conclusion

The survey was designed to locate and identify submerged cultural resources in the Cape Fear and Northeast Cape Fear rivers that may be affected by the deepening project. The USACOE conducted the preliminary magnetometer investigation; the UAU evaluated the results and chose the likeliest targets to be investigated. Once the targets were relocated by remote sensing, diver investigations were initiated. Despite poor diving conditions, the survey provided valuable data; over 30 previously undocumented shipwreck sites were located in three months of fieldwork.

The archaeological investigation proved beneficial to the State of North Carolina and to the USACOE for the future development of the deepening project, and for the further study of

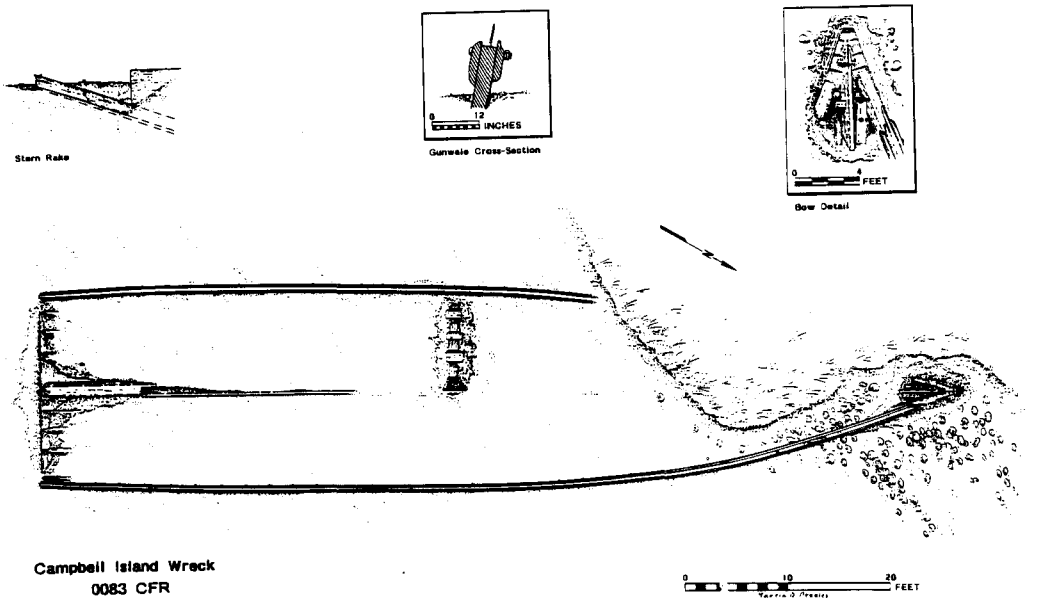

FIGURE 3. Campbell Island wreck. (Drawing by Martin Peebles.)

submerged cultural resources in the Cape Fear and Northeast Cape Fear Rivers.

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CSS *Raleigh*: the History and Archaeology of a Confederate Ironclad in the Cape Fear River

Introduction

In fall 1993, the North Carolina Underwater Archaeology Unit (UAU) conducted a survey of the Cape Fear River, which included a brief investigation of the Confederate ironclad ram *Raleigh*. The remains of the ironclad were found to be remarkably well preserved, warranting further analysis of their extent and condition in the following year. As it represents the first standard of Confederate ironclad design, *Raleigh* has historical significance in addition to its architectural uniqueness and archaeological integrity.

This report focuses primarily on the findings of the 1993 and 1994 surveys. Although *Raleigh* belongs within a much broader scope of naval innovation, the vessel's history will be treated in brief, yielding mostly to particulars of construction and site development.

Conception of the "Harbor Defense" Vessel

During one of the most monumental engagements of the American Civil War, the Confederate ironclad *Virginia* sank two Federal ships and fought USS *Monitor* to a draw. Although statistically impressive, the victory at Hampton Roads belied *Virginia's* difficult maneuverability and tendency to run aground. Confederate Naval Secretary Stephen R. Mallory was forced to recognize that future ironclads would better be suited to harbor defense. Since *Virginia* was a conversion of the salvaged remains of USS *Merrimac*, naval constructor John L. Porter was commissioned to draft the plans for an entirely new class of vessel. *Raleigh* and five other ships were built to Porter's first design (Holcomb 1993:63-67).

The basic form of *Virginia*'s sloping casemate remained, but Porter's new vessel was much smaller, measuring about 172 ft. in length and 13 ft. in draft. Only four guns could be carried, but two were mounted on pivoting carriages at either end so that three guns could operate on either broadside (Confederate Naval Museum [CNM] 1862 Builder's Plans).

The most distinctive feature was the armored "knuckle," which became the standard configuration for Porter's future designs. The sides of the casemate extended over the main hull, rejoining it 4 ft. below the waterline. The casemate's 35° slope continued with 2 ft. of freeboard toward either end of the vessel. The overall design made the vessel's ram an integral part of the hull, protected against being rammed, and also formed a propeller guard at the stern (Holcomb 1993:65-67).

The casemate was formed of three layers of wood, consisting of a vertical main frame of 13-in. yellow pine, a horizontal layer of 5-in. pine, another vertical layer of 4-in. white oak, and two layers of 2-in. armor (U. S. Government Printing Office [USGPO] 1894-1914:VIII, 207). The only departure from *Virginia*'s basic casemate form was the facilitation of flat (rather than rounded) ends for easier construction.

The new design might have fared well in the deeper waters of Hampton Roads. Unfortunately, the six vessels built to this design found service in the much shallower rivers and harbors of Richmond, Savannah, Charleston, and Wilmington.

A Promising Career Cut Short

Built at the yard of J. L. Cassidy and Sons, *Raleigh* was one of two ships constructed to Porter's new design in Wilmington, North Carolina. Across the river, *North Carolina* was built in the yard of Beery and Brothers. Both ships were begun in 1862 and suffered the delays of labor strikes, material shortages, and yellow fever. *North Carolina* was rushed to completion and suffered all the defects of unseasoned timber and salvaged engines, proving "too shaky and weak to go to sea" (USGPO 1894-1914:IX, 235). *Raleigh*'s long wait may have resulted in better materials (USGPO 1894-1914:VIII, 82, 88-89).

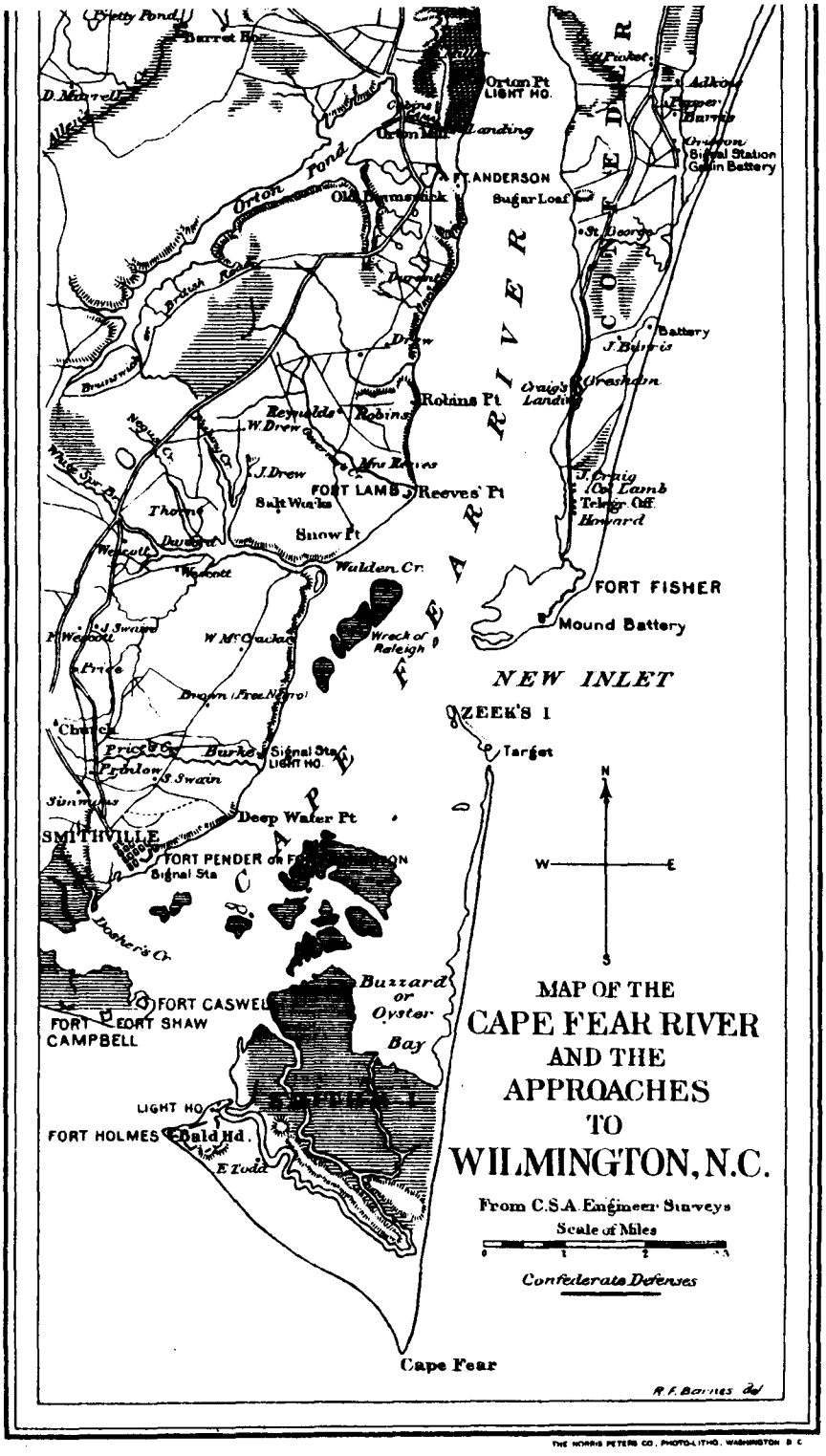

FIGURE 1. Entrances to the Cape Fear River, 1864. Note the wreck of *Raleigh* inside New Inlet (USGPO 1922-1927: XII, 38).

On the evening of 6 May 1864, *Raleigh* crossed the bar at New Inlet under the command of J. Pembroke Jones and Flag Officer William F. Lynch (Figure 1). The night attack routed two Federal ships, allowing two blockade runners to escape. Morning found *Raleigh* in possession of the Federal anchorage but unable to close action. The Federal commanders described the ironclad as "fast -good 6 knots," able to turn "very quickly," and it steered clear of the "torpedo on her bow" (USGPO 1894-1914:X, 21, 24). After two hours of futile ramming attempts, *Raleigh* turned back toward the bar. The guns of Fort Fisher rang out nine times in salute. Moments later, *Raleigh* grounded on the bar between New Inlet and the river's main channel (USGPO 1894-1914:X, 18-25; Sprunt 1992: 482-483).

Site History: 1864 to Present

The rapid fall of tides in the Cape Fear River doomed the ironclad to the weight of its own armor. As the hull settled unevenly along the river bottom, the vessel began to hog until the weight of the armor "just crush[ed] the decks in" (UAU 1864 Papers of Charles Peek:26). Within 24 hours, the living and engineering spaces were flooded. The guns were removed and the Confederates set fire to the casemate in order to salvage as much of the iron as possible (USGPO 1894-1914:IX, 770; UAU 1864 Peek:26). Divers removed the boilers and attempted to recover the engines (Williams and McEachern 1978: 3). The shifting habits of the river bottom caused the wreck to sink further, and two months after grounding, nothing remained above the water (USGPO 1894-1914:X, 203).

As *Raleigh* became a navigation hazard, at least two ships grounded on top of it, including the blockade runner *Talisman* in 1865 and the schooner *L. Waring* in 1868 (USGPO 1894-1914:XI, 746; *Star*, 15, 16, and 22 August 1868). Both vessels were saved, but in 1881 the wrecking schooner *Wave* visited the site. Several kegs of powder were used to salvage a portion of the vessel described as "the front of the turret" (*Morning Star,* 6 April 1881). Such accounts left little hope that much of the wreck would survive.

Also in 1881, New Inlet was closed to navigation with the construction of a rock jetty. The closing of the inlet was designed to deepen the main shipping channel by constricting the river's flow toward the mouth (Rayburn 1984:5). The wreck site was also considerably changed. Although the water at *Raleigh's* grounding could not have measured deeper than its maximum

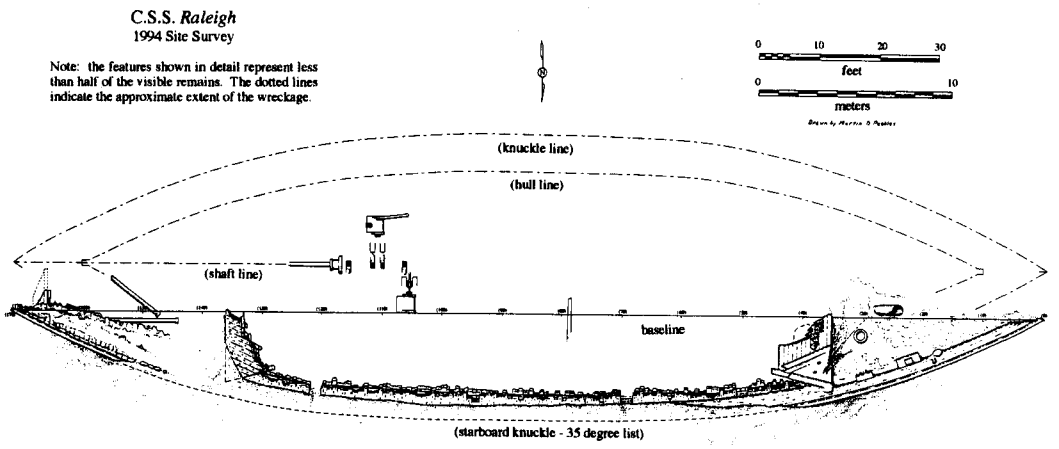

FIGURE 2. 1994 survey plan of *Raleigh* site, detailing starboard features and engine room (only). Port side remains are indicated by original vessel outline. (Drawiing by M. D. Peebles.)

draft of 13 ft., the wreck now rests in waters of 25 to 35 ft. The cessation of shipping traffic through New Inlet may have also protected the site from further salvage.

Recent Investigations

Local interest in *Raleigh* prompted investigations as early as 1974, but no official reports have been filed other than its nomination to the National Register of Historic Places in 1985 (Randt 1974; Wilde-Ramsing and Angley 1985). Measures toward nomination included a magnetometer and side-scan sonar survey, and diver visitation to confirm the presence of wood and iron wreckage.

Not until fall 1993 was the wreck slated for a more detailed investigation by the UAU at Fort Fisher. The UAU included *Raleigh* and its sister-ship *North Carolina* among several other vessels to be investigated during a comprehensive survey of the Cape Fear River, as a prerequisite to channel dredging by the U. S. Army Corps of Engineers.

The sparse remains of *North Carolina* lowered expectations that much would remain of *Raleigh*. When a magnetometer survey was conducted around the site on 20 October, a large swirl was observed on the surface. Divers confirmed that the swirl was caused by the prominently-exposed features of the wreck's forward remains. The bulk of the vessel appeared to be buried in a river bottom of sand and shell hash. A baseline was set and enough measurements were obtained to confirm the vessel's congruity with the builder's designs of John L. Porter. Tentative plans were set for the following year to continue work on a preliminary site plan.

The UAU team returned to the site from 20-24 June 1994. As in the earlier survey, the swift currents limited investigation to windows of slack tide, which lasted about three hours and occurred once or twice daily. High tides and calm surface conditions improved visibility to 3 ft. or more. Radio communications enabled divers to relay measurements to note takers aboard the research vessel. By the end of the week, the UAU team was able to map about half of the site and had a good idea of how the rest of the vessel was laid out.

Site Description

In the 1994 site plan (Figure 2), the features shown in detail represent the remains that could be tied in directly with the baseline, consisting primarily of the starboard side and engine room. The port side remains are also visibly extensive but buried under a considerable mass of disassociated wreckage. John Porter's design plans were useful in calculating the basic form of the ship. The dashed lines of the site plan indicate *Raleigh*'s original form and the probable extent of the remains.

Since the engines present the best key to determining the orientation of the wreck's main features, some account of them is necessary before describing the starboard and port sides in more detail (Figures 2 and 3). Finding the engines was suprising, since most accounts suggest that they were salvaged (USGPO 1894-1914:X, 24; Williams and McEachern 1985:3). Only the crank shaft is missing, with the four mounts standing empty between the two cylinders. Segments of the propeller shaft are also strewn about the site. The cylinder arrangement is the same as on three of *Raleigh*'s sister-ships. Commonly referred to as the "direct-acting horizontal" type, these were the preferred engines for *Chicora*, *Palmetto State* , and *Savannah* (USGPO 1922-1927:II, 612; Holcomb 1983:314). Any builder's names remain hidden under marine growth.

The relatively high position of the engine bed (Figure 3) might be explained partly by the original hogging action that "crushed the decks in" (UAU 1864 Peek:26). Hence, the ends of the main hull may rest deeper than the midship section. Like *North Carolina*, *Raleigh*'s lower hull was probably unsheathed. Consequently, both sides of the ship could have collapsed further as a result of erosion and teredo damage. Both sides appear to have settled deep into the river bottom, especially the starboard side which fell over quite dramatically at some point. Angle measurements were taken with a level to deter-

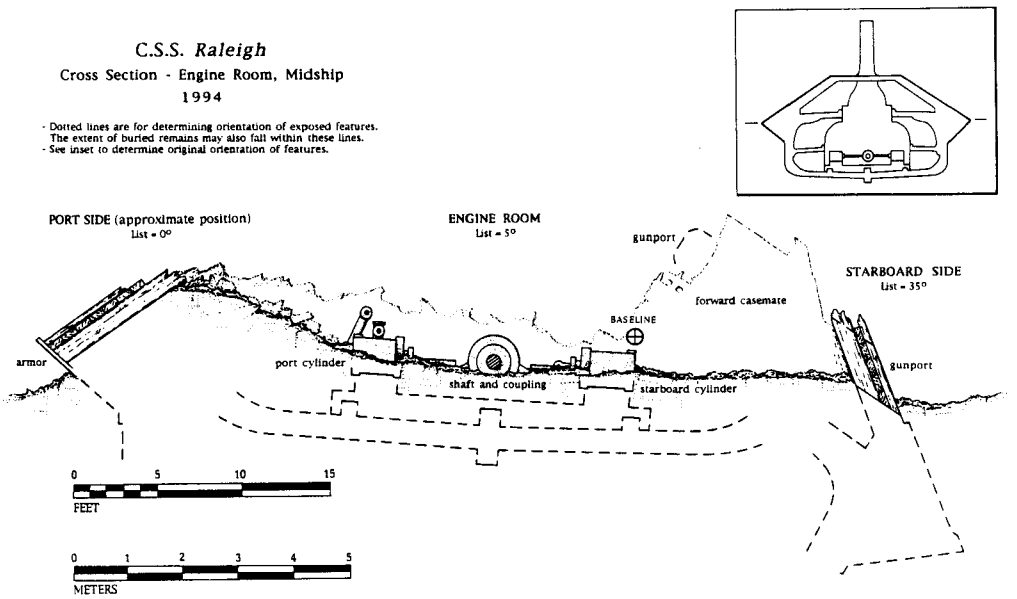

FIGURE 3. Cross-sectional conception of engine room and midship remains. (Drawing by M. D. Peebles.)

mine that the engine bed held a slight list of 5°. The port side was closest to an even keel at 0°, and the starboard side listed to a sharp 35°.

Despite its apparent collapse away from the main wreck, the starboard side presents some of *Raleigh*'s most remarkable features (Figure 4). The extant armor holds that side together down the entire length of the knuckle. The rudder is swung to starboard with its axis tilted to the same 35°. The ram is suspended 10 ft. above the river bottom, and the forward face of the casemate rises to the height of the spar deck. This highest feature, however, is precariously suspended since most of the forward deck has collapsed from under it.

The composition of *Raleigh*'s casemate appears to be of the same structure and material as prescribed by Porter. The interior frames are scarred by fire and erosion, making their dimensions difficult to verify; but the composition of yellow pine and white oak was determined by lab analysis (UAU 1994). The first, or interior course of iron, is exposed between the level of the gunports and the knuckle's edge. Although concreted, the armor appears to fit the 2- x -8-in. plates manufactured in the Tredegar foundry in Richmond. The second, or outermost course of iron, still exists on the forward face of the casemate. Unlike the first course, the plates of the second course were set closely together, presenting a smooth, seamless surface. The same smooth surface of iron was found on the underside of the knuckle running all the way back to the stern.

Among the smaller features noted are deck fittings, such as a chock, and a small cathead for handling the anchor. A capstan was also noted inside the forward casemate (not shown in Figure 2). A small passage for the anchor cable measuring 8 in. diameter was located in the casemate's forward face about 2 ft. above the deck. During the 1993 survey, a large iron coaming and a hawsepipe were found amidst the partially-collapsed wreckage of the forward bow.

Both measured about 18 in. (interior diameter) and were suspended close to the main deck level. In 1994, the hawsepipe was found to have fallen through to the river bottom, as shown in the site plan (Figure 2).

A wooden bulkhead was also noted 78 ft. from the bow in the approximate position between the coal bunkers and shell room. The bulkhead disappears in the sand to starboard and is buried under the wreckage to port.

Although not shown on the site plan (except as indicated by *Raleigh*'s original outline), the remains of the port side are also very extensive. The forward remains have suffered the worst from exposure where the river bottom descends toward the channel. The casemate and knuckle are also more exposed along this side, shrouded in fishing net toward the bow and disappearing into the sand toward the stern. With most of the iron stripped away above the knuckle, the interior courses of oak and pine are eroded like Swiss cheese, as aptly described by one diver. Part of the structure continues on within the arch of the vessel's outline, disappearing within 10 ft. of the stern.

Iron plate, copper and brass piping, wooden decking and structure, coal and brick scatter all form the greatest mass which fills *Raleigh*'s midship section and covers most of the port side. So far, a total of seven days has been committed to mapping some of *Raleigh*'s most prominent features (Figure 2). However, these comprise less than half of the total exposed remains, and complete mapping and investigation of the entire wreck will likely take much longer.

Artifacts

Since these investigations were primarily focused upon mapping as much of the site as possible, very few artifacts were recovered. The first artifacts found did not even belong to the ironclad but to one of the ships that grounded on top of it. Two brass pintles from a lost rudder were recovered during the 1993 survey. The 1994 survey recovered two glass bottles and a small brass lamp fitting from the stern quarter of the port side where *Raleigh*'s officers would have been quartered.

Unlicensed recovery cannot be ruled out, although the natural conditions of the site discourage most underwater activities. The Confederates may have saved most of their personal effects, unless the flooding of the lower compartments outpaced their efforts to save the vessel. Since the lower quarters are either deeply buried or collapsed beneath the upper works, it is likely that the small amount recovered thus far is indicative of much more artifactual evidence. While the notorious living conditions aboard ironclads compelled the housing of some crews onshore, *Raleigh*'s hidden compartments might convey the extent to which the ironclad became their home.

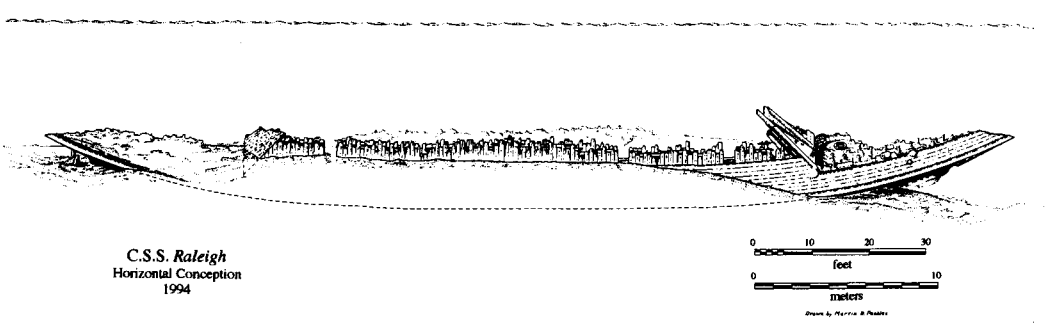

FIGURE 4. Horizontal conception of *Raleigh*'s starboard side. (Drawing by M. D. Peebles.)

Conclusion

Raleigh is significant both in its architectural uniqueness and remarkable state of preservation. As it represents the first standard of Confederate ironclad design, it also marks a revolutionary step in the innovative history of naval warfare. Furthermore, *Raleigh*'s remains are the best-preserved of any Confederate ironclad known to exist. The Cape Fear River often presents favorable conditions for archaeological investigation. Unfortunately, it also leaves the site open to unlicensed recovery. The threat of exposure is also very great, as noted by the damage to the bow area between the 1993 and 1994 surveys. National Register designation will have to be upgraded to National Landmark status if the site is to be adequately monitored, protected, and completely recorded before its present condition is lost.

ACKNOWLEDGMENTS

This article is drawn from my thesis, which is still in the works for completion through East Carolina University in Greenville, North Carolina. It is made possible by the UAU at Fort Fisher, whose personnel put forth the interest and facilities to make the investigation possible. My appreciation for their commitment goes to present staff Leslie Bright, Barbara Brooks, Julep Gillman-Bryan, Claude "Sandy" Jackson, Richard Lawrence, and Mark Wilde-Ramsing, and to temporary staff Chris Olsen, Glenn Overton, and Howard Scott. Vital research material was also contributed by Edwin Coombs of East Carolina University, Henry Harris of Chapel Hill, North Carolina, Bob Holcomb of the Confederate Naval Museum in Columbus, Georgia and Bill Reaves, whose collection at the UAU is invaluable for North Carolina maritime resources.

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Investigations of the CSS *Curlew*: A Victim of the Battle of Roanoke Island, North Carolina

Introduction

During the Civil War the Confederacy lacked the shipbuilding capability of the Union, due to a deficiency in industrial capacity. The Confederate Navy was thus forced to find other means to raise a fleet. As a result of their efforts, the Confederate Navy consisted of assorted ironclads, commerce raiders, steamboats, and sailing vessels of various designs and hurried conversions. This paper will trace the history and provide a preliminary archaeological report on *Curlew*, an iron-hulled gunboat of the Confederate Navy in North Carolina.

Prewar History

North Carolina's coast is characterized by low, sandy islands that separate the ocean waters from the sound waters. These sounds of North Carolina give access to navigable rivers that extend nearly a third of the way into the state. The sounds generally are always passable for shallow-draft vessels (Scharf 1977[1887]).

Edenton is one of the many towns located along the Albemarle Sound in North Carolina. The town prospered as a trade center during colonial times. However, the 1820s and 1830s were a period of decline for Edenton as an international port, due to the silting in of Roanoke Inlet. One course of economic prosperity was through the formation of passenger and freight steamboat lines, which served communities along the Chowan River and the Albemarle Sound (Parramore 1967; Butchko 1992).

One such line was the Albemarle Steamboat Company, founded in Edenton in 1850. The company operated up to three steamboats before the Civil War, and all became casualties of that conflict. In 1856, the company ordered an iron-hulled steamer named *Curlew* from the Harlan & Hollingsworth Company in Wilmington, Delaware.

The Harlan & Hollingsworth Company was founded in 1836 as a railroad car builder but by 1844 had ventured into iron shipbuilding. The fourth vessel built by the firm, *Bangor*, has the distinction of being the first iron merchant ship in America built for deep sea use. Harlan & Hollingsworth developed a reputation for building quality ships known for their speed and strong construction. *Curlew*, its 38th vessel built, was launched in 1856. It was a side-wheel steamboat 135 ft. long and 23 ft. wide, drawing 8 ft. of water. The dimensions of the steam cylinder and the length of the piston stroke suggest that the engine was of the low pressure walking beam type (Harlan & Hollingsworth 1886). The steamer was enrolled on 31 July 1856 at Edenton. Its enrollment form states that it had no figurehead, a round stern, and no mast (National Archives 1856, Record Group 41). *Curlew* operated as a passenger and freight carrier between Edenton, Hertford, Elizabeth City, and Nags Head (*American Banner*, 7 August 1856). In 1859, *Curlew*'s route was extended up the Chowan River to Franklin, Virginia, where it continued to operate until the Civil War (Johnson 1986).

Civil War Period

North Carolina left the Union on 20 May 1861; in June the state transferred its military and naval forces to the Confederate government. The Confederate government planned two lines of defense for the North Carolina sounds: one was a string of forts guarding the entrances to the sounds, and the second consisted of various ships purchased and converted to gunboats. North Carolina's small navy was to play a major, if not always effective, role in the early coastal fighting. The navy's small size earned it the nickname "Mosquito Fleet," and its vessels were purchased at various locations. *Curlew* and another steamboat were purchased at Edenton in August 1861 for $35,000. After a period of out-

fitting, *Curlew* was ready for service by the end of September. It was armed with a long navy 32-pound rifled cannon mounted at the bow. In addition, an old 12-pound smooth-bore gun mounted on a field carriage was placed on the stern (Scharf 1977[1887]).

The Mosquito Fleet made its presence felt from the moment of inception. Its steamboats conducted a series of commerce raiding sorties near Cape Hatteras, bringing in many prizes. Commerce raiding created much concern among the northern shipping businesses. These shipping businesses in turn spurred Federal naval authorities to take action against Confederate forces in the North Carolina sounds. The first action taken by the Federals was a joint army and navy expedition resulting in the capture of the Confederate forts guarding Hatteras Inlet on 28 August 1861. This victory boosted Union morale and provided a foothold from which to stage future operations (Barrett 1963).

The next three months saw brisk action between the Union forces at Hatteras Inlet and Confederate forces at Roanoke Island. *Curlew* was one of three Confederate ships involved in the capture of Union Army supply ship USS *Fanny*; five days later it participated in an abortive attempt by the Mosquito Fleet to recapture Hatteras Inlet. *Curlew* also was involved in the rescue of the crew of the French warship *Prony*, which had wrecked on the beach below Cape Hatteras. After the rescue *Curlew* set fire to *Prony*'s wreckage (U. S. Navy Department [USND] 1987[1922]; Barrett 1963).

To understand the circumstances surrounding *Curlew*'s sinking, the arrangement of the Confederate army and naval defense of Roanoke island needs explanation (Figure 1). Roanoke Island is bordered by Croatan Sound on the west and Roanoke Sound to the east. Albemarle Sound and Pamlico Sound lie to the north and south side of the island respectively. The land defenses were concentrated on the northern half of the island facing Croatan Sound. Three forts were situated on the west side of the island. A 2-gun emplacement guarded the east side of the island, while a 3-gun emplacement defended the middle of the island. Mounting seven guns, Fort Forrest was located at Redstone Point on the mainland side of Croatan Sound. The southern entrance to Croatan Sound was a narrow channel that passed through an area of swampland. The land defenses were manned by a total of 1,024 men (USND 1987[1922]; Barrett 1963).

During the late fall and winter of 1861, *Curlew* and other Mosquito Fleet ships engaged in patrolling and towing supply ships to Roanoke Island. In January 1862, the fleet's actions consisted mainly of towing schooners to be sunk as obstructions in Croatan Sound. Blockships and pilings were placed across the northern third of the sound. The object of this barricade was to compel vessels to pass on either side of the sound, close to the guns of the Confederate forts. The barricade, however, was incomplete by the time the Federal invasion fleet arrived (Scharf 1977[1887]; USND 1987[1922]).

In autumn 1861, the U. S. Navy Department organized another expedition to extend Union control over the North Carolina sounds. This expedition was to counter the Confederate raiders' harassment and destruction of commerce, which continued after the capture of Hatteras Inlet; Roanoke Island was chosen to be the objective. This operation was a cooperative effort between the Union army and navy, under the joint command of General Ambrose Burnside and Admiral Louis Goldsborough. A fleet of 17 war-steamers and 40 transports gathered at Newport News. The fleet mounted a total of 48 guns, and embarked with an army of 17,000 men on the transports. It sailed on 11 January 1862 and was beset by severe weather off Cape Hatteras, which caused the loss of two of the expedition's ships. Not until 4 February was the fleet safely inside Pamlico Sound (Scharf 1977 [1887]; USND 1987[1922]; Barrett 1963).

At the time of the invasion, the Confederate fleet at Roanoke Island consisted of six steamers and one schooner; *Curlew* was the largest Confederate Navy steamer present. The total amount of firepower the Mosquito Fleet could muster was 11 cannon against the Federal fleet's 48 (Scharf 1977[1887]).

After entering Pamlico Sound, the Federal expedition regrouped and got underway on the morning of 5 February. Bad weather, however, delayed the attack for two days. In spite of advanced warning of the invasion, the Confederate defenses on Roanoke Island were weak and undermanned.

The battle opened at 10:30 A.M. on 7 February. The Federal gunboat fleet was divided into two squadrons: one engaged the Mosquito Fleet while the other attacked Fort Bartow, the fort closest to the landing site at Ashby's Harbor on Roanoke Island. The Confederate fleet congregated north of the barrier, in an attempt to lure the Federal gunboats into range of the forts, and perhaps to lure them onto the obstructions.

Twice during the battle the Mosquito Fleet passed through the obstruction line, then turned around in a fruitless attempt to lure the Union gunboats into the line of fire of the three north-

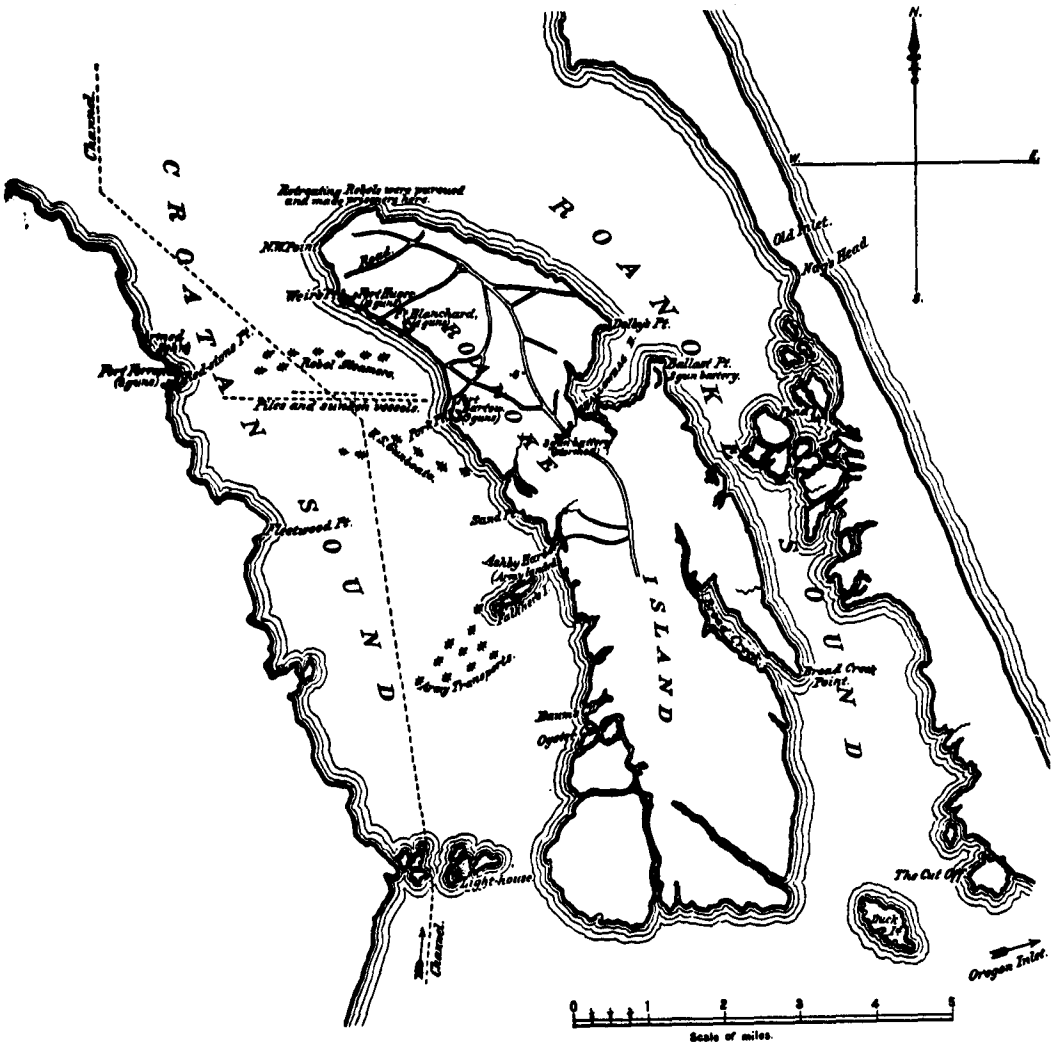

FIGURE 1. Roanoke Island on 7 February 1862. (Courtesy of USND.)

ern forts. All afternoon the Federal and Confederate gunboats traded shots. At about 2:30 P.M., *Curlew* was struck by a heavy shell that passed through the magazine and displaced one of its hull plates. *Curlew*'s captain Thomas T. Hunter immediately turned towards the North Carolina shore with the intention of grounding his ship. Unfortunately, he grounded *Curlew* in front of Fort Forrest, completely masking its fire. Hunter later admitted that during the battle he suddenly noticed that he wasn't wearing any pants (Parker 1985[1883]; Scharf 1977[1887]; USND 1987 [1922]; Barrett 1963).

The remaining gunboats of the Mosquito Fleet continued the action. The fleet retreated up the sound at about 4:30 P.M. after exhausting all its ammunition. Before retreating, the Confederates tried to salvage as much ordinance and stores from *Curlew* as possible.

In the meantime, the Federal transports made their way through the swampy south entrance to Croatan Sound and landed their troops at Ashby's Harbor (Figure 1). About 10,000 Federal troops made it ashore by midnight. The next day the troops overcame the island defenses. By this time, the only Confederate steamer present was the stranded *Curlew* in front of Fort Forrest. Though *Curlew* was out of action, its condition was not evident to the Federal fleet. When several Federal ships approached the pilings, they treated *Curlew* as a potential threat. When the Federal steamers started penetrating the barrier, the Confederates set fire to Fort Forrest and *Curlew* before departing inland. The fire reached *Curlew*'s magazine by sundown, exploding at almost the same moment the surrender of Roanoke Island became official (USND 1987 [1922]).

After expending all ammunition on 7 February, the remainder of the Mosquito Fleet retreated up to Elizabeth City. Ships too big to pass through the Dismal Swamp Canal were destroyed on 10 February at Elizabeth City by the pursuing Federal gunboat flotilla, thus fulfilling the Union objective of gaining absolute control of the sounds. With the capture of Roanoke Island, Federal gunboats were able to use at will the waterways of eastern North Carolina. This made the capture of Fort Macon, New Bern, Plymouth, Washington, and other coastal towns an easy matter. Control of the North Carolina sounds and inland waterways was one more step towards achieving a total blockade of the Confederacy (Barrett 1963).

Postwar Period

Salvage work on *Curlew* started immediately after the battle. In 1863 its engines were removed by Underdown and Company of Norfolk. Time and weather gradually removed all trace of the ship above the water level. Soon *Curlew*'s precise location was forgotten—until 1988 during Operation Raleigh. Operation Raleigh was a youth leadership program consisting of international students engaged in various state archaeological operations in cooperation with the North Carolina Underwater Archaeological Unit. The search for *Curlew* was initially conducted around Redstone Point using a magnetometer. Several magnetic targets were located and searched. At first, a steam engine piston guide and a hull plate were located. A larger area of wreckage was later discovered. It became apparent that the wreck was virtually undisturbed by looters. From the main wreckage area a sample of artifacts was recovered, including cannonballs, ceramic sherds, two portholes, and a bottle. Positive identification was made when diver Takafami Yamaguchi recovered the builder's plate. A rough sketch of the wreck was made before the end of the fieldwork (Richard Lawrence 1994, pers. comm.).

In October 1994, graduate students at East Carolina University's Maritime History and Nautical Archaeology program and members of the North Carolina Underwater Archaeological Unit returned to *Curlew* to construct a Phase II predisturbance site map. In the course of five days a better understanding of the distribution of the wreckage was achieved. A 180-ft. baseline was laid out across the major components of the wreck. The main wreckage area consisted of two components: a 48-ft. hull section running in a north-south direction, and a 40-ft. hull section laying perpendicular to the north-south section.

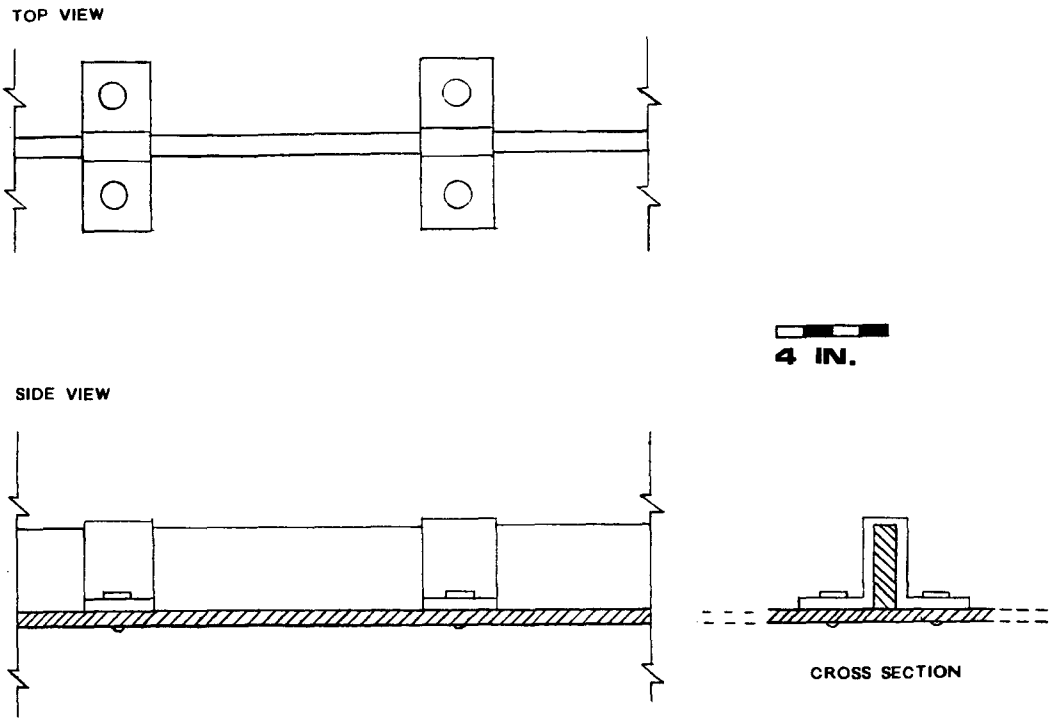

FIGURE 2. Three-view drawing of a typical frame on *Curlew*. (Drawing by Christopher Olson.)

This section contained what is identified as the bow, which is twisted on its side with the port side facing upwards. A section of the gunwale is visible, and a portion of the stem was uncovered. The sides of the hull are intact up to the turn of the bilge, with the upper sections variously collapsed outward and inward. Off the north end of the main wreckage lays a portion of hull plating that was re-identified as the location of the cannonballs recovered in 1988. Closer examination of this wreckage resulted in the discovery of the stern post and rudder.

The hull itself shows early American iron construction details. The keel is semi-circular in cross-section, with remnants of a reinforcing timber inside. This semi-circular keel assembly is attached to the garboard strakes by a string of 1-1/2 in. diameter rivets. The hull bottom was reinforced by longitudinal stringers, five of which have survived. The stringers appear to be notched to fit over the frames. *Curlew* was constructed with bar frames riveted to the shell plating by means of metal clamps (Figure 2). Frame spacing along the starboard side is 1 ft. 3 in. On every frame, spacing between the clamps is 8 in. The rivets are 1-1/2 in. in diameter. Due to heavy concretion of the wreck, it was difficult to determine how the hull strakes butt against each other. According to surviving plans of Harlan & Hollingsworth vessels from the 1870s, there is a strong possibility that the hull plates are arranged in clinker-fashion.

Curlew's construction is rather primitive when compared to British iron ships from the same era, such as Brunel's *Great Britain*. One example is the design of the keel. The semi-circular hollow keel protruding from the hull made vessels like *Curlew* greatly susceptible to damage from grounding. Contemporary British iron keels usually were constructed with horizontal plates. The half-circular design of *Curlew*'s keel continued into the 1870s in other Harlan &

Hollingsworth ships. Their method of attaching the shell plating to the frames was anachronistic; British iron ships were constructed with "T"- or "L"-beam frames riveted directly to the shell plating. This is a much stronger method that the clamp-over-bar method used on *Curlew* (Figure 2). It is interesting to note that the U. S. Navy's first iron warship *Michigan*, built in 1841, used the "L"-beam frame construction riveted to a clinker-built shell plating. *Curlew's* method of construction was primitive when compared to the technology available in the 1850s (Brad Rodgers 1994, pers. comm.).

Conclusion

Curlew is one of the lesser-known ships of the Confederate Navy. Its relative obscurity makes it valuable archaeologically and historically. The histories of Confederate ironclads, blockade runners and commerce raiders are well known. The more mundane vessels of the Confederate Navy, however, tend to be overlooked. *Curlew* is also important for its iron hull construction. Construction details for American-built iron ships of this era are not well documented. The history of *Curlew* fills a gap in the overall knowledge of the Civil War and iron ship construction.

ACKNOWLEDGMENTS

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A Preliminary Report on the *Scuppernong*: A Mid-Nineteenth Century, North Carolina-Built Centerboard Schooner

Introduction

In August 1993, members of the North Carolina Underwater Archaeology Unit (UAU) and East Carolina University (ECU) staff and graduate students performed a limited Phase II excavation of the schooner *Scuppernong* in Indiantown Creek, North Carolina (Figure 1). This paper presents archaeological and historical data pertaining to *Scuppernong*, a centerboard vessel constructed in antebellum Elizabeth City, North Carolina. The vessel remains represent an example of North Carolina shipbuilding, as well as regional vessel adaptation to natural and man-made operating environments.

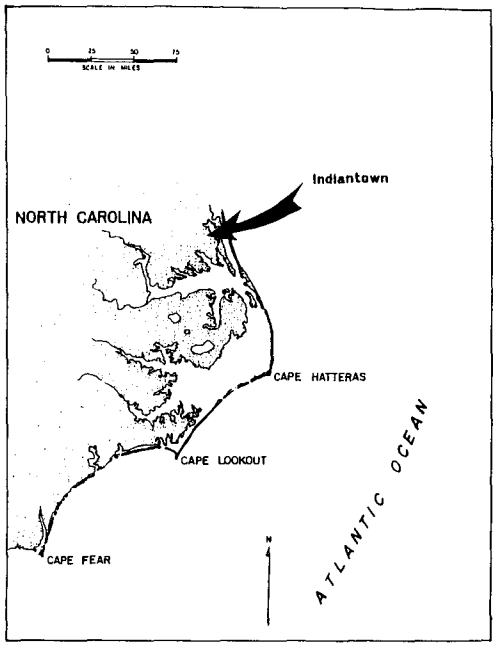
Regional Context

To provide a regional context for the remains of *Scuppernong*, the author examined antebellum environmental and economic conditions within the Albemarle Sound region. By examining regional environmental and economic factors, one can begin to accurately depict the vessel's place within the region's cultural systems—specifically its economic and transportation systems. In addition, this approach allows an examination of the adaptation of vessel types within a particular region. For the purposes of this paper, the Albemarle Sound region is designated as the sound, its tributaries, and bordering counties.

Geography hampered the economic and maritime developments of the Albemarle region. During the 18th and 19th centuries, this region was relatively isolated due to swamp morasses, large, winding rivers, and meandering creeks. Barrier islands commonly known as the Outer Banks were another limitation to Albemarle shipping. Essentially, these islands separate North Carolina's sounds from the Atlantic Ocean. Extremely shallow and variable inlets provide the only access from the sounds to the Atlantic Ocean. In 1861, Edmund Ruffin aptly described the shipping problems associated with North Carolina's coast, stating:

> There is no access to the ocean, through the sand reef, so good and deep as the narrow Ocracoke Inlet, which now permits vessels of only six feet draft to pass over the bar across the inlet, after tedious delays and much danger, and which passage opens upon an unsheltered and most dangerous seacoast. The whole ocean shore of North Carolina is a terror to navigators, and is noted for the number of shipwrecks, and especially near Cape Hatteras (1861:114-115).

The Albemarle's agricultural economy, which consisted of extractive products such as corn, lumber, and fish, depended upon maritime trans-



Map showing area of work.

FIGURE 1. Map of eastern North Carolina showing the work area.

portation. Rather than travel over miserable roads to the interior of North Carolina, the region's inhabitants transported their products (usually by water) to the markets of Norfolk, Baltimore, Philadelphia, and New York, and purchased their necessities there (Lefler and Newsome 1954: 300-301). Without efficient water transportation routes, the Albemarle's capacity for economic growth was limited.

In an effort to circumvent the dangerous inlets, the citizens of the Albemarle region began construction on a canal to the commercial market of Norfolk, Virginia, in the late 18th century. With a canal, the region's merchants could easily access a sizable shipping and commercial center with less risk and delay. In 1828, after 36 years of work and an expenditure of $800,000, the Dismal Swamp Canal was completed. The waterway, with its northern terminus at Deep Creek, Virginia, and its southern terminus at Elizabeth City, North Carolina, was 22-1/2 mi. long with sufficient depth for vessels drawing 5-1/2 ft. (Wertenbaker 1962:160).

Without question the canal's completion influenced Albemarle shipbuilders. Its increased importance as a trade route led to the construction of vessels, primarily schooners, designed for use on the waterway. Consequently, the major design limitations for vessels using the canal were channel depth and lock sizes. Specifically, the size of the canal's smallest locks dictated the maximum beam of vessels in the canal trade. During the 19th century the locks at Elizabeth City, North Carolina, the waterway's southern terminus, were 17-1/2 ft. wide. Shipbuilders, therefore, constructed vessels with lesser beam widths than that. Shipbuilders also produced shallow draft vessels to accommodate the canal's average depth.

As evidenced by data compiled from the enrollments of North Carolina-built vessels (Still and Stephenson 1993), many Albemarle schooners built before 1830 exhibited lengths between 50 and 80 ft. and beam widths between 19 and 22 ft. Conversely, between 1830 and 1860 (after the canal's completion), many vessels were constructed with beam widths between 16 and 17 ft., while vessel lengths remained relatively consistent. Although not all vessels were constructed with the smaller beams, the increase in the number of vessels with narrower beam dimensions indicates the production of vessels tailored for canal trade. Vessels were adapted to the shallow operating environment of the Albemarle region, but also to the size limitations of the Dismal Swamp Canal.

One example of a schooner specifically constructed for use in the Dismal Swamp Canal was *Scuppernong*, built in 1853 by master carpenter John Boushell at Elizabeth City, North Carolina. *Scuppernong* was 77 ft. 8 in. long, 17 ft. wide, with a 5 ft. 11 in. depth of hold, a square stern, and billethead (*Scuppernong* Enrollment 1853). These dimensions coincide with other schooners built between 1830 and 1860 in Albemarle ports such as Elizabeth City, Edenton, and Plymouth. Clearly the canal's growing importance as a trade route dictated the adaptation of vessel sizes and forms.

Field Investigations

In August 1992 members of the UAU performed a remote sensing survey in a section of Indiantown Creek, in northeastern North Carolina. Historical research prior to the survey revealed that in 1862 Union Naval Officer C.W. Flusser burned and sank the schooner *Scuppernong* in Indiantown Creek. According to Lt. Flusser, "a short distance below the bridge was found the schooner *Scuppernong*, partly laden with oak timber. As we could not spare time to clear the river, she was burned." (Rush 1894-1914:I, Ser. 7, 487).

During the Indiantown Creek survey, researchers located a magnetic anomaly just downstream of the Indiantown Creek highway bridge. Groundtruthing revealed the remains of a badly burned, wooden centerboard schooner ca. 77 ft. long. Based on measured and historical vessel dimensions, burn evidence, wreck location, vessel type, and the remains of several large oak timbers within the vessel's hull, UAU members concluded that the vessel remains were those of *Scuppernong* (Wilde-Ramsing 1992:3-4).

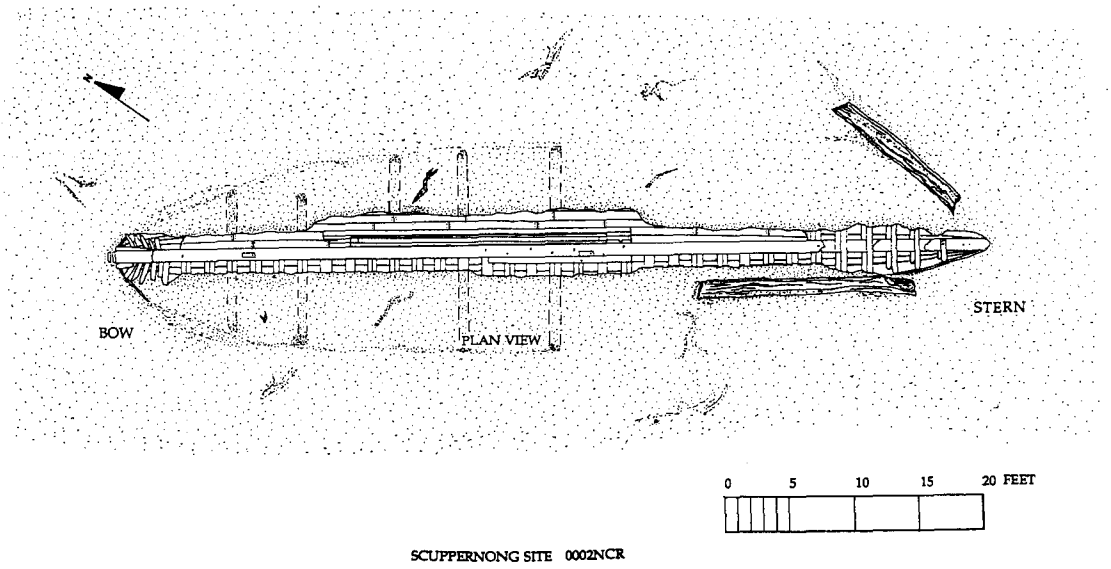


FIGURE 2. *Scuppernong* site plan.

In August 1993, UAU personnel and ECU staff and graduate students performed a Phase II excavation of the vessel remains. Given the project's limited five-day time frame, research focused on the vessel's centerline. By concentrating on the vessel's longitudinal aspect, researchers gathered data associated with the bow, keel, keelson, framing pattern, centerboard structure, and stern.

Scuppernong lies in ca. 15 ft. of water with its bow pointing up creek towards the Indiantown Creek highway bridge. The vessel's remains are covered by ca. 1 to 1-1/2 ft. of organic sediment and debris, including leaves, branches and several fallen trees. The first 6 in. of sediment represent aerobic silt, while the resulting layers are an anaerobic mud environment. Due to the water's high tannin content, visibility is limited to ca. 2 ft. with artificial light.

Description of Vessel Remains

The *Scuppernong* remains are extant from the turn of the bilge to the vessel's bottom. Measured from the forward side of the stem to the aft side of the stern post, the vessel's extant length was 75 ft. 9 in. The stem and stern post rise ca. 3–4 ft. above the creek bottom; the remainder of the structure is submerged. Significant portions of the vessel's centerline structure, including its stem, keelson, frames, ceiling planking, centerboard trunk, and stern are relatively intact, but badly burned. Although the vessel's beam extremities were not excavated and recorded, probing indicated that the surviving beam width ranged from 16–17 ft. (Figure 2). Wrought-iron spikes and drift pins were used to fasten the vessel's major structural elements. In the vessel's forward section, three large oak knees, ranging in length from 5–7 ft., were recovered and recorded. These timbers probably represent the oak timber cargo referenced by Lt. Flusser.

Wood analysis of selected features revealed that the vessel was constructed of Southern timber types, probably obtained within the Albemarle region. The keel and keelson were sweetgum, the stem and stern posts white oak, the floors a combination of red and white oak, and the centerboard trunk and hull planking were southern yellow pine (Lee Newsome 1994: pers. comm.). All of these wood types would have been readily available within the Albemarle region.

The keel and keelson timbers, which were constructed of sweetgum, provided longitudinal strength for the vessel. Although the entire length of the keel was not fully excavated, it appears that the vessel may have been built with a keel plank. Excavations in the stern revealed that the keel timber was sided 11-1/2 in. and molded 4-1/2 in. The keelson, sided 12 in. and molded 8 in., was rebated to fit over the frames, thereby locking the floor and futtock combinations in place. Wooden blocks resting between the keel and keelson occupied the majority of spaces between frame sets.

Two mast steps were mortised into the vessel's keelson. The forward example was centered along the keelson, 11 ft. 8 in. aft of the forward edge of the stem. The mainmast step, located 41 ft. 7 in. from the forward edge of the stem, was offset to port on the keelson. The mainmast step was also positioned just forward of the aft end of the centerboard trunk. Nineteenth-century shipbuilders sometimes positioned the mainmast beside the trunk in an effort to balance the hull and rig (Chapelle 1967:283).

In the bow, the builder employed a form of radial cant frames for support, resembling several 18th- and early 19th-century vessels. The *Scuppernong* cant frames are similar to those of the Fig Island #2 wreck, an unidentified late 18th-century derelict vessel in Savannah, Georgia, (Watts 1994:83) and the Hilton wreck, a small mid-19th-century centerboard schooner in Wilmington, North Carolina (Watts 1994:79). On a shallow-draft hull, this relatively full bow configuration may have contributed to a limited draft forward as well as increased cargo capacity.

To facilitate documentation of the vessel's framing pattern, the port side limber board was removed along the entire length of the vessel's keel and keelson (Figure 3). *Scuppernong*'s 33 frames, observed along the keelson and stern deadwood, were a combination of single and double timbers. Based on the placement of 1-in. iron drift pins along the keelson, the floors appeared to be positioned forward of the adjacent first futtocks. While the blocks between frames hindered observation of the first futtocks, the

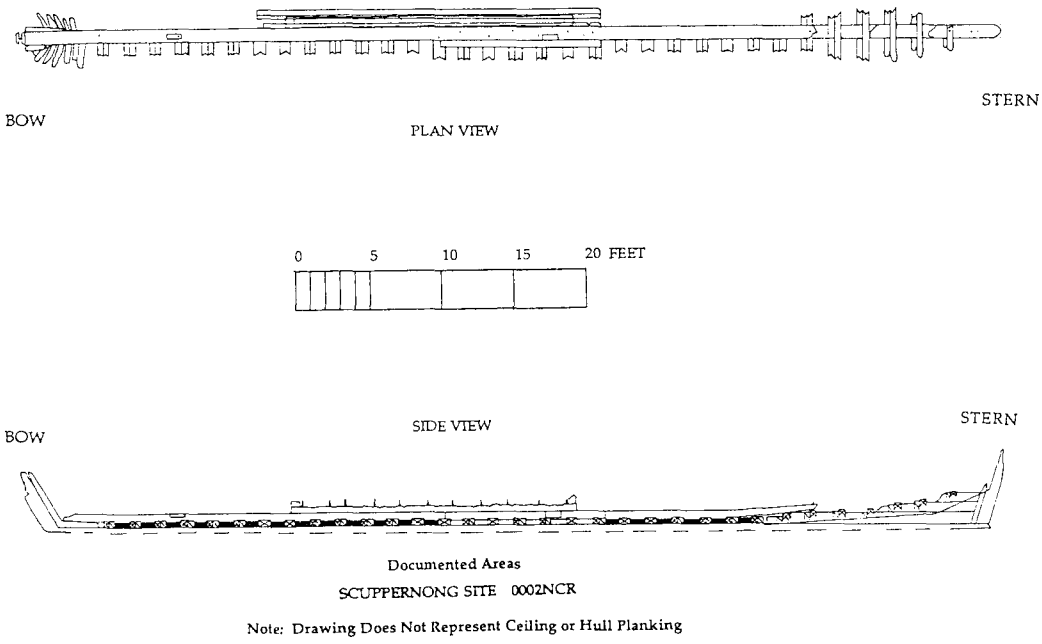


FIGURE 3. Plan and side views of documented areas. The ceiling and hull planking have been omitted.

latter appear to butt under the keelson on the first full frame aft of the cants. This pattern corresponds to a tradition in use throughout most of the 19th century, where frames were composed of floors and staggered futtocks (Watts 1994:82). The average room and space measurement for the frames was approximately 24 in., with room being ca. 10-1/2 in. and space ca. 13-1/2 in.

The centerboard trunk structure, offset to the starboard side, was approximately 22 ft. long, while the centerboard slot was 20 ft. 8 in. long and 4 in. wide. *Scuppernong*'s trunk was constructed to butt against the keel and keelson, with two 4-in.-sided pine timbers forming the port and starboard trunk pieces (Figure 4). Although there seems to be some variation in trunk construction, most centerboard vessels examined in North Carolina have had trunks offset to the starboard side (Watts 1994:82).

The final area of observation was the vessel's stern. The builder constructed the stern by stacking three deadwood timbers forward of the stern post (Figure 3). The floors were rebated into the deadwood structure, while the half floors (or futtocks) were mortised into the deadwood forward of the accompanying floors. Fillet pieces were also used to shape the bottoms of floor and futtock timbers and improve the vessel's stern waterlines.

Also in the stern area, the garboard rabbet began to angle up from the keel plank through the deadwood. The garboard rabbet intersected the stern post ca. 3 ft. above the bottom of the keel (Figure 3). The garboard strake was seated in this rabbet; therefore, portions of the deadwood were unplanked. A similar feature was documented on the Hilton wreck, a centerboard schooner at Wilmington, North Carolina (Watts 1994:83-84). Although the rabbet on the Hilton wreck did not continue into the deadwood, the garboard rose through the deadwood, leaving portions exposed.

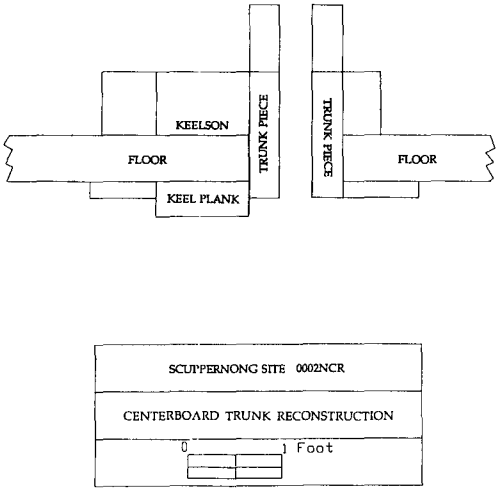


FIGURE 4. Centerboard reconstruction.

Conclusion

Scuppernong reflects the developments and adaptations of shipbuilding within the Albemarle region. Designed for travel on the Dismal Swamp Canal, the schooner was required to sail efficiently in a variety of conditions, including shallow, narrow creeks and open water, such as the Albemarle Sound and even the Atlantic Ocean. Constructed primarily of local materials, including oak, sweetgum, and pine, this vessel represents an attempt by Albemarle shipbuilders to adapt vessel forms to natural and man-made environments. Although additional research is needed, the *Scuppernong* site provides valuable insight into Southern shipbuilding techniques, as well as important data for future comparative studies.

ACKNOWLEDGMENTS

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ROGER C. SMITH, MODERATOR

The Emanuel Point Ship: A Florida Experiment in Research, Development, and Management

Introduction

The 1992 discovery of a small, oyster-encrusted mound of ballast stones on a sand bar in shallow water during the course of a magnetometry search of Pensacola Bay has accelerated the course of marine archaeology in Florida's waters. Initial testing of the site by its discoverers, the Pensacola Shipwreck Survey team, uncovered the remains of the lower hull of a wooden sailing ship and produced samples of coarse earthenware ceramics that appeared to be older than those from other sites previously recorded in the bay. The state team of James Spirek, Della Scott, and Charles Hughson interrupted its survey operations to further investigate the site during the winter months of 1992-93.

The source of the magnetic anomaly was found to be a wrought-iron anchor, its shank broken below the stock, buried fluke-down at the shoreward edge of the ballast mound. The ship's mainmast step and associated architecture were discovered beneath shell and stones in the center of the mound. The anchor and structural components were strikingly similar to those of 16th-century shipwrecks recorded in Europe and America. Field specimens of organic materials, such as rope, leather, and botanical remains gathered during initial testing demonstrated an unusual state of preservation at the site. A growing collection of clues suggested that the ship had been Spanish, and that it grounded violently on a sand bar near Emanuel Point sometime in the 16th century. Lying undisturbed for centuries except for visits by occasional fishermen, the shipwreck represented an unprecedented find.

Two seasons of limited excavations amidships and in the stern have confirmed that the lower hull of the ship is articulated from the stern post to amidships, although portions of the port side and the rudder assembly were damaged during the wrecking event. Sealed for centuries under a compact matrix of shell and sediments that accumulated over the ship, the site has produced an amazing variety of well-preserved materials that include European and Native American ceramics, Old and New World botanical and faunal remains, wooden tools, stone and lead ammunition, copper galley wares, and remnants of insects and rodents that inhabited the bilge. Preliminary analysis of these materials has confirmed that the ship is Spanish and sailed to Florida probably from Mexico sometime between 1550 and 1580.

The findings also tend to support a current and popular hypothesis that the Emanuel Point Ship was associated with the first European attempt to settle what is now the United States. Under the command of Tristán de Luna, a fleet of 13 ships embarked from Mexico in 1559 to establish a colony at Pensacola, which would extend north and east to the Atlantic coast and secure the northern territory of New Spain for the Crown. Aboard the ships were 1,000 colonists and servants, 500 cavalry and foot soldiers, and 240 horses. Aside from clergymen, Aztec mercenaries accompanied the expedition to help to reduce the local Florida natives. Equipped with livestock, agricultural, and construction tools, the settlers disembarked at Pensacola, only to suffer a hurricane which destroyed all but three of the ships in the harbor, some still laden. This catastrophe prevented the success of the Luna colony, and it was abandoned in 1561.

Although its association with the Luna expedition is not yet conclusive, the Emanuel Point Ship is the earliest shipwreck thus far encountered in Florida's waters, offering a unique arena for the study of early European colonial archaeology in a maritime context. In a state that has traditionally permitted such resources to be commercially salvaged and dispersed, this shipwreck's discovery in 1992 presented an opportunity to Florida for a different path toward the development and management of a site for

research and public benefit. To pave this path, the Florida Bureau of Archaeological Research devised a strategy of cooperative partnerships to expand the playing field beyond a simple research permit or salvage contract.

We decided early in 1993 to invite the University of West Florida (UWF) to become an academic partner in a proposed multi-year project, not only for the shipwreck's obvious research potential for students, but also due to the UWF's record of public-oriented archaeology in Pensacola. This arrangement also was seen as a mechanism by which the UWF could increase its academic capabilities in marine as well as terrestrial archaeology. Together with Dr. Judy Bense, we organized a plan by which students from UWF and other universities could participate in courses, fieldwork, and internships. The agreement thus far has resulted in a field school, undergraduate classes, graduate seminars, four graduate internships, and two ongoing Master's theses focused on the Emanuel Point Ship.

The Historic Pensacola Preservation Board, situated in the waterfront historic district, manages three state museums as well as a number of historic buildings and exhibits, and it has established a strong local-community support network. Given its public mission and central role in historic preservation and interpretation, the Board also became a partner in the Emanuel Point project. A conservation laboratory dedicated to the shipwreck was constructed in the basement of the T. T. Wentworth Museum in 1994. Equipped to stabilize and treat waterlogged objects, the laboratory represents a staging point between the shipwreck site and its public display.

The public impact of this shipwreck discovery on Pensacola has been one of intense interest, support, and involvement. In a region noted for its active participation in, and promotion of history and archaeology, the project has become a favorite media and print topic. Local television coverage of ongoing excavations in the bay has allowed the people of Pensacola to view the wreck site from their living rooms; and in late 1994 a live underwater broadcast was made via satellite on national cable television. In response to continuous requests, public lectures by project staff to historical and archaeological societies, civic groups, and schools have created enthusiastic volunteers and sponsors for the ongoing investigation. For example, one private civic organization, Fiesta of Five Flags Association, has sponsored for two consecutive summers a shipwreck lecture series, which has featured several prominent nautical archaeologists invited to Pensacola to visit the Emanuel Point site and present evening lectures to the public.

Of necessity, funding for the shipwreck investigation has come from various sources. Initially, the Shipwreck Survey was partially supported by a grant of federal NOAA funds administered by the Florida Coastal Management Program of the Department of Community Affairs. With the discovery of the Emanuel Point Ship, increased state support was obtained by the Bureau at the Division level, and a legislative appropriation of monies collected by the Florida Department of Commerce from sales of quincentennial automobile license plates was made to the project. Support from Pensacola's private sector has grown in direct proportion to the project's public exposure. To date, over 25 local businesses have become corporate sponsors of the research, providing cash, goods, and in-kind services. These sponsors include hardware and lumber outlets, marine supply vendors, chemical suppliers, dive shops, advertising companies, and banks.

Thus far, this cooperative experiment appears to be well along the path we hoped. The path has not been without its ups and downs, as well as dead ends; however, one thing is clear—as a publicly owned resource, this shipwreck is gradually being adopted by the people of Pensacola, who feel that they have a stake in its history, its archaeology, and its future.

ACKNOWLEDGMENTS

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Pinned to the Bottom: Emanuel Point Hull Remains

Introduction

Investigation of a shipwreck on the Emanuel Point sandbar in Pensacola Bay has revealed a unique submerged resource from Florida's Spanish colonial past. Initial excavations and preliminary analyses have identified the Emanuel Point shipwreck as a mid-16th-century Spanish sailing ship, most likely a galleon (Spirek et al. 1992; Smith 1994). Comparable to a number of contemporary New World wreck sites, the Emanuel Point galleon provides a well-preserved example of a vessel used during the initial phases of North American conquest and colonization by European nations. Drawing upon these other wrecks, historical documents, models, and drawings from the time period, this paper will describe the structural components of the hull, discuss future excavation strategy, and offer preliminary conclusions about the shipwreck.

Research Strategy

Shortly after discovery of the site in August 1992 in 10 ft. of water, attention focused on three test pits in the ballast mound to locate diagnostic ship structure. A portion of the mainmast step assembly was revealed and an assortment of artifacts was recovered for analysis. Two pits in the sandflats fore and aft of the ballast exposed a broken anchor and an assortment of concretions; molds from these concretions revealed a fragment of a forelock bolt with washers and one square-shanked spike.

1993 field excavations opened a series of eight 1-m units: six amidships on the port side and two on the edges of the ballast mound. Documented structure includes an extensive section of the mainmast step assembly and several starboard bow cant frames, as well as disarticulated ship hardware and timbers. One intriguing aspect of the 1993 work was the signs of destruction on the port side, combined with a sizable length from amidships to the gudgeon strap, implying that the vessel had suffered extensive damage when striking the sandbar. In 1994, excavations concentrated in the stern to determine construction features and reveal additional signs of the wrecking process.

Hull Structure

After limited excavation, the well-preserved lower hull extending from bow to stern and athwart to just below the turn of the bilge has started to emerge. Extant hull length is estimated at 23–25 m, with a port breadth of 1.8 m and a starboard breadth of ca. 2.8 m. The wreck lists 4–7 degrees to port. Surrounding the 8 x 16 m ballast mound are scattered timbers and fasteners—remnants of the upper hull structure. No rigging components have been uncovered, although a thick line outboard of the midship section may be standing rigging.

Cant Frames

Uncovering a metal target 10 m forward of amidships revealed three starboard bow cant frames, whose on-center spacing is ca. 45 cm. Frame dimensions range from 20–22 cm sided and 14–16 cm molded. Fastener concretions protruding through the planks indicate that first futtocks (no longer present) were mated to the forward edge of the cant frames. Plank dimensions in this area of the hull are 25 cm wide and 5 cm thick. Loose bits of wood were found between the frames, and a severely degraded plank (probably ceiling) was observed lying across two frames.

Amidships

The principal feature exposed in the port amidships of the galleon was the mainmast step and associated timbers, which exhibit characteristic 16th-century architecture (Figure 1). Composed of an enlarged and thickened section of the keelson, the step has a large mortise to house the mainmast's tenon. Inside the mortise

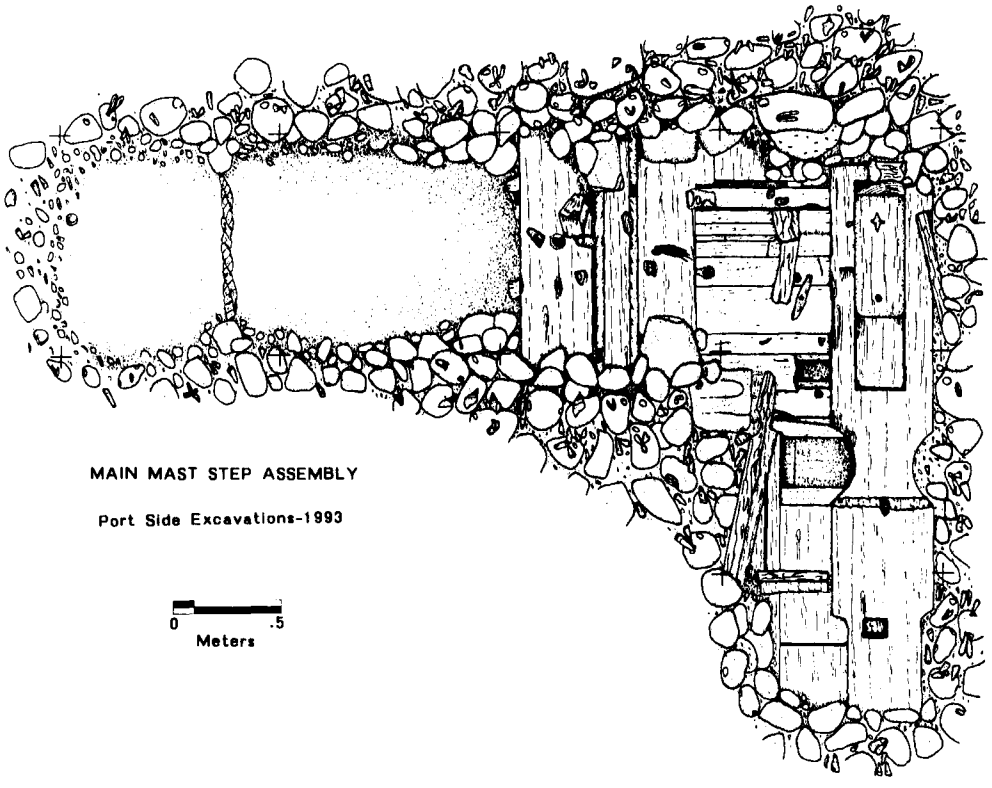

FIGURE 1. Plan view of main mast step assembly.

two wooden pieces lodged at either end (a shim forward and a chock aft) were used to firmly wedge the mast heel (no longer present) in place. Space between the two wood elements allowed a mast heel ca. 47 cm to be fitted, thereby providing a minimal estimate of the mainmast's diameter. Also, a treenail hole of 3.5 cm diameter and an etched cross (6 x 10 cm) are present in the mortise's base. The cross may have had religious significance, much like the secular practice of depositing a coin in the step for good luck. It also indicates the midpoint of the vessel, for the master couple frame lies directly below the carving. Just forward of the shim, a tenoned stub still mated to its mortise may represent a post supporting an upper deck beam. One visible fastener at the aft rise held the keelson in place over the floors. Additional fastening between these two elements was obtained by notching the keelson over each floor.

Carved aft of the mast mortise and on either side of the step are two pump notches of ca. 32-cm radius leading to the bilge. A dual pump has also been recorded on one of the Red Bay galleons (Grenier 1988:76, Figure 14). A small square board with a nail at each corner lying on the garboard strake may have been a bed for the foot valve. A similar board found on the Fuxa *não* differs in having an impression of the foot valve base on one side (Roger Smith 1993, pers. comm.). This suggests that the Emanuel Point pump tube rested not on the board and subsequently the garboard, but rather on the exposed floors on either side of the pump shaft. A smaller-diameter section of the tube (ca. 22 cm) would have extended the pump bore into the sump. Arranged in this fashion, stress created by downward tube pressure was transferred from the

planking to the floors to relieve pressure on the caulked seams. Disarticulated boards around the sump probably represent baseboards from the pump well. A small mortise at the transition from the step to the keelson may have housed a pump-well framing timber.

Four buttresses ca. 60 cm in length on either side of the expanded mast step provide athwart stability to control mast movement. The inboard (thicker) end of the buttress rests against the mast step, while the outboard (thinner) end butts on a ceiling board. Each timber is toe-nailed in place to the mast step and fastened to the floor at the opposite end. Between each buttress' outboard end, the adjacent ceiling is crenellated to create wedges to prevent the timbers from shifting. Rabbets on the interior side of each buttress allow three bilge boards to fit between the four timbers. The two forwardmost boards were cracked and partially caved-in from the weight of the ballast, while the aft board's inboard end is missing.

Ceiling consists of seven common planks (totaling four strakes) and a footwale. Ceiling widths are ca. 31–33 cm, with a thickness of 5 cm. One butt joint between planks was visible next to the after section of the mast step. A total of three square iron fasteners pin the two outermost common planks to the frames below. Inner ceiling runs lay unfastened on the frames. Two fasteners in squared recesses secure the chamfered footwale, 20 cm sided by 11.5 cm molded, to the frames.

Framing amidships consists of an 87-cm solid band of overlapping floor and first futtock timbers. On-center floor spacing is 36–38 cm; frame dimensions were 18–20 cm sided, and molded 18 cm at the wronghead, and 25 cm at the keel. Each floor head is carved in an L-shape (in plan view), with evidence of two small spikes directed towards the first futtock. Based on the direction of the carved floor heads, the master couple frame was determined to lay below the forward end of the mast mortise. Deadrise in the midship floor, from centerline to the outboard edge of the port footwale, is flat at ca. 1°. Beyond the footwale the floor curves upwards to begin the turn of the bilge. Observed floors have a rectangular limber hole carved in the middle of the arm crossing the keel. One visible treenail on the forward molded face of the master couple frame extends horizontally to connect the first futtock. Offset from the centerline of the keelson, the aft futtock of the master couple extends from a heel fastened to the floor to a splintered end that terminated parallel to the floor heads—tangible evidence of structural damage during the wrecking.

Additional timbers noted amidships were the keel, garboard, and two planking runs. Excepting only a first futtock of live oak, all sampled timbers in the amidships were white oak (Lee Newsom 1993, pers. comm.).

Stern

A distance of 12 m separated the master couple frame from the aft end of the stern post; earlier assumptions about the possible separation of the stern section from the hull proved unfounded. Excavation of the hull exposed a span of 4.5 m from the stern post to the forward edge of frame 11 (Figure 2). Depth of preservation from the top of the extant stern post to the keel is ca. 1.4 m. The stern lists to port between 4–7°, corresponding to the midship list. Disarticulated ship structure consisting of unidentified timbers (one possibly an upper section of stern post), loose gudgeon straps, lead scraps, and fastener concretions lay about the stern units.

The stern post has an estimated rake of 60°. Rabbets let into the stern post's forward face accommodated the hood-ends of the outer planking. The aft edge of the stern post was originally rounded as shown by the shape of the loose gudgeon straps, the lowermost of which remains fastened to the frames and planking. A stern knee secured by an iron fastener and a treenail shored the critical junction of the keel and stern post mortise. Both the stern knee and keel have an observed sided dimension of 20 cm—2 cm less than the keel dimension at amidships.

Eleven frames were recorded in the stern, varying in width from 18–30 cm, with frame 1 measuring 10 cm wide. On-center spacing between frames was approximately 43–44 cm.

Most of the frames have a slight rake aft. Frame 1, perched on the rising arm of the stern knee, was fastened in place by one large spike and two smaller nails. Frames 2–10, all Y-frames and probably composed of compass (or reaction) timbers, were tabbed over the stern knee and keel and most likely fastened through the tabs to the saddled timber. Frame 11, where the 22-cm-wide keelson terminated, has fasteners on either arm connecting the timber to an outer plank. Only frame 10 retained the original worked crux between the two frame arms forming the hull's concave aft end. Environmental factors degraded the other floors' cruxes and subsequently the floors' rising line, or gradual longitudinal rise in height of the Y-frames' arm positions, to effect a narrower, lower stern for added rudder performance.

Both starboard and port sides have four runs of outer strakes with varying plank widths from 14–33 cm, and varying thicknesses from 5–7 cm (dependent on location). A pattern of 2–3 round-headed and square-shanked iron fasteners, alternating in one example and arranged vertically in another, fastened the planks to the frames. Past fastener positions also were evident on some of the eroded frame tops, such as those on frames 2 and 3, where fastener grooves were still present. Iron corrosion and sediment buildup combined to distort mildly the hull's original fair lines. Lead sheathing observed on the hull covered hood-end seams with thin strips, gudgeon arms, and various places on the strakes.

Future Investigations

Several key architectural elements present in 16th-century shipbuilding are notably absent from this hull description. Explanations relating to the keel and stern post scarf, determining whether the stern knee was notched for the Y-frames, and noting the presence of dovetail joints between midship floors and futtocks (among other components of period ship construction) await further excavation. We will complete the stern excavations and continue elsewhere depending upon future research needs. For example, one question requires opening units in the bow to confirm the galley location. Acquiring basic hull measurements will allow speculation about original dimensions, tonnage, and vessel type. A firm base of the extant hull, contemporary iconographic sources (the wooden silhouette of a galleon (Smith 1994:17, Figure 2)), votive models (Smith 1993:172), and Brueghel the Elder woodcuts of Dutch galleons (Klein, 1963:59, 71, Figures 10, 12), will offer suggestions for the general appearance of the upper hull structure.

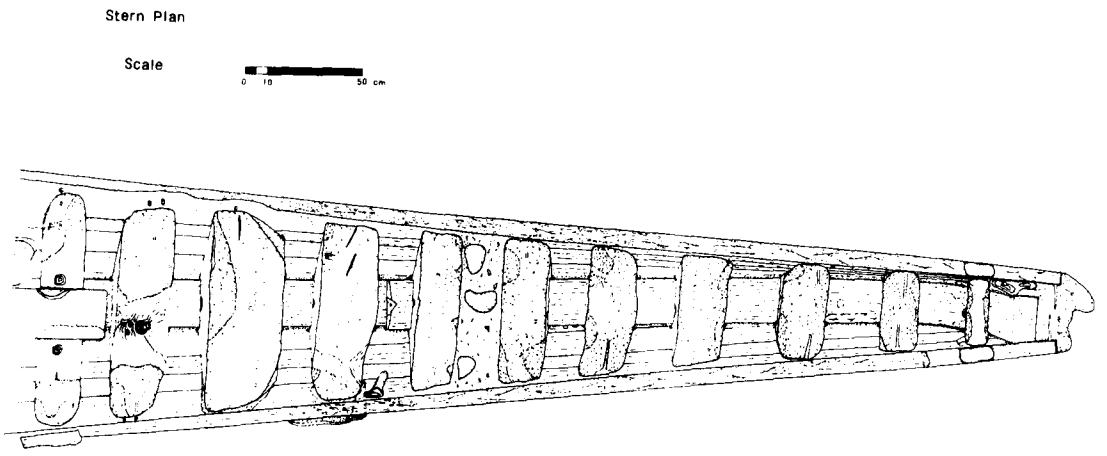

FIGURE 2. Plan view of stern section.

Theoretical formulas expressing desired ship dimensions of the time period, such as those found in Garcia de Palacio's 1587 *Instruccion Nautica para navegar*, will also aid in interpreting the Emanuel Point hull (Palacio 1988).

Conclusions

Notwithstanding the lack of crucial information regarding the vessel's construction and dimensions, some preliminary conclusions can be reached. The Emanuel Point wreck exhibits many of the Iberian shipbuilding characteristics found in other 16th-century New World shipwrecks, namely the notched keelson over the floors and use of a deadwood stern knee to strengthen the keel and stern knee post join. One unique and important aspect of construction was the juxtaposition of the ceiling between the buttress and footwale. Typically on contemporary wrecks, the outboard buttress end was butted to the footwale. Perhaps the use of wedged ceiling reflects a regional difference or individual preference for shoring up the critical mainmast step assembly.

Based on measurement, the Emanuel Point galleon seems to be a large vessel for its time, as evidenced by initial comparison with other examples in the archaeological record such as the Molasses Reef and Highborn Cay wrecks (Oertling 1987, 1989a; 1989b), *San Estéban* (Rosloff and Arnold 1984), Fuxa *não* (Lopez Pérez 1993), and *San Juan* (Grenier 1988; Steffy 1994:138). The hull exhibits fine craftsmanship, especially in the expanded mast step, with no observed traces of unfinished wood (such as bark) on the timbers. One live oak timber may signify that the vessel at some point in its career underwent a repair in the New World. Stone and lead shot found in the stern debris field implies that the vessel was armed. Patches and strips of lead suggest the hull below the waterline was lead-sheathed, at least in selected areas. Whether it was extensive structural damage or a great storm that forced the galleon onto the sandbar off Emanuel Point, the hull's condition apparently caused the Spanish not to recover it. However, it could have been salvaged of desired ordnance, cargo, and timbers while aground in the ca. 14 ft. of water at the time. The current designation of the shipwreck as a galleon rests largely on its estimated size, dual pumps and presumed ordnance, although further information is needed to secure this distinction.

In addition to considering the physical attributes of the wrecked hull, contemporary accounts of a galleon's use and function in 16th-century Spanish society present a humanizing quality to the shipwreck. Eugenio Salazar, while sailing to the New World in the mid-16th century, viewed the vessel he was on as "a floating city and settlement" (Phillips 1987:7). Hopefully, one day we will view the site not only as the ancient remains of a broken and scattered hull, but as it looked when sailing into Pensacola Bay over 400 years ago.

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Olive Pits, Rat Bones, and Leather Shoe Soles: A Preliminary Report on the Organic Remains from the Emanuel Point Shipwreck, Pensacola, Florida

Introduction

In recent years archaeologists have been extremely successful in evaluating often-fragile organic remains recovered from site sediments. Their success is largely due to improved methods in floatation processes and statistical analyses (Hastorf and Popper 1988:ix). Using these techniques to recover and analyze a variety of plant macrofossils, charcoal, pollen, and phytoliths, researchers have been able to form hypotheses about historic subsistence, medicinal practices, seasonality, and environmental conditions (Bryant and Holloway 1983: 191).

Like their terrestrial counterparts, underwater archaeologists have made the excavation of submerged shipwrecks into a specialized multi-disciplinary pursuit (Watson 1983:23). Yet, only recently have shipwrecks been examined for the smallest of bones, seeds, insect remains, pollen, and phytoliths (Weinstein 1993, Haldane 1990). Organic materials from shipwrecks may reveal clues to types of cargoes shipped, sailors' diets, and perhaps the date or season of the shipwreck (Weinstein 1993:3).

Methods and Materials

During the 1993 and 1994 field seasons, portions of the overburden were removed from the Emanuel Point shipwreck. A variety of well-preserved plant macrofossils, animal and fish bones, insect fragments, and fibers were uncovered. These specimens, along with larger leather fragments, dunnage, and other wooden artifacts, were recorded, given preliminary identifications, and placed in water-filled bags for the conservation laboratory. More fragile items were wrapped in gauze in plastic containers.

Owing to excellent organic preservation throughout the wreck, sediment samples for pollen analysis were collected. Once the overburden was removed from the upper portions of the floors and mast step buttresses, a "compost-like" bilge accumulation was found between each pair of timbers. Intermixed with this spongy, organic deposit were small ballast stones, wood scraps, clay deposits, and mercury droplets. Polyethylene bottles were used to remove approximately 100 ml of this material. To ensure that no extraneous water containing intrusive pollen was collected along with the samples, divers opened air-filled collecting bottles upside-down and above the compact layer of bilge sediment. By forcing the bottle into the sediment, a sample was collected with essentially no excess water, minimizing modern contamination. Upon recovery, organic artifacts were photographed, drawn, and conserved. After documentation, representative samples were sent to experts in faunal, fiber, botanical, and palynological analysis for identification and interpretation.

Insects

A number of chitinous fragments resembling insect wings were uncovered between the frames and keelson buttresses. Samples were sent to the Entomology Department at Texas A & M, where Dr. Horace Burke identified the most abundant insect parts as belonging to cockroaches. The remainder of the sample consisted of elytra (wing covers) from a species of Dermestes, most likely *Dermestes maculatus* De Geer, commonly known as the hide beetle. To identify the specific species of cockroach, a second examination of the fragments was made at the USDA research station in Gainesville, Florida, which identified the wing, pronotum (thoracic segment), and ootheca (egg case) of the American cockroach (*Periplaneta americana*).

In 1573, Eugenio de Salazar detailed his voyage from Spain to Santo Domingo (Hispaniola). In his narrative he jokingly refers to the numerous cockroaches aboard his ship as "game birds"

which he called *curianas* (Phillips 1987: 8). Cockroaches have also been called the "world's most persistent stowaways" (Peterson 1977: 734), which should not surprise anyone imagining the hold of a 16th-century wooden ship.

Fragments of 16 cockroaches and five egg cases were found in five encrusted artifact conglomerates from the site of *San Estéban*, wrecked off Padre Island in 1554 (Durden 1978: 407). Articulated wings and bodies, wings and empty oothecae were also found preserved between the stone cobbles of the ballast and hidden in the rope lashings of a gun carriage. Two species were present: *Blatta orientalis* and *Periplaneta americana*. A single American cockroach egg case was also recovered from the Spanish vessel *San Antonio* that sank off Bermuda in 1621 (Peterson 1977:734, Roth 1981: 1).

Despite its name, the American cockroach is not endemic to the Americas. According to Roth (1981:1), *Periplaneta americana* is believed to have originated in tropical Africa and was transported to South America, the West Indies, and the southern United States on slavers sailing from Africa's west coast. However, evidence from the above shipwrecks shows that the American cockroach reached the Americas before the slave trade reached large proportions.

Unlike the cockroach, the hide beetle has a cosmopolitan distribution (Hinton 1963[1945]: 262). Hide beetles produce larvae which are very active and avoid light. Larvae bore into hardwoods, and softwoods and have been known to damage cork, books, tobacco, tea, linen, cotton, woolens, salt, and even lead (Hinton 1963[1945]: 265). Full-grown beetles bore pupal chambers into any almost compact substance. The beetle's indiscriminate boring into various non-food materials is often noted; perhaps the earliest reference to this is in *The Last Voyage of Thomas Cavendish*. In 1593 Admiral Cavendish's ship *Desire*, pressed for a food source, was obliged to carry ca. 14,000 improperly-dried penguins aboard (Quinn 1975:37). Crew member John Jane wrote:

> "...after we came neere unto the sun, our dried Penguins began to corrupt, and there bred in them a most lothsome & ugly worme of an inch long. This worme did so mightily increase, and devoure our victuals, that there was in reason no hope how we should avoide famine, but be devoured of these wicked creatures: there was nothing that they did not devour, only yron excepted: our clothes, boots, shoes, hats, shirts, stockings: and for the ship they did so eat the timbers, as that we greatly feared they would undo us, by gnawing through the ships side." (Hakluyt 1925:256)

Both larvae and adult hide beetles eat high-protein substances, e.g. bones, carcasses, skins, meats, cheese, etc. (Hinton 1963[1945]:265). The presence of numerous hide beetles aboard the Emanuel Point ship suggests they came aboard with a cargo, possibly leather hides.

Botanical Specimens

In a 1-m-wide trench across midships a mass of ca. 400 olive pits (*Olea europaea*) was collected among several Spanish olive jar sherds. Although they were darkened by lengthy immersion, they are well-preserved in a variety of sizes (1.2 - 2.4 cm in length). Nearly all are complete except for a few in two pieces.

Ongoing analysis of the botanical remains is being conducted by Dr. Lee Newsom at the Center for Archaeological Investigations, Southern Illinois University at Carbondale. In addition to olive stones, identifications include cherry or plum stones (Prunus spp.), native hickory shell fragments (*Carya* sp.), North American black walnut shells (*Juglans nigra*), hazelnut shell fragments (*Corylus avellana*), acorns (*Quercus* sp.), a single almond shell (*Prunus dulcis*), a peach pit (*Prunus* sp.) and live oak leaves (*Quercus virginiana*). Equally interesting are pieces of coconut husk (*Cocos nucifera*), gourd fragments (c.f. bottle gourd, *Lagenaria* sp.), three pieces of

a sponge-like material resembling a young papaya stem (*Carica papaya*), a large, tropical sapote fruit seed (*Pouteria* sp.) and persimmon seeds (*Diospyros* sp.). Other seeds whose presence may be the result of drift include magnolia (*Magnolia grandifolia*) and swamp tupelo (*Nyssa* sp.).

The large number of olive pits found intermixed among the olive jar sherds confirms that olives were transported in storage vessels. Olive remains are common in Spanish ship and land sites. Several olive pits were recovered from San Estéban (Arnold and Weddle 1978:368), the 16th-century Western Ledge wreck found off Bermuda (Franklin et al. 1994:59) and in 16th-century levels at Saint Augustine and Santa Elena (Reitz and Scarry 1985:55). According to Reitz and Scarry (1985:35), "olives, grapes, and products derived from them, olive oil and wine, were important elements in the traditional cuisine. While survival did not depend upon these products, Spaniards felt deprived if they were absent from their daily diet." The Emanuel Point vessel may have been carrying wine or olive oil as well. The presence of pitch-covered corks confirms the Spanish practice of sealing liquid-containing jars with corks (*corchos*) and pitch (*escoperoles*) (Smith 1993:140).

The presence of nutshells and fruit remains may represent supplements to the official rations carried aboard the vessel. Phillips (1986:169) believes that "spices and condiments always accompanied the basic provisions—cinnamon, cloves, mustard, parsley, pepper, and saffron, to mention a few." She also mentions that fresh fruits and vegetables supplemented the voyages. Similar botanical remains were recovered from the Western Ledge wreck: almonds, plum or cherry stones, a coconut hull fragment, European walnut shells, and the base of a pumpkin stem (Franklin, et al. 1994:59). Food remains found on the *San Estéban* included almond shells and hazelnuts (Arnold and Weddle 1978:368).

Rope and Fiber

Eight rope fragments ranging in length from 21 to over 70 cm were found in test pits near the bow and midships. Examination revealed two distinct fiber types: hemp (*Cannabis sativa*) and what is tentatively identified as sisal (Agave *sisalana*). The larger rope fragments are hemp fibers worked into several threads 0.15 cm in diameter. These threads are right-hand laid and form three yarns, each 1.5–2 cm in diameter. By lying the yarns left-handed, ropes approximately 3.5–4 cm in diameter were fashioned. Two other rope lengths are each ca. 21 cm long and composed of three strands of interwoven sisal threads forming a 2.6-cm-diameter rope. Their excellent preservation is due in part to iron corrosion products that allowed individual fibers to remain in place. The discovery of sisal fiber is more illuminating. Sisal is a strong, durable, white fiber produced from the leaves of a West Indian agave, so the ropes may have been manufactured in the New World.

During excavation, divers recovered several small bundles of fiber resembling animal hair. Samples were sent to Bonnie Yates, Senior Forensic Scientist (Mammals) at the National Fish and Wildlife Forensics Laboratory in Ashland, Oregon. Exterior impressions of the fibers were examined to determine if cuticular scale patterns were present. Their absence and the cellular structure morphology showed that the material was vegetable fibers, not mammal hair. Surprisingly, their closest parallel is an unknown fiber decorating African Congo anthropomorphic masks. A second analysis of these fibers is now being conducted at Microtrace Inc. in Chicago, Illinois. Between planking seams in the stern area, divers recovered a material very similar to wool or cotton; undoubtedly caulking, this material has also been sent to Microtrace for identification.

Leather

During the 1993 field season, ten leather pieces were found. The three largest are shoe remains. Each exhibits stitching holes along its outer edge, and many of the holes retain traces of the original thread securing the fragments to the missing upper shoe. One heel-less insole measures 16.3 cm long and is comparable in

size to a modern woman's 5-1/2–6-1/2 B. Wear patterns indicate that it was a left shoe and originally may have resembled a moccasin with a soft leather sole sewn to a soft upperwork. The second fragment consists of a left heel or toe piece from a larger shoe or boot; the third appears to be part of an outer sole. The remaining leather consists of small pieces of various thickness and texture. One appears to be felt, and another, recovered from the port pump well, may be a remnant of the sump pump's flapper valve.

Dunnage and Cork

Lots of dunnage of various lengths was found in the lower hull of the vessel. These small branches range in diameter from 2 to 6 cm. A considerable number retain a golden-colored bark. Two species of wood are present: persimmon (c.f. with Caribbean Diospyros sp.) and alder (Almus *sp.*) (Lee Newsom 1993, pers. comm.). That the vessel was supplied with persimmon dunnage suggests that it may have been provisioned and loaded in the New World prior to the voyage to Florida.

Two corks, undoubtedly olive jar stoppers, were found lying near ceramic sherds. The most complete would have fit a jar with a maximum 6.6-cm opening. It measures 1.9 cm in thickness and has been trimmed to a tapered width of 4.8 cm at its charred lower end. A resinous deposit similar to pine pitch was found adhering to its upper surface.

Pollen Analysis

To test the feasibility of recovering pollen from the wreck, several sediment samples were collected from bilge debris in the pump wells, mast step mortise, and between the floors and buttresses of the ship. Four sediment samples were sent to the Palynology Lab at Texas A & M for pollen processing and presence/absence analysis. Before processing, each sediment sample was given a known quantity of an exotic tracer spore (*Lycopodium*, 11,300 ± 400 spores/tablet) to determine concentration values (Weinstein 1994:2).

Pollen preservation ranged from fair to good. A number of grains, particularly pines, showed evidence of maceration, collapse, and fragmentation. These effects indicate that the grains were subject to some type of mechanical stress. At this site, "these probably include abrasion, grinding, and maceration due to the proximity of the shipwreck to the north shore of the bay, wave action, the shallow depth of the site, and periodic high energy storm events" (Weinstein 1994: 4). However, each sample contained a large amount of pollen, a variety of taxa, few indeterminate grains, and high concentration values. The samples were dominated by pine with lesser amounts of pecan, walnut, maple, oak, *Ambrosia*-type (ragweed), and *Helianthus*-type (sunflower) composites, non-*Zea* grasses, and Cheno-*Ams* (Weinstein 1994:3).

According to Weinstein (1994:3), pollen types recovered in the Emanuel Point wreck sediments reflect floral types indigenous to the Pensacola Bay area. Although all samples exhibited evidence of mechanical and biological degradation, the presence/absence analysis confirmed that sufficient quantities of identifiable pollen are preserved in the bilge sediments to warrant statistically valid 200-300 grain counts. A complete analysis of these and future samples from the wreck may yield more specific information on the environment, shipboard diet, and cargo.

Faunal Remains

During the two field seasons, nearly 350 bones were recovered from inside the hull. Although mostly disarticulated, the bones are in extremely good condition, darkened by organic staining. The identification and taphonomic analysis of these bones is presently undergoing study at Texas A & M's Physical Anthropology department. However, a majority represents a shipboard stowaway, the black rat (*Rattus rattus*). Others attest to the utilization of beef, pork, sheep or goat, chicken, fish, and possibly shark aboard the vessel (Derrow 1995).

Excavation of the Emanuel Point shipwreck is at an early stage, and only ca. 10 percent has been thoroughly excavated. However, the range and excellent preservation of organic materials shows that considerable information can be derived from their continued analysis. As more organic samples are recovered and analyzed, a clearer picture may emerge of the ship's route, cargo, diet, and life aboard.

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Examples of Ceramics from the Emanuel Point Shipwreck

Introduction

Artifacts recovered from the Emanuel Point wreck during preliminary archaeological excavations consist of several materials ranging from leather and organics to metal and ceramics. This paper presents an analysis and discussion of the ceramic assemblage recovered during the first phase of excavation of the Emanuel Point Shipwreck, designated 8Es1980 in the Florida Site File. An attempt will be made not only to establish a site chronology but also to explore other ways in which ceramics assemblage study can be of use to anthropologists.

Maritime Earthenware

The dawn of the Age of Exploration was accompanied by an increased reliance on ceramic storage vessels for Iberian sailors sailing into the unknown. With the depletion of timber resources from centuries of shipbuilding and domestic usage, a stable and versatile alternative was needed to the cask or barrel for storing and transporting such goods as olive oil, wine, vinegar, and other needed liquids (as well as staples like olives and other foodstuffs). Amphorae, long used to transport liquids in the Mediterranean, seemed perfect for the task. These coarse, porous earthenware vessels were shaped to be stacked easily in a ship's hold. The containers had the added benefits of strength and the ability to be reused. With little modification—a slight change in shape and a decrease in handle size and form—the amphora, now in the form of *botijas*, *botijuela* and *botija peruleras*, joined the Iberian sailors on their explorations (Deagan 1987). On transoceanic voyages, these storage vessels served the dual function of storage container and ballast, for a large Middle-style jar weighed ca. 53 lb. (Marken 1993). Once a voyage was complete, the jars could be off-loaded, washed, and readied for another.

One problem with storing liquids in porous containers is seepage. Coarse, low-fired wares tend to absorb liquid, leading to loss of supplies. One solution is to seal the interior of the vessel with a waterproof substance such as pitch or resin, as found on many Emanuel Point Shipwreck sherds. In addition, container surfaces can be sealed with a kaolin clay slip. While not as permanent as resin, a slip provides adequate protection for thicker liquids like oils. Examples of this waterproofing also exist in the Emanuel Point assemblage. Another solution is lead-glazing a vessel's surface. Early glazes, usually a medium to light green or brown, were often applied thicker in some spots than in others. The intent was to seal the vessel, not necessarily to beautify it.

The ceramic assemblage from 8Es1980 consists of four distinct groups of pottery. The first, an unglazed coarse earthenware, is by far the largest percentage of the collection. For this study, a representative sample of ca. 25 percent of those sherds has been analyzed after conservation.

Olive Jars

The common form for the Iberian storage vessel is that of an ovoid jar or "olive jar," as first termed by W. H. Holmes in *Aboriginal Pottery of the Eastern United States* (1903). John Goggin (1960) continued this tradition, using the term in his typology of the three basic forms of storage ware found at archaeological sites with Iberian components. Believed to have its roots in the Mediterranean, the olive jar bears a striking resemblance to the amphora of classical antiquity (Marken 1994: 33-4). Goggin's was the first detailed exploration and classification of olive jars, and he developed a typology that remains the basis for identification today. By dividing the range of olive jars into three distinct styles based on form and rim shape, he established separate chronologies for the different styles. His Early, Middle, and Late styles are further divided into

shape types as well (excluding the Early style).

According to Goggin, Early-style olive jars average ca. 24.8–23.5 cm in height, with vessel walls ca. 7 mm thick. Their most distinctive feature is the rim shape, which is characteristically lipless and lacks the later styles' donut appearance. Rims are ca. 4.7 cm in diameter and some vessels have irregularly-shaped handles positioned on each side of the vessel's shoulder. According to Deagan (1987:33), a thin white slip is often present on the exterior with a green lead-glaze on the interior. However, Marken (1994) disagrees, suggesting this slip-like appearance may reflect either weathering, water damage, or a chemical change from the firing process. Avery's research (George Avery 1994, pers. comm.) offers yet another explanation: the addition of salt to paste containing calcium carbonate before firing produces the slip-like effect known as efflorescence. He believes this was an intentional result of the firing process.

Another storage-vessel analysis by Avery (1993) compared rims from marine contexts to establish a shape chronology. He used the Padre Island Wrecks (1554), the Spanish Armada Wrecks (1588), *El Rosario* (1590), *San Martín* (1618), and an unidentified wreck excavated by Seahawk Deep Ocean Technology (believed to be from the 1622 fleet) to push back the Middle-style rim date to 1554. He is also attempting to discover a connection between rim shape and function (Avery 1994).

Emanuel Point wreck ceramics can be seen as temporal markers of the probable deposition date. To establish their relative timeline, it is necessary to look at other sites with similar material. Sites for comparison include the wreck sites listed above and terrestrial contexts such as the colonial depositions at Santa Elena, South Carolina, and St. Augustine, Florida.

Emanuel Point wreck rim sherds are not of the typical Middle-style shape. Of the eight rims analyzed, two were 7 cm in diameter and were thin and straight. Four rims were 8 cm in diameter and possessed a slightly thicker lip—almost an inverted-teardrop shape. One sherd 10 cm in diameter was attached to a relatively large shoulder section and had a relatively straight lip. A single *El Rosario* rim demonstrates a different style from those on the Emanuel Point wreck. The 1590 rim has the donut shape typical of the Middle-style jars defined by Goggin and is similar to the Type 3 rims defined by Marken.

The Padre Island Wrecks yielded 15 coarse earthenware olive jar rims. Seven were of the thick, Middle-style variety; eight were of the Early style. Along with these rims, 718 unglazed and 21 glazed sherds were recovered. One 1554 fleet rim shape is similar to those recovered from the Emanuel Point wreck. The rim termed by Marken as Type 2 from this fleet is very similar to the inverted-teardrop-shaped rims recovered from 8Es1980 (Marken 1994).

The 1588 Spanish Armada wrecks off the Irish coast provide archaeologists with a *terminus post quem* for Middle-style rims. Rims profiled by Martin (1979) are representative of both Early-and Middle-style rims. Of the 11 rims he profiled (1979:280), only one is of the Early style similar to the 8Es1980 rims. The other ten are of Marken's Type 3 variety (1994). The Spanish colony at Santa Elena (1566-1587) on present-day Parris Island, South Carolina, provides a comparison for both Early- and Middle-style jars. Included in the collection are flat-based and standard, rounded vessel shapes. Rims range from the inverted-teardrop shape and straight rim to the donut-shaped, thickened rim typical of Goggin's Middle-style vessel (South et al. 1988:274-276). Comparison with the Emanuel Point rims confirms that the typical Middle-style sherd common after 1580 is not found on 8Es1980.

A major point becomes clear from this comparison. Sites containing pre-1580 depositions contain rim sherds similar to those recovered from the Emanuel Point Shipwreck. Sites with depositions dated 1580 or later contain rim sherds not found in the Emanuel Point assemblage. Sites with long occupations, such as Santa Elena and St. Augustine, contain both rim types. From this, one can conclude that the ceramic

assemblage thus far recovered from 8Es1980 pre-dates 1580 rim styles. It is hoped that further research will narrow this temporal framework.

Analysis of body sherds in the ceramic assemblage revealed a range of wall thicknesses from 0.3–1.2 cm, suggesting at least two separate olive jar styles. The thinner-walled sherds are distinctly colored and probably have an inner slip. These sherds are almost certainly from an Early-style vessel, though not necessarily one with handles.

The thicker-walled sherds are indicative of Middle-style vessels, yet no Middle-style rims have been found. This places these vessel sherds in a gray area between known types. Attempts to reconstruct the Emanuel Point olive jars suggest that the assemblage contains Middle-style jars and at least one Early-style *cantina*, based on rilling patterns and vessel shape. Avery suggests that the Early-style vessel defined by Goggin is not an olive jar but rather a form of *cantina* (George Avery 1994, pers. comm.). According to the Listers (1987:132), it likely is a *cantimplora*, an early style of container descended from the Near Eastern pilgrim bottle which fell into disuse as a primary vessel in the mid-16th century. Vertical rilling patterns on one partially-reconstructed sherd suggest that it is a *cantina* rather than an olive jar. However, at this point no handle remnants or breakage scars appear on the recovered sherds. It is possible then that it is a transitional vessel between the handled, thin-walled *cantina* and the Middle-style olive jar. The Emanuel Point sherds may bridge the Early- and Middle-style vessels and provide additional information for understanding the true nature of the puzzling olive jar tradition.

Lead-Glazed Earthenware

The second group of ceramics recovered from Emanuel Point is lead-glazed coarse earthenware. These sherds include two diagnostic types: Melado and El Morro. Melado (1490-1550), a lead-glazed ware with a white underslip, is distinctively honey-colored and easily dated to the early- to mid-16th century. A handle fragment tentatively identified as Melado has been recovered from the Emanuel Point Shipwreck. The apple-green variant exactly matches fragments of a form of Melado. El Morro ware (1550-1770) is characterized by a thick, shiny glaze with some temper inclusions. The dates for these two wares have been established in contexts at St. Augustine and Santa Elena, as well as other Caribbean colonial sites (Deagan 1987:28).

Tin-Glazed Earthenware

The third group of ceramics found at Emanuel Point is tin-glazed enamelware, first introduced during the 15th century in Italy and later popular throughout Europe. Referred to as *maiolica* (Italian), *majolica* (Iberian), *faience* (French), or *delft* (Dutch and British), the original Italian form was a thick white tin slip, hand painted (usually with a floral or geometric design), overglazed with a clear glossy finish (*coperta*), and fired. One drawback of this type was that the combination of soft, chalky, coarse earthenware and low-fired glazes frequently led to heavy crazing or cracking in the enamel surface (Lightbown and Caiger-Smith 1980). Two enamelware sherds have been tentatively identified. The first is possibly a Sevilla Blue-on-White or Blue-on-Blue, dating between 1492 and 1600 (Deagan 1987:62-4). The second appears to be from a Yayal Blue-on-White basin with a blue-on-white design on the interior base surface.

Aboriginal Ware

The final group of ceramics recovered from Emanuel Point consists of four sherds ostensibly aboriginal in origin. The first has a red-slipped, highly burnished surface with a geometric design. The pattern of zigzag lines and dots is possibly of the Aztec IV period and appears to be drawn in graphite. Two effigy sherds, one with a grimacing mouth with outlined teeth and surrounding face paint, the other with a molded left eye and cheek and facial decoration (Figure 1), also appear to be of the Aztec IV period (Pasztory 1983). Aztec IV consists of a buff paste with a highly burnished red slip exterior,

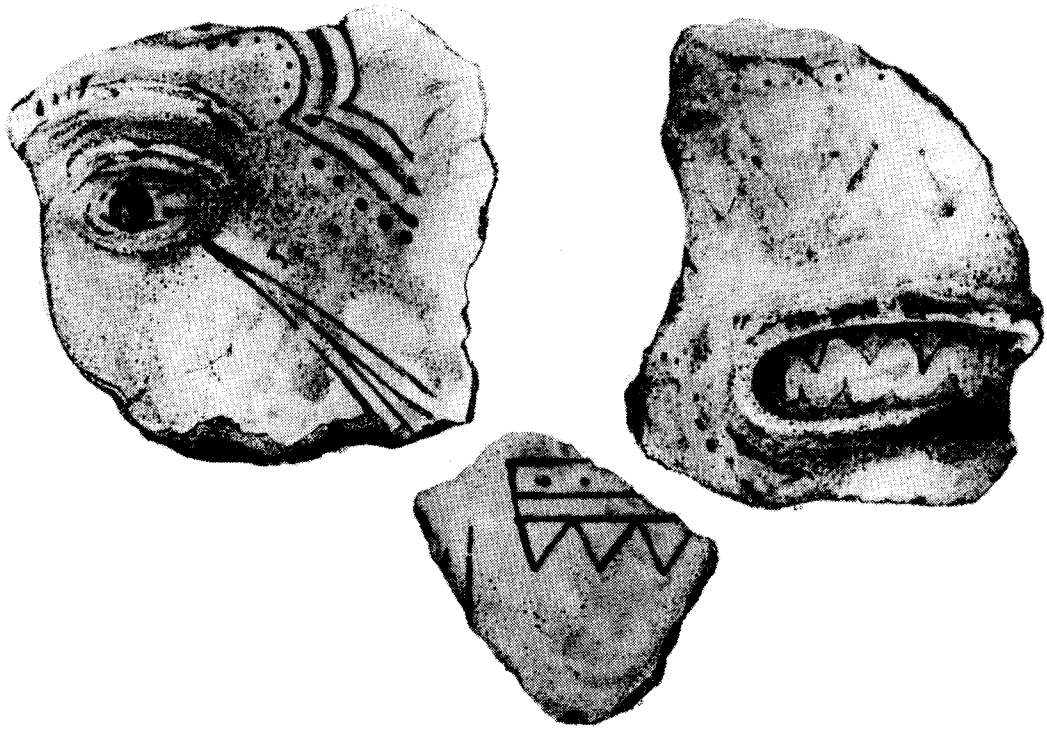

Figure 1. Aztec IV Ceramics. (Drawings by Lydia Davis.)

frequently seen with graphite-based paint applied in geometric patterns. This type of pottery ceased to be manufactured after 1576 due to an epidemic disease within the Mixtec potter community. Identification of these ceramics is tentative and analysis is ongoing.

Conclusion

Analysis of the Emanuel Point ceramic assemblage suggests that the shipwreck occurred between 1550 and 1580. However, ceramics can be used for purposes other than establishing site chronology. With the Emanuel Point ceramics, sherd-mending offers information for a possible reconstruction of the ship's wrecking process. While cross-mending sherds from various proveniences, a trend seemed to occur in one particular vessel. A partial rim and shoulder were recovered from the outer port footwale, with upper body sherds found slightly more inboard and middle body sherds found above the keel. Tracking their positions indicates that the vessel fell to port and broke, depositing the sherds in a linear pattern. By tracking these patterns, we may be able to reconstruct the wrecking process.

Although archaeologists can learn basic chronological information from the site ceramics, we can learn much more if we look closely at the assemblage, how the sherds cross-mend, and what they can tell us about the users.

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Unique Artifacts from the Emanuel Point Shipwreck

Introduction

In fall 1992, the Pensacola Shipwreck Survey team ground-truthed a target generated by a magnetometer survey of the Emanuel Point area. The ballast mound located by this search seemed similar to others located during that summer of remote sensing. However, upon testing, the ballast stones were found to conceal the final resting place and remains of a unique ship. This 16th-century Spanish sailing vessel is the earliest shipwreck in Florida waters and may have been associated with the first attempt to colonize what is now the United States—the 1559 Tristan de Luna expedition.

During the last two seasons, significant amounts of ship timbers have been uncovered, mostly well preserved due to the thick bilge sediments and overburden protecting the wood from wave action and marine borers. Associated artifacts also protected and preserved by the sediments have aided in establishing the nationality and date range of the vessel. The ubiquitous "olive jar" was well represented and indicated Spanish nationality for the ship, as did the comparatively few glazed ceramics recovered from the site. Organics, many perfectly preserved, gave clues to the history of the ship, as detailed in John Bratten's accompanying paper. However, along with artifacts common to 16th-century Spanish shipwrecks are others never before seen in this context. This paper describes these items and presents information obtained to date from their various analyses.

Artifacts

One unique object has become the iconographic image of the Emanuel Point Shipwreck. A small carved silhouette of a 16th-century ship, it was found on the ceiling just abaft the port pump sump. Stained dark from ambient bilge sediments, the carving is perfectly preserved and undamaged from its 400-year burial. Original dimensions were 11.3 cm long by 4.4 cm tall with a thickness ranging from 0.4–0.7 cm. Fashioned of fir, the carving exhibits classic 16th-century galleon characteristics such as a heavy projecting beak, lofty forecastle, and towering stern castle with gallery. It appears to have been whittled of scrap and deposited in the bilge during the ship's construction. It was treated with polyethylene glycol (PEG) 400 and freeze-dried. The only other known contemporary image of a Spanish galleon from the New World is a graffiti-like rendering on a plank discovered on the Red Bay galleon San Juan (Stevens 1986:2).

A large metal jug was discovered in the wreck's bow area. Unlike any artifact recovered from a 16th-century wreck site in the Old or New World, the jug appears to have been used to heat liquids for cooking. This conclusion is based on the shape of the jug, rather like an "admiral's" coffee mug with a large flared base and relatively small mouth enhancing stability on a heaving ship. The jug is 27.8 cm high; the inside diameter of the mouth is 8.7 cm with the body graduating to an extreme width of 31.8 cm at the flared base. The bottom of the jug was attached separately and has a shallow concavity rather like a wine bottle pontil. The handle and rim also appear to be formed of a separate piece of metal attached to the body of the jug. A small spout molded into the 1.1-cm-thick rim facilitated pouring. The 2.5-cm-thick handle opposite the spout extends from the top of the opening to ca. 13 cm down the body of the jug at the attachment point.

In order to determine the jug's material, a sample was sent to the Western Australia Maritime Museum to be analyzed with the Chemistry Centre's scanning electron microscope. Results concluded that the jug was copper and that there is probably no original metal left—only corrosion products. Further tests indicated traces of sulfur, tin, and iron consistent with contamination from nearby objects. Later x-ray fluorescence of the jug at the Winterthur Museum Analytical Laboratory confirmed that it was copper with small amounts (less than 1 percent) of

trace metals such as tin, antimony, silver, and lead. However, analysis of a sample from the interior revealed much higher concentrations of tin (up to three times as high as the exterior samples), suggesting that the interior may have been coated or lined with tin. Conservation of this artifact is focusing on the removal of chlorides with a 3 percent solution of sodium sesquicarbonate; since little original metal is left, electrolytic removal of the corrosion products might leave nothing at all. Research in contemporary art has produced a woodcut depicting a similar jug; based on a 1558 Bruegel the Elder drawing, it shows an alchemist's laboratory with the jug on the floor near a stove (Klein 1963: 171). Interestingly, this jug also appears to have a separate mouth and handle piece. Currently, the jug is in an exhibit on colonial Pensacola in the T. T. Wentworth State Museum in Pensacola—the first artifact from the Emanuel Point Shipwreck to be displayed in a museum.

A small brass ring was found associated with the metal jug. This ring is 0.5 cm thick, with an inner diameter of 3.6 cm and an outer diameter of 4.7 cm. It is in pristine condition and was shiny when first recovered. It may be associated with the galley, but excavation was limited to test units to determine the extent of metal scatter on the site. Both the ring and jug were found to be resting on what are probably forward starboard cant frames. A similar, slightly smaller brass ring of unknown usage was recovered from the wreck of *San Estéban* off Padre Island (Arnold and Weddle 1978:292).

A large copper cauldron was discovered less than 2 m from the metal jug and ring. Although incompletely excavated and left in situ, certain attributes were noted. It has a solid, 1.5-cm-thick copper handle curving from one side of the neck to the other and fastened with copper lugs measuring 2 cm wide and 1 cm thick. The rim is 1 cm thick and 8 cm in height; the mouth diameter is 34 cm. Although the metal appears to be in good condition, the body of the cauldron appears collapsed and fragile. The presence of these two artifacts probably associated with cooking suggests that this area of the bow was the galley; this hypothesis will be further tested in future excavations.

Two tool handles were recovered from sediments near the main mast step. The larger was found resting on the port forward bilge boards and measures 20.8 cm long by 4 cm wide at the middle, tapering to ca. 2 cm in width at the extreme ends. It is circular in cross section. A small square hole measuring 1.1 by 1.8 cm is in the middle of the handle. The hole placement and overall handle shape indicate that the hole may have been for an auger-like tool or cargo hook. The smaller handle is also circular in cross-section but measures only 14.2 cm long and 1.1 cm wide. One end is worked and may be the attachment point for an implement. Both handles have been conserved with PEG and freeze-dried.

During the 1994 season additional artifacts were recovered; although not unique among 16th-century shipwrecks, they are diagnostic for the Emanuel Point Shipwreck. Five stone cannon balls, or bolaños, were discovered near the stern. Four of these have been recovered; one is attached to a metal concretion obstructing accurate measurement. The balls appear to be fashioned by hand of limestone and their similar size indicates use in the same gun. Their weight ranges from 1,709.8–1,821.8 gm with diameters from 10.65–11.02 cm. Similar cannon balls were found on the 1554 Padre Island, Texas wrecks—one on *San Estéban* and five on *Espíritu Santo* (Arnold and Weddle 1978:250-252; Olds 1976: 85-86). The *San Estéban* ball is limestone, weighing 1,147.3 gm and measuring 9.9 cm in diameter (smaller than the Emanuel Point Wreck bolaños (Arnold and Weddle 1978:250-252)). Those from *Espíritu Santo*, also limestone, measure from 9.9 to 12.6 cm in diameter and weigh 1,289.9–2,693.2 gm (Olds 1976:85-86). Two stone balls have also been recovered from the 16th-century St. Johns Bahamas wreck currently under investigation. These appear to be limestone as well and measure 9.2 cm and 9.8 cm in diameter (Malcolm 1992). Stone balls were formed by hand, probably with a template to ensure uniform size for a particular weapon. Shot from

a pedrero, the stone balls were intended to shatter upon striking an enemy ship and aid in clearing the decks of men—an early form of shrapnel. To date, no weapon capable of firing the stone shot has been discovered on the Emanuel Point Ship, but the balls will be exhibited in a Pensacola museum.

Lead shot also were recovered from the stern area. These appear to have been wrought from lead stock, as no mold marks or sprue scars are evident. There is also no evidence of iron cubes inside the lead shot, in that they lack magnetism. As stated by Keith (1987:197, 210) in his report on the Molasses Reef Wreck, an early 16th-century Spanish wreck in the Turks and Caicos Islands, typical verso bore diameter was approximately 45 mm while the bore diameter of a haquebut measured around 20 mm. The lead shot recovered from the Emanuel Point Ship measure 35 mm in diameter, thus falling between these two weapons' bores. No evidence of either versos or haquebuts has been found on the Emanuel Point wreck.

Mercury also was recovered from the Emanuel Point Shipwreck. A small piece of wood containing mercury droplets was found in 1993 and larger quantities have since appeared. To date, approximately 250 ml (3,270 gm) of mercury have been recovered, all from the stern area between floors. Although quicksilver often was carried on voyages for medical purposes, the liquid metal was not transported in quantity until 1556 when it was imported to the Spanish colonial mines in the Americas for the amalgamation of silver from ore (Haring 1964[1918]: 158). Smelted from cinnabar ore, mercury used in the silver mines of Mexico was largely imported from Almadén, Spain, site of one of the largest European mercury mines (Whitaker 1941: 5); smaller amounts were imported from the mines at Idria in the Austrian Alps (Haring 1964[1918]:158). Another 16th-century shipwreck in the New World with mercury includes the as-yet unexcavated Cayo Nuevo site in the Bay of Campeche. This wreck was investigated in 1979 by members of a joint Institute of Nautical Archaeology and Mexican National Institute of Anthropology and Archaeology survey team who recovered brass pins with mercury adhering to them (Smith 1988: 88).

Conclusion

Analysis and research on these unusual artifacts from the Emanuel Point Shipwreck continues. A few artifacts currently are on display; more will follow as conservation is completed. The excavation has piqued the interest of the local community and has been featured in area magazines and on the local news. As a result, public support for the project is growing. The citizens of Pensacola are protective of their shipwreck; local divers and recreational boaters are respecting this shipwreck site and helping to monitor it.

Excavation and research to date lead to some preliminary conclusions. For example, the discovery of the ship's cauldron and the metal jug in the bow seems to indicate this area was the galley. The discovery of shot but no guns implies the weapons may have been salvaged, an hypothesis supported by the shallow depth of the wreck. The presence of mercury suggests the ship may have been involved in the quicksilver trade to the New World for the mining industry; alternatively, the metal could have accumulated over the life of the ship. Although these ideas are based on current research, more investigation and analysis is needed before any conclusive theories can be formed. An open invitation is extended to anyone who may have encountered similar artifacts or who can provide information for further research.

The Emanuel Point Shipwreck has been investigated for only two seasons. Excavations so far have focused on a small portion of the midships area around the main mast step, the stern of the vessel, and minor test units to investigate the metal scatter; an estimated 90 percent of the shipwreck remains to be studied. Yet, in these small areas, unique artifacts have been discovered that can provide new information about early European contacts in Florida.

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From Maritime Antiquarianism to Underwater Archaeology Along the Potomac Corridor, 1825–1994

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From Maritime Antiquarianism to Underwater Archaeology Along the Potomac Corridor, 1825-1994

In 1588 a small Spanish reconnaissance expedition sailed into a great, unexplored estuary known only as Bahia de Santa Maria, in a vaguely defined region of the New World called Ajacan. The mission of the expedition, which had been launched from Saint Augustine, Florida, under the command of Captain Vincente Gonzales, was to locate a reported English settlement at what is now known as Roanoke Island. Although he failed in his primary objective, Gonzales was destined to become the first European to explore the full extent of the great estuary of Bahia de Santa Maria. One of the principal discoveries made during his exploration of this vast embayment was that of a great river that was promptly named San Pedro. Bahia de Santa Maria was, of course, the Chesapeake Bay, and the Rio San Pedro was the Potomac River. Not until 1608, however, a year after the first European settlement in America had been established at Jamestown, Virginia, would the first thorough mapping of the bay and the navigable reach of the Potomac be undertaken by Captain John Smith. Within two decades, the river was being regularly visited by traders from Jamestown and Kecoughtan, Virginia, and Kent Island Hundred, the first English settlement in what is now Maryland.

In 1634 the first European settlement on the Potomac was erected just a few miles up one of its many tributaries, the St. Mary's River. The settlers had been carried aboard two small vessels, the *Ark* and *Dove*, chartered by the Proprietor of the colony, Cecil Calvert, Lord Baltimore, to establish the new colony of Maryland. For the next 60 years, St. Mary's City would serve as both the seat of colonial government and the focal point of interminable social and military conflicts. It would also serve as a launching pad for the missionary efforts of a small but influential band of Jesuit priests bent on the conversion of the many native peoples along the river's shores. In 1642, the first recorded shipwreck in Maryland waters occurred in a small tributary of the Potomac called Piscataway Creek owing to the missionary zeal of one such priest, Father Andrew White. A New England-built vessel, it had been hired by the priest to carry him in mid-winter to a settlement of Piscataway Indians. Upon arrival at its destination, the ship became lodged in the winter ice and sank.

Thereafter, shipwrecks and strandings on the wide and often treacherously shoal Potomac waters became quite common. Many have dramatically influenced history. In 1657, for example, when the London merchantman *Sea Horse* anchored to ride out a storm off Mattox Creek near the Kettle Bottom Shoals, it was lost. The ship's second officer settled on the Virginia shore, erected a plantation, served in the House of Burgesses, and fathered a patrician family. His great-, great-grandson was George Washington.

The rise of international maritime commerce on the river began with the foundation of the city of Alexandria, Virginia, in 1749. By the end of the 18th century (Figure 1), the city had become the fifth most important port in English America and was even considered as a candidate to become the new nation's capital. The arrival of the steamboat era, which helped facilitate the ascendancy of Alexandria and supported the infant capital city of Washington, brought with it many catastrophes on the river. Some, such as

the destruction of the steamboat *Wawasset* off Chatterton's Landing in 1870 with the loss of nearly 100 lives, had far-reaching consequences in the development of regulatory measures throughout the American steamboat industry.

In the many wars of America, the Potomac was often the scene of major naval conflict, with Maryland and Virginia often fielding their own naval forces for defense of the waterway against invaders. During the American Revolution, the

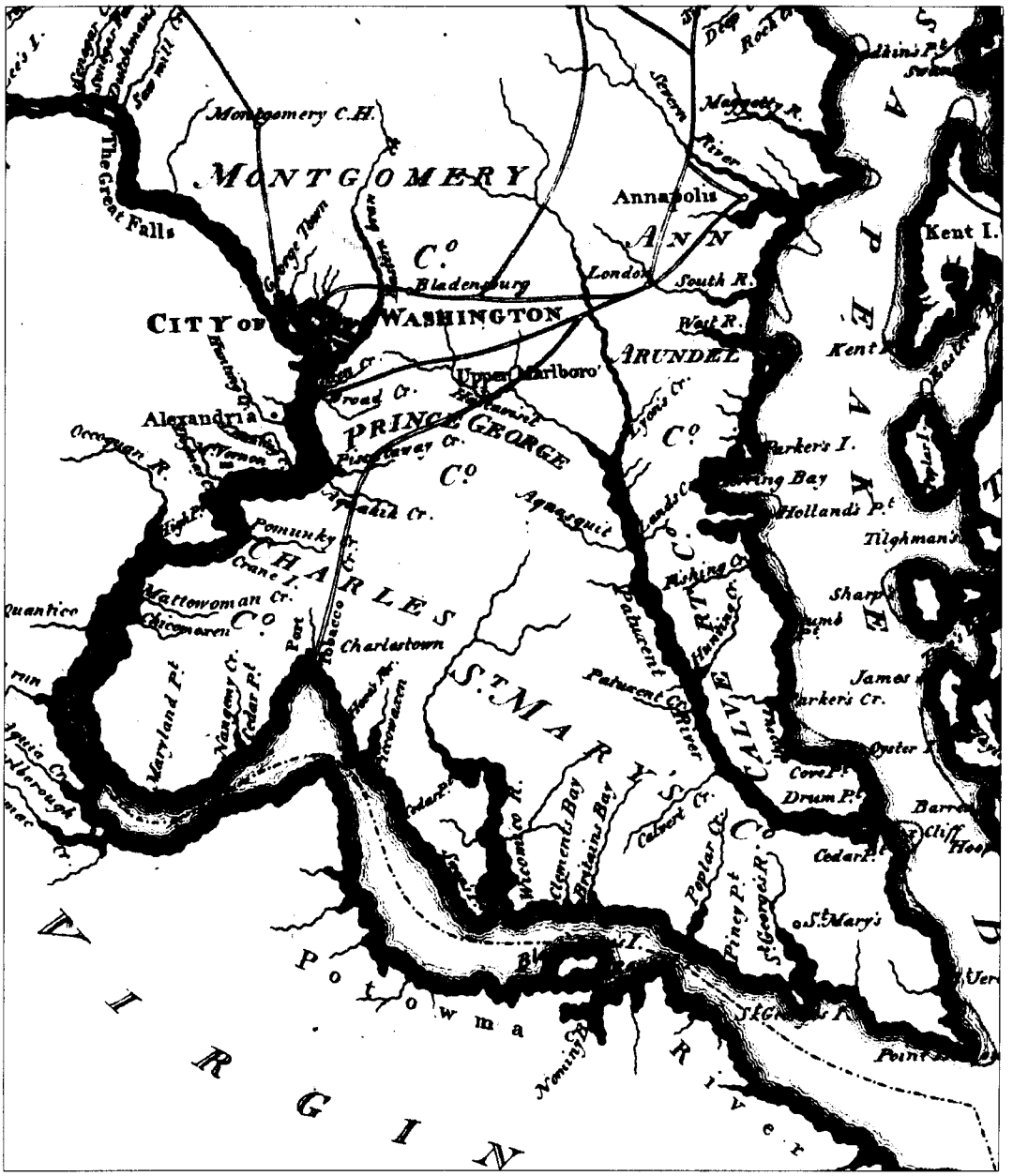

FIGURE 1. Detail from Samuel Lewis's map *The State of Maryland* showing the navigable reach of the Potomac River in 1795.

river suffered from many seaborne invasions, not the least of which was promulgated by Lord Dunmore, the last royal governor of Virginia. Dunmore entered the river in the summer of 1776 with a flotilla of nearly 100 vessels and raided as far north as Sandy Point, Maryland, destroying plantations and local watercraft as he went. When he departed, lacking the manpower to take them with him, he left behind 20 loyalist refugee ships on the river bottom off St. George's Island.

From the onset of the War of 1812, the Potomac witnessed repeated naval conflicts. Royal Navy forces plundered at will, opposed by only a weak U.S. Potomac Flotilla. In 1814 a British fleet ascended the river, destroyed Fort Warburton (Washington) and captured the City of Alexandria, where 20 vessels had been scuttled by merchants to prevent capture.

During the Civil War, the river saw constant action. Defended by the U.S. Navy's Potomac Flotilla, the Potomac witnessed the demise of many lighthouses, blockade runners, merchantmen, and both Confederate and U.S. Navy warships. At the mouth of the river at Point Lookout, Maryland, the largest Confederate prisoner-of-war camp in the Union was erected, containing as many as 35,000 men.

Following the close of World War I, the Potomac became the repository for 218 wooden and composite steamships built by the U.S. Shipping Board. They had become obsolete and were sentenced to be broken up for scrap at Widewater, Virginia, and Mallows Bay, Maryland.

During World War II and afterwards, the river hosted a considerable military presence, primarily for the testing of weapons such as torpedoes and mines. In 1949, it accepted into its bosom as a naval test subject a vessel which would prove to be of great importance to American Cold War military technology. The ship was *U-1105*, a World War II German submarine surrendered at the end of the war and employed for top secret testing thereafter. *U-1105* was one of fewer than ten vessels built for the German Kriegsmarine to be coated with synthetic rubber tiles intended to deceive Allied sonar. It was the first successful adoption of "Stealth" technology during wartime—and one later adopted by the United States.

The archaeological resources of the littoral of the Potomac River Corridor are well known. Yet the submerged cultural resource base is only beginning to be assessed. Within the bosom of the Potomac lie at least 350 documented shipwreck and derelict vessel sites dating from the Contact Period onward. An ongoing demographic study by the author regarding the lives and final dispositions of a random sample of 2,600 vessels registered or owned in Maryland and Virginia between 1866 and 1900 suggests that as many as 300 additional vessels may have been abandoned in the river and its tributaries without being reported during and after that same period. It is a tradition that still holds sway over many watermen to this day. Wharves, landings, harbor facilities, inundated prehistoric and historic settlement sites, military works, towns, and random deposition sites also survive in greater or lesser measure.

Yet with a single exception, the submerged cultural resources of the Potomac River were completely ignored until the 1980s. The sole exception occurred in 1824 when Father Joseph Carberry, Procurator of the oldest Jesuit mission in the United States at St. Inigoes Church, recovered from the waters off St. Mary's City and at an inundated 17th-century military site known as Fort St. Inigoes seven cannon believed to have been brought to America aboard the *Ark* and *Dove*. It was not archaeology, but it was the first recorded antiquarian effort to recover the artifacts of history from the river for the sake of history. One of the guns was presented by the priest to Charles Benedict Calvert, direct descendent of the Lords Baltimore, and mounted at his estate at Riversdale, Maryland; one was presented to the State of Maryland and mounted on the statehouse lawn in Annapolis, and two were mounted at Georgetown University. In a most unantiquarian act, three were buried as boundary markers on the mission property on St. Inigoes Creek. In 1934 two of the latter were recovered from their burial sites and mounted on the lawn of the reconstructed statehouse at St.

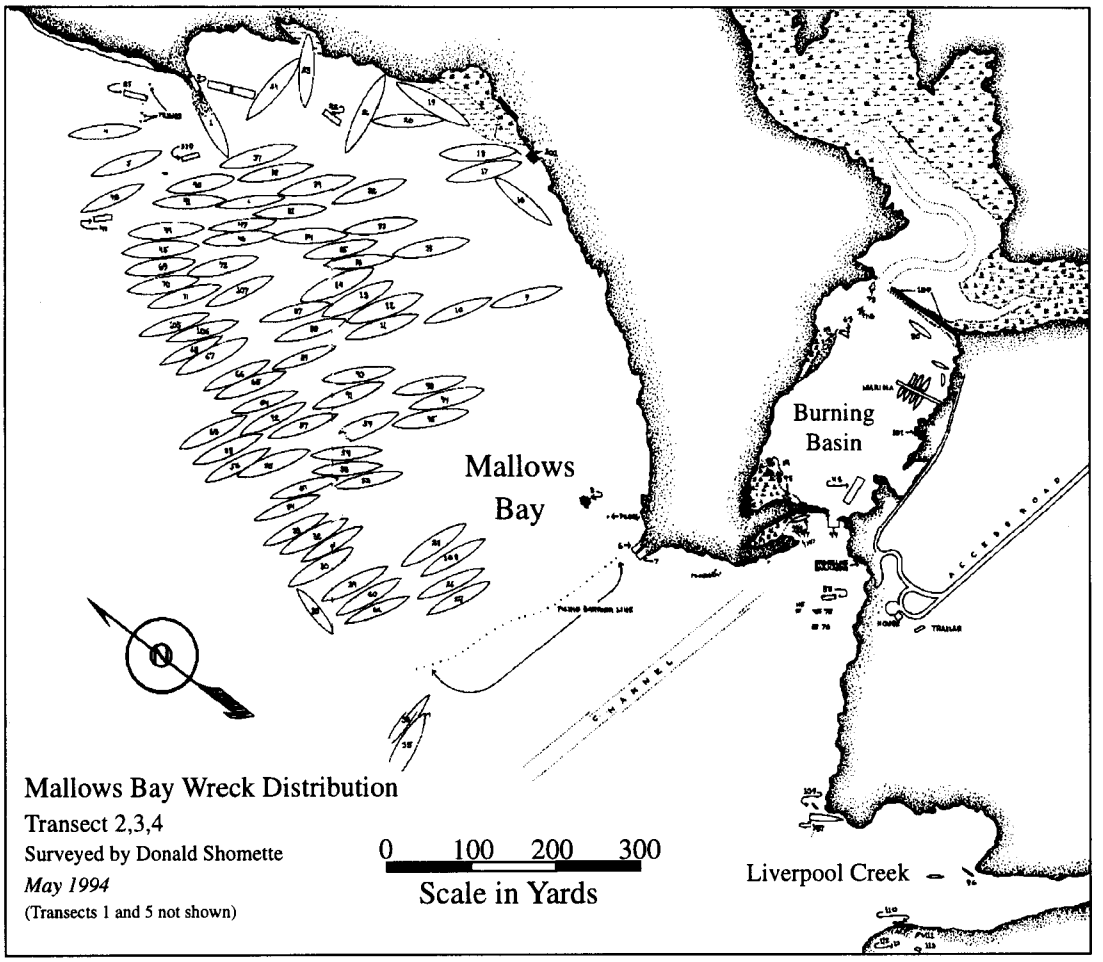

FIGURE 2. Shipwreck distribution in Mallows Bay, Maryland, the largest concentration of shipwrecks in the United States.

Mary's City. In 1958, Dr. Frank Howard of Silver Spring, Maryland, began a study of the guns recovered by Carberry and relocated and recovered the last remaining gun from its burial site on St. Inigoes. Howard's study revealed that at least four of the guns were demi-culverins and sakers, and of the correct typology and period as the establishment of the St. Mary's settlement. In September 1958 he conducted an underwater search for additional guns believed to be lying off Fort Point, at the purported site of Fort St. Inigoes, but failed to discover any more weapons. In 1971 the St. Mary's City Commission contracted Harold L. Peterson to assess the two pieces of ordnance brought to St. Mary's in 1934. Comparing the St. Mary's guns to samples in European and American collections, documents in the written record of gunfounders, and artillery recovered from a Bermuda shipwreck dating to 1595-1600, Peterson determined that one of the demi-culverins definitely had been produced prior to the settlement of St. Mary's and could have been brought to the colony with the first settlers. The other gun, a falcon, had arrived in the colony later. In 1980, further study by Herbert Robinson of the Maryland National Capital Park and Planning Commission confirmed that the Riversdale gun was a saker

manufactured prior to 1634 and was probably one of those brought to America aboard Lord Baltimore's ships.

Not until 1983 would the first systematic underwater archaeological projects be carried out in Potomac waters. A survey of the eroded Potomac nearshore of the Civil War prison camp known as Camp Hoffman at Point Lookout State Park, it was conducted by Nautical Archaeological Associates, Inc. (NAA) for the Maryland Park and Forest Service. The project was undertaken to evaluate the extent of the submerged resources resting in park waters in response to ongoing relic hunting and a possible legal challenge by relic hunters to state authority over the resource base. Point Lookout had lost over a third of its landmass to erosion between 1849 and 1967. Possibly as much as a quarter of the prison complex, as well as the site of the Hammond General Hospital erected in 1862-63, had been inundated. The survey resulted in the first evaluation of the impact of natural marine transgressions against the Point Lookout peninsula, and the first gauge of the enormous resource base lying therein. A wide array of cultural materials from the Civil War period through the early 20th century was located, as well as a single partially copper-sheathed shipwreck of the period 1870-1890. The vessel was a lumber schooner, apparently lost ca. 1876 while carrying a cargo of granite blocks destined for a monument to be erected in memory of the 3,384 Confederates who had died at the camp.

The second survey was conducted at Broomes Wharf, St. Mary's City, by Karell Archaeological Services for the St. Mary's City Commission. The survey had been warranted as a result of the discovery of a shipwreck site in the nearshore during a reconnaissance of the area by NAA the previous year. The vessel remains proved to be those of a centerboard Chesapeake Bay fishing or sailing schooner of the late 19th century. The wreck's presence led to the reconfiguration of a wharf designed to host the reconstructed *Dove* at the same site.

The following year, a second survey was carried out at Point Lookout by the Underwater Archaeological Society of Maryland assisted by NAA, in the first major cooperative effort in Maryland between professional archaeologists and the diving public. The project resulted from a beach stabilization effort that would severely impact archaeological features along the Potomac shore boundary of the state park. Erosion had already attacked the western side of Fort Lincoln, one of three earthen fortifications erected along the camp's northern perimeter, and bulkheading of the shoreline had become imperative to prevent complete destruction of the site. One of the more important finds was an inundated but intact sod and timber section of the original fort wall and moat. The feature corresponded perfectly with construction descriptions of earthen ramparts and moats published by Major General John G. Barnard, USA Corps of Engineers, as guidelines for fortifications to be erected for the defense of Washington. But more importantly, the find proved that archaeological features located adjacent to eroding shorelines were not always destroyed, but indeed could retain a great deal of site integrity.

In 1984, the city of Alexandria initiated a study to evaluate the resource base lying in the Potomac within the limits of the city waterfront preparatory to a proposed dredging project. The literature search carried out by the author revealed that more than two city blocks' width of waterfront had been reclaimed from the river and developed between 1783 and 1800. Additional reclamation efforts in the 20th century had added 60 acres of land at both the northern and southern extremities of the city. In the process, as many as 15 wrecks dredged from river frontage by the Corps of Engineers in 1911 had been deposited in 50 acres of fill at the southern end of the town. One ship, the 141-ton steamboat *Cygnet*, built at Washington in 1829 and abandoned in 1834 in a small embayment known as Orinoco Bay at the north end of the town, had been covered beneath lands that now form a city park. The schooners *Emily Washington* of 1898 and *Plumie E. Smith* of 1890, had been abandoned along the riverfront following the dredging in 1911. In 1985, the city contracted with Tidewater Atlantic Research of Washington, North Carolina, to conduct a remote sensing sur-

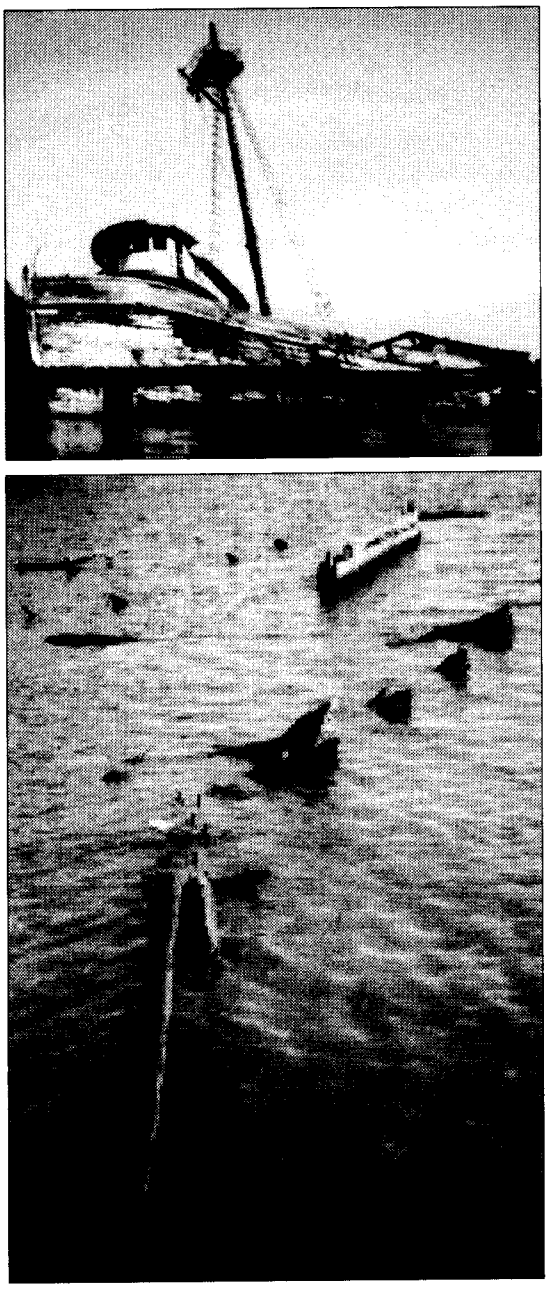

FIGURE 3. The derelict of the North Carolina-built menhaden fishing boat *Mermentau* near Mallows Bay (top), and the wreck of a 19th-century centerboard fishing boat (Site 114) in Liverpool Point Creek are among the nearly 100 shipwrecks lying in and about Mallows Bay.

vey of the waterfront. No shipwreck sites were found. Then, in 1990, a development consortium, Cook Inlet Region Inc. of Anchorage, Alaska, and Northern Virginia Classics of McLean, Virginia, initiated a $100 million waterfront condominium and canal project on the southern edge of the city's waterfront and was obliged to conduct archaeological testing of the impacted area. The firm of Engineering-Science, Inc. was contracted to conduct the testing. Under the direction of Dennis Knepper, a total of ten 19th- and early 20th-century vessels such as schooners, barges, scows, and flats, as well as 18th- and 19th-century bulkheads, wharves, and an 1849 marine railway were partially excavated.

In 1991-92 a Phase I-II survey of the shipping channel off the mouth of the Potomac was conducted by Christopher Goodwin and Associates under contract with the U.S. Army Corps of Engineers prior to a dredging project. Three significant targets were evaluated. The first, 18ST624, proved to be the disarticulated remains of a late 19th-early 20th-century wooden coaling vessel. The second was the hulk of the steamboat *City of Annapolis*, built in 1913 at Sparrows Point, Baltimore, and sunk after being rammed on 24 February 1927 by its sister ship, *City of Richmond*. The most significant wreck proved to be the 416-ton steamboat *Columbus*, built at Baltimore in 1829 for the Maryland and Virginia Steamboat Company and sunk off Point Lookout on 27 November 1850. In 1993, Goodwin and Associates carried out a Phase III operation, during which the ship's crosshead engine, built by Charles Reeder of Baltimore in 1828, and the ship's paddle wheel were recovered. The engine is among the earliest marine engines extant and is currently undergoing conservation in Louisiana.

At the same time as the *Columbus* Project, another survey was underway in the Potomac off historic Piney Point Light. Sponsored by the St. Clement's Island-Potomac River Museum with funding provided by the Maryland Historical Trust, an expedition under the joint direction of Michael Pohuski, John Kiser, and the author had been outfitted to relocate the remains of the World War II submarine *U-1105*. The proceed-

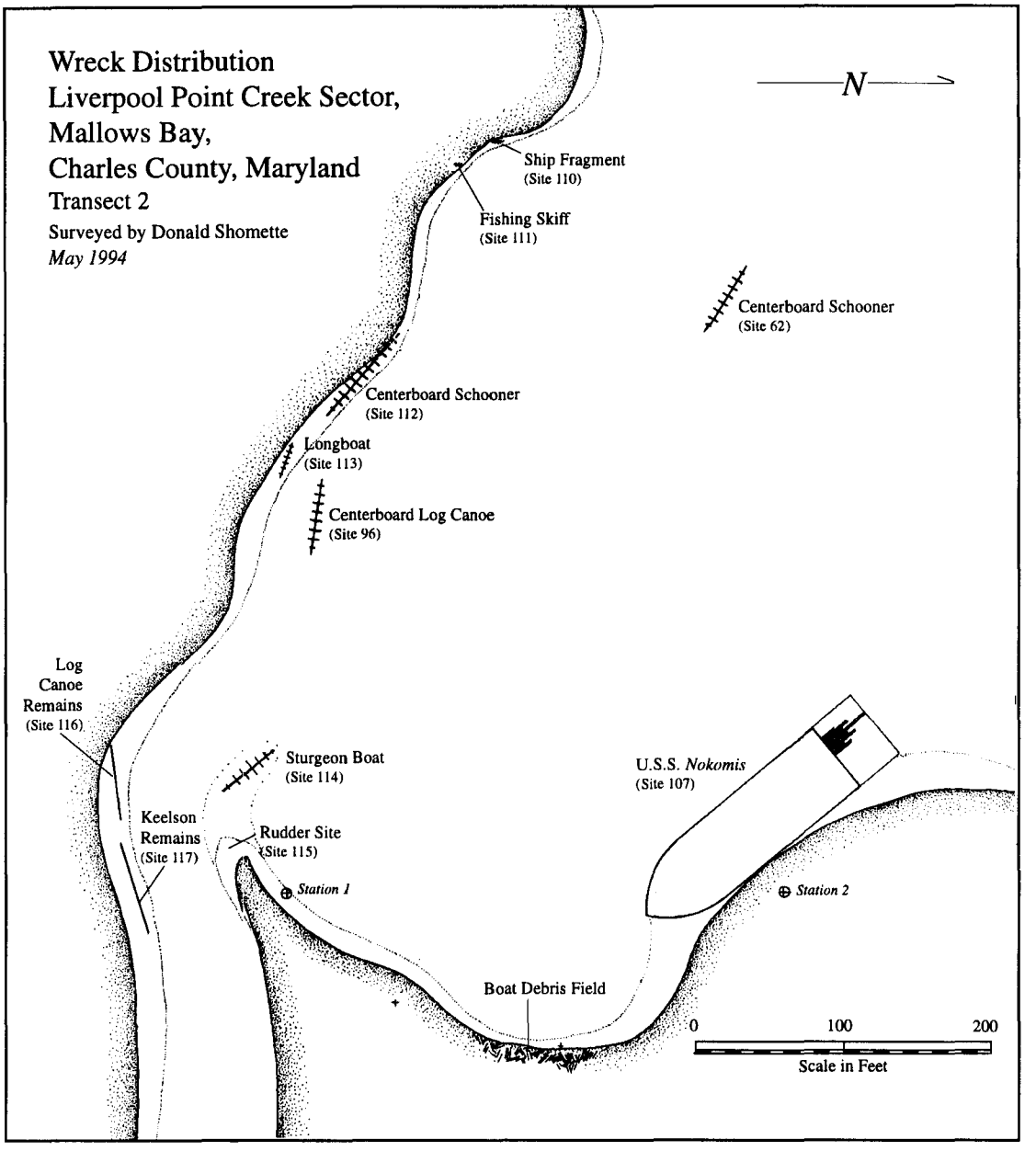

FIGURE 4. Seven 18th-, 19th- and early 20th-century sites, including the ex-Navy submarine patrol boat *Nokomis* of 1914, are clustered about the entrance to a small creek feeding into Mallows Bay.

ings and findings of the project eventually led to the development of the site as Maryland's first underwater shipwreck preserve.

Further upriver and less than 30 miles below Washington, D.C., a survey of the largest graveyard of ships in the United States was initiated by the author in 1992-93 under the auspices of the St. Clement's Island-Potomac River Museum and the Maryland Historical Trust. This project entailed the development of a survey and inven-

tory of nearly 100 shipwrecks lying in the mile-long embayment of Mallows Bay, Charles County, Maryland (Figures 2, 3, and 4). The project was also aimed at identifying the extent of the terrestrial maritime resources in the basin, such as remnants of the once-extensive fisheries and shipbreaking facilities. Its final mission was to assess the impact of the shipwreck population upon the Mallows Bay environment. The shipwreck sites clearly fall within the jurisdiction of the State of Maryland, and efforts are currently being considered by the Charles County government to secure a section of shoreline as an easement for an historic interpretive center, and public access for boating and hiking trails. It is hoped that with proper tutelage and state support, Mallows Bay will become the first maritime ecological preserve in the nation.

I have attempted to briefly address the history of marine archaeological research in the Potomac. However, it is a story far from complete for it is evident that we have only begun to recognize the importance of the river's vast submerged cultural resources. As elsewhere in America, however, time is running out and much already has been lost. Already the lighthouses are gone; the fisheries have disappeared, and shipbuilding is no longer conducted. Once-abundant working watercraft such as the bugeye, pungy, and shad boat exist now only in the archaeological record or in the collections of a few museums. Dredging projects, derelict removal programs, and "harbor beautification" for ports that now host only plastic boats and shopping malls continue to take an increasing toll on the resource base. Yet the historic Potomac Corridor is still an archaeological treasure that must be counted as important as any in the nation. For it is, after all, the nation's river.

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FRED HOPKINS

The Final Anchorage: The WWI Emergency Fleet Wrecks at Mallow's Bay

As dawn broke on 7 November 1925, a great wall of fire and smoke arose from the waters of Mallow's Bay on the Maryland shore in Potomac River about 6 mi. downriver from the Quantico Marine Base. The conflagration marked the planned destruction of over 200 wooden vessels produced by the Emergency Fleet Corporation (EFC) in the waning months of World War I, in an effort to offset the losses of allied merchant shipping to Germany's unrestricted submarine warfare (*Washington Post* [*WP*], 8 November 1925).

Occupied with westward expansion and domestic politics, the United States merchant marine had become almost nonexistent on the world's oceans. In 1914 Great Britain produced 1,683,553 gross tons to only 200,762 tons in the United States. The problem facing planners in the United States was how the country might support up to a projected 5,000,000-man army in Europe in addition to dealing with losses to German submarines. Just prior to the United States' entry into the war, German submarines were sinking over 200 ships per month (Webb 1975:275). Concerned that the United States would sooner or later become entangled in the conflict, in 1914 President Wilson's Secretary of the Treasury William G. McAdoo conceived the idea of a federally-owned shipping company charged with the regulation and promotion of United States water transport. Congress finally passed the U.S. Shipping Bill in 1916, putting McAdoo's ideas into law in the form of the U.S. Shipping Board (USSB). The unrestricted submarine warfare by Germany led the Shipping Board in April 1917 to form a stock corporation, the EFC, which was empowered to purchase, construct, equip, lease, charter, maintain and operate merchant vessels in the service of the United States (Webb 1975:276).

The USSB soon realized that it could not quickly produce enough steel ships to offset the losses to German submarines. In February 1917, noted yachtsman F.A. Eustis proposed a plan by which a fleet of 800–1,000 wooden cargo vessels would be produced to augment the steel vessels. Over the objections of naval architects, the EFC embraced the Eustis plan. The United States timber reserves appeared adequate, and soon over 40 yards were constructing wooden hulls (Williams 1992:56-58).

One of the chief proponents of the wooden ship concept was naval architect Theodore E. Ferris of New York. By July 1917, Ferris had completed plans for a 3,500-ton wooden cargo steamer that would become the EFC standard. The principal measurements of the design were: length overall: 281 ft. 6 in.; breadth: 46 ft. 5 in.; burden: 23 ft. 6 in.; sea speed: 10 knots; I.H.P.: 400 (Ferris 1917294)

Almost from the start, the wooden construction program was plagued with problems. A Ferris hull required either 1.5 million board feet of yellow pine or 1.7 million board feet of Douglas fir. Problems arose not only with obtaining the proper timber but also in its transport from forest to shipyard. When the hulls were finally ready, their engines were not. Many of the wooden hull contractors were first-time shipbuilders and had no experience in planning and operating a shipyard (Webb 1975:280); paperwork also proved a bottleneck. By October 1917, orders were approved for 433 wooden vessels, but by November only 310 contracts had been let (United States Shipping Board [USSB] 1918: 139-40).

During the wartime period the EFC would let contracts for over 500 wooden vessels, of which ca. 300 would be constructed. Although the Ferris design was the most popular, other designs were produced by Allen, Dougherty, Gray's Harbor, McClelland, Pacific American, Supple and Ballin, and Hough. McClelland and Supple and Ballin produced a composite design of steel frames with wood planking (Webb 1975: 279).

The first wooden cargo vessel, the Hough design *North Bend*, was launched by Kruse and Banks of North Bend, Oregon, on 1 December 1917 (*Emergency Fleet News* [*EFN*] 27 May, 10 June 1918). The first east coast vessel was the Ferris design *Coyote* launched on 18 March 1918 at the Passaic River, New Jersey, yard of the Foundation Company (*New York Times* [*NYT*], 18-19 March 1918). Due to problems with machinery production, *North Bend* did not enter service until 24 May 1918 (Lyman 1945: 7). Production techniques slowly began to improve and at the Gray's Harbor Motor Ship Corporation in Gray's Harbor, Washington, the Gray's Harbor design *Aberdeen* set the record for wooden ship construction with a time of 27 days from the laying of the keel to delivery (Mattox 1920:108).

By October 1918 the war on Europe appeared to be drawing to a close, and the EFC announced plans to reduce or cancel many of its wooden ship contracts. As of that date, only 134 wooden cargo steamers had been completed and another 263 were less then half-finished. Not a single wooden vessel from the program had sailed into a European port. By the end of 1919, however, 167 wood and composite ships sailed to Europe and back while 49 carried cargoes along the East Coast (Webb 1975:283-85).

The decline of world commerce in the early 1920s resulted in a vast withdrawal of wooden vessels from active service. This withdrawal resulted in massive "tie-ups" of wooden hulls in rivers and bays on both coasts of the United States. Wooden steamships constructed for approximately $676,703.00 (USSB 1918:102-06) were valued at only $100,000.00 in 1921 (U.S. Congress, Senate 1921:18).

Beginning in 1920 the USSB began proceedings to auction off the now-rotting hulks, which were costing the government $30,000 per month to keep afloat (USSB 1923:147). Between 1920 and 1922 efforts to sell off the ships individually brought limited results, so the USSB attempted to sell the remaining vessels as a unit. Two attempts were unsuccessful, because the bids were far below what the government expected. Finally, in September 1922 a third bid was accepted (USSB 1923:147). The greatest number of the 293 vessels sold, 234, went to the Western Marine and Salvage Company (WMSC). Organized by attorneys George D. Perry and William F. Humphrey, the WMSC's sole purpose was to dismantle the wooden hulls and salvage the scrap metal (USSB 1923:151, 247). Having purchased the wooden fleet, most of which was anchored in the James River off Sandy Point, Virginia, the WMSC planned to tow the hulls to Alexandria, Virginia, where engines, boilers and all other removable iron and steel components would be salvaged (National Archives and Records Service [NARS] 1923a). Plans then called for the hulls to be towed on the Potomac about 30 mi. below Washington, D.C., to Widewater, Virginia, where each would be burned to the waterline and any remaining scrap salvaged. What remained of each hull then would be dragged further up on the beach and burned a second time; any remains would be eventually covered with dredge spoil (NARS 1923b). Ironically, the first vessel to undergo this process was *Aberdeen*, which held the record for the fastest construction time (NARS 1923b).

All did not go well with the WMSC salvage project. Local residents and waterman complained that the operation at Widewater was a threat to the environment and navigation. By spring 1924, the WMSC had decided that the problems at Widewater were proving too great a hindrance to their operation and began seeking a new location. Across the Potomac from Widewater in Charles County, Maryland, lay a small embayment known as Mallow's Bay, marked on the north by Sandy Point and to the south by Liverpool Point. On 21 April 1924, the WMSC purchased the 566 acres surrounding Mallow's Bay; plans called for the construction of four marine railways near Sandy Point, where the dismantling process could proceed on WMSC land. Widewater would be retained as an anchorage (NARS 1924). In order to protect the federal government should the MWSC not be able to fulfill its dismantling agreement, a surety bond was required. By May 1924 the bond covering the 123 hulls awaiting disposal had cost the WMSC $910,000.00 (NARS 1924).

The WMSC continued its dismantling and burning operation at Mallow's Bay until March 1931. Finally, the cost of the surety bonds, complaints from local residents and falling scrap metal prices forced the closing of the operation (Court of Appeals of Maryland [CAM] 1936). The position of 152 hulls in Mallow's Bay had been documented on a survey map drawn on 11 August 1929 by the Corps of Engineers (U.S. Corps of Engineers [USCE] 1929).

With the departure of the WMSC and its official dissolution in December 1932, the local residents moved in and began to salvage the iron remaining in the hulls and sell it to junk dealers in the Washington, D.C., area (CAM 1936). A court case even developed over the ownership of wrecks and the rights of the local residents to remove the scrap metal (CAM 1936).

The WWI hulls in Mallow's Bay would not sink quietly into mud. In the years prior to WWII there was constant concern that the hulls would break loose and drift into the Potomac shipping channel. The Corps of Engineers was assigned the task of attempting to contain the hulls (NARS 1937). With the outbreak of WWII, scrap metal again became national priority. The Metals Reserve Company (MRC) was formed with one of its goals the organization and management of strategic metals. Under the direction of the War Production Board, the MRC was ordered on 16 July 1942 to develop plans for the recovery of a possible 20,000 tons of scrap metal from the Mallow's Bay wrecks. The company therefore contracted with the Bethlehem Steel Company of Sparrows Point, Baltimore, Maryland, for the recovery of the scrap metal. Bethlehem Steel's plan for the salvage operation called for the construction of two cofferdams at the mouth of Mallow's Creek. It appears that the procedure was to tow the hulls into the basin created by the dams, then pump the basin dry, burn the hulls, remove any metals. and finally re-flood the basin and repeat the process. In early May 1943, however, delays occurred in the recovery process when a sizable break appeared in the cofferdams which would cost $15,000 to repair and bring admonishments from the MRC that lack of supervision by Bethlehem Steel had contributed to the breakthrough. By December 1943 the Mallow's Bay salvage effort had cost an estimated $360,000.00 but yielded very little. In the fall of 1944, the demand for scrap metal had slowly declined and the MRC recommended that all work at Mallow's Bay cease. By 11 November 1944 Bethlehem Steel had dismantled the Mallow's Bay operation and on 16 January 1945 the project came to its official conclusion (Metals Reserve Co. 1942-45).

For the next 36 years periodic confrontations over the Mallow's Bay wrecks arose among local residents, the Corps of Engineers, the State of Maryland, and even the U.S. Congress. The debates generally centered around the wrecks' potential hazard to navigation, their environmental impact, and waterfront property values. Over the years the Corps of Engineers proposed several plans for either the removal or containment of the hulks. All of these plans came to naught, usually over matters of funding by state and federal officials. On 24 June 1981 the last attempt to remove or contain the hulks died on the funding issues (Peck 1981), and the hulks remain to this day.

In 1992, with the support of the St. Clements's Island-Potomac River Museum and an $8,000 grant from the Maryland Historic Trust, a survey was undertaken not only of the EFC hulls at Mallow's Bay and the various shipbreaking facilities but also scores of other shipwrecks in the bay dating from the 18th through the early 20th centuries. Of the 154 EFC vessels listed on the 1929 Corps of Engineers survey, all have been identified by name and type: Ferris-18; Peninsula-4; Hough-2; McClelland-8; Pacific American-4; Grays Harbor-3; Supple and Ballin-3; Dougherty-1; Unknown-1. Of the 91 shipyards building wooden and composite hulls for the EFC, 58 are represented in Mallow's Bay.

Up to the present time the Mallow's Bay Survey Project has inventoried 80 EFC hulls, of which 24 have been definitely identified as to name and type. Among this group is *North Bend*, the first EFC wooden hull to be launched. The condition of the hull remains range from excellent to poor. Those classified as excellent

display as much as 10–12 ft. of vertical hull elevation still intact with bulkheads, boiler and engine mounts, shaft alleys, rudders, and concrete supports for gun mounts still visible. Still to be documented are the remains of several dredgers and barges employed in the salvage operations.

As pointed out by Donald Shomette, project director of the Mallow's Bay Submerged Cultural Resource Survey, Mallow's Bay is the largest shipwreck assemblage in the United States, and possibly the world. The range of vessel types includes not only the WWI EFC wooden hulls but possibly other wrecks, ranging from a Revolutionary War longboat to the ex-USS *Nokomis*. The Revolutionary War longboat may have been one destroyed in July 1776 by Virginia's Potomac Flotilla to prevent capture by forces under the command of Virginia's deposed royal governor James Murray, Earl Lord Dunmore (Morgan 1970, 5:1312-14, 1194). In the early 19th century Mallow's Bay became part of the expanding Potomac River fishing industry. In 1888 Captain Morgan Monroe erected a sturgeon fishing station at Liverpool Point on the southern tip of Mallow' Bay and imported at least five Philadelphia 2-masted centerboard sturgeon skiffs. Monroe closed his operation in 1926 and abandoned his skiffs on Liverpool Point; one has been surveyed for the project (Tilp 1978:21-22, 32).

Along with the EFC vessels lies the wreck of the 4-masted schooner *Ida S. Dow*. Built in 1918 at Thomaston, Maine, the 225-ft. schooner was severely damaged in a collision in 1931. While awaiting wrecking at Newport News, it was acquired by Mallow's Bay salvors as a dormitory. Its hull was eventually filled with sand and sunk by the Corps of Engineers to prevent drifting into the Potomac River channel (Morris 1973:135; Tilp 1978:88).

Two other WW1 wrecks are found in Mallow's Bay; SS *Commack* may be the last extant example of the Class A Hog Islander, and nearby lies the stripped frames of *Nokomis*, a subchaser off the coast of France (Eller 1970, 5: 102). Less famous hulks include the North Carolina menhaden fisherman *Mermentau*, a 19th-century log canoe, two 19th-century centerboard schooners, a rowboat, three workboats, a possible Potomac River herring boat, and one WWII PT boat.

The shoreline of Mallow's Bay from Sandy Point on the north to Liverpool Point in the south provides several interesting sites relative to the wrecks lying in the bay. Numerous wooden and cinder block structures remain that were associated with either the fishing industry or the salvage operations. The steel, wood, and earthen drydock walls built for the 1942-43 Bethlehem Steel burning basin are still in place, as are four marine railways and one wharf associated with the 1920s WMSC salvage efforts. Though not related to the hulks in the bay, two Civil War gun emplacements and one prehistoric firepit have been surveyed.

One aspect of the Mallow's Bay project not yet fully explored is an inventory of flora and fauna aboard the hulks and along the shore. Mallow's Bay offers a unique opportunity to observe their recolonization process after having been driven off by the salvage operations and Potomac River pollution.

The centerpiece of Mallow's Bay remains, however, the WWI EFC wooden steamships. These rotting hulks are the end products of the greatest shipbuilding effort by any nation in history, exceeded only by a similar effort in WWII. The ships in Mallow's Bay necessitated a mass movement of people and material from all parts of the nation to points of production. This movement along with the training of unskilled workers was unique. As much as the wooden hulks were the end products of a new mass production system, they were also the last of the coal-fired steamships, victims of diesel power, and other more efficient methods of propulsion.

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Treasure Trove, Wreck, and Salvage: Issues in the Reporting and Management of Discoveries Underwater in Britain

Introduction

Britain has inadequate statutory provision and no coherent strategy for the reporting and management of portable antiquities above or below the water. For terrestrial finds and discoveries in inland waters, only the law of Treasure Trove provides any legal requirement for reporting and recording finds. The protection afforded by this law varies across Britain (Longworth 1993). All antiquities in Scotland must be reported and may be claimed by the Crown regardless of the circumstances in which they were deposited. In England and Wales, only finds of precious metals must be reported, and Crown title may depend on determining that the finds were deliberately buried and that there is no better legal claim.

The situation is as complex for marine finds, for which the relevant laws are administered by different agencies and government departments. The only procedures for mandatory reporting of underwater finds are salvage laws, originally drafted to uphold ownership and compensation principles rather than safeguard underwater heritage. This paper outlines problems with the laws for reporting and disposal of marine finds and highlights attempts to resolve them.

Merchant Shipping Act 1894

The main acts concerned with salvage, reporting, ownership, disposal, and protection of finds are the Merchant Shipping Act 1894 and the Protection of Wrecks Act 1973. Part IX of the Merchant Shipping Act 1894 requires all salvaged wreck within British waters to be reported to the Receiver of Wreck, now an official in the Coastguard Agency (Department of Transport [DTp] 1894:s. 518). Wreck consists of the remains of a vessel, cargo, fittings, ordnance, and personal effects of the officers, crew, and passengers, as well as anything deliberately or accidentally lost overboard or abandoned.

Non-wreck material includes anything that did not originate from a ship or shipwreck, such as inundated settlement remains and anything that has washed out to sea from the foreshore or non-tidal waters. There is no mechanism for mandatory reporting of non-wreck finds, and there is no obligation to report discoveries if material is not raised. As a result, a wealth of archaeological information is being lost, as is the opportunity to capitalize on a valuable management resource.

The Merchant Shipping Act is administered by the DTp and until recently, the Receivers were local Customs and Excise Officers not particularly concerned with heritage matters. There is now a centralized system of reporting to just one Receiver in all Britain, located in Southampton. While this makes administration easier, it does not necessarily encourage divers to report their discoveries when they are hundreds of miles away.

The Receiver of Wreck has three primary responsibilities: (1) to find the owners of wrecks and their materials; (2) to stop items of wreck being misappropriated, and (3) to compensate law-abiding salvors with suitable payment, regardless of determining an owner (Department of National Heritage [DNH] 1993).

Reporting Procedures, Ownership, and Disposal

The finder completes a form which asks for a description of items found, their precise location, and the wreck and owner names (if known). The form indicates that if false information is given, any claim the finder may have may be forfeited.

Generally, salvaged items are then handed over to the Receiver, who retains possession for up to one year. During that time, the Receiver advertises the goods and tries to locate the

owner. In the past when there were several Receivers, much of the salvaged material placed in their care fell apart during storage due to lack of conservation facilities and expertise. Such procedure is no longer standard practice, and divers and large-scale operators who raise material which requires conservation are often allowed to keep the finds on behalf of the Receiver.

Meanwhile, if no owner is found, as is the case with many historic wrecks, the Crown becomes the owner. The Receiver, acting on behalf of the Crown, may first offer the material to a suitable institution such as a museum. If a museum purchases the finds, the salvor gets an award based on their market value. If no museum or other institution is interested (often because of the conservation cost), the Receiver may sell the material at auction or allow the salvor to keep the finds in lieu of an award (DTp 1894:s.525). The Receiver is not obliged to pass on any information about the finders, salvaged items, or their ultimate destination to any archaeological body or sites and monuments record.

While it is commendable that the Receiver of Wreck now offers salvaged items to museums first, is it realistic to expect museums to rescue all such finds? Not all museums are interested in purchasing marine finds, even if they have the resources to do so. Many museums may wish to acquire some items but not all, or may have no budgets or conservation facilities. In addition, maritime museums may have archaeological ethics policies which constrain them from purchasing or displaying material raised from sites believed to have been commercially exploited, although the interpretation of these policies seems to be flexible as shown by the recent exhibition of *Titanic* artifacts by the National Maritime Museum in London.

What happens to finds which get left behind or returned to salvors? Many of the smaller items are scrapped as the cost and hassle of conservation are not considered worth the trouble, or they are used to adorn mantelpieces or to fill dive shop windows. Larger, more valuable items such as bronze cannon are generally sold to the highest bidder or featured in private salvors' collections. Whatever their final destination, these artifacts are taken out of the public domain and generally remain lost to the archaeological record.

Reluctant Reporting

Despite the law to report salvaged materials, in practice few reports are made and most of these relate to modern items. Many sportdivers are unaware of the legislation as current dive training is not obliged to include lectures on the relevant laws; others are just willful souvenir- or treasure-hunters. Fishermen are generally aware of the law, but frequently keep quiet about trawled or dredged finds. Most professional salvors are equally aware of the law, but may not comply unless they believe there is profit to be made from a site, particularly an historic one. Failure to report is an offense, but in practice, prosecution rarely occurs. However, there have been cases where misappropriated wreck items have been seized from would-be salvors.

It is often only when sportdivers or fishermen seek a valuation for their find that discoveries come to light. Recent examples of accidental discovery involved post-medieval pots recovered off the west coast of Scotland. Fishermen contacted the National Museum of Scotland for appraisals, and the museum contacted the Receiver of Wreck. In this case, the salvors relinquished the pots to the Receiver in return for awards based on the market value of the items. The Receiver offered the pots to the museum, which now owns them.

Salvor-in-Possession

Another aspect of the Merchant Shipping Act concerns unclaimed wreck and wreck ownership (Dtp 1894:s.521, s.526). Often parts of wreck and cargo are salvaged before protective action can be taken, and resolving claims to wreck is not always straightforward. Salvage disputes frequently occur from rival claims and misunderstanding the law. The recognized concept of

Salvor-in-Possession has evolved through case law to settle such disputes, but it is not statutory.

Divers and salvors raise objects from the sea not only for short-term financial gain, but also for the right to claim possession of a wreck. They are legally able to do this by being the first to discover and physically interfere with a site, so they raise objects, lay floats, and markers, and return to the site as often as possible to establish their claim. They do not always report their finds, but if they think that others might be interested in the same site, they will almost certainly do so.

Having established the right of Salvor-in-Possession, the divers can then prevent others from interfering with the site by getting a court injunction. Essentially, the only way to protect the site from commercial exploitation is to designate it under the Protection of Wrecks Act 1973, but this would not necessarily prevent dispersal or sale of the objects (see below).

Conflict and confusion often ensue over who had possession first, and disputes are common especially when treasure may be involved. The Receiver cannot arbitrate but encourages rival factions to agree among themselves. The outcome is rarely in the best interest of the finds.

The Law vs. Cultural Heritage

It is clear that the provisions of the Merchant Shipping Act and the concept of Salvor-in-Possession are detrimental to underwater heritage preservation. The Act encourages the loss of archaeological information and the dispersal of archaeological material. Without any deterrent, individuals and companies are encouraged to seek historic wrecks for financial reward, and it is perfectly legal for them to do so.

As in all countries where free enterprise prevails, these salvors can even call upon public money to set up their treasure-hunting projects and do so in the name of maritime archaeology. This is happening in Scotland, where British and American treasure hunters are searching in the Forth Estuary near Edinburgh for King Charles I's ferry, reputedly sunk there with royal treasure.

There are no safeguards monitoring underwater work carried out by commercial divers without archaeological experience, and it is possible that many wrecks and other submerged remains are being destroyed in the search for the royal bounty. As they operate within the law, nothing can be done to stop treasure hunters until discovery of the wreck is claimed; even Protection of Wrecks Act designation may not prevent irresponsible exploitation of the wreck and eventual sale of finds.

Protection of Wrecks Act 1973

Protection of Wrecks Act designation consists of specifying a restricted zone around a wreck site or what is believed to be a wreck site of archaeological, artistic, or historical importance (DTp 1973:1(1)b). Designation prohibits site interference and generally disallows diver access without a license. Effective policing of designated sites is as difficult as enforcing the Merchant Shipping Act 1894, so prosecutions rarely occur.

The Act is administered by the DNH in England, Historic Scotland in Scotland, and their equivalents in Wales and Northern Ireland. Designation advice to these agencies is supplied by the non-statutory Advisory Committee on the Protection of Historic Wreck and the Archaeological Diving Unit (ADU) created in 1986. The Government-contracted unit carries out wreck inspections and recommends which sites should be protected and to whom licenses should be issued. Applications for designation can be made by anyone, but they are frequently made by divers who fear that rivals will loot a site in their absence. There are currently 41 designated wrecks, most of which lie along the south coast.

Emergency designations are possible, as in 1990 with a Danish wreck believed to be the warship *Wrangels Palais* sunk in the Out Skerries off Shetland in 1687. The ADU happened to be working in the area and came across a salvage operation in progress where two bronze

guns were being raised. The team was unable to stop this but called for an immediate designation order to be placed on the site. This was obtained and work was stopped, but the cannon were retained by the salvor (ADU 1994:23).

License Arrangements

Licenses to visit, survey, or excavate are issued by the DNH, Historic Scotland, or their equivalents. Before April 1991, when responsibilities for historic wreck were transferred to these agencies, licenses were issued by the DTp without concern for the eventual destination of the finds. Unfortunately, there are quite a few examples where many of the items salvaged from supposedly-protected wrecks were sold at auction.

One of these was the wreck of the 74-gun, third-rate *Invincible*, a French ship captured by the British that sank off Portsmouth in 1758. The wreck was designated in 1980. A license to excavate was granted, despite archaeologists trying to ensure that the site was worked legitimately, and many of the items were subsequently auctioned to fund further excavation. Some were purchased by a museum and others were sold throughout Britain, splitting an important assemblage of artifacts.

Licenses now are issued upon consideration of certain criteria, including a prospective licensee's ability to provide a research strategy, conservation facilities, and expertise; the cooperation of an appropriately-qualified or experienced archaeological advisor; and an undertaking that the finds will be deposited in a suitable place. In general, licensees retain possession of finds for conservation, and an annual report of all objects raised must be made to the Receiver of Wreck. Although licenses would be revoked if sale of objects then occurred, there would be nothing illegal in doing so.

Initiatives

These examples present a dismal picture of the system of reporting and disposing of marine finds. However, a number of steps have been taken during the last five years in an attempt to assess and address the problems with this system. Among these measures are:

(1) A nationwide 1989 museum survey on their underwater finds collections and attitudes towards inquiries. This informative survey generated 158 responses out of 250, which illustrated several problems, including a lack of awareness on laws and points of contact; lack of budgets, conservation facilities, and expertise; lack of knowledge concerning material remains; and lack of records on finders and provenance of items.

(2) The circulation of two publications (Joint Nautical Archaeology Policy Committee [JNAPC] 1989, 1993) aimed at lobbying the government to change the legislation in view of the threats to the underwater heritage. The documents have not changed the finds-reporting laws, but they have been responsible for obtaining government financial support for national marine site inventories and for the training of sportdivers through the Nautical Archaeology Society's program.

(3) Continued lobbying resulted in a government publication (DNH 1993) aimed at dispelling confusion among salvors, divers, and fishermen.

(4) Government planning policies and discussion papers have been produced on proposals for coastal zone management and for regulating offshore development in which consideration is given to cultural as well as natural resources (Department of Environment [DoE] and Welsh Office 1992, 1993; DoE 1993).

(5) A national but voluntary Code of Practice for Seabed Developers (JNAPC 1995) has been published and ratified by some of the largest offshore operators in Britain, in which the principle of preservation of submerged cultural remains is established.

(6) Statutory and voluntary organizations have collaborated on the production of a sportdiver recording form, which is being widely circulated and promoted through the Nautical Archaeology Society. The form encourages divers to report finds, whether recovered or not. The data are then entered into the maritime section of the National Monuments Record for En-

gland & Wales (at the time of writing, a similar record is not yet available in Scotland).

(7) Proposals for national reporting guidelines have been drafted, and pilot schemes to raise public and professional awareness are being introduced regionally in England and Scotland (Andrian 1994).

(8) The new Receiver of Wreck is well disposed towards the preservation of historic wreck. She is also attempting to raise awareness and is actively becoming acquainted with heritage agencies and archaeologists. A new leaflet has been produced to encourage all finders to report their discoveries (DTp 1994). It has been widely circulated through the national dive training agency British Sub Aqua Club, government agencies, and museums councils, and it is already making a positive impact. Although there is no formal requirement to do so, the current Receiver communicates reports of material of potential historic importance to the ADU, the National Maritime Record, and to regional museums.

Conclusion

It is clear that there are problems with legal provisions for the reporting and management of marine finds in Britain, with a corresponding loss of historical and archaeological information. As the present government does not accept the need for new legislation, collaborative measures must be taken by a wide range of institutions and individuals—regardless of any perceived land/water divide—in order to devise a coherent strategy for the better management of portable antiquities in Britain.

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USS *Hatteras*: Site Monitoring and Mapping

Introduction—Requiem for a Featherweight

"Under no circumstances...can a steam vessel, built expressly for the transportation of freight or passengers, be made, in any manner, equal in convenience or efficiency to a vessel originally intended for war purposes." Perry was absolutely right in the quote above (Howarth 1991:186), and the quick disposal of USS *Hatteras* by CSS *Alabama* on 11 January 1863 off Galveston was a textbook example. For centuries it was common to convert merchantmen for naval service in time of war. However, by the mid-19th century, offensive armaments had developed to the point that a lightly-constructed merchant vessel could no longer be expected to stand up to a purpose-built, heavily constructed, man-of-war (Keegan 1989:97-99). Nevertheless, the Navy acquired many commercial vessels for Union service during the Civil War. The West Gulf Blockading Squadron, of which USS *Hatteras* was a part, was mostly composed of such ships. This paper reports a program to monitor the *Hatteras* wreck site and map the remains visible above the bottom (Figure 1). The report also describes the ship, its history, wreck site, site history, and artifacts.

The Ship—Physical Description

Harlan and Hollingsworth of Wilmington, Delaware, built a sidewheel steamer called *St. Mary*; on 25 September 1861 the Navy acquired the 1,126-ton iron-hulled ship from the builders at a cost of $110,000 (Wilbur 1927:100). Fitted

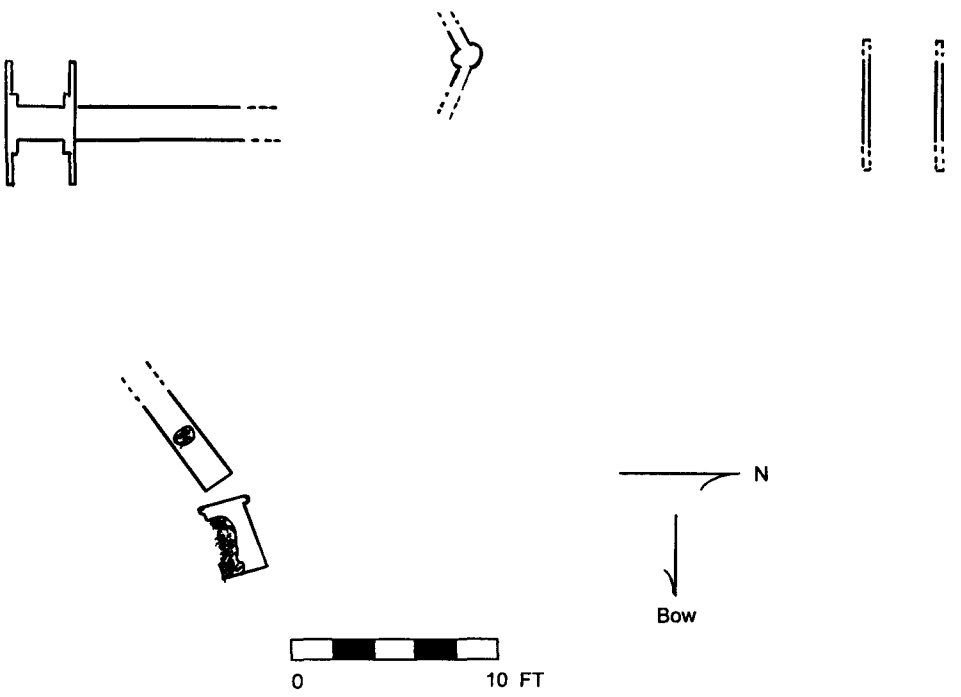

FIGURE 1. Preliminary site plan of the USS *Hatteras* wreck.

out at the Philadelphia Navy Yard and named USS *Hatteras*, its measurements were 210 ft. in length, 34 ft. in beam, 18 ft. in draft, and an 8-knot speed. The third-rate warship had a three-masted schooner rig and a condensing, walking-beam engine developing 500 horsepower whose cylinder diameter was 50 in. with a 132-in. stroke (Silverstone 1989:73). The engine had a Sickell's cutoff. The boiler had the flues mounted below and tubes above (Wilbur 1927: 100). *Hatteras* had a complement of 126 officers and men and was armed with four 32-pounders of 27 hundredweight (short 32-pounders) and one 20-pounder rifle (Navy Department 1977: 270). The 20-pounder rifle was not part of the original suite of guns but was added 21 November 1861. The warship was commissioned in October 1861 (Silverstone 1989:73).

The Shipwreck Site

The site is located about 32 km (20 mi.) south of Galveston and about 8.7 km (14 mi.) offshore; snagged shrimp nets had pointed to this area, which otherwise could have been missed. A cooperative effort between the Texas Historical Commission (THC) and the Minerals Management Service (MMS), Gulf of Mexico OCS Region, recorded new site coordinates with a Trimble Navigation, Inc. Differential Global Positioning System (DGPS) in 1993. The DGPS system has an accuracy of one m. In 1994, as a test of the DGPS system, the magnetometer was not used to buoy the site prior to sending down the first dive team. Rather, navigating with the same model Trimble DGPS system, the research vessel anchored on the DGPS coordinates from 1993. The divers found and buoyed the site immediately upon descent, and several hours were saved in the process. Water depth at the site is 17.6 m (58 ft.), and maximum relief above the bottom is ca. 1.2 m (4 ft.). The shipwreck site's official number is 41GV68; the Texas Antiquities Committee has designated it a State Archaeological Landmark, and it is also listed on the National Register of Historic Places.

Little of the wreck is exposed above the sand. Paddlewheel hubs on both sides of the ship and some parts of the steam engine rise partially above the sand bottom. The only other remains showing above the bottom in 1992 and 1993 were a very small section of encrusted iron near the bow which was tentatively identified on the assumption that it was located forward of the paddlewheels and on its orientation and distance from other exposed remains. In 1994, the bow wreckage was buried.

Site mapping and monitoring were conducted in 1992, 1993, and 1994 through a joint THC/MMS project under co-directors Barto Arnold and Rick Anuskiewicz (Anuskiewicz and Arnold 1992; Arnold 1993). The 1993 fieldwork included a detailed magnetometer survey to provide a contour plot of the magnetic anomaly and locate any scattered remains (Figures 2 and 3). Remarkably little scatter was detected—only three small, isolated point sources. These anomalies could result from scattering by shrimp trawls, battle damage, or *Hatteras*' portside guns, which had been jettisoned to correct a list as she was sinking. The magnetic signature with multiple highs and lows was typical of a shipwreck.

The Ship's History

In fall 1862, Union forces captured Galveston. Earlier, the West Gulf Squadron had been running past Confederate forts and temporarily capturing such towns as Corpus Christi and Indianola. Texas was a major cotton producer, and it was important to the Confederacy to get that cotton past the blockade or down to Matamoros, Mexico, by wagon. General Bank's Union army was to come to Galveston for a thrust into Texas, but on New Year's Eve General Magruder's Confederate forces staged a surprise attack and recaptured the town and several hundred troops of the garrison. USS *Harriet Lane* was captured by cottonclads armed only with sharpshooters. USS *Westfield* went aground and was blown up to prevent capture. The premature explosion of *Westfield*'s magazine killed Captain Renfrew, the ship's as well as the squadron's commander (Fehrenbach 1968 and Snyder 1938). This disaster set the tone of Union frustration in assaults on Texas for the

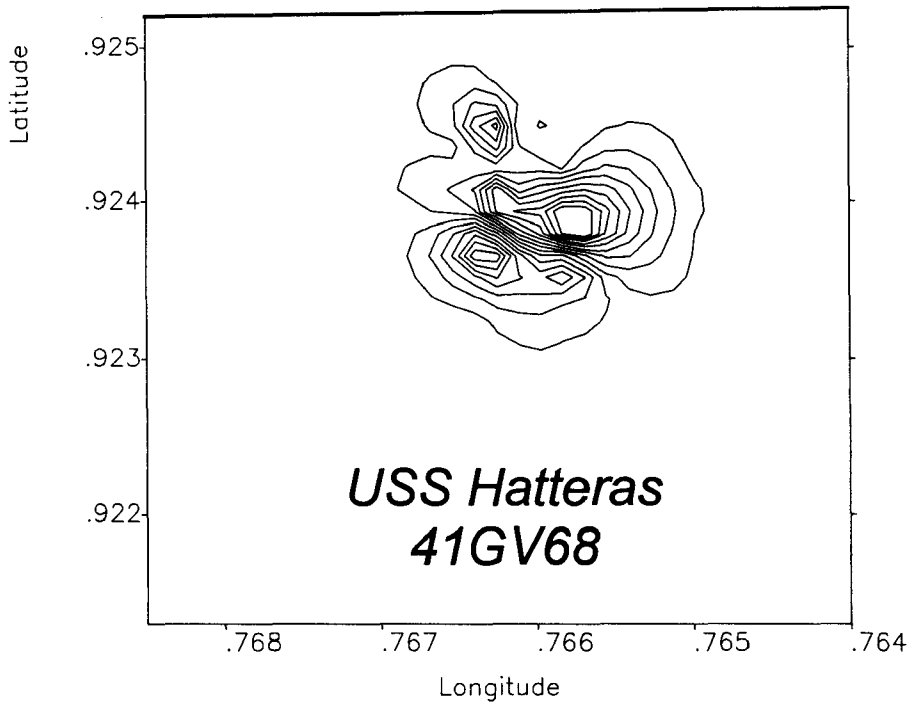

FIGURE 2. Contour plot of magnetometer data from USS *Hatteras*. One hundred gamma contours. (Surfer for Windows software provided by Golden Software.)

rest of the war (Neyland 1993). "There was never to be a Union song called 'Marching Through Texas'" (Fehrenbach 1968:372).

At the same time, the famous raider CSS *Alabama* was lurking across the Gulf of Mexico preparing to attempt to catch General Bank's invasion force and destroy the transports. The loss of Galveston changed Union plans. USS *Hatteras* joined Farragut and his reinforcements to the remnants of the West Gulf Squadron off Galveston on 6 January, just in time for an encounter with Semmes' *Alabama*.

Under her first captain, Commander George F. Emmons, *Hatteras* began her Civil War career when she joined the South Atlantic Blockading Squadron at Key West, Florida, on 13 November 1861. She served off Apalachicola and Cedar Keys, Florida, before transferring to the Gulf Blockading Squadron. The time in Florida included a highly successful raid on Cedar Keys harbor, when the crew burned seven small blockade runners loaded with turpentine and cotton. The raiders also burned the railroad terminal, several buildings, and flatcars and captured half the small garrison and its commander.

After 26 January 1862 when it arrived at Berwick, Louisiana, *Hatteras* had a successful cruise and captured a number of blockade runners in less than a year. Most of this action occurred off Vermilion Bay, as the ships ran either toward Havana or Sabine Pass (Navy Department 1977). In November 1862, Commander Homer C. Blake took command as the second captain of *Hatteras*.

When *Alabama* sighted Galveston on 11 January 1863, it found not General Bank's trans-

ports but a fleet of warships anchored offshore. The crew deduced that the Confederates had recaptured the town when they saw the fleet lob a shell that burst over the town. One of the Union ships stood out to investigate the stranger. Semmes lured *Hatteras* away from the support of her sisterships, and just after dark a sharp but brief battle took place (Semmes 1962). The reports of this action by the two captains, ex-colleagues in the pre-war Navy, appear in Arnold and Hudson (1981).

USS *Morning Light*'s log recorded heavy firing to the southwest during the 6–8 p.m. watch. *Morning Light* was blockading Sabine Pass on the Texas-Louisiana border about 80 mi. from the scene of the battle (National Archives 1863).

The 13-minute battle took place at close range, ending when a shell exploded in *Hatteras'* engine cylinder and knocked down the walking beam. Whole plates of iron were blown away at the waterline. Captain Blake surrendered with his ship on fire and rapidly sinking and *Alabama* maneuvering to rake it. *Hatteras* suffered two dead and five wounded, while *Alabama* had two injured and very light damage. *Alabama* launched her boats and helped take off *Hatteras*' crew, who were later paroled at Port Royal, Jamaica. The morning after the battle, USS *Brooklyn* found the wreck sitting upright in 9-1/2 fathoms of water with its masts visible above the waves. In relation to potential artifacts at the site, Captain Blake mentioned an extra gun, a 30-pound Parrot rifle. Semmes mentioned yet more guns on *Hatteras*: a second, similar Parrot, and a 12-pound howitzer.

The Shipwreck Site's History

Historical research so far reveals no salvage contemporary with *Hatteras*' sinking. Since it went down very quickly, there was likely no time for removing even personal possessions. The site may contain the fully-intact remains of the ship and its equipment. There has been considerable deterioration of the hull and organic objects above the sediment, but the site's archaeological potential is tremendous. The water is deep enough that scattering of the contents by wave action should not be significant.

Treasure hunters discovered the wreck in the mid-1970s and filed an admiralty suit in 1978 (U.S. District Court nd). The Navy won the lawsuit since naval vessels always remain government property, and they are not available for commercial salvage. As litigation proceeded to the court of appeals and back, the Bureau of Land Management (BLM, from which the MMS later emerged) sponsored two trips to the site which yielded good remote-sensing data (Arnold and Hudson 1981), and its location was firmly fixed with microwave radar positioning. The THC and the Institute for Nautical Archaeology at Texas A & M University participated in the BLM projects. During one of these trips archeological divers attempted to visit the wreck. It was the end of the day, and they could not locate the wreck in the fading light; however, Donald Keith later succeeded.

The MMS's renewed interest in *Hatteras* began as a cooperative study effort with the THC in 1992. The MMS was specifically interested in the wreck because of its proximity to existing oil production platforms (less than 1 mi.) and the potential impact of oil and gas development upon it. In 1992 the two agencies initiated a program of site monitoring and mapping that continued in 1993 and 1994. They conducted dives at the site on two days in 1992 and 1993. The first year's dives were for familiarization and preliminary mapping of surface remains. In 1994, bad weather shortened the trip to one day of diving. The second and third years' dives included the beginning of measuring for a site plan and placing a sediment meter. From 1992 to 1994 sediment levels remained fairly constant, and there was no apparent disturbance of the site.

Comparing the condition of the site today with slides provided by Donald Keith reveals one noticeable major change. In the 1970s, there were upright engine components described by the treasure hunters as the steam condenser. It may have been the valve assembly, but in any case the structure has now been knocked down, probably by a shrimp trawl.

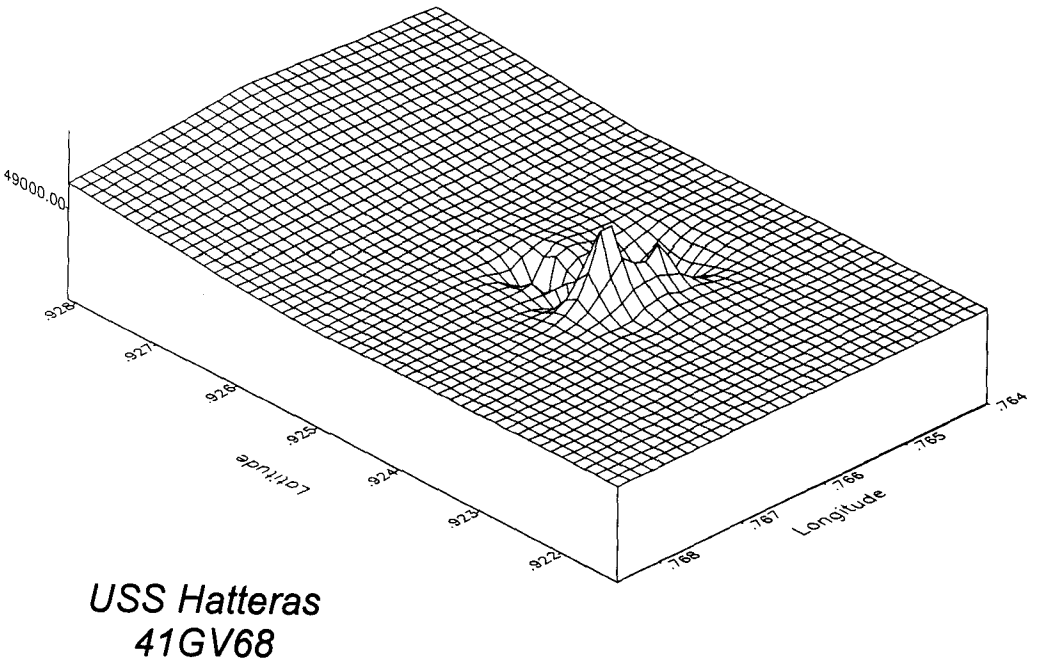

FIGURE 3. Three-dimensional plot of the magnetometer data from USS *Hatteras*. (Surfer for Windows software provided by Golden Software.)

The Artifacts

The treasure hunters removed artifacts from the wreck and turned them over to the court as part of their salvage claim, including a builders' plate marked "Harlan and Hollingsworth and Co., Iron Ship and Steam Engine Builders, no. 327, Wilmington, Delaware, 1861," two small bronze oil cups with covers, a brass steam valve, two large bronze priming cups (one with attached pipe stem), an oiling pipe stem, and an iron ball with eye weighing ca. 45 pounds. These artifacts have languished with the court records since 1983 when the case was decided in the government's favor. With the help of the Naval Historical Center and the Navy Judge Advocate General's Office, the THC hopes to have the artifacts in a museum soon.

Conclusion

The wreck of USS *Hatteras* is an integral part of the story of the Civil War on the Texas coast. The remains of an unsalvaged, fully-equipped naval vessel are expected to be found at this site, making it one of the most important underwater archeological sites in the country. The responsible agencies continue to monitor the site's condition on a regular basis. "Historians generally regard the defense of the Texas coast and borders as one of the greatest military feats of the Confederacy" (Fehrenbach 1968).

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Childsbury and Ashley Ferry Town: Elements of Control in the Economic Landscape of Colonial South Carolina

Introduction

Colonial expansion on the South Carolina frontier tended to move southeast and northwest of present-day Charleston, South Carolina. Although several towns were established during this period, many failed to achieve long-lasting economic viability through the 18th or into the 19th century. However, two exhibited a measure of control over South Carolina's colonial economic landscape: Childsbury, northwest of Charleston, and Ashley Ferry Town, southeast of Charleston. Childsbury no longer exists, and Ashley Ferry Town is now a Charleston suburb.

These towns and their associated transportation infrastructures resulted from trade of the diverse resources in colonial South Carolina. Deerskins, livestock, tar kilns, and staple crop production were common to the rise of both towns. The deerskin trade utilized existing inland Indian trade routes, while tar kiln production opened up new areas requiring new transportation routes. Specific crops such as rice, corn, indigo, fruit, and vegetables may have differed between the two communities, yet transportation similarities between them are more than coincidental.

Both Childsbury and Ashley Ferry Town were associated with ferry crossings: Strawberry Ferry at Childsbury and Ashley Ferry at Ashley Ferry Town. Both were located at the crossroads of a major river and overland transportation route. The road northwest of Charleston split ca. 5 mi. out of town. One section ran north towards the town of Goose Creek. The road split again at Goose Creek, with one section heading northwest toward the newly-emerging town of Monck's Corner and on to 96 District. The other ran through Goose Creek toward Strawberry Ferry and Childsbury across the western branch of the Cooper River. From Childsbury the road continued north across the Santee River toward Cheraw, South Carolina, and the road to Pennsylvania. The other fork north of Charleston split northwest toward Dorchester, on the northwest side of the Ashley River ca. 20 mi. from Charleston. This road split toward the southeast ca. 7 mi. northwest of Charleston, crossed the Ashley River at Ashley Ferry, and continued southeast from Ashley Ferry Town toward the emerging port of Savannah, Georgia.

The economic viability of both these towns and their ferry crossings ended by the early 19th century. Their only remaining vestiges are the structures of St. John's parish Chapel of Ease, Strawberry Chapel (within the borders of what was once Childsbury) and the St. Andrew's parish church, St. Andrew's (north of Ashley Ferry Town). The degraded ferry crossing landings also survive.

Strawberry Ferry and Childsbury

Strawberry Ferry was established in Saint John's parish by the South Carolina Assembly in 1705. It crossed the western branch of the Cooper River ca. 30 mi. by road and 60 mi. by river, northwest of Charleston. The northwest side of Strawberry Ferry is referred to historically as Strawberry Landing, probably emphasizing its secondary function (Rogers et al. 1974: 669). The southeast side joined a causeway connecting the ferry with the road to Goose Creek and Charleston.

Strawberry Ferry continued to operate into the mid-1800s. The landings were possibly repaired as late as 1801 (Deas 1978 [1909]; Terry 1981:194). Eventually, it was supplemented by a bridge across Wadboo Creek. This bridge connected Monck's Corner and the St. John's parish church, Biggin Church, to Cooper River residents.

In 1707 James Child surveyed, plotted out, and sold lots on the bluff overlooking Strawberry Ferry, where he established the town of Childsbury. This logical extension of the ferry crossing served to highlight the crossing's grow-

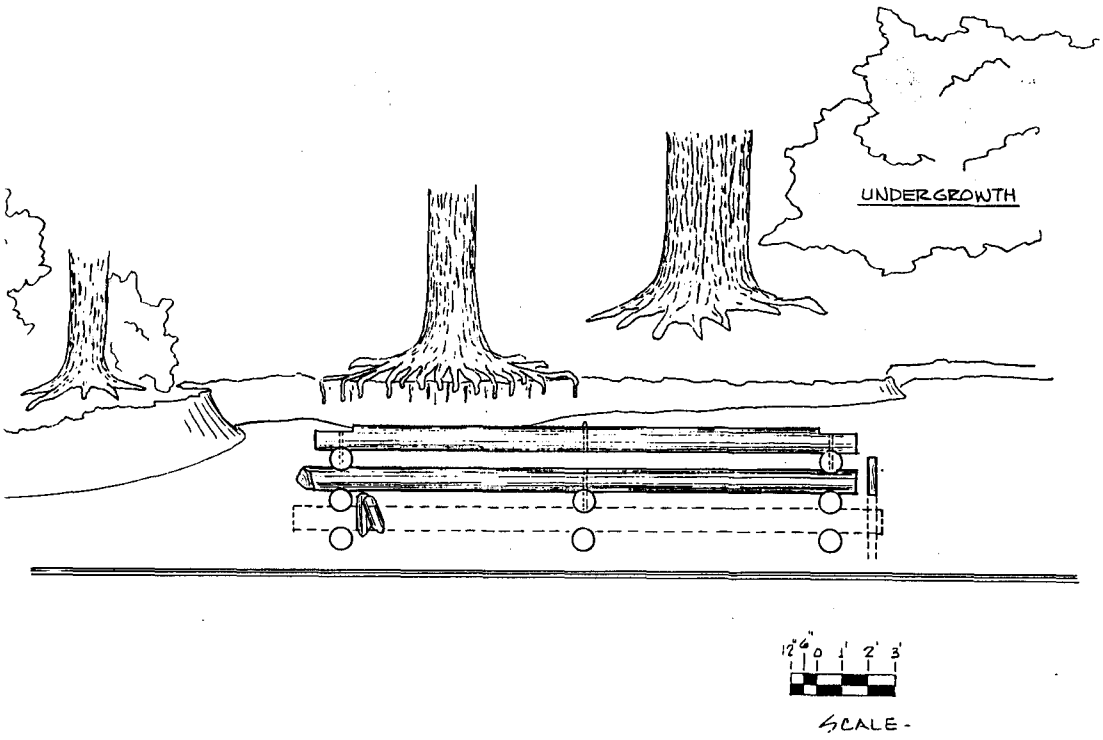

FIGURE 1. Reconstruction of "Baker's Wharf" on Ashley River, Old Dorchester. (Drawing by William R. Judd.)

ing importance to the economic landscape and transportation of South Carolina's frontier. Even though there are numerous historical records for Childsbury, little physical evidence remains other than the chapel and two brick ferry landings (Deas 1978[1909]; Smith 1913:198; 1914:107-112; Moore and Simmons 1960:65-66; Merrens 1978).

According to James Child's 1707 plat map and 1718 will, Childsbury consisted of 185 numbered lots. Included also were two large town squares and a market area. Three lots were designated for the construction of community buildings (chapel, school, and university), and 182 were offered to the public—over 50 percent of these can be traced to their original owners. Letters, wills, deeds, and indentures confirm that some private homes were constructed in Childsbury. Over time the town seems to have acquired many full-time residents, including a doctor, lawyer, shoemaker, several tailors, butchers, tanners and carpenters (Smith 1913:199; Moore and Simmons 1960:66, 203; Moore 1961: 248; Rogers et al. 1974:599; Terry 1981:209).

Ashley Ferry and Ashley Ferry Town

Ashley Ferry was established in Saint Andrew's parish by the South Carolina Assembly in 1711 (McCord 1841:23). It crossed the Ashley River ca. 7 mi. upriver from Charleston. The location of this ferry crossing was derived from colonial maps and found between a bluff on the southeast side of the river and a salt marsh on the northwest side. Much like Childsbury, the southeast landing was probably used as a loading place. Due to a swampy lowland environment, the northeast side required a causeway similar to the southeast side at Strawberry Ferry. Ashley Ferry operations continued into the mid-1800s despite the construction of a ferry closer to Charleston (also known as Ashley

Ferry), due to political and social connections maintained by Ashley River residents with Charleston.

Ashley Ferry Town's associated development is known to have occurred even though there are no physical indications today. A 1724 map shows that it contained 102 plots, ca. 25 percent of which are traceable to their original owners. Residents included a blacksmith, carpenter, and vintner. It is suspected that there were key structures within the town such as a tavern and general store (Smith 1913:204-205). The construction of the Parish Church of Saint Andrew's was begun in 1706; it was vested as the parish chapel shortly after completion. In 1723, the legislature passed an act providing for public and open markets to be held in Ashley Ferry Town every Wednesday and Saturday for three years. The South Carolina Assembly occasionally held sessions in Ashley Ferry Town during the mid- to late colonial period, generally during times of epidemics or illness in Charleston.

Landing Construction for Ferry Crossings

As important as ferry crossings were to early settlement and the colonial economy, their construction is poorly understood. There are no colonial documents or diagrams delineating their construction, and there are also few extant examples available for study in South Carolina's low country. Those that exist are generally in poor condition. Recent work by this author in the region has shown them to be more complex than first imagined (Beard 1994:63).

Comparative data for this study is drawn from three extant examples: Strawberry Ferry (38BK1723) established in 1705 on the western branch of the Cooper River; Ashley Ferry (38CH1506) established in 1711 on the Ashley River, and Bonneau's Ferry (38BK1267) established in 1712 on the eastern branch of the Cooper River (McCord 1841:6-8, 23; Terry 1981: 189). Strawberry and Ashley Ferry operated into the 19th century; Bonneau's Ferry was circumvented in 1737 by Huger's bridge over the eastern branch of the Cooper River, and it is not known when its operation ceased (Deas 1978 [1909]:134-135; Terry 1981:196).

The northwest landing of Strawberry Ferry is in pristine condition, mainly because of its location on the inside curve of the river, fluvial overburden and heavy tree and sawgrass growth (Barr 1994:82). Its condition has eliminated the possibility of a full-scale excavation at this time. The southeast landing at Strawberry Ferry has been much eroded by fluvial action and boat wakes. SCUBA has allowed a preliminary study of its primary inner construction.

Neither Ashley Ferry landing is in good condition. The northwest landing is the better preserved of the two, probably due to its location on the inside bend of the river. However, it is heavily eroded with little left except for base logs possibly used for support. The southeast landing of Ashley Ferry was destroyed during the Drayton family's phosphate-mining operations in the late 19th century, when a railroad and dock structure were built.

Both Bonneau's Ferry landings are in poor condition. The northwest landing has practically disappeared between the high and low water marks, although site survey indicates that much may be intact. The heavily eroded southeast landing has lost most of its upper structure; even disarticulated members seen in 1991 have disappeared, leaving only the round base support logs. Survey indicates that much of the terrestrial and underwater portions of this landing also may be intact.

It has been suggested that ferry landings were constructed using crib-like structures similar to those in early colonial docks (Beard 1994: 67). The dock at Fort Dorchester on the Ashley River is representative of that construction (Figure 1). The structure consisted of a 20 x 20-cm beam framework possibly floated into place, filled with rubble, and sunk (Coker 1987:39).

Ferry landings, on the other hand, tended to be built in situ. The techniques used to restrict water flow during construction are unknown. They may have been built during droughts or possibly with sandbag dams—a technique used today for inter-tidal archaeological investigations.

This construction method should be considered in landing typology because of their patterned brick floors and slopes (Barr 1994:83).

Each of these ferry landings exhibits similarities that aid the development of a construction typology (Figure 2). Round 10-cm logs are common to all three of the crossings studied. There is no evidence for round logs at the northwest Strawberry Landing and it is suggested that they are the base structure for the landing (like a corduroy road). A layer of 5 x 10-cm boards laid on the round logs would give additional support to the final structure. These too are common to all the landings except the northwest Strawberry Ferry landing. A 20 x 20-cm timber frame, laid in "Lincoln-Log" fashion with each beam resting upon the other was then constructed on the support planks. These beams, with cut-outs for cross members, are found at both Strawberry Ferry landings and one Bonneau's Ferry landing. Board-and-puncheon technology then supported a patterned brick floor—its final covering. Large amounts of brick are associated with all of these landings.

A construction typology for ferry landings has not been established within an upland con-

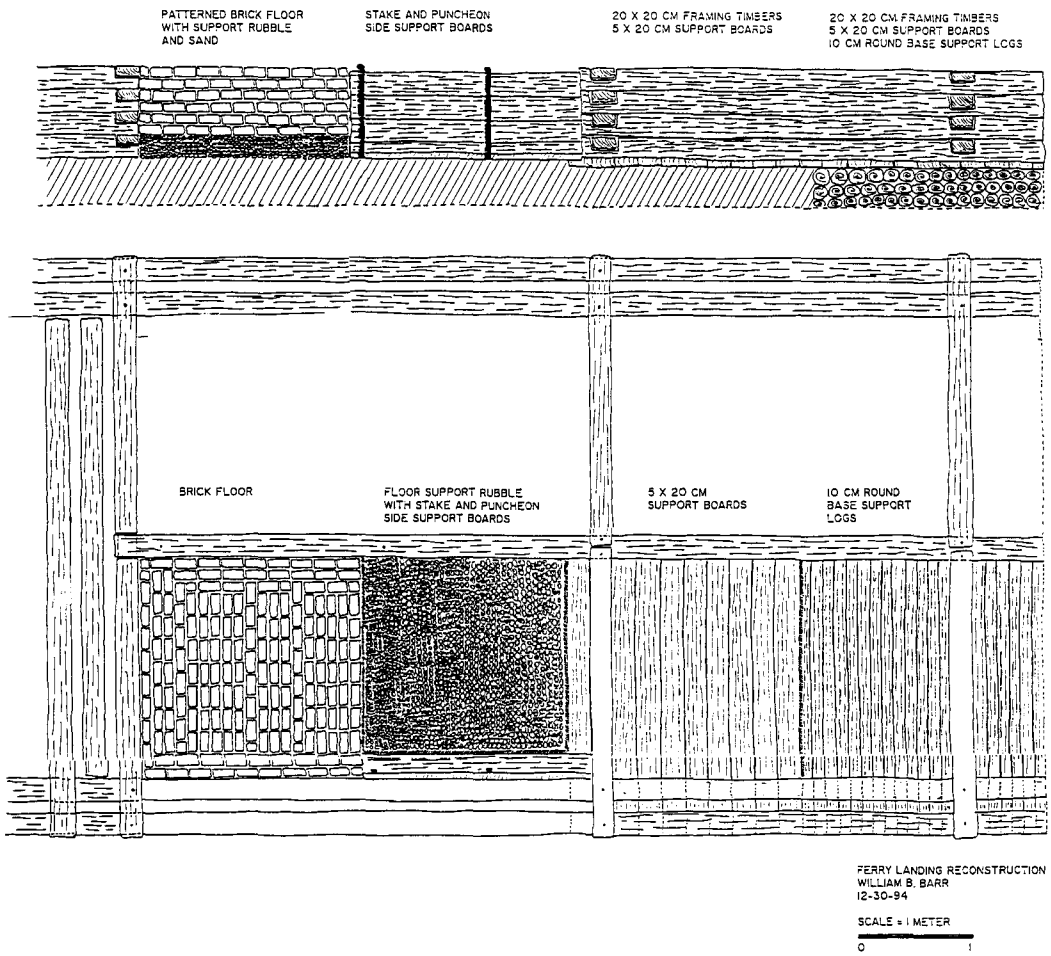

FIGURE 2. Preliminary construction typology for northwest landing of Strawberry Ferry. (Drawing by William B. Barr.)

text. Indeed, deposition factors from fluvial buildup along upland rivers have made it almost impossible to locate these structures. An example of this problem is found at the riverport city of Cheraw, South Carolina. Historical data suggest that a ferry crossing was established there across the Pee Dee River in the mid-18th century. Evidence of a "Lincoln-Log" structure similar to low-country ferry crossings, which may be Cheraw Ferry remains, has been found on the north side of the river. It is eroding out of a creek bank ca. 10 m from the present river bank and is covered by ca. 5 m of overburden. Studies to develop an upcountry ferry crossing typology are continuing.

Conclusions

The towns of Childsbury and Ashley Ferry Town post-date the ferry crossings associated with them. It is logical to assume that these towns were built to exploit the growth of a diverse commercial export market. The transfer of goods from the Carolina back country, whose shipment to Charleston markets would cross these ferries or utilize their landings for downriver shipment, gave these towns a measure of economic control over what Charleston received. Political and business dealings related to these economic ventures also would supplement that traffic.

Thus, as the only means of access northwest or southeast of Charleston to trade or production areas, ferry crossings were tied to a static transportation system. Changes to that infrastructure would adversely affect their economic positions and also lead to the establishment of new towns such as Monck's Corner (near Childsbury) and Summerville (northwest of Ashley Ferry Town). A major 1740s depression eliminated many resident tradesmen in these towns.

A time frame for the engineering and construction techniques of ferry crossing landings has yet to be established. The board-and-puncheon system is known to have been used in England in 1760 by canal builder Francis Egerton (Rolt 1969:29). Yet this technology is also found in the construction of post-1760 rice gates common throughout the Carolina low country (Mark Newell 1995, pers. comm.). It is suspected these construction techniques may predate 1760, but firm dates will require further investigation.

It is felt by this author that a preliminary construction typology for low country landings associated with ferry crossings has been established, subject to modification. This typology is based upon ongoing studies of colonial ferry crossings within the South Carolina low country. Once this typology is confirmed, comparative data with upcountry crossings will be used to determine whether similar techniques were used in their construction.

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Archaeology, History, and Public Policy: The Results of the Submerged Cultural Resource Project at Lake Champlain's Fort Ticonderoga and Mount Independence, 1992-1993

Background

On 4 July 1777 American troops stationed at Fort Ticonderoga and Mount Independence celebrated the first anniversary of the signing of the Declaration of Independence, unaware that within 24 hours they would have to abandon their fortifications and retreat. These frontier Lake Champlain posts were the northernmost line of protection separating British forces from the heart of the rebelling colonies. British success on Lake Champlain was followed by a stunning defeat at Saratoga just a few weeks later. British rear-guard units stationed at Ticonderoga and Mount Independence now abandoned their positions and retreated north into Canada (Burgoyne 1969 [1780]; Thacher 1827).

On 4 July 1991, a diver from Indiana was arrested for removing Revolutionary War artifacts from the waters around Mt. Independence. In that same period, concern had also been raised about the structural integrity of the remains of Revolutionary War bridge caissons still resting on the lake bottom. These two issues focused public concern for this historic region and stirred the Lake Champlain Management Conference, a federally-authorized program, to call for a survey and documentation project to determine the extent of cultural resources in this area. The project investigators were also asked to provide management recommendations for these waters, based on survey findings. The enterprise was funded by the Environmental Protection Agency as a "demonstration project."

Survey Methodology

The 1992 project was executed in two parts. The first phase utilized electronic remote-sensing equipment to examine a large area of lake bottom. This phase identified cultural targets between a northern line at Larrabee's Point and south to Chipman Point, a distance of approximately 5 mi. (Figure 1). Promising targets were examined and evaluated by divers. A unique component of this archaeological survey plan was the simultaneous collection of data to map and analyze the geology of the area's lake bottom. A third task of this survey phase examined the artifact-rich submerged archaeological site

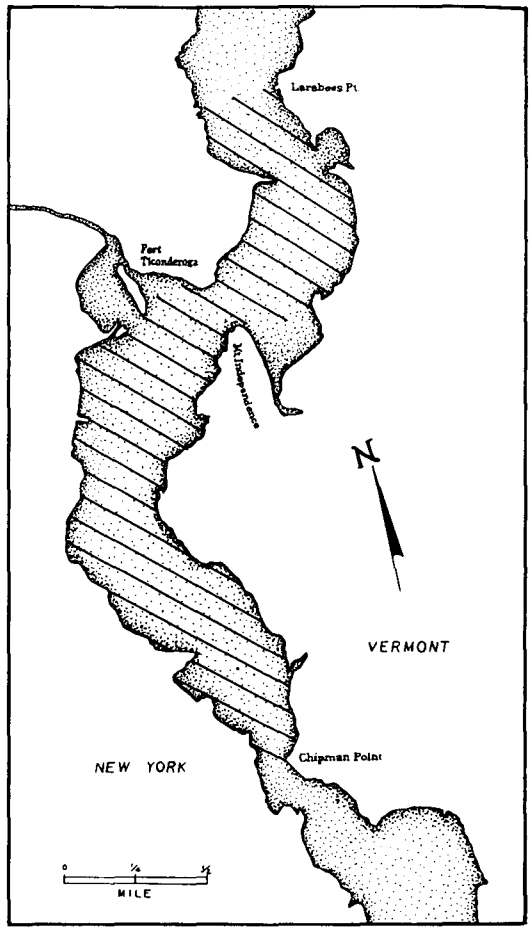

FIGURE 1. Detail adapted from NOAA Chart #14784. The shaded portion indicates the 1992 survey area.

surrounding Mt. Independence to determine its size, characteristics and significance.

The second survey phase identified and examined each of the remaining "Great Bridge" caissons. This extraordinary structure was built by American forces during the winter of 1777 to span over 1,700 feet of lake connecting Fort Ticonderoga and Mt. Independence (Baldwin 1906). Remains of the bridge and its artifact-rich environs had been located in 1983 during a Champlain Maritime Society survey and subsequently reported (Cohn 1985:40-45). The Indiana diver arrested for looting in 1991 had requested and received a copy of this report from State officials.

Phase I: Remote-sensing Survey Findings

The remote-sensing phase utilized side-scan sonar and a proton magnetometer; during the two-week survey, a number of promising targets were located. Diver verification of these targets was complicated by the near-zero visibility of the water, a normal condition in this region of the lake. Nonetheless, a number of significant new cultural properties were located, including several 19th-century canal boats. Three of these are largely buried under the lake's preserving mud bottom. A significant new find was the remains of 300-ft.-long sections of two railroad drawboats associated with the railroad trestle which crossed the lake from 1872-1920. A grouping of four large iron cauldrons of unknown origin was located on the bottom of the lake.

The Mt. Independence Submerged Archaeological District

The 18th-century artifact concentration located off Mt. Independence proved to be one of the richest collections of Revolutionary War material ever located (Figure 2). This submerged archaeological site was designated the Mount Independence Submerged Historic District, North End, VT-AD-711. Realization of the quantity, quality, and vulnerability of this public collection led to an immediate management recommendation for the documentation, recovery, and conservation of this unique historic and nationally significant collection (Cohn 1992). This recommendation was implemented in 1993 by the Lake Champlain Maritime Museum in collaboration with the Vermont Division for Historic Preservation through an appropriation by the Vermont legislature. Recovery and conservation of over 900 Revolutionary War artifacts was successfully completed in conjunction with the Institute of Nautical Archaeology at Texas A & M University and the University of Vermont.

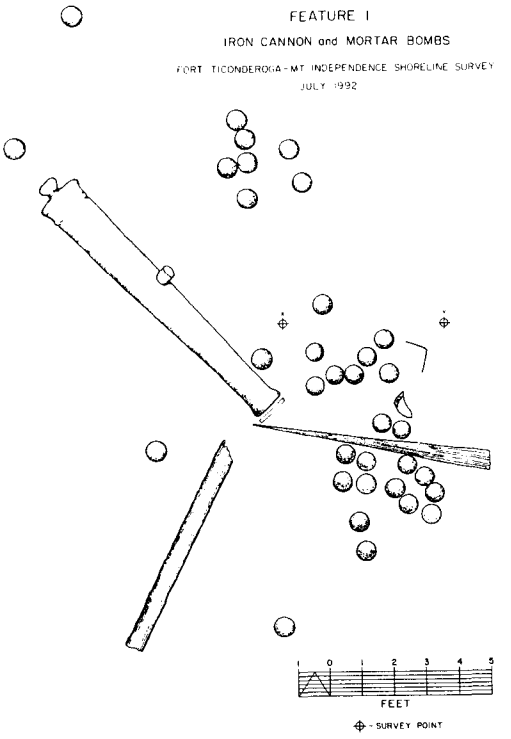

FIGURE 2. Archaeological drawing of Mt. Independence Feature 1, detailing the relationship of the 12-pound iron cannon and mortar bombs on the lake bottom. (Drawing by John Bratten and Kevin Crisman.)

Phase Two: The "Great Bridge"

The second phase of the 1992 project focused on diver documentation of the "Great Bridge," designated VT-AD-731 in the Vermont Archaeological Inventory. Project co-director Dr. Kevin Crisman guided this process, aided by stu-

dents from Texas A & M, the University of Vermont, and volunteer divers from the community. During this survey divers were able to locate 21 of the original 22 caissons. The most intact caisson, caisson #2, was selected for complete archaeological documentation (Figure 3). All the other examples were located, surveyed, and structurally analyzed to determine their relative stability. This analysis determined if proactive efforts were needed to preserve these structures into the future. The caissons' archaeological and structural analysis, coupled with results of historical research, suggests that they are in reasonably stable condition and do not require any additional stabilization at this time.

Geological Findings

This project demonstrated that an archaeological survey of the lake bottom could also gather important geological information. The resulting analysis of bottom furrows, sediment waves, and pockmarks has profound implications for understanding the hydrodynamics of Lake Champlain. In addition, results of the coring project in the vicinity of the "Great Bridge" corridor suggest a new and potentially valuable tool for analysis of historic land use and lake sedimentation rates.

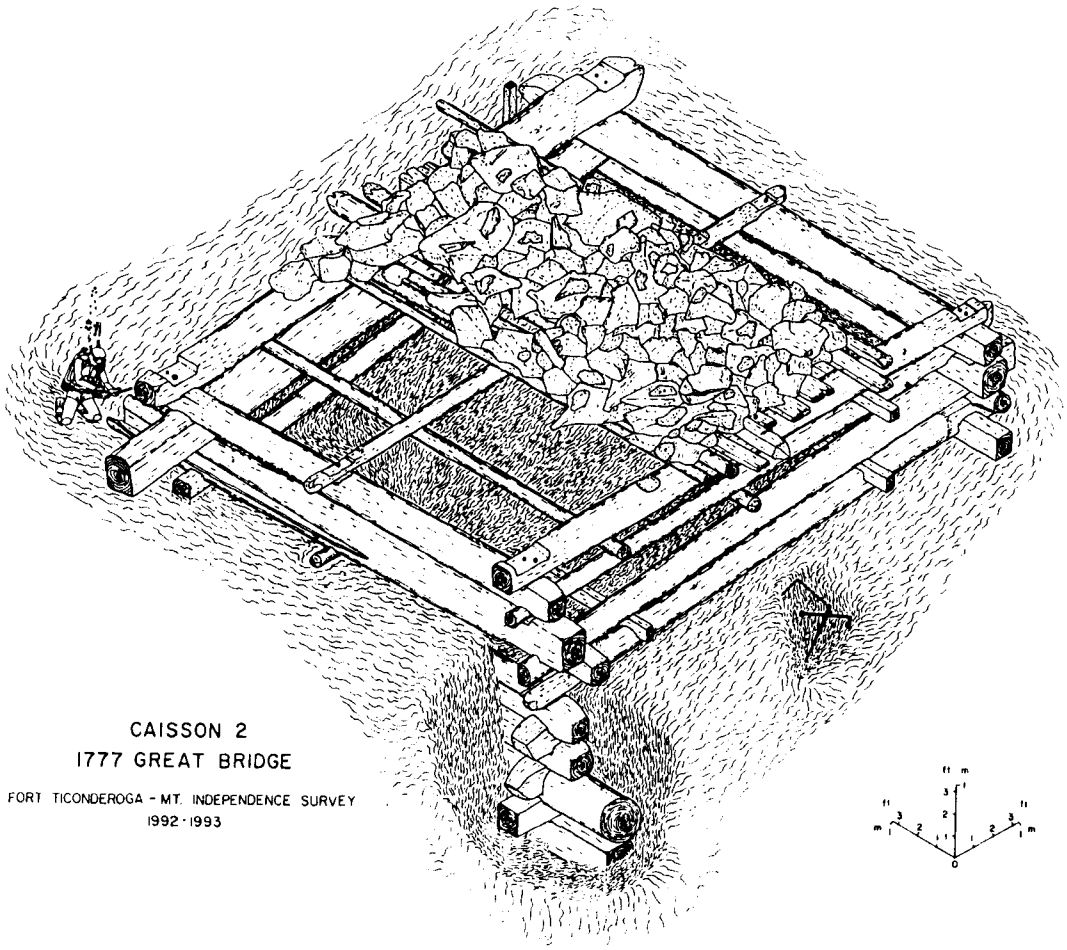

FIGURE 3. Archaeological reconstruction of Caisson #2. (Drawing by Joe Cozzi.)

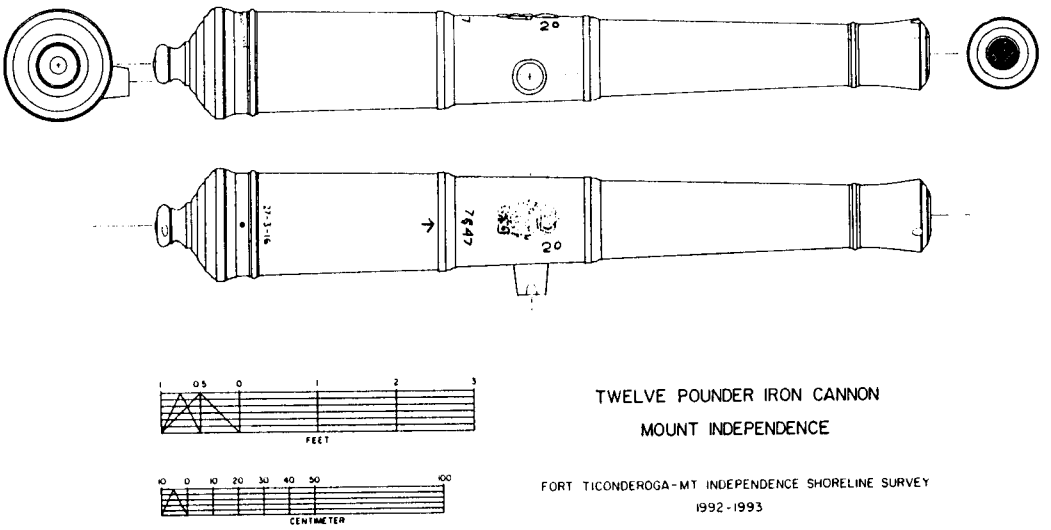

FIGURE 4. Drawing of the conserved Mt. Independence cannon. Preliminary identification of the cipher indicates the cannon is a rare example of a Scottish Naval gun, ca. 1670. (Drawing by Scott McLaughlin.)

1993 Artifact Recovery and Conservation Project

During the Mt. Independence diving survey, it was determined that this extraordinary collection of material could not remain on the bottom. Most artifacts lay unburied on the lakebed, and much attention had been focused on this area by the diver's 1991 arrest and our own research activities. This led us to conclude that this material would gradually disappear if not recovered. The 1992 survey had been federally funded; however, the artifact collection rested solely on Vermont bottomland and therefore any recovery of these objects would be the state's responsibility. A recommendation for the recovery and conservation of this collection was made to the Vermont Division for Historic Preservation, which forwarded the request to the Vermont legislature. A coordinated lobbying effort produced the funds needed to implement the project in 1993.

The recovery project was executed during a joint field school co-directed by the author and Kevin Crisman; it again utilized students from Texas A & M, the University of Vermont, and local volunteers. After an additional month of survey, over 900 artifacts were brought to the Lake Champlain Maritime Museum for conservation (Figure 4).

One of the primary opportunities presented by this program was public education. The importance of public understanding of the value of submerged cultural resources cannot be overstated. Because of its unique historical and archaeological context, this project provided an extraordinary opportunity to expose the public to management issues for this area. To take advantage of this, a conservation laboratory was established at the Lake Champlain Maritime Museum by Texas A & M graduate students John Bratten and David Robinson. An exhibit was installed within the conservation laboratory to interpret the project and stimulate debate about public policy issues. As the artifacts were recovered from the lake, they were transported to the laboratory where they were immediately available for public viewing. Over a four-month period, more than 15,000 people visited the conservation laboratory and received a special orientation to the preservation and management of submerged cultural resources.

A school curriculum entitled "Digging, Diving and Documenting: the Process of Nautical Archaeology" was developed under the supervision of Lake Champlain Maritime Museum educator Laurie Eddy. During a six-week period, this program was presented to over 1,600 regional school children. Students learned how to map an archaeological debris field and were able to handle real 18th-century artifacts while assisting in the conservation lab. In late fall, the conservation was completed and the Museum transferred the conserved Revolutionary War objects to the Vermont Division for Historic Preservation.

Management Recommendations

As a component of the 1992 survey, investigators were asked to articulate management recommendations. The Museum's primary recommendation for the removal and conservation of the exposed submerged Revolutionary War collection was successfully implemented. We also recommended that a Visitor Center be established at Mt. Independence to interpret its significant history and become the permanent repository for the artifact collection. The author is happy to report that initial funding for this proposed Visitors Center was appropriated by the Vermont legislature in 1994.

The Museum recommended that recreational diving not be encouraged because of the extremely limited visibility within the survey area. While the bridge caissons and other submerged cultural properties are interesting, the potentially dangerous conditions make them inappropriate for "underwater historic preserve" status. Some divers may choose to locate and dive these properties on their own initiative. The Museum recommended that the Vermont and New York State Historic Preservation offices adopt a policy which allows voluntary diver access to appropriate resources, with the provision that divers cannot adversely impact these historic properties by anchoring or removing any historic materials from the water. State managers will determine if this process can be self-regulating or whether some type of pre-dive registration will first be required.

The survey identified a number of sites of great archaeological potential in the Fort Ticonderoga/Mt. Independence area. The collection of canal boats provides a great opportunity for understanding the development of characteristics of this category of watercraft and aspects of life on board. Documentation of the railroad drawboat and associated trestle features also has great archaeological importance in helping to understand this unusual and little-documented aspect of Lake Champlain history and technology. The Museum also pointed out that two vessels located during the 1983 survey, preliminarily identified as being ca. 1758-9 French and British naval craft, hold great archaeological potential as well.

A major emphasis of this project was to determine the structural status of the bridge caissons. Initial concern had been that deteriorating condition or new stresses could be causing the caisson remains to further break up. Final analysis of all data suggests that after 218 years the remaining caissons are quite stable, held together well by their configuration. The two documented 20th-century cases of caisson break-up appear to have been caused by accidental fouling in lines and nets. The Museum recommended that the "Great Bridge" corridor be designated a "no-anchor" zone by the U.S. Coast Guard and that the locations of cultural targets be made available to all legitimate research vessels and law enforcement personnel. Consideration should also be given to the impacts and benefits of locating all significant submerged sites on standard lake charts. In the interim, local charter captains, the Vermont and New York marine patrols, and officials from Fort Ticonderoga and Mt. Independence should monitor submerged archaeological sites.

As of this writing, the implications of a newly-discovered infestation of zebra mussels on these structures are not known. While no evidence of zebra mussels was noted during the 1992 or 1993 surveys, it is predicted that they will cover the exposed portions of the historic

sites located during the 1992 survey. The Museum recommended that efforts be undertaken to study their impact on submerged historic properties.

The Museum's final recommendation addressed the need to obtain secure and appropriate funding for preserving, monitoring, documenting, implementing, and managing the cultural resources of the Champlain Valley. The heritage tourism potential of uniquely-historic Lake Champlain is one obvious benefit to be derived from appropriate funding levels. It is hoped that the Fort Ticonderoga/Mt. Independence Survey Project has demonstrated the extraordinary potential for scholarship and public benefit from this type of program.

Conclusions

This project demonstrated both the extraordinary cultural wealth of Lake Champlain and how modern technology can be applied systematically to examine the lake bottom both archaeologically and geologically. We have strongly recommended that the investigation of the entire Lake Champlain bottomland be implemented as soon as possible; the recent discovery of zebra mussels adds urgency to this inventory.

The project also demonstrated that the public has great interest in the stewardship of submerged cultural resources. If we expect them to value the resource and fund projects for their documentation, protection, and management, then the museum and archaeological communities must involve the public in the process to the greatest extent possible.

POSTSCRIPT: *The arrested diver contested the charge of "excavating without a permit," and after failing to rally regional divers to his cause was convicted in 1992 in Vermont District Count.*

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The Reader's Point Project: The Excavation of an Eighteenth-Century Sloop in St. Ann's Bay, Jamaica

During the summers of 1991 and 1992, archaeologists from the Institute of Nautical Archaeology (INA) at Texas A & M University (TAMU) discovered the remains of six 18th-century ships near Reader's Point, in the center of St. Ann's Bay, Jamaica. This survey was conducted for the Columbus Caravels Archaeological Project (CCAP), directed by Dr. James Parrent. Test trenches indicated numerous repairs on each of the hulls and considerable wear on the timbers. Their close proximity to each other, away from the eastern half of the bay where most maritime activity occurred, suggested that this area was a ship graveyard, or disposal area, for vessels that were no longer seaworthy (Figure 1).

Sediment ranging from 1–3 m in depth covered the vessels. CCAP archaeologists used subbottom sonar to penetrate the seafloor and pinpoint the locations of the sites. The initial trenches excavated on the Reader's Point sloop, designated "Site 16" in the CCAP survey, exposed a medium-sized vessel, not heavily built but definitely capable of sailing the open ocean. Since all of the vessels found on the CCAP project had been stripped of cargo and useful items, Reader's Point directors did not expect to find an abundance of artifacts. Enough remained, however, to securely date the vessel. Divers only uncovered a small area of the hull, but the findings were intriguing. The integrity and preservation of the hull combined to make the site a very interesting example of 18th-century ship construction.

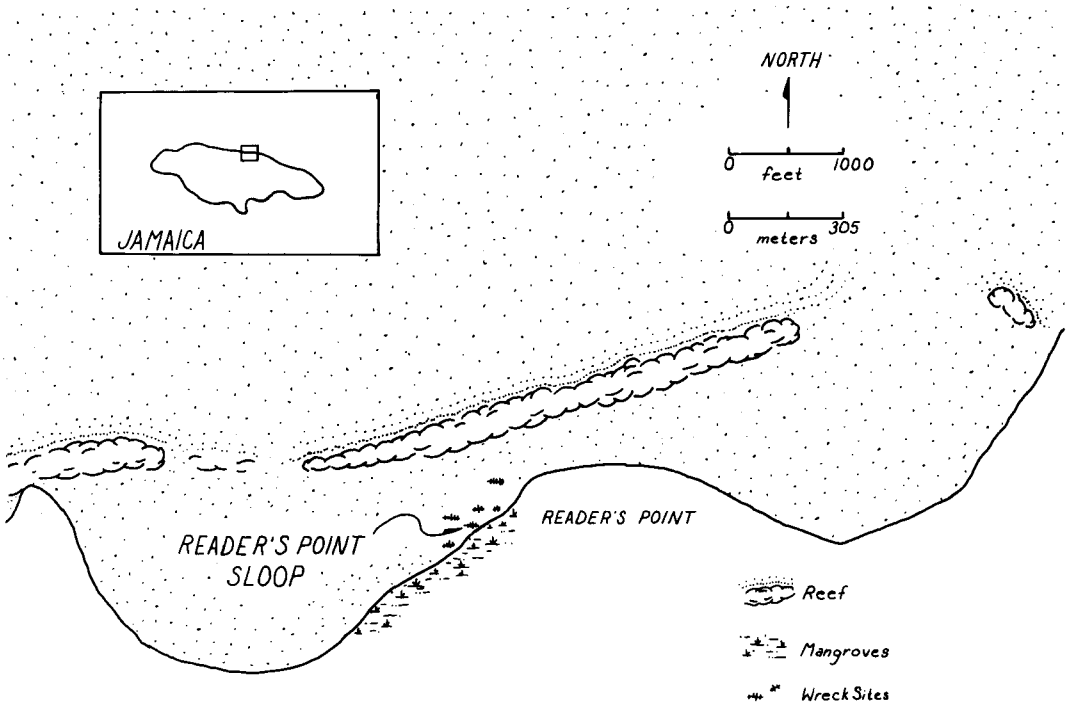

FIGURE 1. Map of St. Ann's Bay showing the location of the Reader's Point sloop and five other 18th-century vessels in close proximity.

Despite the magnitude of maritime commerce conducted in the West Indies during the colonial period, our knowledge of contemporary ship building is extremely limited. This was a time of dynamic hull evolution and adaptation. Instead of using ships sent over from Europe, the colonies began to build their own vessels adapted for the West Indian trade. Shipbuilders produced these vessels in small shipyards by eye rather than to plans. Sloops quickly filled a niche in the colonial economy, providing merchants with a relatively inexpensive means to conduct local trade. These vessels gained a wide reputation for being fast, maneuverable, and capable of avoiding larger, heavier-armed ships in unfriendly waters. Only a few archaeological studies have been conducted on ships of this period, and none in the Caribbean. The accidental discovery of these sites, representing a little-known era of ship construction, provides a potentially invaluable resource for 18th-century ship studies.

An opportunity to investigate one of these ships came in March 1994 after securing funding to return to St. Ann's Bay and excavate the Reader's Point vessel. Excavation began with a core crew of Dorrick Gray, Director of Field Research for the Jamaica National Heritage Trust; Clive Chapman, a TAMU graduate student; Amy Rubenstein from the Maritime History Program at East Carolina University; and Greg Cook of INA. Additional volunteers worked on the site for periods ranging from one week to a couple of months, including David Ames, Norine Carroll, Karl Gottschamer, Darren Hurst, Mike Krivor, Mike Lenardi, Daria Merwin, Tom Shannon, Juan Vera, and Rich Wills.

Using a surface-supplied air system and two water induction dredges, archaeologists initially uncovered "sterile" areas previously excavated for the CCAP test trenches. With the orientation of the vessel determined, project members then set up permanent datums around the site perimeter. These datums were used in conjunction with the WEB direct survey measurement computer program, developed by Nick Rule during the *Mary Rose* project in Great Britain. This innovative software applies best-fit algorithms to raw field data, providing an accurate site plan and alerting archaeologists to erroneous measurements. Using this program, the crew mapped artifacts and the hull structure. Over 3,000 individual measurements were taken of the hull, with an average accuracy of under 2 cm.

The ship lay in only 1 m of water, but under 2 m of soft mud and clay, which contributed to excellent preservation of the remains. With over 200 years of commercial activity in St. Ann's Bay, there was concern about intrusive objects which may have migrated down to the 18th-century levels in the soft sediments of the bay. For this reason, only objects found within or under the ballast pile were considered as definitely associated with the vessel. Even with these parameters, divers retrieved nearly 650 artifacts from the site. The paucity of the assemblage indicated the vessel was thoroughly salvaged before abandonment, although a substantial ballast pile remained amidships.

Field conservation, like excavation, was limited by financial and logistical constraints. Lab assistants set up stations in the project house for desalinization, electrolytic reduction (ER), bulking, consolidating, solvent dehydration, air drying, and labeling.

The artifact types retrieved from the Reader's Point Vessel included ceramic, bone, glass, leather, wood and metal. The number of ceramic objects in the assemblage totaled nearly 400, with 21 different ceramic types. These were agate, brick, faience, and kaolin, and included varieties of astbury, creamware, earthenware, jackfield, porcelain, slipware, and stoneware. The creamware family contained examples of clouded ware, diamond-and-dot patterned ware, scalloped and feather-edged ware, and Royal patterned ware. Most of the coarse earthenware fragments were made of red clay pastes. The stoneware was often saltglazed or white-slipped-and-brown-glazed; one example proved to be a blacking bottle. Ceramic vessel types included cups, mugs, plates, jugs, bowls, pipes, and tiles; no intact examples were found.

Conservation of the ceramic artifacts was simple—each object was rinsed and air dried. The faience, astbury, and creamware sherds were

treated in a 15-percent solution of hydrogen peroxide and water to bleach them. Some ceramics were treated in a solution of hydrochloric acid to remove encrustation.

Cupreous, iron, lead, and pewter metal objects were recovered, but most were iron of two categories: those with existing metal and those that were simply molds (ca. 50 percent of each). Iron artifacts consisted of bolts, spikes, square nails, barrel strap, buckles, buttons, washers, a wedge, an iron, and a chisel. These objects were completely encrusted. Where metal remained, pneumatic chisels were used to remove the encrustation.

ER treatment in a solution of sodium carbonate was chosen for most artifacts with extant metals. The treatment vat was connected to a DC power source, and a silver nitrate test determined when chlorides were no longer present. Iron artifacts were coated in a tannic acid solution and immersed in molten microcrystalline wax for sealing. Three lead shot artifacts were simply boiled in a distilled-water rinse. Three fragmentary pewter spoons received ER and rinses. A cupreous buckle received a chemical treatment of sodium sesquicarbonate.

Where no metal remained, an epoxy cast was made. Emptied molds were filled with a mixture of epoxy base and hardener. With the use of the pneumatic chisel or air scribe, the replicas emerged from their molds and were coated with graphite powder to give the appearance of black iron.

Two fragments of leather shoes were recovered and treated by means of solvent dehydration. A bone button, bone comb, and all skeletal remains were treated similarly and consolidated with polyvinyl acetate (PVA). Conservation aides treated wooden objects by the acetone/rosin method, chosen because it was effective whether heated or not. Wooden objects proceeded through solvent dehydration to a 100-percent acetone vat and then to the rosin, where they remained for several months. The project had more success with wood that was less dense. Wooden artifacts included portions of barrel lids and staves, pulley sheaves, treenails, a button, a wedge, and a plug.

Glass artifacts also underwent solvent dehydration. Additionally, these objects were treated in a 1-percent solution of nitric acid to remedy devitrification and then were consolidated in a PVA solution. Divers recovered four different types of glass: soda, clear, leaded, and green or black glass. Most samples were as common 18th-century wine bottle fragments; the one complete example, however, was an undersized English beer bottle.

The largest and most complex artifact was the hull itself. Once the overlying sediment, ballast, and artifacts were removed, the vessel's structure was recorded in situ since bringing the timbers to shore was impractical and the shallow water depth allowed long dives. Archaeologists produced measured sketches of every hull component, mapped timber locations, recorded sections to show the hull's curvature, and prepared a site photomosaic. After the initial recording, portions of the bow, mast step, and ceiling planking were disassembled to gain a better understanding of the ship's construction.

In general, the construction of the sloop shows a high degree of regularity and workmanship. Nearly the entire length of the vessel was preserved, extending 18 m from the bow timbers to the stern knee (Figure 2). The maple keel was exposed in three locations, averaging 30 cm molded and 24 cm sided. The keelson is made of a single oak timber over 11 m long. A rectangular mortise is cut into the keelson for the foot of the mast, located approximately one-third of the vessel's length from the bow. Small wooden chocks that kept the mast foot in position are present in the after part of the mortise. Radial cant frames form the bow of the sloop; this construction technique has been documented on other 18th-century ship sites and seems to be a relatively common characteristic for period vessels. Frames are generally cut very evenly and square, with a few exceptions which are most likely repairs. Nine "made" frames, consisting of floors and futtocks joined with horizontal treenails, were erected on the keel to define the shape of the hull before the outer hull planking was added. Forward of midships, floors are fixed to futtocks situated aft of them, and aft of

midships they are joined to the futtocks forward of them. At the bow and stern every second floor is a made frame. This changes to every third floor amidships, where hull curvature is not as drastic. The remaining futtocks are not attached to floors, but instead are simply treenailed to the hull planking. Hull and ceiling planking are predominantly fixed to frames with unwedged treenails, though a few iron nails are present. The stern knee is fashioned from a single piece of oak.

Evidence suggests that the hull had been heavily used before it sank. Beside the repaired frames mentioned above, numerous ceiling planks show repairs and additions. Lead patches indicate weak or leaking spots in the outer hull planking, and the keel shows heavy wear. The most striking damage occurred at the mast step, where a split on the starboard side of the keelson extends from the mortise for nearly 3 m. This may indicate that the vessel was violently dismasted—one of the most serious and damaging accidents that can occur to a ship. Several measures were taken to repair the fractured keelson: two large, iron bolts were driven horizontally through the keelson to close the gap created by the crack; two smaller sister keelsons were spiked on either side of the mast step mortise; and heavy buttress timbers were added on either side of these in an attempt to strengthen the broken timber (Figure 3). It is interesting to note that the sister keelsons are joined to the keelson exclusively with horizontal fasteners, while the buttress timbers are spiked to the frames below them with vertical fasteners. This technique secured the various components of the keelson repair without sacrificing the integrity of any individual timber by driving fasteners from two opposing directions.

Glass, ceramics, and bones were analyzed to date the site. It is our belief that the vessel was abandoned in the last quarter of the 18th century. Analysis of the bases and necks of glass bottles agree with this hypothesis, although the glass study entailed an error factor of ±33 years.

An examination of the small sample of kaolin pipe bowls indicated a date between 1690 and 1820. However, the results do not appear to deviate from our previous beliefs concerning the date of abandonment. The pipe bowls demonstrate only that the derelict was left after 1730. Similarly, the remaining ceramics were produced throughout the 18th century. The presence of the feather-edged creamware, though, showed the vessel was not abandoned before 1765.

Preliminary study of the bones revealed that the bulk are probably cattle and pig (presumably salt beef and pork); there were also examples of sheep and rabbit in the food debris. There was one specimen of brown (Norway) rat (*Rattus norvegicus*), which demonstrated the vessel was abandoned later than ca. 1740 or 1750. Documentation shows that the Norway rat displaced the black rat in western Europe at that time.

Research on the artifacts and hull of the Reader's Point sloop has just begun and pledges

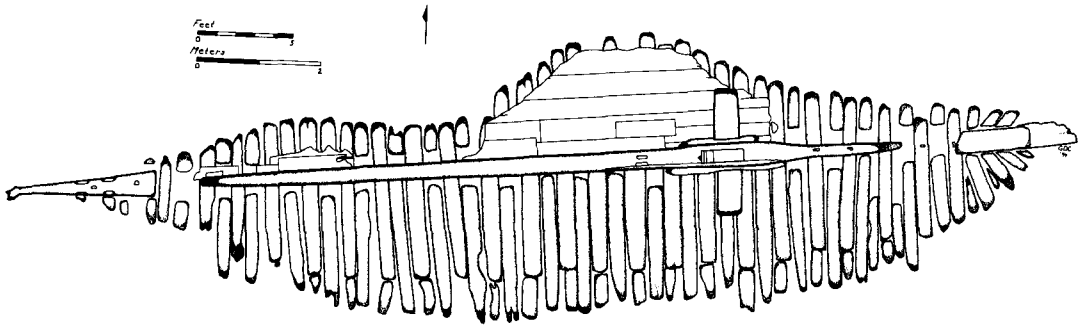

FIGURE 2. Site plan of the Reader's Point sloop. Note the radial cant frames in the bow, the mast step construction, and the grown knee timber in the stern.

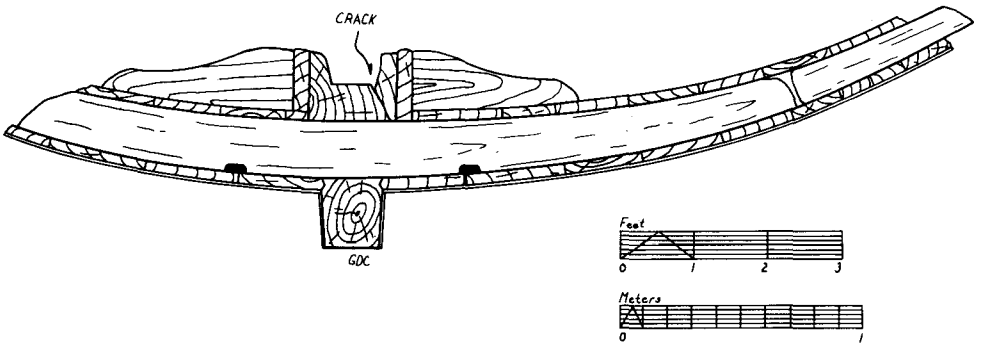

FIGURE 3. Profile of the Reader's Point sloop at the mast step. Note the crack running through the mortise and the associated repair timbers.

to give a clearer understanding of the vessel's origin, purpose, and sailing characteristics. Archival research in Spanish Town and Kingston, Jamaica, has produced considerable information about the use of sloops in the Caribbean during the 18th century. Hull drawings and profiles will be analyzed, producing lines drawings and reconstructions of the ship. Our tentative conclusion is that the sloop was built in North America, most likely in the Northeast, around the time of the American Revolution. The use of exotic tropical hardwoods for repairs suggests that the ship traded extensively in the Caribbean. As research and analysis of the vessel continues, the Reader's Point sloop promises to contribute significantly to our knowledge of 18th-century maritime history and ship construction.

ACKNOWLEDGMENTS

The success of the Reader's Point Sloop excavation is due in large part to the assistance of numerous organizations and individuals. We are indebted to the following groups: the Reader's Point crew and volunteers; INA; the Jamaica National Heritage Trust; the Discovery Bay Marine Laboratory; the South Carolina Institute of Anthropology and Archaeology's Bermuda Sloop Project; Paradise Scuba; Taff Office Equipment; and Seascape Dive Resort. Several individuals provided invaluable advice and assistance, including Dr. Philip Armitage, Dr. George Bass, William Charlton III, Dr. Kevin Crisman, Marianne Franklin, Peter Gail, Dorrick Gray, Jerome Hall, Dr. Donny Hamilton, Dr. Fred Hocker, Becky Holloway, Phil Janca, Dr. Margaret Leshikar, John William Morris III, Dr. James Parrent, Maureen Brown-Parrent, Wayne Smith, Dr. Frank Tainter of Clemson University, and Chip Vincent. Project funding came from several sources: the Institute of International Education granted Greg Cook a Fulbright Fellowship to cover project costs and living expenses in Jamaica. The award of an INA Marian M. Cook Fellowship and a gracious donation by Frederick R. Mayer of INA allowed the excavation to become a reality.

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Recent Developments on the *Mary Rose* Project

Introduction

Mary Rose was built in Portsmouth between 1509 and 1511 and served in Henry VIII's Navy for 34 years before sinking in the Solent on 19 July 1545. Contemporary salvage attempts failed to raise the wreck, which was soon abandoned. Numerous items, including guns, were recovered during those early salvage attempts and in the 1830s when pioneer helmet divers John and Charles Dean carried out further work. The wreck was otherwise left alone until 1965, when Alexander McKee initiated modern attempts to find it. Remote sensing surveys in 1967 and 1968 identified a seabed anomaly, but the first frames were not seen until 1971. Over the next seven years, Archaeological Director Margaret Rule and Director of Excavations Alexander McKee gradually exposed the outline of the remains, restricting excavation to outside the hull until it was clear how the ship lay in the seabed. The first major interior trench was excavated across the bow in 1978; full-time excavation of the hull and contents took place between 1979 and 1982.

The remaining hull section (a substantial part of the starboard side and some of the port side hold) was recovered on 11 October 1982. By July 1985, *Mary Rose* was ready for the next operation: rotation onto an even keel from the 60-degree angle at which the hull had lain on the seabed. After this was completed, it was then possible to consider replacing the decks removed underwater (Figure 1). The story of the search, discovery, excavation, and salvage has been related elsewhere (Bradford 1982; McKee 1982; Rule 1983a, 1983b); this paper will outline more recent developments.

Major Programs

Between recovery and the start of "active conservation" on 30 September 1994, the hull was kept in a special "passive conservation" phase, during which it was sprayed with chilled fresh water for a minimum of 20 hours a day. A number of major activities were carried out in this period, as outlined below.

1) *Scientific research to establish the best hull conservation method.* This program, carried out by Dr. Mark Jones, Head of Conservation at the Mary Rose Trust, started with "beaker scale" trials and progressed to "pilot scale" trials using representative timbers. This resulted in the decision to use a three-stage process, starting with increasing concentrations of low molecular-weight polyethylene glycol (PEG 200). This will be followed by a second stage using the higher molecular-weight PEG 4000, and finally a third stage of controlled air-drying. Based upon the pilot scale program, it is estimated that this complete treatment will take ca. 20 years. Details of the research behind this treatment choice and other aspects of the hull conservation are available in specialist papers (Jones et al. 1986; Hoffman and Jones 1990; Mouzouras et al. 1990; Jones and Rule 1991 and 1993; Dean et al. 1993).

2) *A survey and documentation program to ensure that the most important structural components were recorded before the hull became inaccessible.* These surveys, including hull sections vital for the salvage cradle design, had begun underwater and were continued and substantially completed by Andrew Fielding and his team between 1983 and 1989. Photogrammetric surveys also were carried out, both for recording purposes and to monitor the hull for movement over time.

3) *The installation of modern strengthening supports to set the decks and other structures into their original positions.* The deck structures had been removed underwater, both to allow

excavation access to the areas below and because the original Tudor fastenings had not survived well enough for the decks to be raised with the hull structure. Titanium was chosen for these supports as it is light, strong, and non-corroding. In addition, it and its fabrication were donated, without which generosity the Mary Rose Trust could not have used this ideal metal (Dobbs et al. 1990). A secondary program (again using titanium) involved replacing many of the steel "tie-bolts" inserted by the diving team in 1982. These bolts had served two purposes during the recovery—they held elements of the structure together in areas of known weakness, and they acted as lifting points for the hull, thus avoiding traditional straps slung underneath. These lifting bolts were now redundant, but those that functioned as structural clamps were replaced with titanium to ensure that structural hull components remain firmly fastened together during conservation (and in perpetuity).

4) *Preparation of the hull and its gallery for active conservation.* This included removing any remaining sediments and salt water from the ship; more recently, it also has involved building a new spray system and installing more powerful pumps for spraying the PEG solutions. The area around the ship has been curtained off to reduce losses from the spray system, and additional monitoring systems have been installed to ensure correct environmental conditions. New air-conditioned visitor galleries will ensure that public access is retained throughout conservation. Visitors can inspect the ship safely from the port side and astern, listen to commentary from hand-held "Acoustiguide" wands, or view the hull from a variety of angles at their own pace.

Archaeological Investigations

Although we are fortunate to have so much hull structure, in some ways we are disadvan-

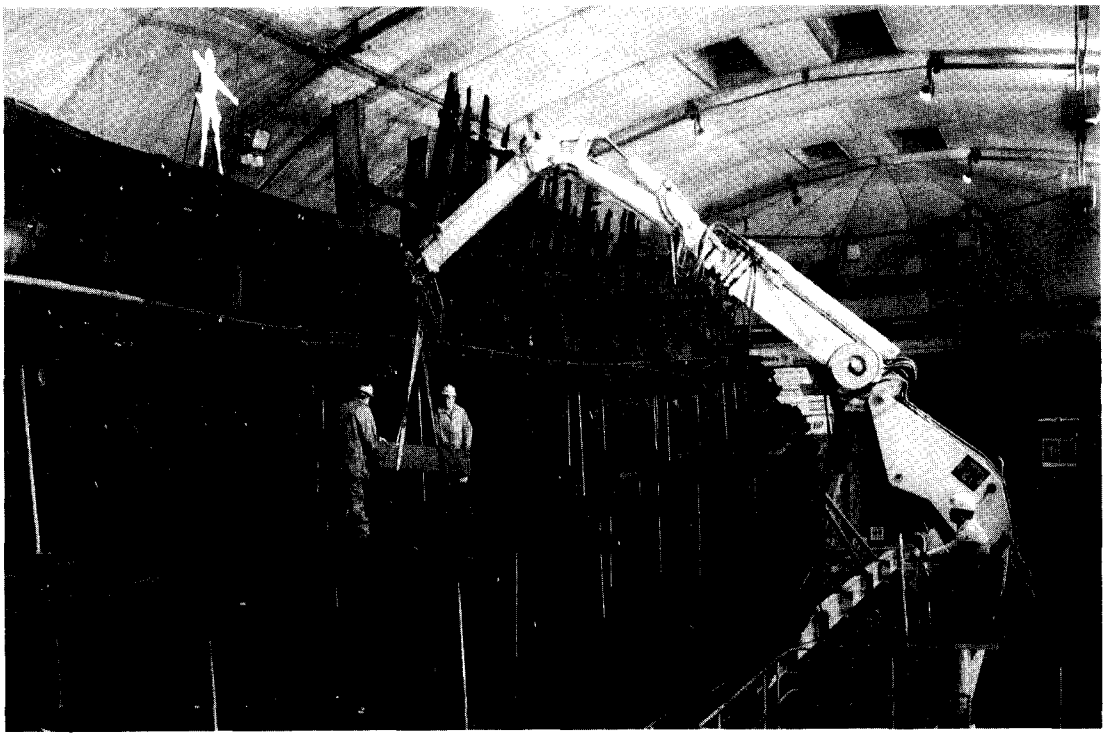

FIGURE 1. An orlop deck plank is replaced into its original position in the hull.

taged compared to ships with only fragmentary remains and easily visible joints. Access to much of the desired information for *Mary Rose* is hindered by the solid hull planking and heavy ceiling and stringers. Archaeologically, it would be preferable to dismantle the hull for this information, but its integrity precludes dismemberment on museological grounds. Numerous ways of overcoming this problem have been tried, including recording what is accessible (the eroded port side and keelson where limber boards could be removed); looking at frame spaces using lamps, mirrors and torches; using fiber optics to inspect gaps too narrow for other access; and inserting "feeler" wires between ceiling planks to obtain an outline of the frames beneath. All these methods have their advantages and disadvantages; when used together they provide some information, but more detailed analyses will have to wait until the hull is available for more rigorous study.

Frames and Fastenings

With the methods outlined above, it is possible to make preliminary observations of the frames and their fasteners. Many scholars are interested in the diagnostic "dovetail tenon" between floor and first futtock. It is important to note that this particular joint type (as seen on the Molasses Reef, Red Bay, Cattewater, and Highborn Cay wrecks) is not evident on *Mary Rose* despite a reference to the contrary (Keith 1988:60). Although it is not possible to inspect all the joints in this hull area, the shipwright appears to have relied on massive hold stringers or hooked scarfs to secure the floors to the first futtock (Rule & Dobbs 1995:27, Figure 1). Detailed inspection of the area reveals that on three floors close to midships there is a rebated joint in the scarf between the floors and first futtocks. However, this appears to be longer than the dovetail type, is not standardized in a dovetail shape, and lacks evidence for a fore/aft treenail near the joint.

The use of treenails to connect futtocks or futtocks to floors appears to be rare on *Mary Rose.* Viewing from the eroded frame ends on the port side, the remains of two treenails are visible in the floor beneath the aft end of the mast step. While one definitely does not connect to an adjacent timber, erosion on both sides of the floor at the level of the other treenail obscures any indication of whether it connected with another timber. A third treenail was driven diagonally through this floor and the first futtock forward of it, but it is at an angle that allows it to have been driven through the planking. In the bow, the last remaining starboard frame in situ has four treenails flush with the forward face of the timber, while on the aft face they are eroded (as is the frame itself). Despite the erosion masking definitive proof, the arrangement suggests that these four treenails were not in use at the time the ship sank. In contrast, another frame in the bow (three frames astern of that just described) does have a treenail connecting it to the second surviving floor. The only other fore/aft treenail currently visible is at the stern immediately forward of a wing transom knee, where it joins the second and third futtocks (Rule and Dobbs 1995).

Dendrochronology

Dendrochronological sampling has been carried out in conjunction with Dr. Martin Bridge at the London Guildhall University to provide information to both archaeologists and dendrochronologists. *Mary Rose* is known to have been rebuilt in 1536 and had other major re-fits in 34 years of service. Could dendrochronology provide independent proof of assumptions concerning which timbers in the hull date to the original build and the refits? Another aim of the study was to seek evidence of silvicultural practices and research the potential of using dendrochronological matching for timber sources. While analysis and research continue, initial results are encouraging (Bridge and Dobbs 1994).

Timber cross-sections may be preferable for tree ring analysis, but difficult access and the destructive technique meant that alternatives were preferred. Experiments with different coring procedures showed that powered corers were inappropriate, so samples were taken with the same 5-mm borer already used on the hull for monitoring conservation. Sampling concentrated on different structural elements within the ship, for which independent assessment was required for dating to the original construction or a rebuild. To obtain this degree of accuracy, sampling had to be carried out wherever possible on timbers with sapwood, or at least on timbers where the sapwood/heartwood boundary had survived. As shipwrights avoided sapwood wherever possible, this narrowed down the sampling range.

Despite these difficulties, outer ring dates for 31 timbers were obtained, of which 19 dated to after A.D. 1510. Whether or not any of their rings are missing, they must have been inserted into the hull during a refit rather than the original construction. Timbers from that group include riders with last rings dating to 1522 and 1523 and examples of the diagonal and vertical braces with last ring dates of 1526, 1528 and 1530. The diagonal braces curve upwards from the outboard ends of the riders and terminate below the main deck beams; while it was assumed that these and the riders were strengthening timbers dating to a rebuild, it is encouraging to obtain independent proof.

One area of a ship known for its inherent weakness is the stern, and evidence that strengthening was carried out in this area comes from cores taken in the transom knees, with last ring dates of 1524 and 1525. A mixture of late and early dates was obtained for the rising knees of the orlop deck and the hanging knees of the upper deck. More research is required to establish whether this reflects changes to the construction in those areas, or if it also demonstrates that valuable knees of grown timber were stockpiled or reused whenever possible.

The latest date for an outer ring is 1535 for a main deck beam. This is also the only true felling date obtained, as the sample included bark. Three other main deck beams have outer rings dating to well before the initial building phase and it is interesting to note that the one with the late date is offset from the normal alignment of beams with those of the orlop deck below. At this stage, the study is raising as many questions as answers, but research is at an early stage and will certainly add to our knowledge of the hull construction and rebuilding phases.

Conclusions

With so much extant structure, only a small proportion of the hull has been studied to date. Other aspects can be considered in the future; some will wait for the next generation of archaeologists with access to the hull after conservation. Now that *Mary Rose* is embarked on the program of active conservation and access to the hull is impractical, it will at last be possible to turn more attention to disseminating information in both academic and popular formats.

This paper is intended to provide information on recent research developments on *Mary Rose*. It is difficult on a project of this size to publish everything at the speed that we and our colleagues would like, but until we have can, we welcome inquiries from scholars with specific questions.

ACKNOWLEDGMENTS

The whole Mary Rose Project, including the work outlined in this paper, would not have been possible without the hard work and support of an enormous range of people including volunteers, staff, trustees, consultants, sponsors, and others. It would be impossible to name them all, but exceptions include Dr. Margaret Rule, Andrew Fielding, Jonathan Adams, and the Mary Rose Shiphall Team. Any mistakes, omissions, or shortcomings in this paper are entirely the responsibility of the author. Finally, I would like to thank the Earl of Malmesbury, whose kind patronage made it possible for me to attend the SHA conference and present a paper.

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Submerged Cultural Resources in Peril: A Naval Perspective

On 28 November 1994 at the Nauticus Center in Norfolk, Virginia, I had the pleasure of observing the National Park Service's presentation of cash rewards to the Confederate Naval Historical Society for its responsible actions in informing authorities about the looting of the Civil War wrecks of USS *Cumberland* and CSS *Florida*. This information led to the apprehension and prosecution of individuals who were helping to destroy this nation's invaluable submerged naval heritage by offering artifacts from these two ships for sale to collectors. Their punishment serves as a model of justice for those protecting and preserving such wrecks for posterity.

Unfortunately, wreck-stripping is common these days. Naval ship and aircraft wrecks have become targets of opportunity for underwater souvenir hunters, for either personal pleasure, profit, or both. The application of technology to underwater electronic detection and SCUBA gear has made it possible for people to locate and identify shipwrecks, both public and private, domestic, and foreign. The lack of sufficient law enforcement personnel has made possible the exploitation of shipwrecks on an unprecedented scale. The spectacular salvage of the Spanish galleon *Atocha* and SS *Central America* wrecks and the discovery and retrieval of SS *Titanic* artifacts, while legal, serve as spurs to the search for, and illegal recovery of, artifacts of another type.

This situation sets the scene for the challenge facing the Navy and other federal departments and agencies, such as the Department of Commerce's NOAA and the National Park Service's Maritime Initiative and Submerged Cultural Resource Unit. The Navy's particular concern, of course, is for its own historic ships and aircraft that ended their careers on the ocean floors and lakebeds.

From time immemorial, naval shipwrecks have been treated with superstition and respect, partly because they usually contain remains of drowned sailors, and partly because wrecks can be dangerous places for unwary and under-educated divers. Shipwrecks are broken ships, whose compartments are usually torn up and are sometimes unrecognizable because of storm or battle damage. Unexploded, unstable ordnance can be strewn about the site or its debris field, posing life-threatening hazards. USS *San Diego*, sunk a few miles south of Long Island, is one example of this kind of shipwreck, yet we know it has been visited by divers for many years.

Until the 1960s most shipwrecks were considered fair game for salvage if they were abandoned by their owners. Indeed, soon after the disasters that sent our ships down, the Navy usually tried to retrieve what was recoverable, either through contract firms or their own salvage unit. Yet an 1870s event provides an interesting counterpoint. One of the most dramatic events of the Civil War was the loss of the monitor USS *Tecumseh* during the battle of Mobile Bay in 1864, when the ship sank very rapidly with 93 sailors, including her captain. Less than ten years later, the Navy and Congress attempted to sell the ship to a private salvor. When the project was announced, a tremendous public outcry arose about the vessel being the last resting place for her sailors and that it should not be disturbed. Congress reversed itself and refunded the money. *Tecumseh* is still embedded in the Mobile Bay ship channel with the remains of its 93 sailors—the government had gotten the message that the public cares about its sailors and its naval heritage.

As naval custom and law have currently evolved, the government is the owner and the Navy is the custodian of its wrecked ships. Naval shipwrecks and aircraft wrecks are not considered abandoned from the mere passage of time or neglect. They remain government property in perpetuity unless the Navy chooses to divest itself of the ship by a formal abandonment, usually requiring the consent of Congress.

The Navy also recognizes and defends the title of other governments to their warships, whether in U.S. or international waters. We expect reciprocity from foreign governments in like manner when U.S. Navy ships are discovered wrecked in their waters. The recent International Convention on the Law of the Sea includes provision for protection of these wrecks.

Such a case is the Confederate cruiser CSS *Alabama*, rediscovered in French territorial waters in 1984, 120 years after she sank in battle with USS *Kearsarge*. After several years of negotiations, in 1989 France recognized the U.S. claim to *Alabama* ownership, while the United States recognized French control of the site and the water column. Further, the two nations established a joint Scientific Committee comprised of maritime historians and archaeologists to oversee archaeological excavation in conjunction with the French Ministry of Culture. The project continues with good will on both sides and has had successful recovery dives each year since 1990. Some significant artifacts have been recovered, such as the ship's wheel, galley stack, pivot gun tracks, ceramics, Brazilian coins, mechanical flush toilets, and a Blakely gun with shell still in the barrel. These are being conserved to the highest standard and most of the articles have been displayed in museums in Washington, Mobile, Paris, and Cherbourg. *The Washington Times* of 19 November 1994 and the *National Geographic* of December 1994 feature in-depth articles on this enterprise.

In 1966, Congress passed and President Johnson signed into law the National Historic Preservation Act (NHPA) which obliges federal agencies to identify, protect, and preserve historic properties within its sphere. If a property is eligible, the department or agency responsible is obliged to nominate it to the National Register of Historic Places. This law includes both submerged and terrestrial properties. The Department of Interior was given latitude in developing regulations for the implementation of this law. In August 1992 the Secretary of the Navy signed Instruction 4000.35 giving specific responsibility to Navy Department activities to undertake historic preservation actions. Since that time, the Naval Historical Center (NHC) has actively implemented the NHPA for the Navy's submerged properties, in close cooperation with the Navy's Federal Preservation Officer, the Admiralty Law staff of the Navy Judge Advocate General, and the National Park Service.

Implementation of the 1966 Act and the 1992 instruction is fraught with difficulties, characterized by the unknown scope of the properties to be identified, protected and preserved, and the lack of adequate resources to do the job properly. Even with strong determination, support from above, and an abundance of people and equipment, this would be a terrific undertaking. We have determined in a less-than-perfect world to make the most of federal interagency cooperation and state partnerships that have maritime interests and State Historic Preservation Officers (SHPOs) with tasking similar to ours.

The NHC has been assigned to oversee the protection, preservation, and management of historic Navy ship and aircraft wrecks. In order to accomplish this, we are building a program that will establish administrative procedures for dealing with the Navy's historic wrecks. To date, the Center's program staff has drafted a submerged resources management plan, initiated a comprehensive global inventory of its over 2,500 shipwrecks and 5,000 aircraft wrecks, and funded projects involving underwater archaeological investigations of Navy wrecks and conservation of their artifacts.

Funding for this is provided by the Department of Defense's Legacy Resource Management Program. The availability of funds is limited and Legacy requests are subject to Congress' annual review and appropriation. However, significant achievements in the management of Department of Defense cultural and natural resources are being attained. Most of the NHC's submerged resources program is conducted by means of partnerships with the National Park Service's National Maritime Initiative, National Conference of SHPOs, and state universities. In addition, other assets such as the Navy Federal Preservation Office, the JAG Admiralty Division, Naval

Investigative Services, and the Justice Department are being utilized for the protection of Navy cultural resources. Navy regular and reserve Marine Underwater Salvage Units and Explosive Ordinance Disposal Units have also been requested in some instances to assist in the program.

Partnerships with SHPOs for the stewardship and management of naval wrecks within their waters are key elements for implementing a successful preservation program. Although the NHC is producing comprehensive ship and aircraft wreck inventories and an overall federal management plan, as well as assisting enforcement of federal preservation and property laws and supporting many related projects, we cannot effectively monitor all naval wrecks at the local or state level.

The potential benefits of alliances between the Navy Department and the states are manifold: helping to create and refine the Navy's national inventory of naval wrecks; providing site assessment and monitoring; developing management plans for wrecks, and making recommendations for protection and/or interpretation. A fusion of state and Navy efforts is already facilitating naval wreck surveys and assessments, funding management plans for Navy wrecks, and allowing for scientific research and public interpretation of historic Navy wrecks.

SHPOs and underwater archaeologists are being contacted by NHC's shipwreck data base manager for their assistance in refining the Navy's wreck inventory, which promises to be one of the largest and most comprehensive inventories of naval shipwrecks in the world. It will be an important tool for preservation, management, and interpretation, with benefits to federal and state agencies, the scientific community, and the public. At present, however, it is incomplete and unavailable for public access.

The Navy is taking an increasingly active role in providing federal oversight to protect Navy wrecks and, in coordination with the appropriate SHPOs, encouraging legitimate archaeological investigations of the resource base. Recent examples of Navy oversight and/or support include the Civil War wrecks USS *Cumberland* and the Navy prize CSS *Florida* sunk in Hampton Roads, Virginia; CSS *Gaines*, USS *Philippi*, and USS *Tecumseh* in Mobile Bay, Alabama; CSS *Virginia II*, *Fredericksburg*, and *Richmond* located in the James River, and USS *Eastport* lost in Louisiana waters. Ongoing archaeological projects currently funded by Legacy through the NHC include the survey for Revolutionary War and War of 1812 naval vessels in the Penobscot River and the Bay of Maine, and the survey and recording of USS *Allen* in Lake Champlain.

A series of plans providing for the management and protection of important Navy wrecks such as USS *Tecumseh*, USS *Cumberland*, and CSS *Florida* are being prepared through Legacy funding. The NHC is working with SHPOs and state universities to draft cooperative agreements and prepare management plans for Navy shipwrecks within their respective states. Prototypes of such partnerships are being developed with the states of Vermont, Maine, Texas, and North Carolina, and the NHC is attempting to implement similar projects in Florida, Maryland, and Rhode Island.

We are also attempting to meet the interests of the diving community by providing public interpretation of naval wrecks through the development of shipwreck preserves. In 1993, the North Carolina Department of Cultural Resources and U.S. Navy entered into the first cooperative agreement to administer a diving preserve involving the wreck of USS *Huron*, sunk during an 1877 storm and now listed on the National Register of Historic Places. Under the supervision of North Carolina's Underwater Archaeology Unit, the *Huron* preserve provides an experience that both educates the public and is a recreational adventure for sportdivers.

In a similar vein, the Maryland Historical Trust and the U.S. Navy have entered into an agreement to develop the wreck of the captured German U-boat *U-1105* as a diving preserve. In preparation, Navy dive teams (Marine Underwater Salvage Units) secured *U-1105* for sportdiving by sealing openings into the submarine and removing debris, thus eliminating safety

hazards. This Legacy program also will provide for the conservation of *U-1105* artifacts and an exhibition at nearby Piney Point Museum, as well as a report on the history and rediscovery of the submarine. The *U-1105* diving preserve is scheduled to open in 1995.

These initiatives, established through the NHC and funded by the Department of Defense's Resource Management Program, are providing protection and preservation, as well as interpretation of some of the United States' most significant underwater cultural resources. In providing for the future while protecting the past, the Navy's submerged resources management program can benefit federal and state agencies, the scientific community, and the public.

Within the last few years, the Navy has been involved in some legal disputes that have gained attention, and these have set important precedents for the cause of maritime preservation and archaeology. The CSS *Alabama* Bell case, more accurately known as Steinmetz vs. U.S. (1992), reinforced the government's title to former Confederate property being sold on the open market. In this case, the United States claimed ownership of the artifact asserted by Richard Steinmetz to be CSS *Alabama*'s bell by right of succession to the Confederate government's military property. Steinmetz bought the bell in England from a dealer who told him the bell was recovered in 1936 from the *Alabama* wreck off Cherbourg, France.

There are many Confederate shipwrecks in U.S. waters, and the Steinmetz case will be useful in asserting government title to the artifacts from these sites. Thus, our ability to protect these shipwreck sites will be enhanced. It happens that actual custody of the Confederate property found in the United States reposes in the General Services Administration. The Navy has initiated conversations with the GSA in these matters and has offered to act as intermediary for protection of former Confederate naval properties.

Another case that recently garnered national recognition involved a Grumman F6F Hellcat salvaged by the Quonset Air Museum in Rhode Island last December without Navy authorization or knowledge. Upon hearing of the incident, we immediately protested and demanded the return of the aircraft to the Navy on the grounds it is government property in Navy custody. The museum's leadership first offered to cooperate and then changed its mind, going to court and suing the aircraft as an act of salvage. The Navy rejected the salvage argument and filed a counter-claim for damages due to injuries to the aircraft in the act of recovery. This case has at last been settled out of court, with the Quonset Air Museum being allowed to retain the aircraft, providing it proceeds with appropriate conservation measures under a loan agreement from the Navy. The Navy's ownership of this historic property was upheld in the face of a challenge which threatened to undermine the Navy's ability to protect and preserve its historic properties. This agreement is one we can live with, and it also provides a model for future loans to responsible organizations that wish to recover and preserve naval aircraft for public display.

The program I have briefly described is what the Navy has developed gradually, over the last five years. We know, however, that we alone cannot protect and preserve our submerged historic warships and aircraft. But we do believe that with the cooperation of other federal, state, and local agencies, and by establishing a positive outreach to the diving public, it may be possible to save what remains of this nation's historic underwater resources for future generations of recreational divers, archaeologists, and historians.

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Ethical Issues in Archaeological Conservation: A Second Look

Introduction

Within the last 40 years, the field of archaeological conservation has grown rapidly, incorporating methods and techniques from the fields of archaeology and conservation. The common meeting ground for archaeology and conservation arose from a growing scientific approach that occurred during the 1960s. New areas of archaeological study such as palynology and archeometallurgy required a more sophisticated approach, utilizing scientific sampling and technology.

In conservation, contributions from the fields of mechanical and nuclear engineering, chemistry, and materials science encouraged the application of more advanced technologies in studying material culture. As a result, the field of archaeological conservation has benefited immensely from these developments.

Accompanying the benefits, however, are the problems and ethical issues that arise where material culture is concerned. As historical objects, artifacts are part of our cultural heritage and occupy a special place in our imaginations. That archaeological conservation draws on such a wide range of disciplines as science, history, archaeology, and cultural anthropology testifies to the complexity of this heritage. In addition, the conservation of artifacts is bound up in personal aesthetics. In view of the rising number of excavated sites each year and backlogged museum collections, the potential for related problems arise, precipitating an increase in ethical concerns that both archaeologists and conservators share. It is not surprising, then, that conservators are faced with ethical dilemmas from time to time.

The purpose of this paper is to address briefly some of the key ethical issues that conservators face today. These are: 1) the restoration controversy; 2) ethical issues posed by working abroad; and 3) matters arising from time and financial constraints. The ideas and issues presented in this paper were prompted by a discussion among fellow colleagues and a noticeable gap in the literature.

The Literature

The literature on ethical issues in conservation, let alone archaeological conservation, is minimal at best. The emphasis on the conservation of paintings, frescoes, and other aspects of fine arts conservation has stimulated some discussion on general conservation ethics, but little has been written on the ethical issues surrounding archaeological conservation.

The few works available are usually limited to discussions on standard methodological approaches common to all professionally-trained conservators. The issues concerning working in foreign countries or those arising from time and financial constraints are nominally treated under the heading of "field conservation" and are discussed in very general terms.

The more pertinent works begin with Jedrzjewska's (1976) discourse on conservation ethics, followed by Caldararo's (1987) background discussion on the parallel developments in conservation, archaeology, and anthropology. Lelekov (1987) presents conservation ethics from a philosophical point of view, while Van de Wetering and van Wegen (1987) concentrate on the more theoretical implications of conservation, including ethical issues. Getting to the heart of the matter are Pye and Cronyn (1987), who address some of the more relevant issues facing archaeological conservators today. Two important additions to the topic are Corfield's (1988) essay on the ethics of restoration and Pearce's (1990) discussion of the conflicts between museum curators and conservators. Tuck and Logan (1987) assess the working relationship between archaeologists and conservators on the Red Bay Project in Labrador.

The Archaeological Conservator

Recently, Pye and Cronyn (1987) defined the role of the archaeological conservator as a specialist who is trained to be familiar with the special concerns of archaeology. What makes this specialization unique is twofold. First, the archaeological conservator is often familiar with a wide range of materials (Pye and Cronyn 1987:355). Secondly, the archaeological conservator has the complex and important tasks of examination and preservation. Examination entails both "forensic investigation and assessment of the object's condition" (Pye and Cronyn 1987:355). This includes the diagnostic attributes of an artifact, such as method of manufacture, the material used, and the object's relation to its cultural context. The archaeological conservator is thus familiar with information that could otherwise be lost in the simple act of cleaning.

The archaeological conservator is also guided by a Code of Ethics, as stated in the guidelines of the American Institute for Conservation of Historic and Artistic Works. The conservator thus has a moral responsibility to uphold these ethics. In an *ideal* world, all conservators uphold these ethics, but in reality, conservation ethics are sometimes violated. Archaeological conservators are especially prone to ethical dilemmas because of the forensic and preservation aspects of their work.

The Restoration Controversy

While most conservators now practice minimum intervention when treating artifacts, problems arise when inadequate interpretations of an object affects its repair or reconstruction, or when a conservator and museum curator or project director do not see eye-to-eye on aesthetic concerns. For example, in the disassembly of a late 14th-century Italian majolica jug in 1986, it was discovered that the sherds belonged to other vessels. Another example is the restoration of the Sutton Hoo helmet. Composed of iron with bronze decorative plates, the helmet was discovered in the 7th-century clinker-built ship burial in Suffolk, England in 1939. After World War II, the helmet was restored by piecing together hundreds of fragments. Twenty years later, several aspects of the helmet reconstruction made little sense. For example, the decorative bronze plates were arranged haphazardly, while the neck guard was placed to pierce the neck of the wearer with the slightest tilt of the head. Furthermore, the eye holes were large enough "to allow a sword to pass through" (Williams 1992:74). The helmet was reconstructed in the 1960s by X-raying the pieces for patterning. By the early 1970s, the reconstruction was successfully completed. The reconstructed helmet along with a model replica is now on display at the British Museum.

When In Rome

An opportunity to work in a foreign country is often welcomed by archaeologists and conservators. Yet it would be misleading to assume that standard conservation practices are known and practiced everywhere. Often in developing nations, the expertise is limited or simply not there—or because other concerns are more immediate, conservation is not a priority. Potential conflicts can arise when differently-trained staff are working together on a project in the host country. These are issues rarely mentioned in the literature, but they are common and can pose sticky problems for all involved. For example, Tuck and Logan (1987:62) made reference to a minor disagreement over the conservation of thousands of iron nails found on the Red Bay Project in Labrador, Canada. The problem was resolved when the conservators and the director agreed that full documentation of the nails was sufficient.

In country Y, where I conserved a large body of bronze artifacts, antiquated methods had been applied to some of the objects. Diplomacy and mutual collaboration were essential in presenting new techniques and re-treating the objects. Tuck and Logan (1987:62) observed that

conflicts over conservation procedures can often be solved if all parties understand each other's objectives, which in this case proved to be accurate.

No Time, No Money

Other ethical issues that concern archaeological conservators involve time, money constraints, or both. Whether in America or abroad, the lack of facilities or resources to carry out proper conservation programs can deter even the most dedicated efforts. Because archaeological conservation is time-consuming and costly, funding is an expensive proposition. For only one field season's artifact yield, a year and several thousand dollars are not unusual estimates when planning a conservation program. If re-treatment is involved for existing museum collections, the costs in terms of time and money are prohibitive as well. For example, a 1950s attempt at conserving the fungus-infected wood artifacts from Gordion, Turkey, was a failure. The artifacts cracked and warped, due to a poor knowledge of chemistry at the time. As a result, the re-treatment of some of these artifacts in the 1980s was a painstaking and time-consuming process (Lipkin 1989:56)

Even with proper planning, the best-laid plans can go awry. Sometimes resources are taxed midway through a project, or the project was originally under-budgeted. In other cases, the director assigns conservation a low priority. Thus, the problems of time and funding constraints can lead to more questions than answers.

Conclusion

Recently, one well-known conservator remarked that "modern scientific conservation is governed by an unwritten set of rules or ethics," and that "numerous attempts have been made to codify these rules, but all are doomed to failure because the approach to conservation can never be generalized, and is very dependent on the aims of the particular museum and curator" (Oddy 1992:12). It is my impression that the Code of Ethics, as a *written* set of rules, is observed by most well-trained conservators. The Code also "provides a firm foundation for the development of...new and concrete models of [conservation] ethics" (Lelekov 1987:547).

Ethical dilemmas will not disappear. As the field of archaeological conservation continues to expand and the number of excavated sites increases, new problems will pose continual challenges for archaeologists and conservators. Continuing self-education and open communications with colleagues are instructive and beneficial ways of handling ethical issues. Furthermore, the scientific analysis of artifacts will require that conservators and archaeologists cooperate in their joint efforts (Cronyn 1990:10-13).

Objects are part of our heritage. Once they are destroyed they cannot be replaced, and the potential knowledge to be gained from them is threatened if ethical conservation practices are not observed. Jules Prown (1993:17) has argued that artifacts allow us to re-experience the past as we touch, examine and study them "with our senses," providing another glimpse into the past. For that very reason, it is our responsibility as conservators and archaeologists to uphold the highest standards in maintaining the heritage that enriches our human experience.

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Archaeological Investigations of the Steamboat *Columbus* (18ST625) in Chesapeake Bay, Maryland: Its History, Architecture, and Crosshead Steam Engine

The Wreck of *Columbus*

During the early morning hours of 28 November 1850, the sidewheel steamship *Columbus* (Figure 1) was en route from Baltimore to Richmond with 16 persons on board, only two of whom were passengers. Very little freight was carried on this trip besides five or six horses on deck (The Baltimore *Sun* [*TBS*], 30 November 1850; *The Baltimore American* [*TBA*], 2 December 1850). Around 3 a.m. off Smith Point, Virginia, a back draft through *Columbus*' smokestack caused flames to shoot out of the furnace doors. This happened so quickly and intensely that the flames could not be checked. Only seven persons were able to get into the one boat not cut off by flames (*TBA*, 2 December 1850). *Columbus* by that time was "a mass of flames from one end to the other" and continued to steam in circles (*TBA*, 2 December 1850). The survivors on the boat watched the burning vessel through binoculars until 11:00 a.m. Friday when it disappeared, sinking after burning for nearly eight hours (*TBA*, 2 December 1850).

Now, almost 150 years later, the wreck of *Columbus* presents a rare opportunity to examine the remains of a vessel built during the formative years of the steam era. It was built during an important transitional period bridging traditional sailing craft construction to the building of specialized steamship hulls responding to a whole new set of problems. Its primitive crosshead engine was among the first to propel watercraft in the United States and is one of the earliest extant ship's engines in this country.

Discovery and Investigation

The *Columbus* wreck lies in 55–60 ft. (16.75–18.3 m) of water off Smith Point, Virginia, on the north side of the channel approach

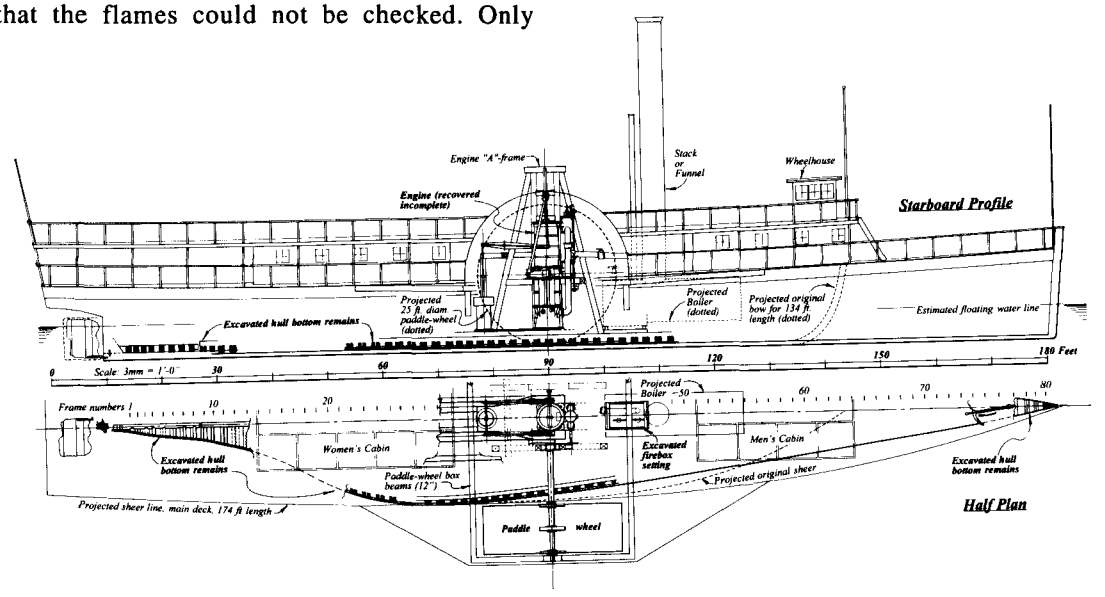

FIGURE 1. Artist's reconstruction of the appearance of the steamship *Columbus* based upon archaeological data and contemporary illustrations.

to the Potomac River. The wreck is oriented nearly perpendicular to the channel with the bow at an approximate heading of 170°. The wreck originally was located in 1987 during a remote sensing survey conducted by the National Oceanic and Atmospheric Administration (NOAA). NOAA divers described the wreck as having a copper-covered wooden hull with a "jumbled mass of large-diameter pipe: possibly [a] ships mast."

A Phase II archival and archeological investigation of the site was conducted during the late winter and spring of 1991 by R. Christopher Goodwin & Associates, Inc. of Frederick, Maryland, under contract to the U.S. Army Corps of Engineers, Baltimore District (Morrison et al. 1992). This survey confirmed that the hull was indeed copper-sheathed, but identified the "jumbled mass of large-diameter pipe" as "the cylinders, steam chests, and piping of a sidewheel steamboat." Archaeologists also identified the starboard paddlewheel on the site (Morrison et al. 1992:31).

Beginning in August 1992 Goodwin & Associates was funded by the Baltimore District of the Corps of Engineers to conduct a data recovery project at the wreck site (Irion and Beard 1994). This investigation was performed in conjunction with the Baltimore Harbor and Channels 50-Foot Project, which plans to deepen Baltimore Harbor and its channel approaches in the Chesapeake Bay to allow safe passage of vessels having 50-ft. drafts. To provide a margin of safety during extremely low tides, a 60-ft. clearance will be required. Because portions of the wreck site, including remains of the vessel's engine, extend into the water column above the 50-ft. depth, the site was classified as a navigational hazard requiring partial removal. This planned federal action to a site eligible for the National Register of Historic Places triggered the requirement to mitigate impacts to the site through data recovery.

The Scope of Work for the *Columbus* project was two-fold. First, an archaeological data recovery project was to be conducted; second, an Historic American Engineering Record (HAER) documentation of *Columbus*' steam machinery was to be completed. Additionally, conservation was to be undertaken of all artifacts recovered from the site due to elevation above the proposed construction limit.

A number of the vessel's power train components were exposed. The engine (main cylinder and condenser) had toppled over, with its head pointed towards the port bow. Its lowest portion, the condenser, was propped up on the platform remains that once supported it. The air pump was still in place on the platform just abaft the engine. The piston rod for the air pump was bent, pointing in the same direction as the engine and attesting to the stresses placed upon it when the engine fell. The starboard paddlewheel shaft with three hubs intact lay across the exposed starboard side, pointing slightly aft.

Most of the wreck interior was filled with loosely-consolidated silty sands, above which very few artifacts were exposed. The platform timbers upon which the air pump was attached acted as a natural sediment trap, and a mound of silt and sand had formed in this area rising several feet above the surrounding bottom.

Architectural Analysis of *Columbus*' Hull Remains

Columbus was built in 1828, during a time of great change in ship design and construction. The age of sail and wooden ships was nearing its end, and the age of steam and iron was on the rise. For these reasons, the *Columbus* hull offers a unique look into shipbuilding technology of this important transition period (Figure 2).

The vessel was flat-bottomed with an extremely sharp bow and stern. The sharp bow in particular is unusual for a vessel built so close to the inception of steam navigation. During this time, most steamships were constructed with hulls similar to sailing ships, with bluff bows and straight sides. *Columbus* was extensively rebuilt and altered in 1836, with an increase in length from its original 138 ft. (42 m) to 174 ft. (53 m). The stem possibly was given its present shape during this refit, as the bow is more remi-

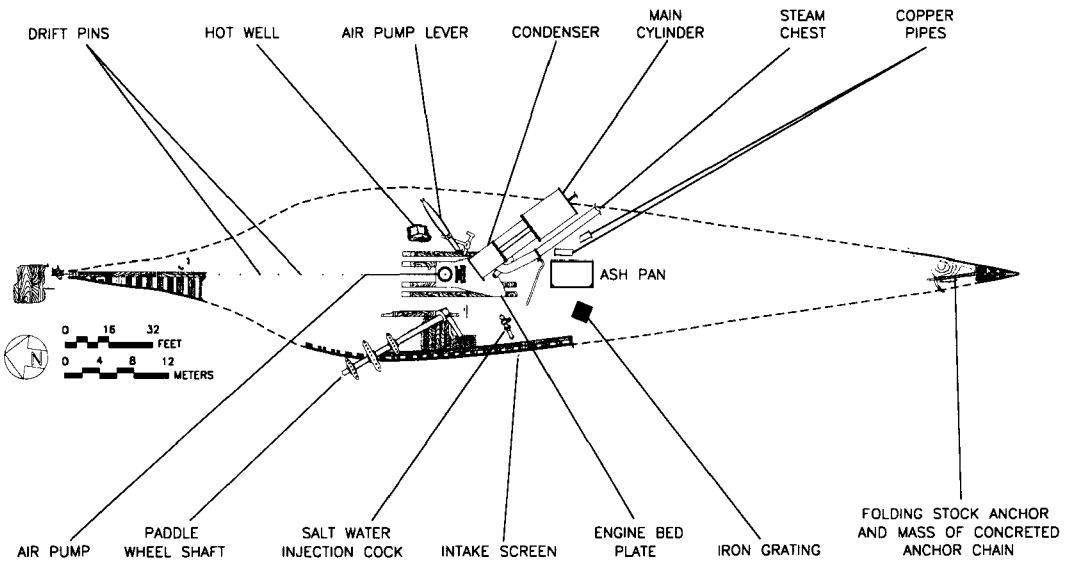

FIGURE 2. Site plan of *Columbus*.

niscent of that era. The framing on *Columbus* has very little deadrise.

Extant cant frames in the bow and the stern are wedge-shaped in cross-section and usually let into notches in the bow and stern deadwood. A sample of wood from one of the frames indicates that it is white oak (*Quercus alba*), as are the keelson, outer planking, and rudder. The arrangement of the cant frames and remaining deadwood was recorded in the stern and stern post remains. The cant frames were in sets of two, with the forwardmost fitting into 2-in.-deep (5 cm) mortises cut into the deadwood.

Approximately the forward half of the lower stern post remains in place. It is probable that the *Columbus* struck bottom stern first, causing the stern post to split and dislodge from the rest of the hull along with the heel and rudder. Based upon illustrations of similar period vessels, it is assumed that *Columbus*' stern post stood at an angle of approximately 90 degrees. No information could be acquired concerning the manner in which the stern post was attached to the keel. It is reasonable to assume, however, that the base of the stern post had a large tenon that fit into a mortise in the top of the keel. A pair of copper fish-plates recovered just abaft the surviving stern post was used to secure this attachment. No gudgeon straps (braces) remained attached to the stern post, since the force of impact tore them from their mounts. Two were recovered lying above the fish-plates, one with a broken pintle still in place.

Excavations abaft the stern post uncovered *Columbus*' rudder. The surviving piece measured ca. 7 ft. (2.13 m) high x 6 ft. (1.82 m) wide and consisted of four timbers fastened together with at least one remaining 3/4-in.-diameter (1.9 cm) copper drift pin. The lowermost pintle is still in place near the base of the rudder. The rudder was attached to the stern post by at least two sets of gudgeons and pintles. One pintle was still attached to the bottom of the rudder and one other and two gudgeons were recovered from the excavation between the rudder and stern post.

The gudgeons and pintles are made from a cupreous metal, probably brass or bronze. An interesting object was recovered near the gudgeons and pintle. Called a "saucer," this cupreous object served to reduce friction between the gudgeons and pintles. The pintles had longer

than usual plugs and were called "saucer-pintles" (Desmond 1984: 208). These pieces would have been nailed to a bearding piece on the aft face of the stern post and fit into the gulleting of the rudder, also called pintle scores.

Despite the severe effects of the fire and natural deterioration of *Columbus*' hull, large sections of ceiling survive largely intact. One section of this planking was cleared and documented starboard of the engine platform. Unlike most ceiling, these planks ran athwartships rather than fore and aft. Their inboard edges butt against the base of three stacked longitudinal timbers that may have been associated with the engine platform or supported the paddlewheel shaft mechanism. They then are attached (with two iron spikes each) to a smaller timber running along the base of the timbers. These thwartships ceiling planks are cut from Eastern white pine (*Pinus strobus*). Some sign of fore-and-aft ceiling planking is on the port side below the air pump. Although badly degraded, these planks appear to be from 6-1/2 in. to 1 ft. (16.5 to 30.5 cm) wide and 1-1/2 in. (3.8 cm) thick. These planks may represent the true ceiling; the thwartships planks may have been added to provide a dry, level surface for the engineers.

The air pump is the only component of the engine still firmly affixed in its original position within the hull. It rests upon a 3-in.-thick (7.6 cm) iron plate attached to a foundation of large timbers. Two high, these timbers are sided 12 in. (30.5 cm) and molded 10 in. (25.4 cm); their lengths cannot be determined due to severe degradation at the ends. There are two rows of these timbers. The first one begins ca. 16 in. (40.6 cm) out from the centerline of the vessel and the second one begins ca. 37 in. (94 cm) out from the centerline. The air pump is supported only by the central two rows, while the engine is supported by all four rows. A similar arrangement of timbers is illustrated in an 1830 treatise on steam engines (Renwick 1830:Plate 7) and in an earlier steamboat illustration of Robert Fulton's *Washington* of ca. 1819 (Lane 1943: 59). On *Columbus*, it appears that the bottom timber of the inboardmost set of support timbers ran under and supported the ash pan under the boilers.

Columbus' Engine

Columbus' engine is the sole surviving Fulton-type crosshead engine (Figure 3). Robert Fulton's arrangement of cylinder, crankshaft, and condenser, illustrated in an 1809 patent application, was designed to free up merchantable space aboard a vessel. The cylinder, crankshaft and condenser were arranged about a common vertical centerline, with the piston rod emerging from the cylinder top. The piston rod is connected to a large crosshead from which two connecting rods extend to cranks on either side of the cylinder. The cranks are kept in phase by fastening them to a common crankshaft, thus preventing any racking of the crosshead or engine during operation. The *Columbus* engine was rated at 100 hp. with a cylinder 50 in. (1.27 m) in diameter and a 78-in. (1.98 m) stroke. Contemporary engineering tables indicate that an engine this size would have operated at 19–20 psi.

The *Columbus* engine was raised in pieces. Only metal parts were recovered since the wooden engine frame burned away in the vessel's demise. We have no definite idea what it looked like, and only illustrations from contemporary engravings like that from James Renwick (1830) hint at its appearance. This engraving and the *Columbus* engine assembly share much in common, but there are also some distinctive differences. Renwick believed the Fulton engine to be superior to the walking beam engine because it dispensed with the "superfluous beam." In referring to this engraving in 1838, Thomas Tredgold stated that "this form of engine is still much used..." and that the engraving showed a "boiler of favorite form" (Tredgold 1838:103).

Engine components raised from *Columbus* include the cylinder with piston and cylinder bottom, crankshaft bedplate, condenser, valve chests, steam piping, valve rocker shaft, a portion of a leg, air pump, and what appears to be a bilge pump. The starboard paddlewheel shaft

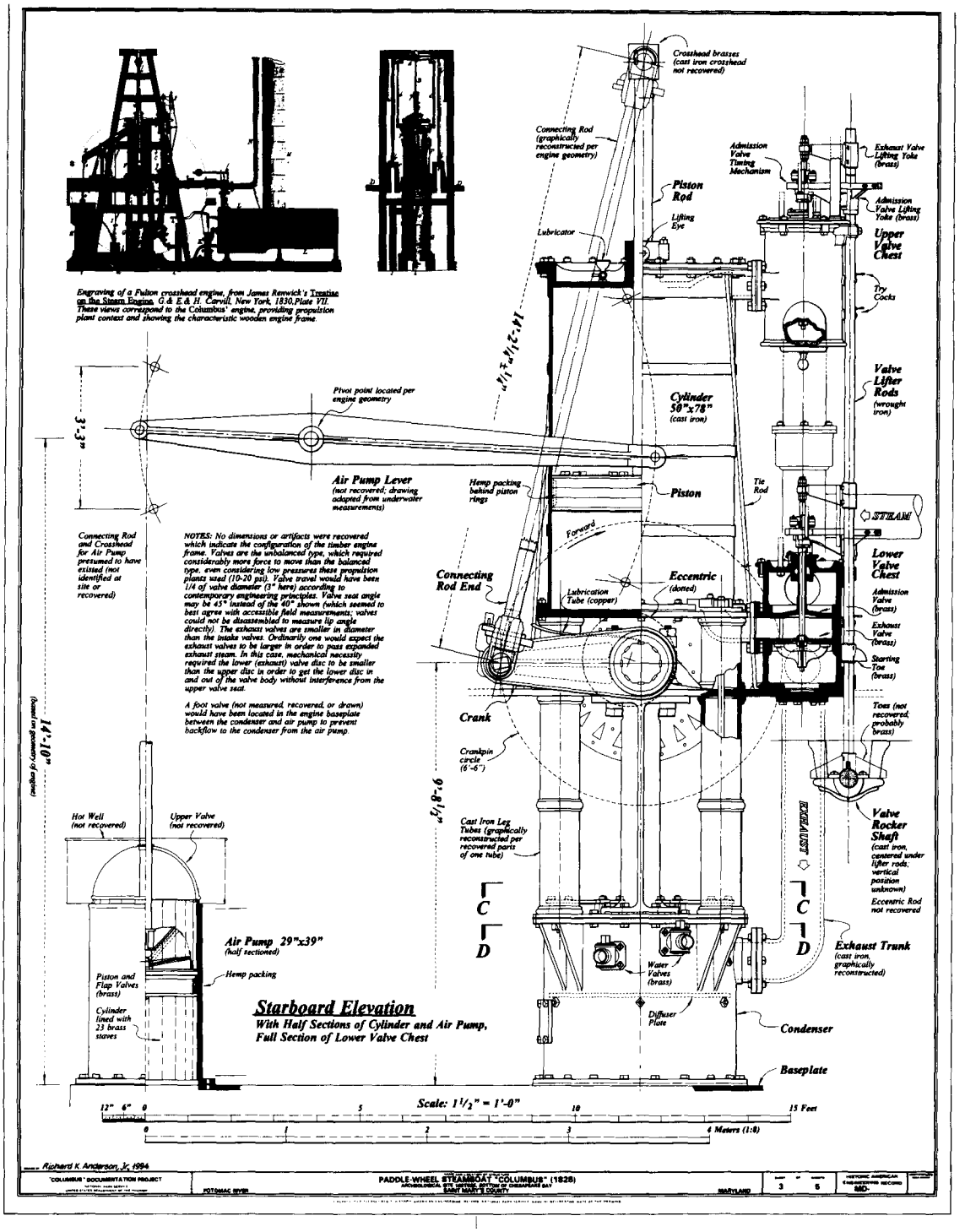

FIGURE 3. The cross-head steam engine of *Columbus*, based upon recovered remains.

was raised earlier and shipped to New Orleans for conservation. Parts not recovered include the port side paddlewheel shaft; engine crosshead; engine baseplate; critical parts of the valve gear drive; engine connecting rods; air pump lever; crosshead, connecting rods; air pump lever bearing brackets; throttle and safety valves; various pumps; cast iron steam trunks; and the "eduction pipe" from the valves to the condenser. The boiler exploded in the sinking.

The *Columbus* engine is the only representative of its type presently known in existence. The low-pressure crosshead engine was prevalent during the first 20 years of steam navigation but eventually was supplanted by the sturdier walking beam type. Examples of walking beam engines still exist: the 1891 engine of the SS *Eureka* is still operable. Some earlier engines also are still extant; Symington's original 1788 engine for *Charlotte Dundas* and the 1816 engine from *Comet* are both preserved in England. The earliest marine engine preserved in the United States is not a ship engine at all but powered John Stevens' 1804 steam launch *Little Juliana*. That engine is now at the Smithsonian Institution in Washington, D.C. (Turnbull 1928, Allen 1987). None of these engines resembles *Columbus*' power plant.

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The Comparative Analysis of 18th-Century Vessel Remains in the Archaeological Record: A Synthesized Theory of Framing Evolution

Introduction

The evolution of ship design and construction is a dynamic process which began the moment man first floated across a stream on a tree limb. The roots of this change across time and space can be found in the changing economic demands on waterborne transport. These demands would eventually create the rise of vessel specialization by functional necessity. This paper does not examine this process as an entity, nor does it provide a seamless theorem without exception. What it does offer is a synthetic view of design and construction shifts as evidenced by archaeological data spanning the 18th century. It should be considered a point of departure for additional research and consideration.

A pattern of vessel specialization by economic necessity is demonstrable in diverse cultures throughout history. The 18th century was chosen due to the wealth of information available from archaeological sites, as well as the large volume of documentary resources. Archaeology has provided excellent design and construction examples often contradicting contemporary documents. This is attributable to the nature of technical documentation, which tends towards the idealized or perfected design concept rather than the resulting reality. A finished vessel is probably never as perfect as the paper record suggests. Far more vessels have been constructed than documented, and countless localized variations and permutations of designs were never recorded at all.

The differences are plainly evident in the shift in framing patterns in the run of the hull and radical variations found in framing the ends. Obviously, changes in hull forms, rigging, and technological innovations accompany this evolutionary process. However, this paper is confined to framing changes in the archaeological record from 1692 to 1853. The examples cross spatial boundaries as well as functional applications. The sites presented are not all those available for this synthesis. However, all vessels discussed in this article have been examined, documented, or excavated by the authors. This presentation format also limits the detail included in individual vessel descriptions.

The vessel remains selected include those from Port Royal, Jamaica (1692); Rose Hill, North Carolina (1725-1750); Otter Creek, North Carolina (post-1772); Readers Point, Jamaica (post-1765); British Site, Bermuda (post-1770); *Betsy,* Yorktown, Virginia (1772); Vessel 20, Savannah, Georgia (late 18th century); Vessel 2, Savannah, Georgia (late 18th or early 19th century); and *Scuppernong*, Elizabeth City, North Carolina (1853). The basic data for these hulls are presented in Figure 1.

Framing Evolution

The general theory of the transition in framing patterns is graphically illustrated in Figures 2 and 3. Figure 2 addresses the frames in the flat run of the hull and covers the following shifts. Single, non-linear frames shown in Figure 2.1 are supplanted by single linear frames (Figure 2.2). Single frames give way to the double frame (consisting of a floor paired with the associated first futtock) and the subsequent rising futtocks, which remain in a linear orientation. In its earliest form the double frame has no horizontal fasteners, a longitudinal space between each frame's components, butt scarfs, tight frame spacing, a large offset from the centerline of the vessel to the heel of the first futtock (Figure 2, space "A"), and sided dimensions exceeding molded dimensions (Figure 2.3). The transition

VESSEL/ LOCATION, NATION, DATE	LOA, BREADTH P- PRESERVED	FRAME TYPE	CANT TYPE	FUTTOCK OFFSET CL	AVG. MOLDED VS. AVG. SIDED DIMENSION
Port Royal, Jamaica Pre-1692	74'P est. 25'	# 3	None	1'8"	M" < S"
Rose Hill, NC 1725-1750	61'9"P 16'P	# 4	None	11"	M" < S"
Otter Creek, NC Post 1772	58'P 16'P	# 4	None	13"	M" = S"
Reader's Pt., Jamaica Colonial Built, post 1765	57'P 15'P	# 4	# 3	6" from Ksn Edge	M" = or < S"
Bermuda, British, Post 1770	69'9"P 24'P	# 4	None	6-8 1/2" from edge of Hogging Piece	M" > S" Floors M" > S" Futtocks
Betsy, Yorktown, VA British, 1772	73'P 23'P	# 5	# 3	10 3/4"	M" > S"
Vessel 20 Savannah, GA, last 1/4 18th c.	77'4"P 21'4"P	# 4	# 3	6" from Ksn Edge	M" = S"
Vessel 2 Savannah, GA, U.S. Built, late 18th c. or early 19th c.	67'9"P 19'7"P	# 4/ # 6	# 4	Heels Under Ksn Do Not Butt	M" < S"
Scuppernong, Elizabeth City NC, Carolina Built 1853	75'9"P 17'P	# 6	# 4	Heels Butt CL	M" > S"

FIGURE 1. Vessel data.

continues with the heels of the first futtocks moving toward the centerline of the vessel, frame components moving closer to one another (Figure 2, space "B"), an increase of space between frames, the use of horizontal longitudinal fasteners between frame components, the advent of chock scarfs, and an increase of the molded value relative to the sided value (Figure 2.4–2.5). The culmination of this transition is the eventual butting of the heels of the first futtocks over the centerline of the vessel beneath the keelson (Figure 2.6). At this point the frame spacing has also increased and the molded value exceeds the sided, with notable exceptions such as coastal schooners, shoal draft vessels, and other craft grounding in the course of their trade.

Cant Frames

Figure 3 illustrates the shifting frame arrangement in the bow of the vessel. Forming a ship's bow is a complex and difficult task seldom documented in the archival sources and poorly preserved in the material record. The technical nomenclature for these frames is diverse and varied; the term cant frame itself cannot rightly be applied to frames perpendicular to the centerline at a vessel's extreme ends. Figure 3.1 shows the final frames in the pattern still squared with the hull. The outer molded surface of these frames was heavily beveled to impart shape to the vessel end, and the timbers of the frames are relatively heavy. These frames were both floors and half-frames, with the heels always on the vessel centerline. Even with the evolution of the pattern of bow frames, stern framing generally retained frames perpendicular to the hull. The subsequent pattern type (Figure 3.2) has canted half-frames, still heavily beveled but with the forwardmost frame heels butting against the forward half-frame rather than against a timber on the vessel centerline. The next pattern type (Figure 3.3) is referred to as a radial cant frame pattern (Morris 1991). Radial cants vary not only in pattern but also can be used to form stern and bow with a framing pattern radiating from the vessel's centerline timbers (Figure 4). These timbers are often segmented and variegated to produce the necessary foundation for the heels of the framing timbers. In the bow these timbers are in the form of a segmented apron; in the stern they are transom chocks (Morris 1991). Radial cants in the bow are also possible while the framing timbers in the stern remain square to the centerline. Variations of this pattern generally differ in the arrangement along the centerline, in the degree of angle relative to the keel and in the extent of the use of filler frames. The culmination of this progression is seen in Figure 3.4, where all bow frames are canted, all still touch the centerline, and filler frames are utilized. This arrangement is codified and fairly well standardized by the 19th century, although variations abound.

Vessel Descriptions

A construction technique common to all of these sites is the use of master (or loft) frames. Although frame spacing between masters varies considerably from vessel to vessel, it is present regardless of vessel size or function. Master frame use is generally indicative of the technique of whole molding, with the vessel's hull form created by these master frames and a series of ribbands or battens. Framing and planking in this construction method occur simultaneously and can be traced as far back as the 16th century in both the archival and archaeological records; it is still employed in wooden ship construction. Beyond this similarity, all the vessels described in this work vary somewhat.

Another element considered is the placement of floors relative to the associated first futtock. Convention says that the first futtock is forward of the floor forward of the mid-ship bend (master couple). Aft of this couple, the first would fall abaft the floor. However, archaeological evidence suggests that this is seldom the case, so variations are included in this discussion. Although there is no discernible chronological sequence to this placement, it is a viable consideration in the framing theory.

Lost in 1692, the vessel remains at Port Royal provide a point of departure for this theory (Clifford 1993). Although the structure is badly degraded with no extant cant frames, the framing pattern in the run of the hull is obviously early double-frame construction (similar to Figure 2.3). Each first futtock is associated with a floor timber, although substantial gaps exist between these components. The first futtocks' heels are offset 1 ft. 8 in. from the centerline and the floors are placed on 2 ft.-6 in. centers. The molded value is 8 in. and is exceeded by the sided dimension of 9 in., with a substantial space between frames. In this vessel the master frames would have been single, consisting of the floors and their organic or linearly associated futtocks. Due to site preservation, it is not possible to establish the floor/first futtock relationship relative to the bow and stern.

The next two sites are both from North Carolina and are similar in size and framing. The Rose Hill site has a date range of 1725 to 1750 (Wilde-Ramsing et al. 1992). The double frames have the first futtock fayed closely to the associated floor (Figure 2.4). These futtocks are offset by 11 in. and are not fastened to the floors. The sided dimension is 11 in., slightly greater than the molded value of 10-1/2 in. No cant frames were present at the site and the floor/first futtock pattern was not recorded. The second site at Otter Creek, North Carolina, dates to post-1772 and has a framing pattern almost identical to the Rose Hill site (Jackson 1992). Other similarities include an apparent lack of fasteners between frame components and the use of whole molding. The first futtocks at Otter Creek are offset 13 in. and the floors have equal molded and sided values. The first futtocks, however, have a greater molded dimension relative to the sided. On this hull, the first futtock is always forward of the floor.

The next site is a colonial vessel dated to post-1765 at Readers Point, Jamaica (Cook and Rubenstein, this volume). Its framing pattern is shown in Figure 2.4, with tightly-fitted floors and futtocks. Despite this close fit, horizontal fasteners are used only in the nine master frame pairs. The first futtocks are offset 6 in., with the average sided value equal to or greater than the average molded value. Additionally, cant frames were preserved, clearly representing a variation of the radial pattern illustrated in Figure 3.3.

The next three sites also have framing patterns somewhat similar to Readers Point in both the cant framing and hull run. Two of them appear to have been in the coal trade at some time in their careers. *Betsy*, a collier built in 1772 at Whitehaven, England, was lost at

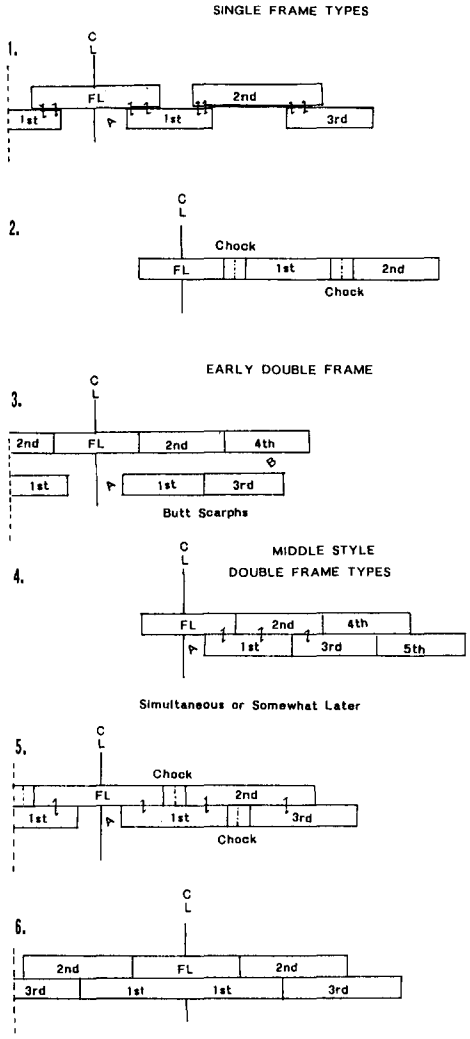


FIGURE 2. Basic 18th-century framing pattern evolution.

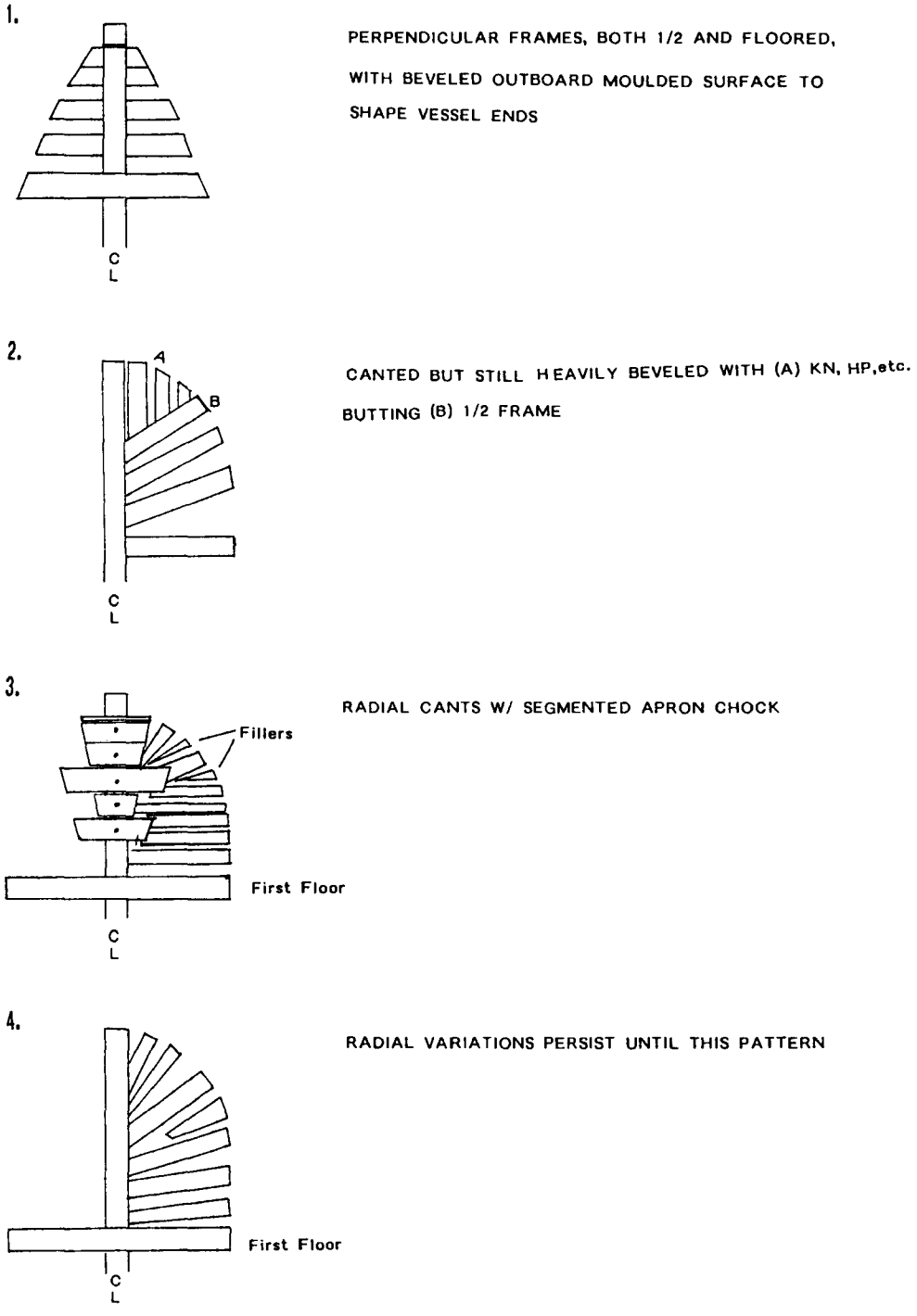


FIGURE 3. Basic evolution of bow cant frames.

Yorktown, Virginia, in 1781 (Morris 1991). It is a heavily-framed vessel, with the first futtocks always abaft their associated floors. The framing pattern is shown in Figure 2.5, although slight gaps appear on some frames between components. Seven bolted master frames were employed in the construction—the only frames on the vessel with components actually fastened together. Frame spacing is tight, with the first futtocks offset 10-3/4 in. Molded values actually exceed sided values but the latter dimension is still massive. The increase in molded values was therefore not accomplished at the expense of the sided dimension, creating a very heavy frame. Extensive use was made of fillet pieces on the heels of the first futtocks and beneath the floors adjacent to the keel. *Betsy* has radial cant frames in the bow and the stern, with segmented centerline timbers variegated to accept the frame heels (Figures 3.3 and 4).

The site off of Bermuda's west coast has all of the construction signatures of a collier, as well as extensive coal residue in the bilges (Watts and Krivor 1995). Dated to the last quarter of the 18th century, this vessel was heavily framed in a pattern similar to *Betsy* (Figure 2.5). Like the Yorktown collier, this vessel has heavy, irregularly-sided timbers with a slightly greater molded dimension. First futtocks are offset 6 to 8-1/2 in. from the edge of the hogging piece, and fillet pieces were used on the heels of the firsts and beneath the floors adjacent to the keel. Room and space is very tight, also like *Betsy*.

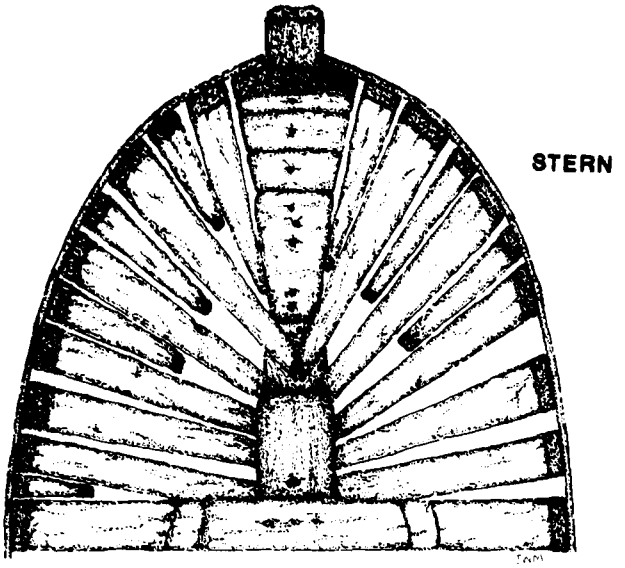
The third vessel grouped with these two heavily-framed merchantmen is Vessel 20 at Fig Island, in Savannah, Georgia (Tidewater Atlantic Research 1994). The greatest similarity is in the radial cant frame variant with a segmented apron. There are five master frames forward of the master couple and seven masters aft. Only the master frames are longitudinally fastened. Forward of the midships bend, the floor is forward of the first futtock. Aft of the bend, the floor is abaft the first futtock. All firsts are offset by 6 in. and molded values are roughly equal to sided. Frame spacing is greater than the previous sites and varies considerably (Figure 2.4). Accurate values were precluded by the degraded remains.

The final two sites bring the pattern into the 19th century. Vessel 2 at Fig Island was most likely built in the last quarter of the 18th century and may be representative of coastal trading vessels from the period (Tidewater Atlantic Research 1993). The framing pattern resembles Figure 2.4, but the heels of the first futtocks pass under the keelson without quite butting on the centerline, as in Figure 2.6. Eight master frames are all longitudinally fastened and arranged with the floor always abaft the first (with one exception). Butt scarfs were employed in forming the frames and the gaps between components were shimmed. Spacing between frames varies but is not as tight as in previous examples. Although the bow cants are degraded, they are closest in appearance to Figure 3.4. The full shape of the bow imparts a radial appearance, but construction is somewhat more linear with a finer entry. In the stern are half-frames squared to the centerline, with beveled outer molded surfaces forming the after underbody.

The vessel chosen to conclude this study is the coastal schooner *Scuppernong*, built in North Carolina in 1853 (Turner, this volume). *Scuppernong* has a framing pattern with the first futtocks butting heels on the vessel centerline (Figure 2.6). The molded value for individual frame components is 6 in. with a sided value of 5 in. All frame elements are fayed closely together with a substantial space of 13-1/2 in. The cant frames are canted from the centerline timbers to form a sharper bow and lack a segmented apron (Figure 3.4).

Summary

The sites described in the text and illustrated in the figures clearly illustrate the shift in framing patterns in both the flat run of the hull and the cant frames. As they replaced single frames, double frames started with separate but paired components, with the heels of the first futtocks far offset from the centerline and room being equal to space. This practice, as illustrated by



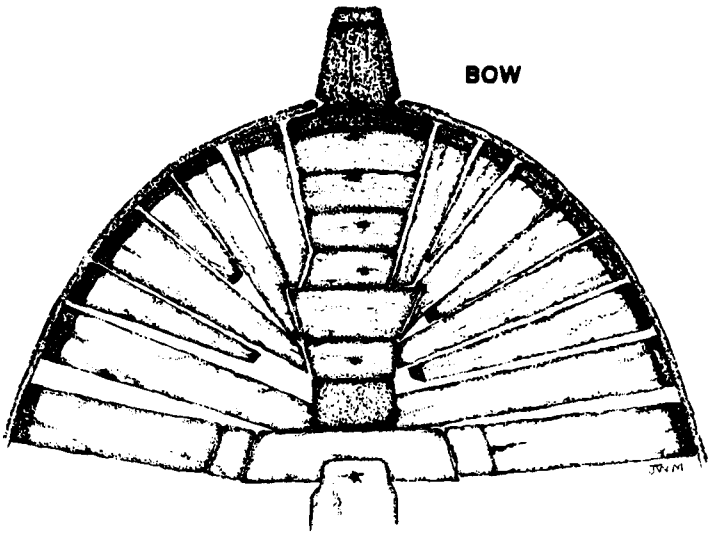


FIGURE 4. Bow and stern cant frames on *Betsy* (Morris 1991:98).

the Port Royal site, was described by Deane (1670). As the framing pattern evolved, the heels of the first futtocks moved toward the center, the components of individual frames moved closer together, and molded values increased (not always at the expense of sided values). This is most clearly demonstrated by the collier *Betsy* and the vessel off Bermuda. As the frame components underwent these shifts, space between frames also usually increased. However, even as the heels of the first futtocks drew closer, space was still needed to allow "breathing," prevent rot, aid in pumping out the bilge, and maintain a dry cargo area (Steele 1805; Morris 1991; Wilde-Ramsing et al. 1992). Eventually, as typified by *Scuppernong*, the firsts would butt on the centerline and the molded and sided values would either be equal or the molded value would become greater. Additionally, space would exceed room. Cant frames also evolved, and the shift in the cant framing pattern probably reflects a shift in hull form and material availability as much as anything else.

Conclusions

The shifts in framing patterns presented here result from several factors. The most significant is economic demand, giving rise to the technological response of vessel form specialization by functional necessity. Construction advances would naturally follow a demand for vessels that were more seaworthy, better suited to specific tasks, and profitable. Other considerations are environmental variations from trade pattern shifts, availability of construction materials, advances in associated technology, and demographic shifts changing specific maritime practices.

Although the proposed theory is chronological in nature, it is neither seamless nor free of exceptions. Framing patterns do shift across the 18th century as the sites described indicate. It should be explained that the list of exceptions to the evolutionary steps presented here is too lengthy to include. However, the typologies presented here, synthesized from numerous archaeological investigations, provide a point of departure for future research on 18th-century wreck sites. Additionally, beyond the specific typological information in this work, there is a conceptual consideration to be made. The application of synthetic data analysis from vessel sites is applicable to other time periods, as vessel specialization is not confined to the 18th century.

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Continuity and Change in Dutch Boat Building

An ancient class of North European watercraft categorized as prams or pram-class may represent the most continuous use of a boatbuilding lineage within northwestern Europe. This classification includes a diverse collection of craft with similar construction and a common lineage, incorporating both small work boats and large freighters.

A typical pram can be described as having the following attributes: (1) a carvel-planked, flat bottom usually lacking a keel or keel plank, although there may be a central plank with skegs underneath; (2) bottom and sides meet at an abrupt angle forming a hard chine; (3) side strakes are usually lapstrake but in post-medieval hulls can be carvel; (4) stealers frequently are used in construction of the sides, particularly in the freighters; (5) typical framing systems consist of knee-shaped futtocks alternating with straight floor timbers and top timbers; (6) the hull is long, narrow and often lanceolate-shaped, usually having a low freeboard; (7) a raking stem and stern post fit directly on top of toe-like projections on the central bottom strake; (8) a wale or inwale is fitted above the heads of the knee-shaped futtocks; and (9) the shipboard organization consists of an open cargo hold with cabins or cuddies in the bow and stern.

While these characteristics define the pram type, the issue of what should be called a pram is far more complex. Within the Netherlands, Germany, and northern France there are sundry comparable types, which have a variety of constructions and localized names. Examples of vessels built as prams but called by other names are the *vlot*, *bok*, *punter*, *snijboon*, *schouw*, and *zomp* (Schutten 1981; Berk 1984). The name "pram" has the advantage of having a broader usage than the others.

The history of prams also is complicated. There are a number of archaeological finds of large river vessels dating to the late Roman era found in the Netherlands, Belgium, and Switzerland (Taylor and Cleere 1978; Arnold 1992). These have several of the aforementioned pram-like features and are distinctly different from vessels built in the mortise-and-tenon, Mediterranean tradition. The oldest reported example with pram-like features was found in Yugoslavia and dated to the pre-Roman Iron Age (Salemke 1973). It is therefore yet to be determined whether prams have their beginning in the Middle Ages, the late Roman period, or even earlier.

Pram appears to be an anglicized noun derived from the ancient Slavonic language (Ellmers 1984:156; Wijk 1949:519). Slavic renderings, such as *parom*, that are translated as "ferry" are particularly significant (Sorokin 1994: 137). Documentary evidence for the Dutch *praam* is chiefly from the Late Middle Ages. During the 13th century, *prahm* is mentioned in tax documents from the Baltic and Eastern Sea cities (Rudolph 1969:85-86), but it is not until the 14th century that *pramen* are referenced in Dutch archives with references to *pramekarle* and *pramekerlen* (Wijk 1949:519).

The type was associated with its first archaeological example by Ole Crumlin-Pedersen (1969). An excavation at Falsterbo Castle in southern Sweden revealed hull remains of vessels that were 18 m long, 3.6 m wide, and had L-shaped strakes that formed the transition between the bottom and sides. These prams had been placed as a foundation for the castle's seaward rampart, which was built between A.D. 1311 and 1318.

The study of these simply-constructed, flat-bottom vessels is important to the history of shipbuilding for several reasons. Pram-class vessels represent some of the earliest types of watercraft to be built in Northern Europe. Also, they may represent a construction intermediary between extended dugouts and more sophisti-

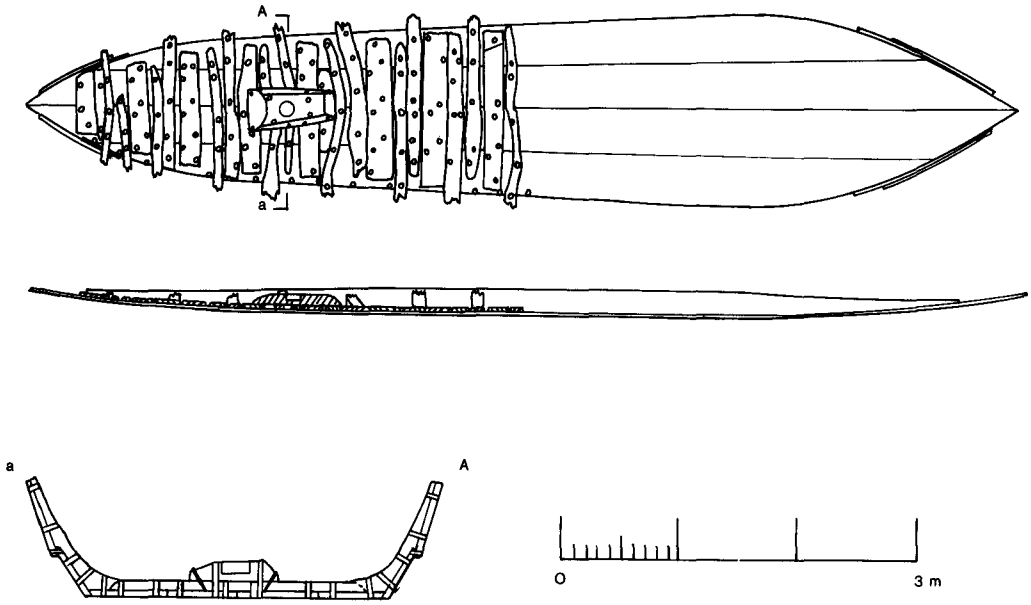

FIGURE 1. Remains of 13th-century vessel from Meinerswijk in the Netherlands. The bow is the narrower end, where the mast step is located. Cross-section is reconstructed. (Drawing by author, after Reinders 1983.)

cated inland and seagoing craft. Several wrecks of late medieval vessels found in the IJsselmeerpolders have pram characteristics but also exhibit more seaworthy constructions with the introduction of keel planks, stem and stern post hooks, and finer entrances and runs formed by bottom strakes that change to side strakes in the bow and stern. Prams were an integral part of the economic expansion within northwestern Europe and were a significant achievement in the development of shoal water transport, canal systems, and trade in bulk materials. These vessels also provide a mechanism with which to study adaptation in water transport over a long span of history.

Several late Roman-period vessels known as the Zwammerdam type bear many similarities to medieval and post-medieval prams (Hulst and Lehmann 1974; De Boe 1978; Haalebos 1988; Weerd 1978 and 1988). These date from A.D. 150 to 260. The chief differences in these vessels and most of the later prams are the use of L-shaped strakes at the chine, referred to as chine-girders or bilge strakes, and the absence of a true stem and stern post. At 20–34 m in length they are remarkably long, even when compared to post-medieval pram freighters.

There is no archaeological evidence for the continuation of the Zwammerdam type after the end of the Roman Era. Although it is tempting to categorize these as prams considering the disruption of large-scale trade, depopulation of urban centers, and convenience of dugout constructions, the building of these large vessels must have ceased. However, some of the same fundamental boatbuilding skills may have continued in the construction of extended dugouts and small planked boats.

During the Dark Ages and Early Middle Ages, there is little archaeological evidence of any inland watercraft in the Netherlands. Two examples from outside the Netherlands, one in Krefeld, Germany (Damman 1974), and the other from Lake Geneva, Switzerland (Arnold 1992), have some pram features. Both of these were scow- or punt-ended. The bottom and side

planks of the Swiss vessel were fastened with pegs, a characteristic also found in the late medieval prams. Relatively modest vessels such as these and extended dugouts were probably the forbears of the medieval prams.

In the Netherlands, it is not until the 13th century that we have the first archaeological examples of bona fide pram-class boats (Figure 1) with finds at Rotterdam, Helledorn, and Meinerwijk (Reinders 1983; Berk 1984; Maarleveld 1993). Unlike the earlier river vessels, these craft were lanceolate in shape, had true stems and stern posts, and lacked the carved L-shaped bilge strakes. Hull planking was fastened with both iron nails and treenails, and the lower side strakes were fastened to the bottom with pegs. The framing pattern was typical of prams and the caulking was of moss and willow lath secured with *sintels* (small, iron staple-like fastenings).

A late 15th-century Dutch shipwreck designated the B 55 (Figure 2) is clearly a vessel having the attributes of a pram freighter (Reinders 1986). It exhibits more sophistication in its design and function than the 13th-century examples. The surviving bottom of the hull was 18.5 m long and 3.5 m wide, and the vessel had a lanceolate shape. The joins of the bottom planking were caulked from the outside with moss and lath and secured by *sintels*. As with the 13th-century prams, the bottom and sides were joined with pegs. This freighter had a greater depth of hold, formed of five overlapping strakes and stealers, than the 13th-century boats. The stern post rabbet was positioned so that the uppermost strakes covered the stern post. Characteristic of medieval Dutch hull construction is the mast step mortised into a large floor timber. The mast step was placed forward in the bow, perhaps indicating the use of a sprit sail.

Several features indicating an increased sophistication can be attributed to pram freighters during this period. These are the employment of a sprit sail, steerage with a stern rudder, and the use of a skeg to protect the stern post and bottom joint. The presence of a galley and quarters in the stern indicates a new shipboard spatial organization for preparing meals, sleeping, and equipment storage. Successive generations of these freighters show increasing spatial organization, with the bow and stern separated from the cargo hold for living quarters and equipment storage.

A better preserved pram from the 16th century was excavated near the city of Workum (Figure 3) in the Dutch province of Friesland (Neyland 1994). In general, it is similar to the previous example but also had a close-fitting

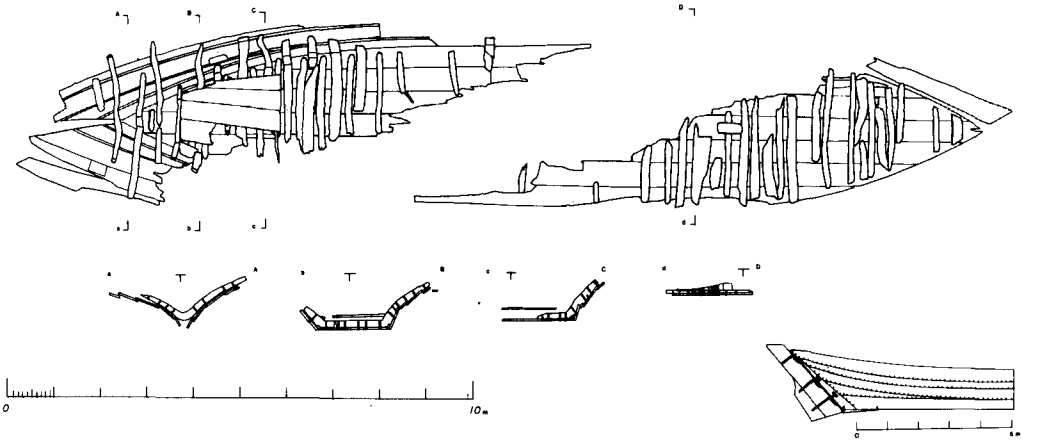

FIGURE 2. Remains of the late 15th-century pram B 55. The mast step was placed in the large frame, shown in section d-D at the far right. The stern, of which a reconstruction is shown, was better preserved than the bow. (Drawing by author, after Reinders 1986.)

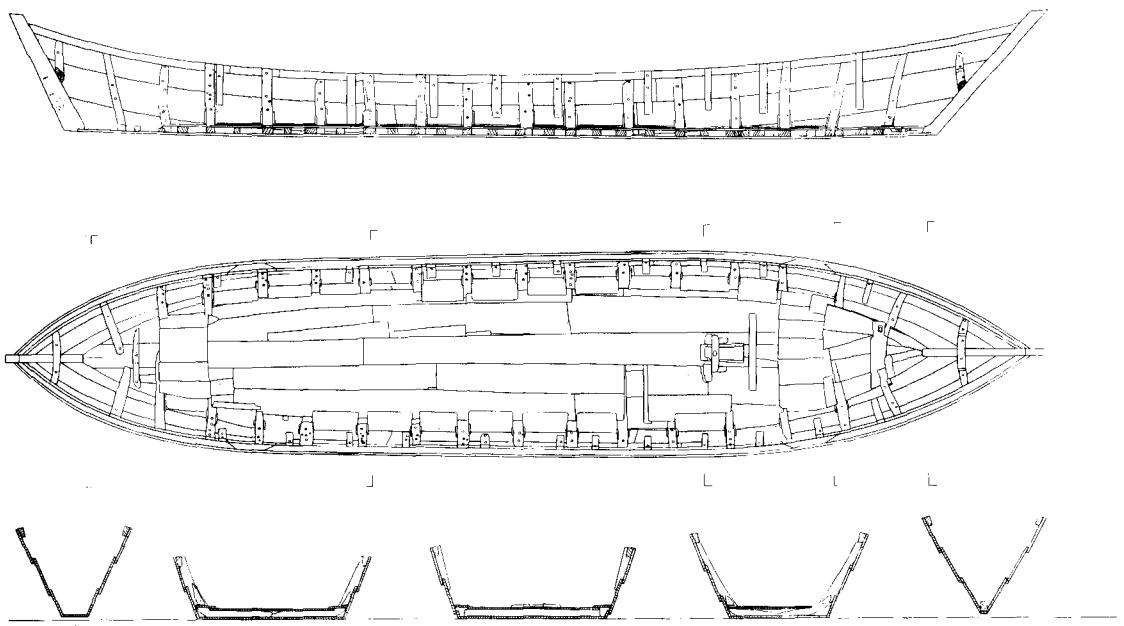

FIGURE 3. Reconstruction of 16th-century pram discovered near Workum, Friesland. Drawing not to scale. (Drawing by author.)

ceiling planking, removable ceiling planks between the futtocks for bilge cleaning, sawn frames, and the bending and shaping of side strakes with the use of fire. Instead of iron *sintels* used to secure the moss and lath caulking, wooden tenons called *prikken* were used. This vessel had the fine, lanceolate shape of late medieval prams but differs from later prams that have a more beamy, box-like shape.

During the 17th and 18th centuries, pram freighters employed in the bulk trade were built as virtual floating boxes with a more constant breadth and fuller ends. Their optimal beam was determined by the size of the canals' locks. This type is exemplified by the late 18th-century pram E 14 (Neyland 1991). It was 19 m long and, compared to the previous examples, had more cargo capacity with greater depth of hold, more space in the bow and stern compartments, and the mast step consisted of a large keelson-like timber oriented along the longitudinal axis of the hull. This pram lacks ceiling planking, which may indicate that it transported pliant cargoes such as peat.

This pram used leeboards, which could be lowered and raised as needed. Leeboards increased the vessel's ability to counteract leeway, the lateral drift of the flat-bottomed hull. Although several changes and innovations can be recognized, the 18th-century pram retains the principal characteristics of the type with its flat carvel bottom, hard chine, and distinctive framing pattern.

The development of prams was shaped by historic events, particularly by periodic crises and opportunities in the local economy. During the 2nd and 3rd centuries A.C., Roman colonization created new economic opportunities. Withdrawal of the Roman legions and state patronage resulted in a period of dramatic economic decline, depopulation, and upheaval. Consequently, the Zwammerdam-type freighters disappeared from the archaeological record and inland vessels do not reappear in significant numbers until the Late Middle Ages.

It is not until the 13th century that we have the first archaeological evidence and archival references to prams. Their development was the result of external stimuli in the local economy—a growth in population, the colonization of frontiers, development of urban centers, and increasing trade. From the late medieval to early modern eras, increases in hull capacity parallel the growth in bulk trade, with the design changing from a lanceolate-shape hull to a more box-like, rectangular form.

The early modern era (A.D. 1550 to 1650) was a period of abundant economic opportunity in the Netherlands. This Golden Age, however, was followed by a long period of recession during the late 17th and 18th centuries. The pram design and construction was well adapted to economic hardship, showing a frugal use of materials and labor. Economizing was necessary for the competitive trade in bulk goods, which yielded small profit margins.

Thus, growth and technological change in Western Europe occurred in spiraling cycles of economic, demographic, and technological expansions, interspersed with periodic contractions. The continued exploitation of shoal waters in order to move freight and passengers reinforced the construction of prams in the Netherlands. Networks of canals and channelized rivers provided cost-efficient and reliable transportation, which was conducive to the development and continuation of this vessel design. In turn, relatively cheap water transportation fostered the growth of new markets and industries.

Continuity of the pram type resulted chiefly from the early adaptation of its efficient and economical design to the environment and economy. Whenever appropriate, boat builders readily introduced innovations in response to changes in the economy, technology, environment, and even culture. Pram builders and captains, rather than inherently bound by tradition, were quite responsive to the episodes of economic crises and opportunities that shaped the Netherlands.

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Teaming Up to Teach Archaeology

Introduction

A growing need for educational reform has been recognized nationally since the early 1980s. Two content areas which directly encourage the teaching of archaeology within the K-12 curriculum are science and social studies. Teachers who follow reform deliver their subjects with an integrated approach, which presents concepts/issues from a practical and realistic view.

Professional archaeologists developed programs for use in museums and classrooms as the 1980s progressed (Hawkins 1987; Smith et al. 1990), and both the SHA and the SAA started public education committees. The workshop session resulting in this article was a joint effort of educators and archaeologists using underwater archaeology as a teaching tool in different settings and geographical locations.

Louisiana—Classroom Archaeology

The senior author is an educator who has teamed up with professional archaeologists for teacher workshops, professional conferences, and a university methods course with pre-service teachers. In 1992 Nobles and Hawkins developed K-12 lesson plans for use by Louisiana teachers. State public education continues to be impacted by a lack of funds for teacher training, and therefore the major areas addressed were to: (a) increase site preservation, (b) supplement state curriculum requirements, (c) develop short, practical and inexpensive resource materials, and (d) minimize teacher in-servicing.

The Louisiana Division of Archaeology also has two suitcase exhibits which teachers can use in their classrooms. These contain artifacts, teaching materials, and slides on Poverty Point (a prehistoric site) and *El Nuevo Constante* (an historic Spanish shipwreck). Nobles has used the latter exhibit in different contexts for educational purposes. Artifacts from the wreck are numbered and placed at different locations in the room. Participants placed in cooperative groups move from one artifact to another, writing down observations and predictions within an allotted time. The groups then hypothesize about the type of site and share their interpretations. As the identity of each artifact is discussed, groups usually change and/or develop their original hypotheses. Depending upon the context, this activity can take less than an hour or a period of days.

In its simplest form this information has been presented at the National Conference for the Social Studies, where educators from across the country teaching elementary through college enthusiastically experienced a brief introduction. More detailed studies are used with pre-service teachers and also in teacher workshops to illustrate the use of archaeology across grade levels and content areas. When used in an 8th-grade physical science class, the author also had copies of a booklet accompanying the exhibit. Students' comprehension of text, science principles, math conversions, and critical thinking were assessed while they learned about a specific archaeological site, its preservation, and significance. This type of integrated, hands-on lesson is indicative of the reforms mentioned.

California—A Shipwreck in the Classroom; Archaeology as a Tool for Teaching Scientific Methods in Public Schools

In 1988 Meniketti developed a simulated shipwreck project for use in the Junior Academy youth program of the California Academy of Science in San Francisco. It is now a full-semester archaeology course for teaching educationally-disadvantaged youth and immigrant children from the inner city whose primary language is not English. The approach is hands-on, student-centered, and challenge-based. It integrates social studies, language arts, science, and math, and students also acquire basic skills.

The challenge is to determine the identity of an unknown shipwreck from among five possible choices, through the guided use of historical accounts, documents, and careful scientific excavation of the ship. This is adapted from work by Mark Wilde-Ramsing and the North Carolina Underwater Archaeological Unit (UAU). The shipwreck is a large wooden model, sunk in a tank and buried with artifacts appropriate to the time period. Divided into small teams, students read through "documents" to find clues to the ship's identity. They compile data charts for comparison, delve into the historical period of each of the vessels, write letters imagining themselves on the ships, and debate the importance of possible clues. The excavation is thorough and takes several days, with one grid unit assigned to each team.

Detailed unit maps are drawn to scale, and eventually a large site map is created with each team contributing to the plan. Written reports about the artifacts and conclusions about the ship's identity are submitted by each student. As a follow-up, two weeks are devoted to student-created Hypercard programs which enable students to demonstrate mastery of content and concepts in a technological manner beyond the usual written report. Students are actively engaged in note-taking, measuring, scaling, drawing, reading, comparative analysis, writing across the disciplines, computer work, inductive reasoning, and cooperative learning. All of these are critical elements of the California Science Framework, which is based upon the reforms stated in the introduction. In addition, project documents written in the student's primary language have been shown effective for developing positive self-image among non-native speakers and improving their second-language learning ability (Ogbu 1992).

Nautical archaeology specifically contains all the elements necessary for generating student success. Controversy surrounding assessment is an educational issue of concern, particularly with an innovative and non-traditional curriculum. Assessment for this project is holistic, affording students ample opportunity to demonstrate mastery of content and to attain competency with essential skills. The integrated content can be evaluated by traditional tests, or more effectively from student writings. Language acquisition can be determined from debates, vocabulary usage, and writings. Archaeology can be a powerful tool for instruction. By carefully weaving basic skills into the fabric of an archaeology curriculum, educators can facilitate students' learning and enrich their lives.

Vermont—Digging, Diving and Documenting at the Lake Champlain Maritime Museum

In 1993 the State of Vermont contracted the Lake Champlain Maritime Museum in Basin Harbor to recover and conserve Revolutionary War artifacts from the waters of the Mount Independence site. A temporary conservation lab was established at the museum to treat these artifacts (Cohn 1993). Children were involved in the conservation process, and a field trip was developed to present the complete process from discovery and site documentation to recovery and conservation.

Thus began the 2.5-hour hands-on museum program "Digging, Diving, and Documentation: The Process of Nautical Archaeology." It teaches shipwreck documentation skills and is a curriculum that uses nautical archaeology as a vehicle to engage students' interest and stimulate learning across content areas including history, math, science, and art.

Teachers of grades four and up are provided with pre- and post-visit materials focusing on the intriguing stories of Lake Champlain's shipwrecks. The pre-visit lessons help prepare students for the technical nature of the program by introducing the basic technology used in shipwreck discovery and recovery, as well as the mapping skills needed for the museum activity. Small groups of students rotate through the hands-on activities. They first examine the SCUBA gear and speculate on the challenges of underwater work, including ways to keep warm in the cold water and how to write underwater. Next is the shipwreck simulator, created on land

with a 16-ft. wooden rowboat in a sand bed with an underwater grid system suspended over it.

With a peer, students map their assigned grid section to obtain a detailed look at the scatter pattern and preserve the clues held by the artifacts' location. The students seek details to help solve the mystery of the shipwreck. Details of the materials and design of the boat can answer questions about the vessel's age, use, and why it sank.

Student equipment includes tape measures, clipboards, and three-fingered neoprene mitts to simulate the thermal protection needed in Lake Champlain's cold water. The students create a dive plan limited to 20 minutes and, because underwater archaeologists cannot talk, neither can the students. Therefore, their pre-dive planning is very important, creating a situation where students must concentrate and work together as a team.

Once they enter the simulator and carry out their plan, their papers are collected for a debriefing. The grid sections are placed together and the outline of the vessel and scatter pattern become apparent. The peer groups describe their findings, try to solve the mystery, and create their own hypotheses. Along with other principles of underwater archaeology, this program emphasizes the importance of context in interpreting a site.

A second activity also reinforces context as the students participate in an activity aboard the gunboat *Philadelphia II*. This is a full-size replica of the original gunboat that fought and sank on Lake Champlain in 1776. It remained at the lake bottom until 1935, when it was raised by hard-hat divers. The original vessel is now a permanent exhibit at the Smithsonian Institution's National Museum of American History.

Students stand on the deck of the replica and pretend they are hard-hat divers in 1935. Since these were salvage divers and not archaeologists, they did not record artifact locations. As the students use contextual clues to try to discover the identities of artifacts, they are also asked to determine the events of 11 October 1776, when the vessel sank. A graphic example for the students is a large rock located under the quarterdeck, used as ballast to counterweight the bow cannon. Out of context it is just a rock, so the importance of location and record keeping are emphasized. This program has been successfully presented to school-age students. It is also intriguing to adults, as evidenced last summer when used for the Elderhostel program "Digging, Diving, and Documenting" by the National Park Service and the museum.

Future museum plans include a permanent conservation lab in 1996. Expanded shipwreck exhibits are being designed to represent the different eras in Lake Champlain's long maritime history. Curriculum kits are also being developed for teachers to help them expand such themes as using primary sources to investigate history. For more information about these programs call or write to: Lake Champlain Maritime Museum, RR#3, Box 4092, Vergennes, Vermont 05491, 802-475-2022.

Conclusion

The challenges for public outreach are met through different means by archaeologists and educators across the U.S. Our country has a wealth of archaeological sites, but site destruction continues. The common theme which all three authors of this paper share in addition to the use of underwater archaeology for education is the extreme importance of preservation of all archaeological sites. We share this with everyone who is interested and participates in public education, regardless of the means of presentation.

Education has been (and will continue to be) necessary to reach the public with conservation and preservation messages. Recycling and environmental programs are two graphic examples which illustrate the success of educating citizens of all ages through teacher workshops and public outreach. Increased awareness for both archaeologists and educators and their joint efforts to educate the public will aid in the preservation of archaeological sites and increase appreciation for these valuable and non-renewable resources.

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Preliminary Report on the 1993-1994 Submerged Cultural Resource Survey at Old Fort Niagara, New York

Introduction

This report summarizes a submerged cultural resource survey conducted at Old Fort Niagara (OFN), New York, in 1993 and 1994. Most archaeological investigations conducted at OFN since 1979 have been terrestrial—either mitigation or research excavation. In recent years we have gone beyond the water's edge to evaluate all potential cultural resources OFN has to offer.

Recent underwater work includes survey and mapping of the foundation remains of an elliptical bastion in Lake Ontario adjacent to OFN's northern seawall. While this area has undergone previous casual survey, it has never been mapped and interpreted. Such data recovery was undertaken these past two seasons due to the timely merging of qualified personnel, necessary equipment, and an archaeological imperative to investigate remains under threat of destruction.

The conclusions and recommendations in this report echo suggestions offered by previous survey groups, to assess and interpret OFN. The study of its submerged bottomlands adds to the site interpretation as well as the general cultural ecology of the Great Lakes. This report discusses site history, field methodology, evaluations, and recommendations for continued interpretation.

Brief Site History

When U.S. troops peacefully reoccupied Fort Niagara in 1815 as a result of the Treaty of Ghent, they found that OFN had deteriorated significantly during the War of 1812. Gen. Joseph G. Swift, the army's chief engineer in 1815, commissioned Lt. John L. Smith to assess Niagara's condition and make recommendations for its fortification. Lt. Smith submitted his plan in January 1816, outlining the building of a bastion (or gun battery) to improve the fort's lakeside defenses (Smith 1816).

Work began on this battery and a substantial seawall in late 1817, guided by a comprehensive engineer's sketch drawn by Lt. William H. Chase. However, construction halted in May 1818 when President Monroe ordered the cessation of Niagara repairs. The bastion was far from complete, but finances were to be redirected to strengthen other American fortifications along the Atlantic seaboard.

The Canadian Rebellion of 1837, resulting in tensions between the U.S. and Great Britain, drew attention again to Niagara and its sad state of fortification. In addition, erosion from Lake Ontario wave action was causing visible damage to Niagara's unfinished seawall (Dunnigan and Scott 1991). In a report sent to Gen. Gratior of the War Department dated 21 September 1838, army engineer Lt. William Smith offered his evaluation of Fort Niagara and suggestions for its fortification. He acknowledged the presence of a "...foundation for a circular battery...near the middle of the seawall [which] extends out into the lake sufficiently far, to give about two guns in a tier" (Smith 1838). Despite his recommendations for finishing the bastion, other fortifications were pursued for Niagara's defenses, including the construction of a blockhouse, stockade, and more substantial seawall. As a result, the elliptical bastion was never completed.

Survey Objectives

The primary survey goal was to measure and record all structural remains of the submerged elliptical bastion, which would allow us to answer questions about the battery's construction. Questions included to what extent the battery was built in accordance with the engineer's plans, and at what point construction had been halted. The second survey objective was to evaluate the bastion's physical condition and environs along the seawall for future site work, management, and protection. A third objective was to employ volunteer divers in the underwa-

ter survey, in keeping with the OFN Archaeology in Progress Team's policy of encouraging trained volunteers to assist in all phases of investigation. With these specific goals as our focus, we allocated our time, personnel, and resources to accomplish the greatest amount of work in a short time. Twenty days were set aside for this survey, during which 70 dives yielded 96 hours underwater.

Site Description

The remains of the elliptical bastion lie submerged in ca. 7–12 ft. of Lake Ontario's fresh water. The feature is ca. 30 ft. north of Fort Niagara's modern seawall, and occupies over 400 ft.^{2} of bottomland. Originally designed with an elliptical, two-story shape of wood, stone, and mortar construction, the bastion would have been a formidable structure. Never completed, what remains today is a masonry foundation of cut stone blocks, mortared in place, forming an east-west ellipse. The west section of the battery has disintegrated, with fragments scattered in the vicinity. This damage is probably attributable to severe annual ice damage common to Lake Ontario, as the west section of the battery is the structure's "weather side." The foundation rises ca. 3–4 ft. above the lake bottom, depending upon position.

In general, the underwater environment where the foundation lies can be described as an active "freshwater reef," home to several species of fish and plants including an exorbitant amount of zebra mussels. To proceed with the project it was necessary to modify mapping strategies to accommodate this active freshwater environment as well as the bastion's vertical interference.

Survey Results

Overall, the 1993-1994 Submerged Cultural Resource Survey at OFN provided an unprecedented view and analysis of the elliptical bastion and environs. While only the east section of the battery was mapped completely in plan view, the on-site time provided an opportunity to evaluate the area. Research determined that not only is the elliptical bastion worthy of further fieldwork, but the entire area along the Fort's northern seawall is in need of further investigation to aid in a more thorough understanding of OFN's northern shore occupation.

With regard to the bastion's construction, the survey indicates that it is likely that Lt. Chase's engineering sketch guided construction to a substantial degree. This is consistent with other OFN structures for which engineers' plans were drawn. In addition, it appears that battery construction was incomplete beyond the foundation level. What appear to be stockpiled building materials (cut stone) were located by divers around the distant perimeter of the bastion. These cut stones resemble what the engineer had indicated in his drawing were footings for the outer battery facing.

In the general survey along the OFN's seawall, several other points of interest were noted, including fragments of the battery foundation (farther out from the immediate site), other potential contemporary building materials, large wood deposits buried in the silt, and a large quantity of ordnance including Stokes mortars and a French Vivien Bessiere grenade launcher. Ordnance was deposited around Fort Niagara sometime after World War II. Annual reconnaissance typically turns up numerous ordnance sightings, and it is removed semi-annually by the local Air National Guard Explosive Ordnance Disposal Division. Also noted along the seawall and bastion area were large amounts of artifacts including ceramics, nails, shot, wood, glass, and metal.

The use of volunteer divers proved to be a very positive experience; those chosen to assist in the field were very adept and capable. The relatively shallow water depth, small crew, and daily training sessions created a manageable and safe working environment.

Recommendations

As expected in this preliminary survey project, several recommendations for continued site evaluation and protection have unfolded. First, excavation is recommended around the

bastion to determine not only the archaeological integrity of this area, but also the type, frequency, depth, and patterns (if any) of associated cultural material. Excavation should be coupled with geologic studies to discern patterns (if any) in lake activities relative to the ambient waters and submerged bottomlands. Analyses of lake levels over time, as well as water current direction and flow patterns, would aid in archaeological interpretation as well as site formation processes. In addition, comprehensive photography and videography of the bastion are archaeological imperatives. These finite cultural remains are eroding and should be recorded in their current state as fully as possible.

A final and significant recommendation is for site officials to enforce the protection of the Fort's submerged cultural resources within the allowable limits, as outlined in the Fort's National Historic Landmark status and New York State Historic Site designation. Excessive site disturbance was noted throughout these surveys, and action should be taken to protect these nonrenewable resources.

To carry out these recommendations, continued mapping of the elliptical bastion is scheduled over the next few seasons at OFN, and annual submerged cultural resource surveys are planned. The 1993-1994 Submerged Cultural Resource Survey at OFN has begun a new chapter in our ongoing archaeological evaluations of this site. The data from the fort's bottom lands have proven significant to the historic record, and this, coupled with future projects, will help the database to grow. On a much larger scale, these resources have the potential to add to the interpretation of the cultural ecology of Great Lakes maritime environments in general—both military and civilian. Studying submerged site features and material culture deposits at OFN promises to broaden our understanding of Great Lakes military settlement, development and defense.

ACKNOWLEDGMENTS

Special thanks to the OFN Archaeology in Progress Team which made this work possible by providing the facilities, equipment, and personnel. My gratitude to Archaeology Director Douglas D. S. Knight, Laboratory Assistant Marbud Prozeller, and volunteer divers T. Kurt Knoerl, William Utley, Peter Hessinger, Frank Dengate, and Bill Adamczyk. Thanks also to OFN Executive Site Director Brian Leigh Dunnigan for his research guidance. Appreciation is extended also to Dr. and Mrs. Stuart Scott for their consistent support. Recognition also goes to Dr. Bradley A. Rodgers of East Carolina University for his encouragement and inspiration. Final site plans and a formal research report will be available in summer 1995.

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Archaeology of Beached Shipwrecks: Investigations of Two Channel Islands National Park Shipwreck Scatters

During fall 1993, two beached shipwreck scatters in Channel Islands National Park, California, were documented and analyzed. The wreck scatters, located in Northwest Cove, San Miguel Island, and Cluster Point, Santa Rosa Island, may represent the Pacific coast lumber schooners *J. M. Colman* and *Dora Bluhm*, built by the Hall Brothers shipyard of Puget Sound. Archaeologists from the Submerged Cultural Resources Unit (SCRU) of the National Park Service (NPS) used this project as an opportunity to conduct a methodological case study of interpreting isolated shipwreck elements and scattered structure. The sites consist of scattered timbers and iron wreckage with no obvious association. Oftentimes, single elements are dismissed as unimportant or useless. This study demonstrates that a systematic analysis of disarticulated structural remains can reveal the identification of each hull component and suggest likely associations. This project's goal was to document visible remains at Northwest Cove and Cluster Point and test whether these wreck scatters represent *J. M. Colman* and *Dora Bluhm*. In addition, the natural site-formation processes affecting these sites were examined to see if they could help determine associations.

Historical wreck accounts suggest identifications for the wreck scatters. The schooner *J. M. Colman* wrecked near Northwest Cove, San Miguel Island in 1905; in 1911, *Dora Bluhm* wrecked near Cluster Point, Santa Rosa Island. Because of these historical associations, the material record could be directly compared to historical information. To determine if the wreck scatters were associated with *J. M. Colman* and *Dora Bluhm*, object attributes, scantling size, fastener type and size, and wood species were compared to the original construction contract of *Dora Bluhm* and to the *Rules for the Construction of Wooden Vessels*, published by the American Shipmaster's Association (ASA) (ASA 1879). Classification rules such as the ASA's were used by marine underwriters to determine insurance premiums and maintain minimum standards for ship construction. By comparing timber and fastener size from a shipwreck site to ASA scantling sizes, minimum vessel tonnage can be determined.

Field work consisted of recording each hull element through scale drawings and photography and removing wood samples for identification. Except for wood samples, the sites were left undisturbed, following SCRU's principle of maximum information from minimum impact.

The Northwest Cove Site consists of two distinct artifact distributions: iron material in the intertidal zone and wooden wreckage above the high-tide line. All intertidal zone material is definitely from a shipwreck based on physical attributes, and, because of direct physical association and similarity, likely represents a single wreck event. During field work, 19 iron objects were recorded in the intertidal zone. Of these, 13 could be functionally identified. These included two hawse pipes of identical dimensions, a steam donkey-engine boiler, a crosshead mechanism from a hand-operated, pump-brake windlass, a steam donkey-engine drive spindle, and several windlass parts.

These iron objects in the Northwest Cove intertidal zone are very likely the collective remains of ground tackle elements and machinery from *J. M. Colman*, because that vessel wrecked in the area. The most diagnostic elements and strongest evidence for site identity are the hawse pipes. Classification rules required that a vessel of 400 tons (*J. M. Colman* registered 463 gross tons and 389 net tons) carry hawse pipes between 11-1/2 to 12-1/2 in. in external diameter (Desmond 1984[1919]:157). The hawse pipes recorded at this site have an outside diameter of 11 in. The donkey boiler, pump-brake windlass crosshead, and windlass parts are all items expected aboard a vessel from this period. In addition, lack of duplicated iron elements indicates

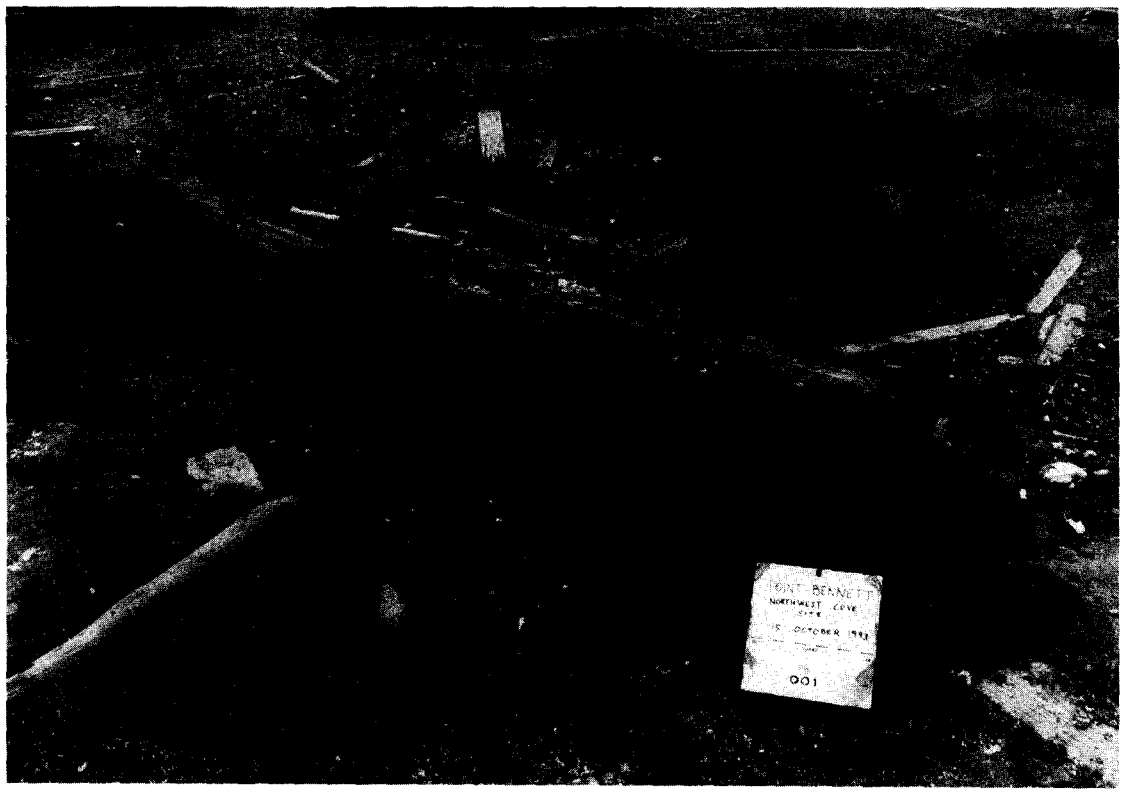

FIGURE 1. Keelson element from *J. M. Colman.*

a single source. Even though several objects cannot be positively identified, the assemblage taken as a whole closely matches material consistent with the date, trade, and size of *J. M. Colman.*

The wooden timbers above the high-tide line in Northwest Cove present a very different case from the iron material. Determination of association with *J. M. Colman* was based on size and characteristics of each timber, evidence and size of fasteners, and wood species. Species identification was seen as a first-line cut for determination of association. Because the Hall-built schooners were constructed entirely of Douglas fir, with the exception of stem and rudder post, any timber on the beach not Douglas fir (unless from a stem or rudder post) could be eliminated from association with *J. M. Colman.* Of the 15 wooden elements recorded from the Northwest Cove Site, one is not from *J. M. Colman* because it was not Douglas fir (Puseman 1994:6-7), while ten others, because of scantling size or the number and size of fasteners, are not structural members of *J. M. Colman.*

Only four elements are likely structural members of *J. M. Colman.* Of these four, only one timber can unquestionably be associated with a large vessel of late 19th-century construction (Figure 1). This timber measures ca. 15 ft. long, with molded and sided dimensions of 23 x 21 in. Both ends are broken, so original length is impossible to determine. There are six 1-1/2-in.-diameter iron drift pins driven through and protruding from the side of the timber. These drift pins range in length from ca. 2–4 ft. long and are spaced an average of 2 ft. apart. There are also nine drift pins ca. 1 in. in diameter protruding from the timber's top surface. The timber's size and fasteners support association with a vessel's centerline structure. The lack of rabbet, the fasteners driven through both axes, and the fact that the large drift pins were apparently first driven through this piece and then into another

discounts this element being a keel portion. These same characteristics indicate that it is a piece of either a main, sister, rider, or assistant keelson, now resting on its molded face. The 1-in.-diameter drift pins vertically fastened the timber, while the 1-in.-diameter fasteners driven through the opposite axis edge-bolted this timber to its adjacent keelson component. The timber dimensions and fastener sizes are consistent with the keelson components mandated by the ASA (1879:50).

The second member also likely associated consists of two timbers fastened together with eight 1-in.-diameter iron fasteners (Figure 2). The top timber contains four mortises cut into its side. The mortises measure 10–13 in. long, 3 in. high, and ca. 5 in. deep. A small, trapezoidal piece is fastened to the side of the bottom timber with five 1-in.-diameter iron drift pins.

This element's attributes suggest it is a portion of deck clamp or shelf. The mortises on 4-ft. centers are for deck beam ends. The trapezoidal element is a reinforcing piece, butted between the clamp and the deck beam. The scantling dimensions of this timber conform to those required by the ASA (1879:50) for a vessel of *J. M. Colman*'s tonnage. In addition, mortise lengths match the sided dimension of deck beams required. However, this identification is inconclusive and association with *J. M. Colman* is only the most likely possibility.

The last two timbers attributed to *J. M. Colman* are probably from a single element: portions of a hatch coaming, originally rectangular, and measuring ca. 11 x 8 ft. They are too small to be from *J. M. Colman*'s main hatch but may be from a smaller, forward hatch typical of late 19th-century lumber schooners (e.g. *C.A. Thayer*). Unfortunately, scantling and fastener sizes for hatch coamings are not specified by the ASA.

FIGURE 2. Possible deck clamp from *J. M. Colman*.

FIGURE 3. Possible poop-deck clamp from *Dora Bluhm*.

The collection of wooden wreckage found above the high-tide line does not offer the same degree of confidence of association with *J. M. Colman* as the intertidal zone iron material. Analysis of the four diagnostic elements, however, supports association with the iron material and with *J. M. Colman*.

Investigation of the Cluster Point Site was conducted in the same manner as the Northwest Cove Site. Twenty timbers were recorded at this site; no iron material was located and no timbers could be eliminated by species identification. Unlike the Northwest Cove site, analysis was expedited by the surviving construction contract for *Dora Bluhm* (Contract No. 40, Schooner *Dora Bluhm* 1883). Of the 20 timbers studied, seven are likely structural members of *Dora Bluhm*. One was so badly deteriorated that this deduction was made solely on iron fastener size (1-1/2 in. diameter).

Of the six remaining elements, three are similar timbers with a variety of large iron fasteners, including 1-in.-diameter drift pins. Like the keelson element discussed earlier, physical characteristics of each timber suggest an identification as centerline structure, most likely keelson fragments. A comparison of these timbers to *Dora Bluhm*'s original specifications show that two elements could only be from the schooner's main keelson, while one could be from either the main or sister keelson (Contract No. 40, Schooner *Dora Bluhm* 1883).

Another structural element probably from *Dora Bluhm* is composed of two timbers edge-bolted together with four 1-in.-diameter drift pins. Lack of fasteners coming through the face indicates this piece is most likely a fragment of *Dora Bluhm*'s centerboard trunk. Timber dimensions and fastener size correspond to those specified for the centerboard trunk in *Dora Bluhm*'s construction contract.

The final two elements have not been conclusively identified, but physical characteristics and numerous iron fasteners suggest association with a large wooden vessel of late 19th-century construction. The first (Figure 3) is possibly part of the deck clamp and planksheer from a vessel's poop deck. Poop deck beams would have been laid into mortises on the inside edge of this timber, and the planksheer, or cover board, would be the plank laid over the beam ends. The last element (Figure 4) is likely part of the stern but remains unidentified. Even though analysis is not conclusive regarding these timbers, their characteristics suggest they are part of a large wooden vessel, which, because of historical associations and congruence with contract specifications, is probably *Dora Bluhm.*

Even if all the elements recorded at each site are from *J. M. Colman* and *Dora Bluhm*, the obvious question is: where are the rest of the hull structures? With few structural members present, most of the hulls are missing from both sites. In the case of *J. M. Colman*, the vessel probably broke up after stranding and was either salvaged or subjected to the vagaries of the winds, tides, currents, and storm activity of Northwest Cove, and scattered widely. Historical accounts of *Dora Bluhm*'s wreck at Cluster Point imply the vessel ran aground, was quickly battered to pieces, and scattered, with few timbers remaining in the vicinity (*Los Angeles Daily Times*, 28 May 1910:10).

The archaeological record at both Northwest Cove and Cluster Point has been contaminated by the "catch-all" nature of these areas, which has complicated analysis by introducing intrusive material. Because of regional currents and prevailing winds, the Channel Islands are repositories for the flotsam of both northern and southern California. Oceanographic phenomena make the job of determining associations much more complicated, but certainly not impossible.

FIGURE 4. Possible stern element from *Dora Bluhm.*

Like any other archaeological site, wreck scatters at Northwest Cove and Cluster Point are subject to predictable natural site-formation processes. The collection of material at these sites arrived by one of two ways: 1) they floated there, or 2) they were deposited there by a wrecked vessel. Although it may not be possible to determine which is the case for every hull component at these sites, this determination must comprise the first step in explaining the archaeological record.

There is no doubt as to how the iron materials came to Northwest Cove. These elements are clearly shipboard objects, and it is impossible that they floated to this location unattached to a whole bow structure. That supposition is unlikely because in a wooden vessel, the bow and stern sections are the weakest parts and it is doubtful that a bow section would stay together and float to another location. The most reasonable conclusion is that the iron material was deposited directly by a wrecked or stranded vessel.

To test whether the wooden material at each site could have floated to its present location, an analysis of the mass of the keelson fragment at the Northwest Cove Site (the largest timber with the most iron fasteners) versus the mass of its iron fasteners was conducted. Using tables found in Desmond (1984[1919]:18, 213), it was determined that the wood of the fragment weighs approximately 2,200 lb. and has a specific gravity of 0.56, while the iron fasteners altogether weigh about 170 lb. This means that this element was positively buoyant—it would float. Based on this observation, it is possible that any of the wood recorded at these two sites could have been transported there from anywhere along the California coast by wind and current. This possibility is extremely unlikely, however, given the historical associations and the fact that the timbers and fasteners are consistent with the ASA mandates for a vessel of *J. M. Colman*'s tonnage and the contract specifications for *Dora Bluhm*.

This study has shown that even widely scattered, beached shipwreck sites can be systematically and productively interpreted. Although the Northwest Cove and Cluster Point Sites contain a relatively small amount of vessel-related material, it could be determined for each element whether it was a structural hull member or not, and, after comparing to original construction contracts and the ASA rules, whether association with *J. M. Colman* and *Dora Bluhm* was likely. Examining site-formation processes demonstrated that the iron material at the Northwest Cove Site was probably associated with *J. M. Colman*, but was inconclusive in determining association for the wooden material at each site. Although frequently discounted in past work, systematic investigation of isolated shipwreck elements using multiple data sets, historical references, insurance requirements, and natural processes can produce useful and important archaeological information.

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Excavation of a Late 17th-Century Dutch Freighter

Introduction

During the summer of 1993, the Center for Ship Archaeology (CSA), a branch of the Netherlands' State Service for Archaeological Investigations (within the Ministry of Welfare, Social Health, and Culture), fielded an international team of American, German, and Dutch nautical archaeology graduate students. Directed by Robert Neyland, the team excavated and recorded a unique Zuiderzee freighter built and launched in the last decade of the 17th century.

Like many medieval and historic Dutch shipwrecks, this site was excavated from land formerly covered by the Zuiderzee, known today as the IJsselmeerpolders (Reinders 1982). The CSA customarily names these wrecks after the agricultural lot on which they are found; thus, this wreck is designated "H 107." It lay buried 2 km away from the CSA, which shares facilities with the State Museum for Ship Archaeology (Museum) at the Ketelhaven harborage, near the northern extent of Eastern Flevoland. H 107 sank in relatively shallow water; at low tide, the site depth was only slightly over 3 m.

Yielding to the waters of the Zuiderzee, H 107 listed to port and settled into the soft silt and clay sediments until the port side and bottom came to rest upon a thick bed of peat (Figure 1). These wet, anaerobic sediments preserved much of the hull and artifact assemblage. Layers of peat and clay sandwiched the port side of the vessel, preserving it up to the cap rail. However, the starboard side of the vessel had deteriorated to above the chine, due to its long exposure above the sediments.

Discovered in March 1962, the wreck was surveyed in November of 1989 by the CSA. This survey assessed the state of preservation and generated an estimate of the wreck's surviving dimensions (16.7 m in length and 3.8 m in breadth), vessel type, and date of sinking. Four methods were used to document H 107 during the excavation and hull recording. Still photography and video were used throughout the excavation and hull disassembly to record general excavation activity, stratigraphic features, artifacts in situ, selected hull construction features, and hull overviews. After the upper 0.5 m of overburden was removed, loose hull timbers, artifacts, and other significant features were recorded. A pantograph for 1:10-scale reductions recorded complicated archaeological features (artifact clusters and loose hull timbers).

After complete exposure of the vessel, a second pantograph developed specifically for recording hull remains was used to create two 1:20-

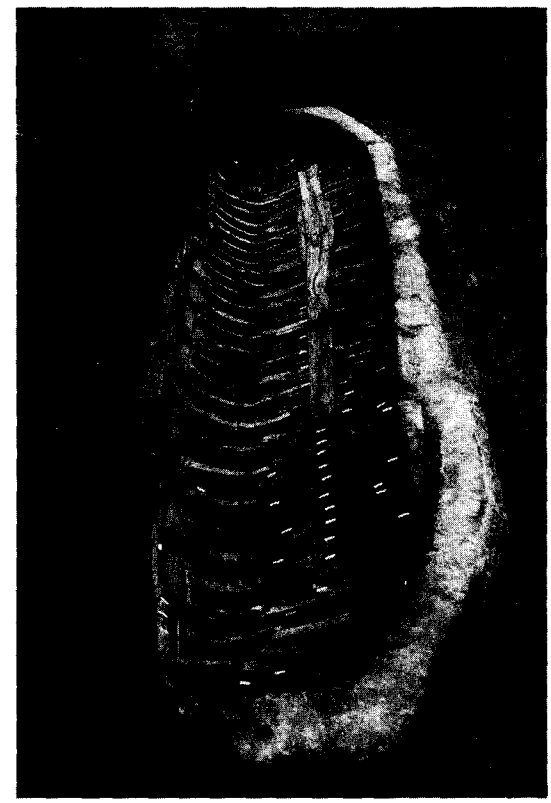

FIGURE 1. The H 107 wreck viewed from the stern. The port side was well preserved, but the starboard side had virtually disappeared. Two mortises in the mast step are for the ends of the tabernacle planks, which supported the mast. (Photo by R. Neyland.)

scale plans of H 107: a recording of the frames, knees and mast step in situ, and a hull planking diagram prepared after removal of the principal timbers (Figure 2). These plans provided an accurate view of the wreck site and were essential in the labeling and disassembly of the hull. Ten cross-sections were also taken using a calibrated measuring beam. Finally, H 107 was disassembled and transported to the CSA, where 1:10-scale recordings were made of all the hull's timbers using two pantographs.

Assigning H 107 to a Zuiderzee watercraft type is more complicated than first expected. During the 1989 survey, it was believed to be a Dutch pram due to its flat bottom, hard chine, long and narrow shape, and distinctive framing pattern of straight, flat floor timbers alternated with L-shaped futtocks. Like examples of late 18th-century prams, the bottom lacks a keel or keel plank, stealers fill the space between the bottom and sides, and the bottom itself was built of a patchwork of planks rather than symmetrical strakes running the length of the bottom (Neyland 1991).

However, it became apparent during excavation that the vessel could not be definitively categorized as a pram. It differs from the standard type by having an atypical, more rounded chine, a bluff bow with upcurving bottom planking fore and aft, and a curved raking stem. These characteristics frequently are associated with the Dutch freighter called a *tjalk*. It is not uncommon for Zuiderzee vessels to show a mixture of building techniques and to have one pram-like end and the other built like a *tjalk* (Zwiers and Vlierman 1988).

Portions of the upperworks are well preserved. In the bow, two bitts, a transverse beam with a portion of the bulkhead nailed fast, the pump shaft, and even 1 m of the mast and its housing (tabernacle) were discovered. As excavation progressed, the reason for the mast's survival surfaced. It was found lying on its forward face, angled slightly to the port side. This face contained a large mortise holding a heavy counterweight—a portion of a cannon from the breech to below the trunnion. Three iron straps held it to the mast. The counterweight assisted in raising and lowering the mast when passing under canal bridges, by the mast pivoting in the tabernacle upon a large bolt. No other example of a mast and counterweight within its tabernacle has been excavated to date.

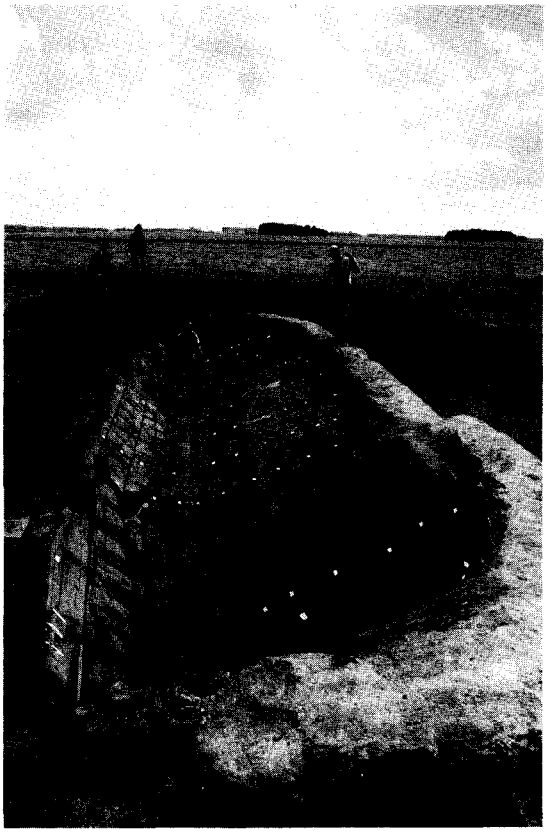

FIGURE 2. Viewed from the stern, H 107 as it appeared after removal of the frames. The hole on the starboard side was left by a ditching machine, which led to the 1968 wreck discovery. Excavation team members clean the hull in preparation for recording. (Photo by R. Neyland.)

The heavy counterweight also trapped other hull timbers underneath the mast-and-tabernacle assembly, including a transverse beam with part of the bulkhead, a large bitt, and the pump shaft. Other preserved bow features were deck planking, a beam from the interior cabin, and chimney fragments.

Surviving in the stern were the port scupper, an upper deck fragment, a small knee, a possible deck beam, and a bitt. Although the hull preservation is exceptional, significant parts of the vessel (including the rudder and leeboards) were

missing. However, the iron gudgeons remained on the stern post and the location where the port leeboard hung was recorded. Also found was rigging for raising and lowering the port leeboard, including two cheekblocks, a single block and a length of tackle running from the helm forward to where the leeboard hung.

Ceiling planking was not used in the hold, possibly indicating that a cargo such as peat was hauled. However, just abaft the keelson was a series of thick planks used as floor timbers, which may have functioned as ceiling. They were laid side-by-side, forming a solid floor across the hull's bottom. Curiously, unlike the other ship's timbers, many of these appear to have been reused.

Artifact Assemblage

Previous Zuiderzee freighter excavations have revealed that most artifacts (excepting cargo) are found around the bow and stern compartments. These locations housed the living quarters, wicker jacket. A jumbled pile of tiles and bricks evidenced the remains of the hearth, which was constructed of bricks overlaid with green-glazed tiles, all supported by a planked framework. Some of the tiles probably represent the remains of the hearth firewall. A few pieces of the box that contained the hearth were recovered, as were three to four planks from the chimney hood and flue. These were thin, well-finished boards fitted together with lap joints, coated with a residue of resin from hearth fires. Outside the vessel and beneath the port cap rail lay a well-preserved cast-iron pot (Figure 3) and a three-legged bronze skillet. The bow area also contained more galley ceramics, numerous kaolin pipe fragments, leather shoes and clogs in three sizes, an adze, ice skate, knife, whetstone, writing pen, wooden-handled brush, a few copper coins, and lead tokens.

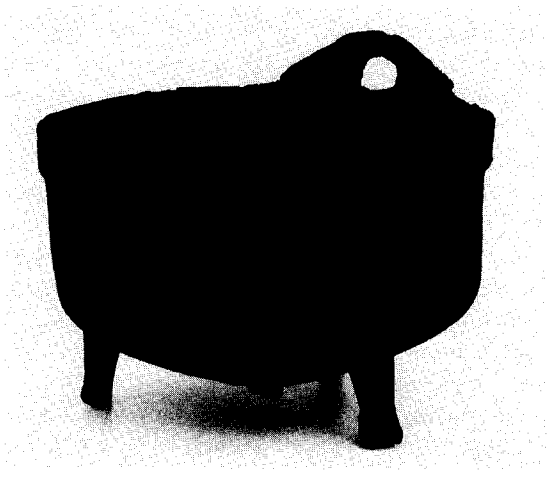

FIGURE 3. Cast-iron cooking pot recovered in the bow from outside the port side of vessel. The casting sprue is visible on the bottom. (Photo by R. Neyland.)

An entirely different artifact assemblage was recovered in the stern. Two ceramic vessels were found, both evidencing reuse. A cooking pot contained tar, while a green-glazed storage pot showed reuse after the rim was broken possibly as an ash or chamber pot. Although a jumble of bricks was found in the stern, it is unclear whether it represented a second hearth (perhaps for heating tar) or simply a brick floor for the stern compartment. No other hearth or galley materials were found in the area. A caulking iron lay beside the tar pot and a hammer was found (head first) inside the port scupper. It probably slid into the scupper when H 107 careened onto its port side. The remainder of the stern artifact assemblage consists of spare equipment such as iron fittings, rigging, pump parts, and scrap leather probably destined to be cut into pump washers. The assemblage suggests that the stern was used for equipment storage and perhaps afforded some shelter and convenience for the helmsman.

A majority of the artifacts are of typical Dutch manufacture. However, a small number are atypical and represent goods more common to the Flemish provinces of present-day Belgium and the Lower Rhine region. Two artifacts (a tobacco pipe and a decorated ceramic bowl or tureen) have the Christ monogram IHS (*Iesus Hominum Salvator*) with the cross fixed above the H and abstracted nails below. The design was known around 1700 mainly from Catholic areas and was a decoration on ceramics manufactured in the Lower Rhine region. These are unusual finds in the Calvinist-dominated Northern Netherlands. The tureen is also like examples

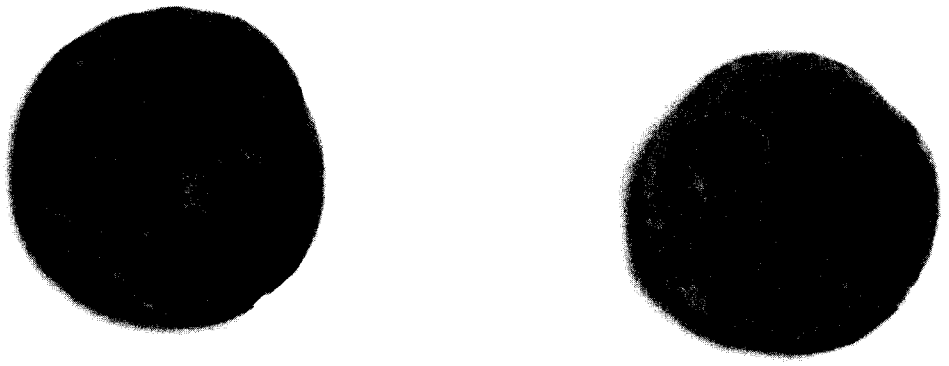

FIGURE 4. Two lead tokens were recovered from H 107 bearing numerical ciphers on one face (91 and 92) and on the other the City of Haarlem's coat of arms. The heraldry of a sword directly below a cross with two stars on each side originated during the Crusades. (Photo by R. Neyland.)

from the Lower Rhine region. The green glass bottle with its woven wicker sheath may have once contained mineral water and is of a type known to have been a luxury item exported from the southern provinces (Molen and Vreeken 1990). These bottles were commonly referred to as "French Bottles" during the 17th century. Also, a wooden handle from a brush has an identical parallel excavated from an archaeological site in Bruges dated to 1700.

Dating H 107

H 107's freighting career dates to the period around A.D. 1700. Dendrochronological analysis reveals that the oaks used to build the hull were felled between 1685 and 1693. The two lead tokens recovered from the wreck are proof that H 107 sank during or after 1692; one face of both depicts the city of Haarlem's coat of arms. The ciphers 91 and 92 appear on the tokens' obverses, apparently representing abbreviations of the dates 1691 and 1692 (Figure 4). These tokens may represent annual toll payments to Haarlem for lock and canal use.

A turn-of-the-century date is confirmed by the style and form of many other artifacts found with H 107. The ceramics, kaolin pipes, and compass have parallels from other archaeological sites dated to ca. 1700. The youngest artifact found is a tobacco pipe with a slightly ovoid bowl form, estimated to have been first manufactured ca. 1710 (Duco 1987). A short career for this vessel is also suggested by relatively few hull repairs or scars than an old hull would have had. Thus, H 107 appears to have been built early in the last decade of the 17th century and sank sometime between 1692 and 1710.

Preliminary Conclusions

The wreck location suggests a voyage along the northern route, perhaps to the cities of Kampen and Zwolle in Overijssel or farther north to Friesland and Groningen. Several Lower Rhine artifacts also indicate a possible involvement in the trade between the northern and southern regions. Peat shippers from Groningen and Friesland were known to travel as far south as Antwerp and other Flemish cities to sell their cargo. A relatively cheap and plentiful source of energy, peat fueled Dutch industries and was one of the principal bulk cargoes of inland freighters. Peat shipments to industrial cities also created opportunities for return cargoes of manufactured goods.

H 107's hull and artifact assemblage offer new insights into Dutch ship design and the

types of ceramics and material goods in daily use during the transition between the 17th and 18th centuries. It is also evident from preliminary analysis that H 107 can reveal a great deal about the nature of inter-regional trade between the Netherlands and neighboring areas at the close of the 17th century.

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Dependent Colonies: the Importation of Material Culture into the Australian Colonies (1788-1850)

Introduction

Great Britain established colonies in Australia during the late 18th and early 19th centuries by importing capital, goods, and people. During the early settlement, colonists were almost totally dependent upon shipping for their goods. Indeed, it can be argued that the capacity of countries like Great Britain to successfully invade and colonize was largely dependent on international trade, which provided familiar, appropriate food, drink, and material culture for the population transported to the colonies. In regard to the Virginia settlement, Isaac (1982:16) observed: "material reliance entailed also cultural and psychological dependence. With goods came tastes, standards and a whole set of assumptions about the proper ways of ordering life."

Regular and sustained importation of goods not only made colonial life comfortable; imported food, drink, and consumer goods made it possible. Geographically-isolated settlements such as the Australian colonies were the recipients of material culture not just from the core (Great Britain) but from a number of sources. In the Australian context, early colonies were quickly involved in extensive trade networks with India, South Africa, Asia, the Pacific islands, and North America.

Questions can be asked about the sources and types of alcohol, food, and consumer goods destined for the Australian colonies during the late 18th and early 19th centuries, and answers can be sought through examination of wrecked cargoes. This paper uses data obtained from two colonial-period shipwrecks excavated in Australia during the last 20 years. In 1797 the merchantman *Sydney Cove* wrecked on a voyage from Calcutta to the newly established British penal colony at Port Jackson (Australia) with a speculative cargo including rum, spirits, wine, leather goods, and ceramics (Strachan 1986; Nash 1991). *William Salthouse* wrecked in 1841 at the end of a voyage from Montreal to the recently-established colony at Melbourne (Staniforth and Vickery 1984).

The "consumer revolution" and the meanings attached to consumer goods are growing fields of interest, producing a number of important works in recent years (McKendrick et al. 1982; Appadurai 1986; McCracken 1988; Hodder 1989; Brewer and Porter 1993). If we consider generally the packaging of food, drink, and consumer goods, it has been suggested that "not all archaeological materials have been studied equally...objects made of wood and metal tend to receive less attention. As a result, the activities that they represent also receive less attention" (Miller et al. 1991:4). During the period under discussion, a majority of bulk packaging was organic, such as wooden casks, cases, boxes and chests, and hessian (sacks) and canvas (bags). Sometimes bulk packaging leaves limited oppor-

FIGURE 1. The head of a 300-lb tierce (cask) containing prime mess beef, inspected by W Moore at Montreal in October 1840. (Drawing by Geoff Hewitt.)

FIGURE 2. This style of "wine bottle" was made of light-green glass and contained a high alcohol (fortified) red wine, probably muscat. It was excavated from the 1841 wreck of *William Salthouse*.

tunities for the examination of the concepts of "luxury" or quality, as it tends to be utilitarian. However, it can be marked with labels that can be "read" by historians.

The information cut, branded, or stenciled on cask heads excavated from *William Salthouse* provide valuable information about a part of the cargo (Figure 1). Information about where and when the casks were inspected (Montreal, October 1840 or May/June 1841), by whom (W Watson or W Moore) and even the quality of the contents (Prime Mess—the 2nd best of four grades of pork as defined by Canadian law) can be derived (Staniforth 1987:25).

Moving from food to drink, as Douglas (1987:8) has suggested, the drinking of alcohol can at one level be seen as a form of ritual. Drinking was common in the early Australian colonies; even among the poorest elements of colonial society, alcohol use (or abuse, as the authorities called it) was widespread. From the 1788 beginning of the Port Jackson settlement, alcohol consumption was a cultural feature at all levels. Manning Clark, perhaps Australia's most famous historian, wrote that within days of their arrival, First Fleet convicts obtained a supply of rum and staged a "celebration" which one onlooker sternly condemned for its "scenes of debauchery and riot, which beggared description" (Clark 1962:88).

Bottles are ubiquitous on archaeological sites, but a majority are broken or empty. In order to understand their cultural context and meaning, it is necessary to look beyond the manufacturing technology, dimensions, shape and degree of variability in the shape or dimensions—in other words, the standard typology. It is also necessary to establish an approximate date of use, although this can be difficult or impossible given the incidence of "vintage" wines bottled many years before consumption or reused later. These issues have occupied archaeologists and others for years and have resulted in some excellent bottle catalogues and typologies (Boow 1991; Jones et al. 1985). However, as Miller has pointed out (1982:23), the categorization of bottles and terminology used to describe them has often been based upon assumptions about the contents—wine bottle, beer bottle, and champagne bottle are clear examples. To avoid projecting "present" categories onto "past" bottles, we need to establish better data about their actual contents. Scientific analysis of these contents from wreck sites can tell us about the type of contents, their quality, ingredients, adulteration, and alcohol content.

Sometimes the scientific evidence is at odds with the available historical record. For example, two distinct forms of "wine bottle" were found on the *William Salthouse* wreck. Analysis revealed that one type contained a high-alcohol red wine—probably a fortified wine of some kind (Figure 2). In addition, a packing case fragment with "muscat" written on it was found. However, the inbound cargo manifest reported in the Melbourne newspaper listed only one wine type—5 cases of sauterne (*Port Phillip Herald*

1841). Recent research in Canada has found that the outbound cargo manifest from Montreal listed 5 cases of muscat in addition to the 5 cases of sauterne (*Montreal Gazette* 1841). Here the historical record subsequently confirmed the archaeological evidence.

In the case of *Sydney Cove* there are nearly 1,000 bottles—mostly broken, but some intact with contents. One of the questions under investigation is whether the "rum" listed in the historical record was actually rum (made from sugar cane) or arrack (made from palm sugar). East India rum and arrack were both produced in Bengal during the late 18th century. Unfortunately, the rum aboard *Sydney Cove* was carried in casks and all the bottle contents analyzed to date contained wine, not distilled spirits. This study is at an early stage, however, and more data may be obtained in the future from more *Sydney Cove* samples.

Ceramics

Ceramics are often used by archaeologists to look at questions related to technological change in a society, but there is now a greater concentration on what can be learned about the acquisition, retention, and loss of ceramic materials and the processes of consumption. One of the problems Miller has articulated for terrestrial sites is the difficulty in separating the archaeological assemblages into "meaningful time components"—one of the strengths of shipwrecks. He suggests that one useful historical source is business records, while acknowledging that the poor level of descriptive detail has made it difficult "to tie record entries...to specific ceramic types and patterns" (Miller 1984:2). Newspapers are the principal source of Australian manifest information for the pre-1850 period; unfortunately these sources rarely contain precise information about ceramic type, form, decoration, or quality. Newspaper manifests tend to artificially "democratize" 20th-century perceptions of the material culture available during the late 18th and early 19th centuries to the point where it is difficult to know the type, form, or quality of the material being imported and therefore for whom it was intended.

In recent years, excavation of the *Sydney Cove* wreck has revealed the remains of a shipment of Chinese export porcelain (Nash 1991: 45). There is little historical information for the quantity, quality, or source of this cargo, except for brief comments indicating that three cases of "Chinaware" were salvaged and transferred to Sydney, where a single cup and saucer sold for 22 shillings (Strachan 1986:74).

Archaeologists are always interested in the function of an object—a subject which can result in endless argument. There appear to be three functional groups represented in the Chinese export porcelain in the *Sydney Cove* cargo—tea ware (tea cups and saucers), dinnerware (plates and hot water plates), and toiletry ware (chamber pots, washing water bottles, and bowls). Within these groups there are examples (such as the chamber pot) where the form clearly reveals

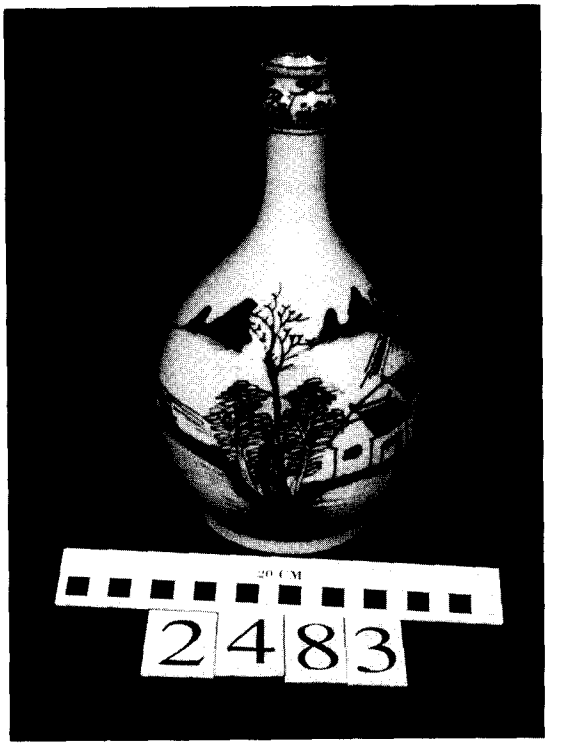

FIGURE 3. Underglaze blue-painted Chinese export porcelain washing water bottle excavated from the 1797 wreck of *Sydney Cove*.

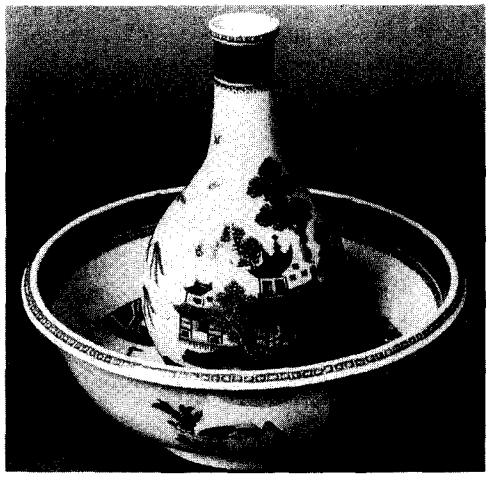

FIGURE 4. Underglaze blue-painted Chinese export porcelain washing water bottle and matching bowl, ca. 1775-1785, held in the Lewis Collection at the National Museum of American History, Smithsonian Institution (Detweiler 1982).

function. However, in some cases the form may have a less obvious function, such as a globular vessel with a long slender neck variously described in the literature as a flask, bottle, vase, ewer, pitcher, or gugglet/guglet (Figure 3). Generally, this form contained liquid, but it is impossible to know precisely how every example would have been used at its final destination. The key point is that there are three possible functions for this form, depending on how the archaeologist chooses to describe or categorize it.

These are as a container for:

(1) Decorative purposes. This form has been described as a vase, implying that it contained flowers or served a decorative function. This is a common attribution made by art historians and museum curators today. It is for their decorative qualities that such pieces are valued, collected, and kept today—they need not have functional utility. Art museums or galleries in particular describe these objects in terms with which they are most familiar but which can obscure an object's original function. This is a clear example of how usage (and therefore meaning) changes over time.

(2) Drinking water. As a flask, bottle or pitcher for drinking water. Certainly this is a distinct possibility for the function of this particular form, but it is less likely than the next option.

3) Washing water. As a bottle, ewer or gugglet of washing water, this form was part of a toiletry set with four pieces: the washing water bottle with a chamber pot, matching chamber pot lid, and washing bowl. This is the likeliest intended use of this particular form.

First is the evidence of the actual decorative motifs and patterns on this form, the chamber pot and its lid, which all share the same decorative elements. Consequently it can be argued that these objects formed a set to be sold as a group. Secondly, there is comparative evidence from similar Chinese export porcelain, such as the matching water bottle and a washing bowl (Figure 4). Thirdly, similar bottles have been excavated from the Hoff store site in California, which Terrey and Pastron (1990:78-80) have classified as part of a toiletry set containing similar chamber pots and chamber pot lids. Finally is the question of quality, which varied in Chinese export porcelain. What quality was the porcelain being imported into Port Jackson and what does this say about socio-economic status in the colonies? Such questions relate to attitudes and taste, for in addition to its functional utility, porcelain can also be both a symbol and a medium of communication. At present this study is in an early stage, so any comments must be tentative.

Some ceramic historians have attempted to link decoration or pattern with quality judgments (Mudge 1986:209-211). It is clear from the *Sydney Cove* collection that the patterns and border decorations varied only in a loose association with the quality of the ceramic. This relationship was not absolute, and significant variation appears possible. One alternative suggestion is that the quality of the piece is more closely related to the variety in form rather than the differences in decoration suggested by Mudge. The finest-quality pieces in terms of the white-

ness of the porcelain, clarity of the glaze, clarity and care with which the piece was painted also appear to be the smallest and most delicate (tea cups and saucers). On the other hand, those pieces with a gray porcelain body, bluish/gray glaze, the most impurities in the body and glaze, and poor or indistinct paint are also the largest and most robust (chamber pots and warming plates). Consequently, it is difficult to compare tea cups with chamber pots and make any conclusions about quality.

Certainly there were quality differences recognized at the time. This is clear from the notebook of an anonymous American trader at Canton in 1797, who refers to porcelain as being of "common" or "best" quality. He also indicates prices and that pieces could be sold in sets—for example, a "common" tea set of 43 pieces cost $1.75 to $2.50 while a "Best Nankin" blue and white tea set with gilt edging of 45 pieces cost $5.00 (Mudge 1962:256-260). Unfortunately, it is impossible to know whether the *Sydney Cove* tea cups and saucers were "common" or "best," but it is clear that within this shipment some cups and saucers are better quality than others.

Conclusion

The study of the cargoes of wrecks like *Sydney Cove* and *William Salthouse* provide an opportunity to look in detail at cargoes which did not reach their destination. By extension to the many other cargoes which did arrive in the Australian colonies at the time, and by comparing what has been found on terrestrial sites, it may be possible to better appreciate the ways in which socio-economic status was established, communicated, and maintained in the early Australian colonies.

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The National Park Service Archeological Assistance Program and Submerged Cultural Resources Protection

Introduction

Preservation and protection of America's archaeological heritage are important responsibilities of the federal government. Federal historic preservation laws ascribe leadership and coordination functions to the Secretary of the Interior to accomplish important preservation and protection goals. These functions include providing programmatic assistance, technical information, guidelines, and regulations for archaeological programs; the Departmental Consulting Archeologist (DCA) is charged directly with developing ways to meet these responsibilities. The work of the DCA is undertaken through the Archeological Assistance Program (AAP) of the National Park Service (NPS). The responsibilities of the Secretary in the Abandoned Shipwreck Act (ASA) are delegated to the DCA, and this presentation is about the current efforts being undertaken.

The AAP is located in the NPS Washington Office and in five regional offices. These five regional offices (Philadelphia, Atlanta, Denver, San Francisco, and Anchorage) also manage the interagency historic preservation activities, which various statutes require of the Secretary of the Interior and which are collectively called the NPS National Register Programs. AAP is part of these. While each of these offices provides programmatic and project technical assistance and guidance in archaeological preservation, other regional offices and units also are important sources. In submerged cultural resources it is impossible to overestimate the contributions made by the Submerged Cultural Resources Unit (SCRU) at the Southwest Regional Office in Santa Fe. Another resource is the National Maritime Initiative, a program in the NPS History Division, and the AAP works closely with them to ensure effective coordination.

This presentation addresses resource protection and directions for developing programmatic partnerships for effective submerged cultural resources preservation. We present these issues because an analysis of the growing state underwater preservation programs since passage of the ASA shows a need for nationwide initiatives and activities promoting protection through cooperation.

The Abandoned Shipwreck Act

The ASA of 1987 (43 USC 2101-2106) deals with shipwrecks and associated cargo abandoned by their owners and embedded in submerged lands of the various states. It also applies to non-embedded abandoned wrecks both lying in state-controlled waters and listed, or eligible for listing, in the National Register of Historic Places (NRHP). According to the ASA, these ownerless wrecks, including historic ones, became U.S. property when Congress used its sovereign power and acquired title to them. Title was then transferred to states in whose waters the wrecks lie. If a wreck is "abandoned," admiralty law governing salvage and finds cannot wrest title from the state.

To encourage states and federal agencies to comply with their responsibilities of managing wrecks and their associated resources, Section 5 of the ASA ordered the Secretary of the Interior to prepare non-binding management guidelines through the NPS. By comparing their programs with ASA guidelines, state and federal agencies could then evaluate the extent to which they were carrying out their responsibilities. They also could develop legislation, regulations, and other management programs to meet those responsibilities. The Archeological Assistance Division (AAD) began work on the guidelines by conducting a 1988 survey of state programs currently protecting and regulating submerged cultural resources, in order to elicit suggestions.

Surveys of State Submerged Cultural Resources Programs	AL	AK	AZ	AR	CA	CO	CT	DE	FL	GA	HI	IL	IN	IA	KS	KY	LA	ME	MD	MA	MI	MN	MS	MO
1988 survey		N	N												N									
State has an established program (20)					*			*	*	*			*				*	*	*	*	*			
State laws or regulations manage wrecks (27)	*			*	*			*	*	*	*	*	*				*	*	*	*	*		*	
Considering new laws or regs. (19)	*				*	*	*	*			*	*	*						*		*	*		*
Program differentiates between historic and non-historic wrecks (18)					*		?		*	*	*		*	?		?	*		*	*	*			?
Hist. Pres. plan includes wrecks (22)					*		*	*	*	*	?	*	*	*			*	*	*	*	*			
State uses NRHP definition of "historic" (12)	*			*	*		*	*	*		*		*	*		?	*	*			*		*	?
If not NRHP definition, do laws or regulations define "historic" (12)					*		?			*	*	*						*	*	*		?		?
States use Historic Preservation Fund money for the program (21)	*				*		*		*	*			*	*		*	*	*			*		?	
Underwater archeologists hired (17)							?		*			*	*				*	*	*	*				
State regulates scientific res. (31)	*				*		?	*	*	*	*	*	*				*	*	*	*	*	*	*	
State retains title to artifacts and materials from scientific studies (25)	*			*			?		*	*	?	*	*				*	*			*	*		
Archeologist required to conserve artifacts and materials (28)	*			*	*		?	*		*	*		*					*	*	*	*	*		
St. access to conservation facil. (16)				*	*		?	*	*			*	*				*					*		
State provides access to sport divers for recreational exploration (23)					*		?	*	*	*	?		*					*	*	*	*		*	
Sport diver access restricted (15)					*		?	*		*		*	*	*			?	*	*	*				
Sport divers prohibited from removing artifacts (20)	*				*		?		*				*				*		*	*	*			
Sport divers given incentives to report shipwrecks (5)							?					*												?
State encourages sport diver volunteers for excavation (20)	?								*	*		*	*				*	*	*	*	*			

FIGURE 1. 1988 Survey, Alaska to Missouri.

Analysis of State Programs

The AAP undertook two surveys to determine the nature and extent of state programs to preserve submerged cultural resources. The first took place in 1988 as part of the effort to develop ASA guidelines. The second was in 1992 to evaluate progress made since guidelines completion.

According to the 1988 survey (Figures 1–4), 27 states said they had a statute or regulation protecting submerged cultural resources. In many of these states, shipwrecks were simply part of the definition of archaeological resources, or the definition of an archaeological site mentioned water as well as land controlled by the state. Several states used salvage laws to protect historic wrecks. A few states (such as Illinois and Minnesota) said that while their laws did not specifically mention submerged cultural resources, they believed that if an incident occurred, the laws concerning salvage or historic preservation could be used to protect submerged resources. Nineteen states said that they were considering new laws or regulations soon, and six of those did not have protection.

Most of the statutes or regulations in effect in 1988 were passed before the ASA. Some contained ideas incorporated into the ASA, such as states claiming ownership of submerged resources; however, the vast majority only contained the mechanics of a permitting process, and most did not contain penalties for disturbing the resources. Eighteen states said that their programs differentiated between historic and nonhistoric wrecks. Some states did not differentiate because their statutes described the process of permitting salvage without discussing the age of the wreck.

Twenty states said that they had established programs to protect submerged cultural resources. Many stated that they had a program but limited staff and funding, or had planned programs but were unable to get enough funding to begin. Several states commented that they had no program because their resources were undisturbed. In coastless Iowa, for instance, there was so little salvage that the issue did not arise. Oregon said that their waters were so deep and cold that they had no problems until the late 1980s, when salvage began.

Twenty-two states said that their Historic Preservation Plan included shipwrecks, and 21 said they were using Historic Preservation Fund (HPF) money for preserving shipwrecks. However, this money was being used on a project-by-project basis to protect individual sites rather than to fund a continuing program. Several others said that they knew HPF money could be used for that purpose but had not done so.

Twenty-three states provided sportdiver access, 15 restricted access, and 20 prohibited artifact removal. Only five provided incentives to report wrecks, and only three gave diver training courses in archaeology, none of which led to certification. Six said that they regulated fishing around wrecks, but none prohibited it. Nineteen educated the public about the many values of historic shipwrecks. The 1988 survey clearly showed that submerged cultural resource programs were scattered and varied greatly. While many states had statutes, often they were not specific to submerged cultural resources.

1992 National Park Service Survey

In 1992, after the guidelines were written, the AAD sent out another survey to gauge state reactions to both the ASA and guidelines (Figures 2 and 4). Reactions varied widely, depending on such factors as existing programs and funding. Nine states said that they had laws or regulations pursuant to the ASA specifically covering submerged resources; for instance, South Carolina's Underwater Antiquities Act was passed in 1991. While several of these laws showed ASA influence, claiming submerged lands as state property and establishing permitting, few went much further. At the time of the 1992 survey, four states (Alabama, Indiana, Ohio, and Wisconsin) had passed laws reflecting the guidelines.

Twelve states said they ran programs that specifically protected submerged resources, and seven others had other programs that protected these resources. Fifteen said they had other programs. These other programs included the review

Surveys of State Submerged Cultural Resources Programs	AL	AK	AZ	AR	CA	CO	CT	DE	FL	GA	HI	IL	IN	IA	KS	KY	LA	ME	MD	MA	MI	MN	MS	MO
State gives training courses on archeological methods to divers (3)													*											
Courses lead to certification (0)		?			?				?	?							?		?				?	
State manages underwater trails (3)				*																*				
State manages underwater parks to preserve and protect wrecks (7)					*				*	*		*									*			
State educates the public on value of historic shipwrecks (19)							*	*	*	*			*				*			*	*	*	*	
Fishing near wrecks regulated (6)					*		*	*		?														
Commercial fishing prohibited near abandoned historic shipwrecks (0)		?								?								?			?		?	
Fishing restricted, not prohibited (1)		?								?		*												
State regulates commercial salvage of abandoned shipwrecks (20)	*			*	*		*	*	*	*			*				*	*	*	*	*	*	*	*
If not prohibited, restrictions placed on the commercial salvage of abandoned historic shipwrecks (7)							*					*						*			*			
State retains ownership of artifacts recovered by commercial salvors from abandoned hist. shipwrecks (20)	*			*	*		*	*	*	*							*		*	*	*	*	*	
What percentage?	100			100				25	20											25				
State law/regulation specifies % (6)																				*		*		
1992 survey					N									N		N							N	N
State laws or regulations to manage historic shipwrecks (9)										*		*	*					*	*					
State has an established program (12)							*		*			*						*	*	*	*	*		
Other State programs that protect submerged cultural resources (15)	*								*	*	*	*	?						*	*	*	*		
Is there a State contact person? (28)	*	*		*			*	*	*	*	*	*	?					*	*	*	*	*		

FIGURE 2. 1988 and 1992 Surveys, Alaska to Missouri.

process from Section 106 of the National Historic Preservation Act and similar state review processes. Only eight states that said they had established programs in 1988 claimed they had them in 1992. While there is less statistical information available for 1992, survey narratives showed that changes in state programs had begun. Many states took the parts of the guidelines that fit best and began implementation from within existing programs.

A number of states began Phase I surveys of their waters after the 1988 survey (Florida and Tennessee), and others (West Virginia and Ohio) planned to inventory known resources. Tennessee also was one of several states that had written a management plan after 1988 specifically for submerged resources; several more said that such a plan was in preparation and only awaited resource inventories.

By 1992, many states had begun newsletters, lectures, and other outreach programs aimed at divers and other interested parties. Another major advance was the designation of underwater preserves and parks, begun in several states after the ASA. In 1988 many states said they had no programs or staff, but by 1992 several of them had begun to develop their programs, although in many cases they still had funding difficulties. While difficult to measure in statistical terms, this activity indicates that the ASA and *Guidelines* have had a significant impact on state work since 1988 to protect submerged resources.

Resource Protection

The ASA *Guidelines* (55 *Fed. Reg.* 50, 116 [1990]) were prepared by the NPS to help state and federal agencies develop shipwreck management programs. Protection is a basic part of any cultural resources management program, and it requires effective law enforcement. Analysis of state programs indicates that effective protection is an important goal nationwide. Protection and preservation of the cultural record requires interagency and interdisciplinary cooperation. Cultural resource managers, archaeologists, attorneys and law enforcement personnel must utilize the full range of applicable law in criminal, civil, or administrative contexts.

In the federal context, several statutes protect various classes of cultural resources, including submerged ones. These laws include the ASA, the Archaeological Resources Protection Act (ARPA; 16 USC 470aa-mm), the Marine Protection, Research, and Sanctuaries Act (16 USC 1431-1445a), and the Antiquities Act (16 USC 431-433). In addition, other criminal and civil statutes can be used to prosecute violations, such as the theft of government property statute (18 USC 641), the depredation of government property statute (18 USC 1361), the conspiracy to commit offense or defraud the United States statute (18 USC 371), and the abandoned property statute (40 USC 310).

Statutes promoting cultural resources protection at the state level vary widely in the areas of scope, construction, penalties, and enforcement. States have different ways of addressing protection issues or defining types of offenses, and often enforcement authority is spread among several agencies. States also have both specific and general statutes applicable to cultural resources (including submerged).

In 1995 the AAD will publish a monograph in its *Archeological Assistance Study* series entitled *A Survey of State Statutes Promoting Archeological Resources Protection.* This survey by attorney Carol Carnett summarizes specific resource protection and enforcement laws, lists indexing categories to locate the laws in each state code, provides citations to each state's laws, and discusses several legal cases. In addition to law enforcement guidance, this survey will allow states to compare easily their law enforcement programs with others. Review of several federal and state cases demonstrates the broad range of law enforcement options available to protect submerged cultural resources. It also underscores the need for effective interagency cooperation and creative legal strategies to protect submerged cultural resources.

In the 1994 case *Zych v. Unidentified, Wrecked and Abandoned Vessel* (19 F.3d 1136 7th Cir. 1994), *aff'g* 811 F. Supp. 1300 (ND Ill.

Surveys of State Submerged Cultural Resources Programs	MT	NE	NV	NH	NJ	NM	NY	NC	OH	OR	PA	RI	SC	SD	TN	TX	UT	VT	VA	WA	WV	WI	WY
1988 survey	N																				N		
State has an established program				*			*	*		*		*	*			*		*	*	*			
State laws or regs to manage wrecks				*			*	*		*	*	*	*			*		*	*	*		*	
Considering new laws or regulations					*				*		*		*					*		*		*	
Program differentiates between historic and non-historic wrecks		?	?	*	?	?	*		*	*	*		*	?	?	*			*	*		?	?
Hist. Pres. plan includes wrecks					*		*	*			*	*	*					*	*	*			
State uses NRHP definition of "historic"			*	*	*		*	?	*	?	*	*							*	*		*	
If not NRHP definition, do laws or regulations define "historic"				?		*	?	?		*		?	*			*		*		?		?	
States use Historic Preservation Fund money for the program				*	*			*	*	*	*	*	*			*		*				?	
Underwater archeologists employed				*		?		*			*	*	*			*		*	*	*		*	
State regulates scientific research				*	*	?	*	*	*	*	*	*	*		*	*	*	*	*	*		*	
State retains title to artifacts and materials from scientific studies				*	*	?	*	*	*	*	*	*	*		*	*	*	*	*			*	
Archeologist required to conserve artifacts and materials			*	*	*	?	*	*	*	*	*	*	*			*	*	*	*	*		*	
State access to conservation facilities				*		?		*			*		*			*	*		*	*			
State provides access to sport divers for recreational exploration				*	*	?	*	*		?	*	*	*		*	*		*	*	*		*	
Restrictions placed on sport diver access						?	*						*			*		*	*	*			
Sport divers prohibited from removing artifacts			*	*	?	?	*		*	*		*			*	*		*	*	*		*	
Sport divers given incentives to report shipwrecks				*	?	?					*							*		*			
State encourages sport diver volunteers for excavation				*	*	?	*	*				*	*			*		*	*	*		*	

FIGURE 3. 1988 Survey, Montana to Wyoming.

[1992]), the U.S. Court of Appeals for the Seventh Circuit upheld the ASA's constitutionality in a case involving a wreck believed to be *Seabird*, which sank in Lake Michigan north of Chicago in 1868. The Court had to decide whether Congress's exclusion of the admiralty laws of salvage and finds from the ASA meant that it had excluded a matter clearly falling within admiralty law. If so, Congress would have exceeded an implied grant of power to revise and supplement maritime law under its Article III powers, and the ASA would be unconstitutional.

The Court held that the ASA has no effect on the law of salvage because salvage does not apply to abandoned shipwrecks. Indeed, the law of finds does apply to abandoned shipwrecks, generally as "finders-keepers." However, an exception to the rule provides that abandoned property embedded in the land belongs to the landowner. Therefore, shipwrecks embedded in the submerged lands of a state belong to it under the embeddedness doctrine, regardless of the ASA. Consequently, Congress did not impermissibly exclude the law of finds when it passed the ASA.

Following the 1994 *Zych* opinion, the U.S. District Court for the District of the Virgin Islands also upheld the ASA's constitutionality. The case *Sunken Treasure, Inc. v. Unidentified, Wrecked, and Abandoned Vessel* (857 F. Supp. 1129 [DVI 1994]) involved a Columbus-period wreck in a National Historical Park in U.S. Virgin Islands waters. The Court extensively cited the lower court *Zych* opinion in reasoning that even without the ASA, the wreck would belong to the U.S. Virgin Islands. Thus, even though the ASA allows each state to develop its own rules governing its wrecks, it does not unconstitutionally introduce non-uniformity into admiralty law. The District Court also agreed with the lower court in *Zych* that the ASA does not violate the Due Process Clause of the Constitution's Fifth Amendment. The ASA's inclusion of *all* "embedded" abandoned wrecks is reasonably related to a legitimate government objective of preserving "historic" shipwrecks. Moreover, the ASA is as narrowly tailored as possible. Its embeddedness and abandonment requirements sufficiently narrow the law's scope, while its inclusion of all similarly situated wrecks ensures the protection of historically significant wrecks whose locations are presently unknown.

Borrowing ASA language, the Court concluded by exhorting the Virgin Islands government to fulfill its public trust responsibilities under that statute. It wrote: "in order to facilitate 'the protection of historical values and environmental integrity' relating to the defendant vessel and others like it...[the Virgin Islands government] would be well advised to carry out its congressionally-declared responsibility to manage its 'nonliving resources in (its) waters and submerged lands' by creating appropriate legislative procedures."

In 1993, the U.S. Attorney for the Eastern District of Virginia successfully prosecuted four people—two watermen and two private collectors—who pled guilty to interstate trafficking in archaeological resources looted from two Civil-War-era shipwrecks in violation of Virginia law and the ARPA. USS *Cumberland* and CSS *Florida* are both U.S. Navy property and Virginia historic landmarks; *Cumberland* is also a war grave. During the 1980s and early 1990s, the watermen dredged artifacts from the two shipwrecks. They also provided brass and copper spikes from *Florida* to the two collectors, who melted them down for belt buckles and advertised them for sale in the *North South Trader*, a national Civil War collectors' magazine.

Officers of the Confederate Naval Historical Society (CNHS), a private, non-profit association, informed the FBI that *Florida* remains were being trafficked interstate. That information led to the recovery of some of the artifacts from the collectors and was incorporated into their prosecutions. The cases resulted in criminal convictions for violations of ARPA, the payment of $1,500 in restitution, and $1,000 in fines.

The NPS, in partnership with the Departments of Justice and the Navy, obtained a reward from those fines pursuant to ARPA's reward provision and presented it to the CNHS during a day-long public program hosted by the Hampton Roads Naval Museum and Nauticus

Surveys of State Submerged Cultural Resources Programs	MT	NE	NV	NH	NJ	NM	NY	NC	OH	OR	PA	RI	SC	SD	TN	TX	UT	VT	VA	WA	WV	WI	WY
State gives training courses on archeological methods to divers				*		?					*												
Courses lead to certification						?	?				?	?										?	
State manages underwater trails						?														*			
State manages underwater parks to preserve and protect wrecks						?							*					*					
State educates the public on value of historic shipwrecks				*		?	*	*					*			*		*	*	*		*	
State regulates fishing near wrecks					*	?					*				*							?	
Commercial fishing prohibited near abandoned historic shipwrecks				?	?		?		?		?	?										?	
If not prohibited, fishing restricted		?			?		?				?											?	
State regulates commercial salvage of abandoned shipwrecks				*	*		*	*	?	*		*	*			*		*	*	*		*	
If not prohibited, restrictions placed on the commercial salvage of abandoned historic shipwrecks					*											*		*					
State retains ownership of artifacts recovered by commercial salvors from abandoned historic shipwrecks				*			*	*		*			*						*	*			
What percentage?				25				25					50		100							?	?
State law/regulation specifies %				*	?								*					*		*			
1992 survey			N		N	N							N			N	N	N					
State laws or regs manage historic wrecks								*	*											*		*	
State has an established program				*				*				*										*	
Other State programs that protect submerged cultural resources	*			*			*								*				*			*	
Is there a State contact person?				*			*	*	*	*	*	*		*	*				*	*	*	*	

FIGURE 4. 1988 and 1992 Surveys, Montana to Wyoming.

National Maritime Center in Norfolk, Virginia. The program recognized significant events for the preservation of maritime heritage and served as a forum for the Navy to present its policy for the protection of historic ship and aircraft wrecks. By incorporating ARPA rewards into resource management, law enforcement, and prosecutorial strategies, agencies can raise public awareness of the looting problem, reward good citizen stewards who have assisted in resource protection, and realize the deterrent effect of their casework.

Successful use of administrative penalties to penalize looters is illustrated by a case in which the National Oceanic and Atmospheric Administration (NOAA) seized a boat and assessed $132,000 in civil penalties against the operator and several divers. The divers had removed artifacts from three shipwrecks in the Channel Islands National Marine Sanctuary and used hammers and chisels to excavate the seabed around one of them. These activities violated regulations NOAA had promulgated pursuant to the Marine Protection, Research, and Sanctuaries Act. The regulations (15 CFR 935.6 & 935.7) prohibit activities that might adversely affect marine sanctuary resources; one section prohibits removing or damaging any historical or cultural resource (15 CFR 935.7(a)(5)). Another section prohibits dredging or otherwise altering the seabed other than to anchor vessels or bottom-trawl from a commercial fishing vessel (15 CFR 935.7(a)(2)(iii)). Only civil penalties apply for violation of these regulations.

In the Channel Islands case, some of the violators were assessed penalties under one or the other section and others were cited under both regulations. Following an administrative hearing involving seven of the violators, the Administrative Law Judge concluded that the divers' activities were prohibited under both of the regulations in question and recommended assessment of the penalties sought by NOAA (6 ORW 150 [NOAA 1990]), *discretionary review denied*, 6 ORW 687 (NOAA App. 1992)). Three of the violators later argued that the NOAA regulation on dredging or altering the seabed within the Sanctuary was unconstitutionally broad and vague as applied to them. The U.S. Court of Appeals for the Ninth Circuit rejected those challenges and upheld the regulation's constitutionality (*Craft v. National Park Service*, 34 F.3d 918 [9th Cir. 1994]).

A shipwreck which is not "abandoned" does not fall under the ASA. It remains the property of its owner and can be acquired by the government only for a public purpose and after payment of fair market value. Without title or an ownership interest, government protection of historic shipwrecks is more limited but not necessarily precluded, as the *Lathrop* case suggests. *Lathrop v. Unidentified, Wrecked and Abandoned Vessel* and *State of Florida v. Lathrop* (817 F. Supp. 957 [M.D.Fla. 1993]) are two consolidated cases involving an alleged unidentified shipwreck lying within the waters of Canaveral National Seashore. When the action arose, Congress had already passed the ASA but it had not become law. In 1988, a U.S. District Court in Florida, refusing to apply the embeddedness doctrine, used the law of maritime salvage to grant Lathrop possession of what he believed was a sunken 18th-century Spanish galleon and its cargo located in the lands of Canaveral National Seashore. Those lands had been set aside by Florida to establish the national park.

To protect the historic values associated with this type of wreck, Florida required Lathrop to obtain a permit. He applied to the Florida Division of Historical Resources for the permit, but the state archeologist and Chief of the Bureau of Archaeological Research denied it because recovery activities would be inconsistent with an agreement between the State and the NPS relating to marine environmental management at Canaveral National Seashore.

Additionally, in 1991, the U.S. Army Corps of Engineers took the position that Lathrop must comply with the Rivers and Harbors Act (33 USC 403) and obtain a Corps permit before dredging in navigable waters subject to their jurisdiction. The NPS took an analogous position, asserting that Lathrop needed an Antiquities Act permit prior to recovery. The Antiquities Act

requires anyone excavating antiquities situated on land owned or controlled by the federal government to obtain a permit from the government agency with jurisdiction.

In 1992, after both Florida and the Corps denied his permit request, Lathrop filed a Motion for Preliminary and Permanent Injunction to prevent the U.S. from requiring him to obtain a permit. In 1993, the U.S. District Court for the Middle District of Florida denied Lathrop's motion. The Court held that the Rivers and Harbors Act and Antiquities Act merely restrict the manner in which a potential salvor can excavate property located on federally owned or managed lands. They do not conflict with the underlying principle of salvage, developed to offer seamen observing cargo in immediate marine peril an economic incentive to undertake rescue efforts. Neither do these laws exceed the constitutional limits on Congress's power to supplement or alter admiralty law. Indeed, it is Congress's job to determine the lawfulness of certain salvage activities and impose necessary restrictions on them through appropriate legislation. The Court held that a salvor must acquire possession of abandoned property lawfully in order to establish a valid salvage claim. Because Lathrop could not obtain a permit from the U.S., he could not lawfully possess the alleged shipwreck. Thus Lathrop would not be able to prevail on his salvage claim.

Prosecution of four looters by the State of Florida, although it involved land-based excavation and looting, is important for two reasons. First, the case focused on organized looting and commercial trafficking in archaeological resources. Second, it demonstrated how general statutes may be used effectively to prosecute archaeological and cultural resource violations.

In 1992, the State Attorney for the Twentieth Judicial Circuit of Florida used the state's "organized crime" statute to charge four people with racketeering conspiracy under Florida's Racketeer Influenced and Corrupt Organizations Act (RICO), as well as with criminal mischief and grand theft. The four were charged with looting and destroying seven state- and federally-owned sites in three counties over a period of ten years. Three of the looters had actually worked together for almost 30 years, during which they looted and destroyed over 20 sites.

The case (*State v. Hudson, Smitt, Webb, and Williams*, No. 92-1757CF [20th Cir. Ct., Fla. 1993]) was the culmination of an intensive joint investigation by the Florida Department of Natural Resources, the Florida State Parks Service, the Florida Department of State's Bureau of Archaeological Research, and the NPS, in cooperation with the State Attorney's Office. The statute of limitations would have barred prosecution of the looters for most of their activities had those acts been viewed separately and in isolation. However, in 1991 they were apprehended while digging illegally at Cayo Costa State Park. Subsequent investigation revealed that the digging was part of an enterprise to loot historical sites in search of buried treasure. The State Attorney then linked the group's earlier activities to the 1991 violation and used the otherwise time-barred offenses to charge the RICO offense.

Developing Programmatic Partnerships

All of these cases show that submerged cultural resources programs will be effective in preserving and protecting the nation's non-renewable underwater cultural heritage. They also demonstrate that a combination of interests is essential. Coordinated policy development, particularly to implement the ASA *Guidelines* and to nominate resources to the NRHP and as National Historic Landmarks, is important for organizing partnerships capable of providing protection and can serve to fund state programs cooperatively.

Shipwrecks have traditionally been nominated to the NRHP only under criterion D, which states that they must yield or be likely to yield information important to history. However, wrecks can also qualify under other criteria by having a famous captain, crew, or passenger; by having been associated with events important in American history or by representing a type of construction or a specific period in history. Shipwrecks can be listed on the NRHP as either structures (if substantially intact) or as archaeological sites (if scattered). Much of the back-

ground research required for a nomination may already have been done by local historical societies or other agencies, and partnerships with these organizations will enable work to proceed more quickly. However, if pieces have been scavenged, salvaged or otherwise removed, a wreck may lack integrity and no longer qualify for NRHP listing.

An excellent example of a protection partnership is the effort undertaken through the Great Lakes Regional Conference on Underwater Cultural Resources. The conference brought together all of the constituencies with interests in submerged resources, including sportdivers, museum professionals, archaeologists, and governmental agencies. These groups then discussed past submerged resource protection in the Great Lakes region. The conference is developing regional guidelines and standards that the eight states and the Province of Ontario can use to identify management objectives, workplan priorities, and decision-making processes. This policy development helps focus efficient use of available staff and funds and clarify the public benefit of specific projects and activities.

Funding state underwater programs is also a function of sound partnership cooperation, which often means that agencies need to find appropriate ways to participate in each others' programs. Currently available funding sources, such as grants and loans through the state-administered HPF, Coastal Zone Management, and National Trust for Historic Preservation, are well known. The new National Maritime Heritage Act will provide grants for both preservation and education. Additionally, effective enforcement of environmental and conservation regulations has provided programmatic funding where remediation was needed to overcome significant and widespread negative impacts. Examples include response to emergencies subject to the Oil Pollution Act and its regulations and coordinated enforcement of the NOAA National Marine Sanctuary regulations. Finally, ASA Section 4(b) authorizes the HPF to be available for management of underwater parks and preserves, including "the study, interpretation, protection, and preservation of historic shipwrecks and properties."

The efforts of state programs and ASA implementation are having a significant impact on submerged cultural resource preservation. The effects are clear, and public benefits have been realized particularly in the areas of protection and public education. State submerged cultural resources programs are now more established and clearly focused. There is a growing body of case law upholding the authorities and responsibilities of federal and state agencies to preserve underwater cultural heritage in the public interest, and there also is a range of funding sources available. Effective, cooperative partnerships in which federal, state and local agencies provide leadership and coordination are the most important goals for the future.

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Impacts on Underwater Cultural Resources: Diagnosing Change and Prescribing Solutions

Introduction

The purpose of this paper is to identify and discuss relevant impact assessment concepts from different management and research fields, as applied to underwater cultural resources. The authors intend to synthesize these concepts and feedback from archaeologists into an article to be submitted in the discipline of park, recreation, and tourism resources. This approach was chosen to enhance communications among fields concerned with impact assessment and public resource management. The type of underwater cultural resource emphasized within this paper is historic shipwrecks, because of (1) increased interest in shipwrecks among different stakeholders, (2) growing recognition of economic benefits associated with shipwrecks, and (3) concerns about "appropriate" types and levels of use of these public resources.

Shipwrecks as Exhaustible Resources

Shipwrecks are commonly classified as unique non-renewable resources. Resource economists prefer the term *exhaustible resources* to non-renewable. Exhaustible resources are a class of non-produced goods or primary commodities that provide a finite sum of *services* and resulting benefits over time (Dasgupta and Heal 1979: 153). This definition (and related mathematical models) incorporate concepts of property rights, intergenerational values, efficiency, and equity. Intergenerational value is often expressed as bequest or "gift" value and existence value.

An important conclusion of economists concerned with public (nonmarket) exhaustible resources is that society has a responsibility to ensure a reasonable distribution of welfare or benefits from these resources among present-day individuals, and between present-day and future individuals. An important constraint to development of efficient intergenerational policy is uncertainty in accurately defining the needs of future generations, and therefore the future "values" of those resources. Dasgupta and Heal (1979:313) suggest that judgments about the distribution of benefits across generations are inappropriate without an analysis of their implications. Social scientists contend that social impacts must also be considered in allocation decisions.

Exhaustible resources like minerals and fossil fuels are subject to commercial exploitation and depletion because of important economic benefits for society. In the past, shipwrecks and their cargoes were also considered primarily commercial resources under the laws of finds and salvage. This classification stimulated quick return of scarce commodities to the marketplace. In part, this classification was the result of an emphasis on present rather than future resource values. Today, society has recognized other benefits and values from historic shipwrecks and shifted allocation of these resources away from commercial exploitation. The Abandoned Shipwreck Act and various state statutes recognize multiple uses of shipwrecks to include archaeology, other research activities, historic preservation, recreation, tourism, commercial fishing, and salvage.

States with historic shipwrecks are only beginning to appreciate the complexity of managing and allocating these resources among different user groups, and between current and future generations. Many are just beginning to undertake shipwreck inventory and assessment. Few have undertaken studies to determine the "values" of shipwrecks or develop processes for allocating use of shipwrecks among different publics.

Impacts on Shipwrecks

Assessment of impacts (if properly designed) provides valuable information on the feasibility and relative cost effectiveness of alternative management strategies. Frequently, discussions about

impacts focus on determining adverse effects upon the resource in order to delay or prevent use and promote mitigation. This approach often fails to recognize that some impacts may also be positive or beneficial. Seawall construction is an example of a beneficial impact if it protects a site from erosion.

Wildesen (1982:53-54) distinguishes between impacts and effects on archaeological sites by defining impacts as "a *measurable change* in a characteristic or property of an archaeological site (as compared with some prior condition). An effect is a *professional judgment about a measurable change* in a characteristic or property of an archaeological site, as it relates to the archaeological values of the site...effects on values are determined by reference to an outside philosophical, methodological, or regulatory standard." This reasoning implies the existence of thresholds beyond which effects may be determined adverse to the resource. Measurable changes do NOT necessarily affect the resource "negatively."

Classification of Impacts

Public resource managers commonly classify impacts according to perceived cause. General types of cause include natural and cultural (or human) processes. Natural processes that affect historic shipwrecks may include waves, currents, seiches, temperature variations, water chemistry, erosion, and sedimentation. Cultural or human processes that may affect historic shipwrecks can be defined as coastal development, dredging and harbor improvement, water-based recreation, water-based commercial activities, vandalism, and depreciative behavior.

Vandalism and depreciative behavior are often perceived as primary causes of adverse effects to historic shipwrecks, although no scientific comparative studies measuring the relative effects from different cultural or human activities were identified in literature. Vandalism has been defined as a willful or intentional act of damage to a resource. Depreciative behavior is understood as "any act that detracts from the social or physical environment" (Knopf and Dustin 1992: 211). Vandalism may include destruction and defacement of property; depreciative behavior may include theft, littering, and violation of user ethics. Gramann and Vander Stoep (1987) developed a typology of normative violations based on motives for vandalism and depreciative behavior, including unintentional, releasor-cue, uninformed, responsibility-denial, status-conforming, and willful violations. Management strategies can be more effective if they influence these different motives.

Impacts can also be classified according to the physical outcomes from natural and cultural processes on shipwrecks resources. Types of outcomes on archaeological sites include alteration, transfer, and removal of artifacts. Transfer and removal of artifacts are particularly important because of "effects on the integrity of the site, and the validity of cultural inferences based on artifact location or descriptions" (Wildesen 1982:55). In addition to describing the cause and type of impact, Wildesen (1982) emphasizes the need to evaluate impact degree, extent, and duration.

Schiffer (1979) provides a general framework for considering *cultural formation processes* changing the condition of cultural materials. Cultural materials exist in a systemic context (i.e. within an ongoing behavioral system) or an archaeological context (i.e. prior to excavation or removal from a site) and can move between these contexts through time. Of particular interest in impact consideration are processes like vandalism, artifact theft, salvage, or excavation transforming materials from archaeological contexts back to ongoing behavioral systems, and the various incentives for this transformation. In addition, processes like coastal residential development, dredging, and harbor improvement or commercial fishing activities may change the condition of materials within an archaeological context. Schiffer advocates the identification of laws or c-transforms from regularities in these processes. These laws are needed to better understand the causes and mitigation of adverse effects upon archaeological resources and to "infer the past systemic context of materials in the archaeological and historical records" (Schiffer 1979:17). Muckelroy (1978) makes a similar

case for consideration of the *shipwreck process* (including extracting filters and scrambling devices) in archaeological theory building.

Carrying Capacity Concepts

In renewable resource management, impact assessment is often conducted as part of a process to determine biological or physical carrying capacities (i.e. feasibility of different uses and the levels of use that can be accommodated). There have been attempts to determine carrying capacities for recreational users of different "natural" environments. Carrying capacity relationships are often defined as the number of humans that an environment can tolerate before exhibiting "adverse effects."

Many attempts to determine and implement recreational carrying capacities for natural environments have failed. Issues and problems include (1) establishment of quantifiable objectives relating to resource management, (2) incorporation of public input, (3) development of accurate use measures, (4) estimation of values and costs of different uses, (5) incomplete knowledge of effects upon resources, (6) separating recreation impacts from other uses' impacts, and (7) development of integrated, interdisciplinary approaches involving ecological, social, and managerial factors to the study of carrying capacity. Application of recreational carrying capacity methods to underwater archaeological resources were not located in literature.

Consideration of negative or adverse effects upon the physical condition of archaeological resources is important, but experience with carrying capacities indicates that impacts also must be considered to effectively manage resources providing multiple benefits to society. As an example, some historic shipwrecks can be managed mainly as recreational rather than archaeological sites. This may be an important strategy for shipwrecks NOT meeting significance criteria, or for which numerous substitutes exist to answer important research questions, and sites that cannot be efficiently monitored and managed for archaeological benefits due to political, administrative or logistical conditions. These recreational shipwrecks may lessen pressure on historically significant sites and educate people about the importance of protecting and preserving shipwrecks.

Management of shipwrecks as recreational environments should include scientific assessment of social and psychological impacts. These impacts include congestion or crowding, visitor use conflicts, depreciative behavior, degradation of the resource that compromises aesthetics and educational opportunities, and control of visitor activities. These impacts can have important effects upon visitor satisfaction and benefits—the outcomes of recreational experiences.

Issues in determining and implementing social carrying capacities resemble those of physical carrying capacities, and in fact may be more complex in terms of measurement. Social carrying capacities are commonly defined as "the level of use beyond which experience parameters exceed acceptable levels specified by evaluative standards" (Graefe et al. 1984:396). Research indicates that recreationists seek multiple satisfactions beyond use levels. The quality of social and personal experiences are also enhanced by clearly-stated recreation management objectives, access to desired experiential and environmental conditions, and realization of multiple visitor satisfactions and benefits.

Impact Decision-Making Frameworks

Concepts involving carrying capacities have evolved into more holistic frameworks for planning and management (including impact assessment). The U.S. Forest Service has developed the *Recreation Opportunity Spectrum* that provides a range of conditions based on such factors as access, other nonrecreational resource uses, on-site management, social interaction, acceptability of visitor impacts, and acceptable regimentation level. The recreation opportunity setting is defined as the "combination of physical, biological, social, and managerial conditions that give value to a place" (Clark and Stankey 1989:128). The Canadian Parks Service has applied its *Visitor Management Process* to parks, providing recreation based on park mandate and

objectives, natural resource features and values, and public needs and expectations.

The *Limits of Acceptable Change* (LAC) planning process identifies desired social and resource conditions, and then designs management strategies to maintain or restore those conditions. LAC process steps may include identify issues, develop and describe recreation opportunity classes, identify and inventory resource and social condition indicators, develop standards defining limits of acceptable change, identify alternative opportunity class allocations, identify management actions for each alternative, evaluate and select alternatives, implement actions, and monitor conditions (McCool 1989:187-188).

The *Visitor Impact Management* (VIM) process was developed to control negative effects on the quality of outdoor recreation. VIM process steps may include: pre-assess data base review, review management objectives, select key indicators, select standards for key impact indicators, compare standards and existing conditions, identify probable impact causes and management strategies, and implementation (Graefe 1989:216-220).

These frameworks are promising for evaluating shipwreck uses and distributing benefits from archaeological research, recreation, and commercial activities. Their application to wrecks may be more difficult where management objectives require some level of historic preservation to enhance intergenerational benefit distribution. Preservation promotes the "survival of information contained in material remains following deposition, and occurs only in an archaeological context" (Firth 1990:5-6).

This dilemma, characterized as *use versus preservation*, can be resolved by managing a representative sample of shipwrecks explicitly for preservation objectives. These sites need NOT be located in parks or preserves. Funding and management strategies may then be developed to actively and effectively reduce any adverse impacts.

Other sites could be managed for *optimal depletion* of benefits, accepting: (1) natural and cultural processes that cause site deterioration over time, and (2) limited funds and public support to preserve wrecks on a large scale. Optimality can be viewed as a dynamic condition defined among stakeholders at different times. Sites could be assessed for present and future benefits from archaeology, recreation, tourism and salvage, and allocated to provide a mixture of opportunities and benefits over time for the public good.

Frameworks for planning or impact assessment require active involvement by stakeholders and the public to define optimality. Public participation is especially important because the perceptions of resource managers are often inconsistent with the needs and perceptions of users. Public participation also enhances the quality of decision-making, increases support for the outcome, and promotes coordinated approaches and partnerships. A stakeholder approach to decision-making is currently being applied to underwater resource stewardship in the Great Lakes.

Scientific impact assessment requires more accurate and efficient technologies/methods to measure and interpret changes in artifact condition and provenience over time. These capabilities are being developed in the fields of remote sensing and research domains involving time-series and longitudinal analysis.

Conclusion

In conclusion, a review of literature on impact assessment and related concepts indicate the following:

(1) Shipwrecks benefit a variety of current and future users, and other publics. These benefits are recognized in state and federal law. As an example, the Abandoned Shipwreck Act requires guidelines that "maximize the enhancement of cultural resources, facilitate access and utilization by recreational interests, and recognize the interests of individuals and groups engaged in shipwreck discovery and salvage." Impact assessment should recognize a variety of publics, not just archaeologists and other researchers.

(2) Shipwreck publics have different needs and values. Consequently, different publics should be involved in management decision-making processes. Managers must develop and implement better methods to incorporate the needs/values of stakeholders and the public.

(3) Impact assessment concepts and methods developed by other disciplines (especially applied social sciences) can enhance the management of underwater cultural resources. Archaeologists must develop a greater appreciation and understanding of them and how they can apply to shipwrecks.

(4) Research must move beyond description of impacts to underlying processes of cause, especially relating to depreciative behavior.

(5) There is a need to apply and demonstrate impact assessment processes which integrate concepts and methods from archaeology and other social sciences. These impact assessment processes should then be evaluated to determine whether they result in more effective shipwreck management.

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The 1758 *Land Tortoise Radeau* Shipwreck—Creating a Seamless Photomosaic Using Off-the-Shelf Technology

Introduction

Using a Klein side-scan sonar, in 1990 Bateaux Below, Inc. discovered the 1758 warship *Land Tortoise* in Lake George, New York. Study of the vessel from 1990–1994 employed a variety of survey methods (Abbass et al. 1992). Under the direction of project archaeologist D. K. Abbass and project director Joseph W. Zarzynski, these included side-scan sonar, diver measurements and drawings, wood sample and bio-system identification, hand-held and remotely-operated-vehicle videography, detailed photography, and photomosaic documentation. What was unique in this work was the post-photography processing of the photomosaic using off-the-shelf computer and photographic technology to create a seamless image.

The Radeau—History and Design

Land Tortoise was a vessel of the French and Indian War. The seven-sided ship is 52 ft. long and 18 ft. wide, built of white pine, white oak planks, and white oak frames (Van Aken 1994:37). It was deliberately sunk by the British and provincials on 22 October 1758 to avoid capture or destruction by French raiders (Bellico 1992:77). Meant to be sunk in shallow water for retrieval and re-use, the warship ended up in deep water (107 ft.) and remained hidden until its 1990 discovery.

The *Land Tortoise* survey has shown it to be "...an undecked, heavily constructed raft- or ferry-type vessel, crudely and casually built of flat panels. A protective single-planked canopy or bulwarks is superimposed on the hull, except at the transom, and exhibits tumble-home" (Abbass et al. 1992:145). The bulwarks likely were intended to protect the vessel's crew from hillside enemy musket fire on a waterway seldom greater than a mile in width (Abbass et al. 1992:145).

The Need for a Photomosaic

By 1993, the need for a photomosaic was obvious. In that year, New York opened two sites for divers as its first "Submerged Heritage Preserves" (Zarzynski 1993:1). These were pilot projects testing the feasibility of shipwreck preserves in Lake George and providing a model for similar underwater parks around the state. With the possibility that the radeau would one day be included in Lake George's "Submerged Heritage Preserve" system, it was likely an increasing number of divers would visit the vessel. Since the radeau's bulwarks are vulnerable to damage from boat anchors, fishermen's downrigger tackle, and sportdiver intrusion, Bateaux Below, Inc. decided that it should be recorded in a photomosaic to permit cultural resource managers to monitor changes in it over time.

Photography

Funded by a grant from the Lake Champlain Basin Program, the photomosaic project capitalized on the vessel's flat panel design by using a photographic tower that gently rested on the vessel's bulwarks, perpendicular to each panel. We constructed the original photographic tower of lightweight 0.5-in.-diameter PVC (polyvinyl chloride) pipe with a 3.5 x 5-ft. rectangular base. This base was intended to be large enough to capture the entire four bulwarks planks and to support a Nikonos V camera with one or more strobe lights. The photography team consisted of one photographer and one or more divers to move the tower. The photography originally was scheduled for eight dives in four days in summer 1993, when the visibility was best.

Site tests showed that the PVC tower was not sturdy enough to support both camera and lights, and hardwood and metal reinforcement of the frame made it too heavy. It was decided to abandon this tower in favor of a smaller, lighter design. We then constructed a 41.75-in.-tall and 32-in.-wide two-legged tower of 1.5 x 1.5 x .25-in. 6061 alloy aluminum angle with stainless steel fastenings. Support footings were 24 in. long and padded to prevent marking the radeau. Vented 0.5-in. (outside diameter) PVC pipe with hand holds was attached to each leg to facilitate lifting during photography. This tower was much lighter and smaller than the prototype, which made it easier to operate but increased (by a factor of around four) the number of photographs needed to complete the task. The tower's height allowed at least two bulwarks planks to be photographed when moved between stations. Because the bulwarks' features were adequate, no artificial visual references (e.g. cross rods or scale bars) were used. The smaller tower also required only a single Nikonos SB-103 strobe for lighting. We set the camera equipped with a 28-mm lens to auto-shutter with a f 5.6 aperture, a 3-ft. focus and Kodak "Gold" ASA 100 color print film. The strobe setting was TTL (through the lens).

This new tower was easy and inexpensive to construct and proved very effective. It had a slight negative buoyancy and therefore was easy to control. A two-person dive team managed the new tower—one photographer and the other to move the tower along the hull. In 12 dives in September and October 1993, we completed the photomosaic photography. In mid-project, we extended the tower legs and footings to maintain the proper distance along the edges of the bulwarks panels. These extensions were made of .75 x .75 x .125-in. aluminum angle and provided a support extending 19.75 in. from the tower's legs. Over 400 photographs were made during the testing and project stages, of which 200 were selected for the computer processing phase.

Compositing the Digital Photographs

To assemble the photographs on a computer, they had to be in digital form. The method chosen was to send the negatives to Kodak to be placed onto their proprietary Kodalux compact disk format. This method gives five possible resolutions at 192 x 128, 384 x 256, 768 x 512, 1536 x 1024, or 3072 x 2048 pixels per square in. At ca. $1.40 per photograph (depending on whether batch processing is used), this is by far the most economical solution to high-quality scans. The medium resolution of 384 x 256 pixels per square in. was adequate for this project since the effective resolution of the finished picture would be magnified. Even at this resolution, the finished file size was 142 MB (megabytes). The digitized CD (compact disk) format also created an archive of highly detailed, individual photographs which will not deteriorate. It must be cautioned that even though the medium is very stable, the technology for reading CDs is advancing rapidly. Archivists should plan to transfer data to a new medium at least every five years to retain access. We were able to place 100 photographs onto each of two CDs.

Computer Hardware

The hardware selected for compositing included a Macintosh 840AV with a one-GB (gigabyte) internal drive, 32 MB RAM, internal double-speed CD, SyQuest 88-MB external removable cartridge drive, and NEC 4FG color monitor. The imaging software was Photoshop 2.5.1. Original testing was on an advanced Silicon Graphics computer, but access proved limited and software expensive. The "off-the-shelf" hardware and software provided affordable, high-quality digital imaging to underfunded research such as this project.

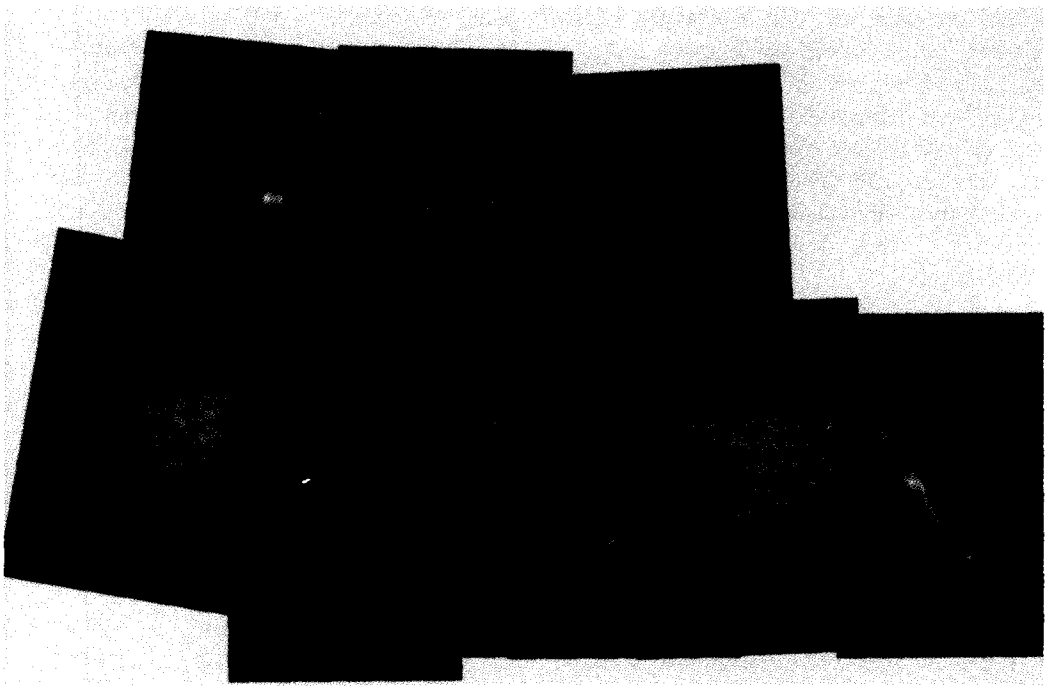

FIGURE 1. Example of rough mosaic of the port quarter bulwarks used as guide. No corrections have been done at this point. (Original photograph in color.)

Photograph Database

The 200 4 x 6-in. prints were taped onto cardboard sheets to form the original rough photomosaic. This version was over 9 x 4 ft. (length:width) in size and had to be dismantled for use. Each photograph was labeled to indicate the position on the ship, date, and dive number. When the CD was produced, a database was created with this information cross-referenced with the position on the disk. This database proved invaluable when assembling the photomosaic pieces.

Preliminary Compositing

A section of the ship was selected and composited as a test and printed (on a dye sublimation printer) to judge the probable outcome. When this was approved, work began in earnest. A rough photomosaic (Figure 1) was created without color correction for a working reference along with the database. This indicated where scaling, color, or positioning problems might occur.

Corrections

Despite the pains taken in shooting the photographs, several factors caused compositing difficulties. A primary problem was the use of a single strobe positioned to shoot from one side of the tower. This caused a curved light gradient slightly different in each image. Due to the filtering effect of water, the strobe also produced a color gradient. When looking at a single photograph this was barely perceptible, but when an image was set beside its neighbor, the effect was dramatic. Another related problem was caused by differences in lighting and water conditions between dives.

Each photograph had to be gradient- and color-corrected individually before assembly. Since there was no reference color strip or gray-

scale, the correction was done by taking median values from two adjacent photographs and correcting each photograph to that reference. After those two were composited, they were treated as one and cross-corrected with a neighbor, and the process was repeated. This meant the reference was constantly changing throughout the project.

Compositing

As each piece was put into place, it was rotated, re-sized, and otherwise oriented as needed. Photoshop 2.5.1 has only one layer of "undo," and once a second image was corrected and laid down, the first was not movable. The upgrade (Photoshop 3.0) provides multiple layers.

Even using relatively low-resolution digital images, the file size quickly became large. Working with 5-MB files went relatively smoothly on the system used, but above 15 or 20 MB, speed became a problem. We therefore opted to complete 5-MB sections at a time and then composite them into 10-MB sections, then 20-MB, etc. until entire logical sections of the port and starboard bow, sides, quarters, and transom were competed. These logical pieces were then put together, and here another problem surfaced. All the photographs were shot equidistant from the bulwarks. This made a three-dimensional image possible but created problems when translated to two dimensions. Each piece was distorted to its proper position using the Photoshop perspective tool and the entire photomosaic was then readjusted for color balance.

For the final print of the photomosaic, the blank areas within and around the vessel were filled with a manufactured texture. A black border and title were added to complete the project. The final product was prepared for museum display and a poster for sale to the public (Figure 2).

FIGURE 2. Finished composite photograph as prepared for museum display (original photograph in color).

Printing the Photomosaic

The final print was made on a large-format IRIS printer, which yielded the highest possible resolution print. There are, however, few printers with this capability, and fewer still willing to print a file of such a large size—the usual sizes are 5 to 20 MB.

Advice for Future Projects

Photoshop 2.5.1 turned out to be a remarkably capable tool for photomosaic generation—the upgrade (version 3.0) with added capabilities in the compositing area should be even better. Macintosh computers equipped with the new RISC chip will quadruple the processing speed as well, making future efforts much faster.

From our experience, we would advise that future projects use multiple balanced strobes, a color strip/gray scale and ruler in each frame for reference, and that film be bought and processed in bulk with the same batch and lot numbers. These steps will cut many hours from the final compositing phase for a seamless image. To our knowledge this project represents the first photographically-accurate seamless photomosaic of a submerged vessel. Painting tools (opaque computerized brush strokes used to mask flaws and redraw features) used by touch-up artists were avoided in favor of adjusting for lightness, color balance, and other non-painterly methods. This yielded an actual picture of the warship as though it had been photographed in its entirety from above. The photomosaic is accurate enough to inspect individual fastenings, wood grain, and other minute details on the wreck. Further magnification can be obtained from the high-resolution CD images.

The project is currently working on a three-dimensional walk-around computer photograph which will allow viewers to turn the vessel to any angle desired.

Conclusion

In summation, this experience taught us that it is possible to create an accurate seamless photomosaic of a submerged cultural resource, such as an intact 18th-century shipwreck, which otherwise would be impossible to view in its entirety. The total sweat equity to produce the final photomosaic was 900 hours, using off-the-shelf technology readily available to low-budget endeavors. The photomosaic served well to document the shipwreck photographically, create baseline data for cultural resource management's development of preservation strategies, and provide an inviting display for the public. More work is needed to reduce production time for the final image and to expand the possibilities of these techniques for future shipwreck archaeology projects.

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