A SEVENTEENTH-CENTURY NORTHERN EUROPEAN MERCHANT
SHIPWRECK
IN MONTE CRISTI BAY, DOMINICAN REPUBLIC

A Dissertation

by

JEROME LYNN HALL

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

DOCTOR OF PHILOSOPHY

August 1996

Major Subject: Anthropology
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ABSTRACT

A Seventeenth-Century Northern European Merchant Shipwreck

in Monte Cristi Bay, Dominican Republic. (August 1996)

Jerome Lynn Hall, B.S., Abilene Christian University;

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Chair of Advisory Committee: Dr. George Fletcher Bass

Beginning in 1991 and continuing through 1994, the Pan-American Institute of
Maritime Archaeology (PIMA), a nonprofit scientific and educational institution based in San
Francisco, California, undertook the excavation of a seventeenth-century northern European
merchant shipwreck in Monte Cristi Bay, Dominican Republic. Although excavation still
continues, with tentative plans of completion in 1998, this document analyzes data collected
from the 1991 and 1992 seasons.

Commonly referred to as “The Pipe Wreck,” owing to the large consignment of clay
tobacco smoking pipes carried as cargo, the remains of the vessel add a substantial corpus of
information to our scant knowledge of seventeenth-century shipwrecks in the New World. The
investigation of the extant hull and cargo was undertaken to test the hypothesis that the wreck
represents a Dutch merchantman headed for a Dutch-American outpost in the New World.
Preliminary results of the excavation and subsequent study seasons, however, suggest that the
vessel was English-built and sank sometime, most likely, between 1652 and 1656. Dendro-
chronological studies, clay pipe morphologies and their accompanying maker’s marks, ceramic
types, and counterstamped silver coins fit well into this temporal framework.

Historical and archaeological data suggest that the wreck represents an English
merchant vessel bound for the northeastern seaboard of what is now the United States. The
possibility exists, however, that it sailed in the service of the Dutch West India Company.
Additional hypotheses examine the likelihood that the ship may have entered Monte Cristi Bay in
search of salt, or perhaps to trade with the *houcaniers* that were prevalent along the northern
coast of Hispaniola.
A major portion of the cargo appears to have been manufactured in Holland, and archaeological collections from contemporary sites suggest that many items were intended for the Native American trade in the Hudson River Valley.

The Monte Cristi shipwreck not only provides data for a period of New World seafaring represented by a surprising paucity of archaeological evidence, it also testifies to the importance of tobacco consumption and tobacco-related trade during the seventeenth-century.
DEDICATION

With all my love to my mother, Malinda Mary Hall; and to my father, Marvin Omar Hall; and to their goodness, which will follow me all the days of my life.
ACKNOWLEDGEMENTS

I wish to thank, first of all, my mother and father, Malinda Mary and Marvin Omar Hall, for their unwavering love, encouragement, and support over the years.

I am deeply indebted to Don Pedro Borrell Bentz of the Comisión de Rescate Arqueológico Submarino in Santo Domingo, who, along with the other commission members, graciously permitted our team to excavate this shipwreck. I also thank Francis Tejeda, Director of the Fortaleza Ozama Conservation Laboratory; Rick, Wanda, Chris, and Scott Berry, James Hickman, Harry Lundberg, and Gregory Thom of North Caribbean Research, Inc.; and Dionisio Jesus Vargas (Johnny Bigleaguer). All were extremely helpful with numerous aspects of this work.

I am grateful to the guidance offered me by my committee members George Bass, Donny Hamilton, J. Richard Steffy, and Larry Yarar. Greta Fryxell, my graduate council representative, was very helpful; I extend my thanks to Joe Templeton, for his willingness to serve as my substitute representative after Dr. Fryxell retired.

I am grateful to the late John McCashen, his wife Fran, as well as Paul and Lois Huey, for their kind assistance, hospitality, and correspondence regarding numerous aspects of this dissertation.

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On behalf of PIMA, I express our debt of gratitude to the Board of Directors of the Monte Cristi Yacht Club: Carlos Vizcaino, Gobernador: Rafael Pimentel, Pasado Comodoro: Otto Knupper, Vice Comodoro: Alvaro Quezada, Comodoro: Rafael Rodriguez, Secretario: Bolivar Diaz, Tesorero: Danilo Cruz, Vocal: Ricky Brugal, Vocal; and Fernando Olivares, Vocal.

There were many companies and organizations that donated equipment and so share in the success of our work: A&E Products; Banyan International; Castle Dental Center; Coleman Outdoor Products, Inc.; Igloo Products, Inc.; the Institute of Nautical Archaeology, and Nikon. Without the help of Continental Airlines, this excavation would have been impossible. PIMA graciously acknowledges the support of Patrick Strassburger, Jim Billstone, and Sam Jones, who showed us that “One Airline Can Make A Difference.”

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_Lector et Emergo_

30 April 1996

Jerome Lynn Hall Jaeger

Old San Juan, Puerto Rico
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CHAPTER I
INTRODUCTION

At the bottom of Monte Cristi Bay, a shallow, sheltered body of water on the north coast of the Dominican Republic, there lies a mosaic of wood, metal, and ceramic known simply as the “Pipe Wreck” (Figure 1). It is the remains of a seventeenth-century northern European merchant vessel that, for reasons unknown, foundered on the shallow reef off the eastern shore of Isla Cabra, probably between 1652 and 1656. Historical data suggest the wreck represents a merchant trader that ventured into Monte Cristi Bay in search of salt, or perhaps to engage in illegal commerce with the *boucaniers* that were widespread along the northern coast of Hispaniola during this period. Archaeological collections from contemporary sites indicate that some items of the cargo were intended for Native American settlements along the eastern seaboard of what is now the United States of America. Other items were probably intended for wealthy European colonial settlers.

Under the direction of the *Comisión de Rescate Arqueológico Submarino* (Underwater Archaeology Commission), established in 1978, the Pan-American Institute of Maritime Archaeology (PIMA) has spent, to date, five years excavating and studying this site. When excavation commenced in 1991, little was known about the wreck. Information was gathered from several small collections of artifacts, mostly ceramic sherds and clay pipes. Additionally, the author was able to conduct personal interviews with many of the salvors and archaeologists who had visited the site and whose field notes were graciously made available. Among their varied theories about the origin, destination, and demise of the vessel was the common notion that the wreck was the remains of a seventeenth-century northern European merchantman.

The decision to excavate the site was predicated on several factors. First, proximity to the town of Monte Cristi made the wreck accessible to divers and snorklers. This placed the resource in danger of being stripped of interpretive information before it could be properly analyzed. Second, it was decided that the best way to educate the public concerning the importance of the study of American maritime history, and the role of underwater archaeology in understanding that history, was to involve nonarchaeologists in the project. This was to be accomplished by training volunteers to excavate and document artifacts from the wrecksite, all in a relatively short period of time. Third, since the Monte Cristi “Pipe Wreck” had a long history of salvage, it was thought that this site would make the perfect first project for PIMA while simultaneously allowing for the incorporation of nonarchaeologists as volunteers.

This dissertation follows the format prescribed by *American Antiquity*.
Figure 1. The seventeenth-century northern European merchant ship wreck (Ft = floors, Ft = futtocks), ceiling (C) and bottom planking (P), as well as the scarp site are also shown. Illustration by Jemison Beshears and Jerome Lynn III.
chant shipwreck in Monte Cristi Bay, Dominican Republic. Note the keel, frames (F = well as the softwood sheathing deals (S). The five large concretions that demarcate the ome Lynn Hall.
Finally, although treasure hunters and archaeologists who had visited the site informed the author that there was nothing of historical value remaining on the wreck, intimating that to conduct such a project would be a waste of time and money, the late Peter Throckmorton felt that the shipwreck might be of great archaeological significance as one of very few wreck sites contemporaneous with the Mayflower.

The preliminary study of approximately 1,000 clay pipes prior to the first season of excavation suggested that the vessel was a Dutch merchantman that sank sometime between 1630 and 1665. Based on this information and the field notes of several groups who had previously visited the site (described below), a series of research questions was formulated: would the extant hull features and their construction techniques indicate a specific vessel type or nation of origin? Would the cargo confirm a nation of origin, or suggest a port of destination? Would the archaeological record reveal specific activities aboard a seventeenth-century merchant vessel? Why did the vessel sink in the shallow water of a relatively well-protected bay? Might knowledge of the regional history of Monte Cristi, and specifically Isla Cabra, assist in the interpretation of the site? These research questions were developed and associated hypotheses tested against data from four years of excavation at the Monte Cristi "Pipe Wreck."

GEOGRAPHY AND GEOLOGY OF MONTE CRISTI

Of all the islands in the Greater Antilles, only Hispaniola comprises two nations: the Dominican Republic occupies approximately two-thirds of the land mass, the Republic of Haiti subsumes the western third (Figure 2). The two countries are divided geographically and politically by the Rio Masacre (Massacre River). The coastal province of Monte Cristi, a subregion of the Western Cibao, extends approximately 116 kilometers along the northwest corner of the Dominican Republic.¹ It comprises four municipalities, including Guayubin, Pepillo Salcedo, Villa Vazquez, and Castañuelas y Las Matas de Santo Cruz (Figure 3).

The mountain of Monte Cristi, located at the northern end of Monte Cristi Bay, forms the summit of the prominent headland of Punta de la Granja.² Referred to as "El Morro" in more recent times, it was given the name "Monte Cristi" by Colón, who described it as

---

¹ The province, which corresponds to 4.1% of the total territory of the nation, has a geographic position of 19° 51.30' N, 071° 0 W (Ortega 1987).
² The mountain of Monte Cristi, which rises 251 m (825 ft) above sea level, is located at 19° 53' N, 071° 31' W.
Figure 2. The West Indies, with the inset showing the location of the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Illustration by Jerome Lynn Hall.
Figure 3. The province of Monte Cristi in the Dominican Republic. The northern European shipwreck in Monte Cristi Bay lies between Isla Cabra and the tip of Punta de la Granja. Illustration by Jerome Lynn Hall.
very tall... finely shaped like a tent... accessible in every part, and which appeared to be an island, but was found to be connected with a low tract of the country... [the latter of] which is flat and consists of very beautiful fields (de Las Casas 1924:158-160).

Local lore relates that it was named after the mountain where Christ was crucified and upon which he died, a reference to the hill of Calvary outside of Jerusalem. The ominous shape of the mountain suggests an apocalyptic beast or a sleeping camel, sobriquets that are commonly used by the townspeople.

Of the three major bays that lie along the coastal province of Monte Cristi, La Bahia de Monte Cristi (Monte Cristi Bay) is the largest. Located northeast of Manzanillo, it is defined by Punta Luna (Moon Point) to the southwest and Cabo Del Morro (Moorish Cape), the northernmost point of Punta de la Granja, to the north. Nearly three hundred years ago, the English Pilot, a seventeenth-century navigational guide, offered the following instruction for the sailors heading westward along the north coast of Hispaniola (Figure 4):

When from Porto de Plato you would sail for Monte Christi, and being off of Cape Frances, observe and steer a more Northerly Course in hailing off, and giving good distance between you and the shore, because the Current always seteth upon it; and except you thus do, you will run the hazard of going a shore. ...And running to the Westward, you will see a Point of Land running off to Seaward, beyond which lieth a high Hill, having thereon a Chappel; which said place is called Monte Christi. The appearance whereof is as followeth.

On the West-side of Monte Christi, close to the Point, lieth a little island; and off from the Point of Mancanilla, reacheth a great Shoal, a pretty way to Seaward stretching it self about West off. And in falling along this Coast, you ought to keep your Lead, by which you may strand into five and four fathom Water.

And although you were never there, yet in keeping close to the aforesaid ragged Point, you may run in boldly. it being wide and broad enough. On the West-side of the Bay, lieth a parcel of Rocks, call Cana Palme, and close to the shore, lie several Islands and Rocks, of which you ought to have special care, if you stand over to that side of the Bay (English Pilot 1689).

No doubt the “parcel of rocks” is a reference to Cayo Ahogado (Hidden Cay), the shallow reef that lies on the western side of Monte Cristi Bay. The “little island” lying close to the west side of the point is unmistakably Isla Cabra and the “Great Shoal.” a reference to the Monte Cristi Bank. Modern navigational directories make clear these same potential hazards to modern sailors, offering similar advice. The Defense Mapping Agency of the United States of America (1991:129) expressly mentions that the “head of the bay is encumbered with shoals for which the chart is the best guide.” Furthermore, it advises sailors entering from the north that “pilotage is
Figure 4. Three profiles of the mountain of Monte Cristi. (A) "Thus appeareth Monte Christi, bearing S.W. about six Leagues from you"; (B) "Thus appeareth Monte Christi, bearing S.S.W. about four Leagues from you"; (C) "Thus appeareth Monte Christi, bearing S.S.E. about five Leagues from you. Monte Christi is a high Hill on the North-side of Hispaniola, which seemeth to be an island, but is not." Illustrations by Jerome Lynn Hall after the *English Pilot* (1698).

Monte Cristi Bay is protected from the west by a small group of islands known as the Cayos Siete Hermanos, or the Seven Brothers: Cayo Montegrande (Big Mountain Cay), Cayo Muertos (Cay of the Dead), Tororin (Tororu), Cayo Tercero (The Third Cay), Cayo Arenas (Sandy Cay), Cayo Montechico (Little Mountain Cay), and Cayo Cabras y Ratas (Goats and Rats Cay). The Cayos Siete Hermanos are strewn with shipwrecks and are therefore considered formidable hazards to the navigation of Monte Cristi Bay. Five of the Seven Brothers are seen in Figure 5, a copy of the first known map of the north coast of Hispaniola. Popular and scholarly literature both contend that the map was sketched by Cristóbal Colón on his first voyage of discovery, no doubt due to the cryptic signature that appears in the upper central portion of the drawing. This theory, however, is not without its opponents. Fuson notes that the map, "...is undoubtedly a later forgery," a conclusion based, in part, on two inaccuracies contained within the drawing: "Not only is Columbus' first colony, La Navidad, incorrectly spelled Nativida," he writes, "but the island itself is labeled La Española, a form that never occurs in the log..." (Fuson 1987:9).

La Bahía de Manzanillo (Manzanillo Bay), the easternmost bay on the north coast, extends well into Haiti and is fed by the Masaeco and Chaquey Rivers. It is large, deep, and tranquil and provides safe anchorage for small craft. The Bahía de Jicaquito (Jicaquito Bay), noted for its sandy bottom, stretches eastward from El Morro to Punta Fragata. Although its northern portion is protected from the sea by a reef, the southern part, sheltered by El Morro, connects with Monte Cristi Bay by means of a small channel that winds through an extensive mangrove estuary.

The city of Monte Cristi, which rises 1.5 to 2.0 m above sea level, is situated on a stratum of gray calcareous clay layered over quartzite gravel. Erosive processes within the Cordillera Central -- the predominant mountain range within the Dominican Republic -- as well as the Septentrional mountains, have deposited massive quantities of heavy minerals along the beaches and flatlands of Monte Cristi (Baldayaque n.d.:23-24). Studies made by the General Dirección de Minería note that the most extensive deposit of this type -- approximately 100 square km -- lies at the mouth of the Rio Yaqui Del Norte, several miles southwest of Monte
Figure 5. The north coast of Hispaniola, from a late fifteenth- or early sixteenth-century map. The mark in the upper center portion of the drawing allegedly belongs to Cristóbal Colón, although his authorship of this illustration is disputed. Monte Cristi and five of the Seven Brothers Islands are clearly visible. Illustration by Jerome Lynn Hall after a copy in the Casas Reales Museum, Santo Domingo.
Cristi Bay. The formation of the northwest corner of the island corresponds to the Pliocene Period of the Cenozoic Era, approximately 12 million years B.P.

The regional climate of the province of Monte Cristi is warm and dry. Average annual rainfall is 600 mm (Ortega 1987:16; Baldayaque, n.d.:20). Vegetative succession is apparent when one travels northward from the Caribbean coast, as tall, semitropical species gradually give way to scrub vegetation typical of an arid environment. The city of Monte Cristi and its outlying regions abound with numerous varieties of cactus, as well as an assortment of trees, including caoba (mahogany), guayacan (lignum vitae), roble (oak), cedro (cedar), grigri, candelón, pine, and palm (Ortega 1987).

HISTORY OF MONTE CRISTI
The Pre-Columbian Era

The historical record of Monte Cristi begins with the ship's log from Colón's first voyage; however, archaeological evidence indicates that, prior to European occupation, the region was inhabited by the Taino, the predominant Native American group of the Greater Antilles. Linguistically, they were descendants of the Proto-Arawaks from Central Amazonia. Socially, each village was ruled by a chief, or cacique, and subjects were divided into the nitaino and the maboria, or the upper and lower classes, respectively. The Taino practiced a sophisticated system of agriculture which produced an abundance of subsistence crops including cassava, maiz, squash, beans, peppers, peanuts, cotton, tobacco, and pineapples (Rouse 1992).

A variety of canoes allowed the Taino to develop extensive interisland trade networks. At Puerto de San Nicolás, Colón estimated that there were many people inhabiting the region as he "had seen so many canoes" (Fuson 1987:129). "Some of them," he noted, "were as large as a rowboat, with 15 benches for the rowers." In his letter to Santángel, dated 15 February 1493, Colón wrote of even bigger vessels:

On all the islands they [the Taino] have very many canoes like galleys, with oars. Some large, some small, and some, indeed many, are larger than a galley with eighteen benches. They are not as broad because they are made from a single tree-trunk, but a galley could not compete with them by rowing, because they travel incredibly fast. And with these they sail around all those islands, which are countless, and trade in their merchandise. I have seen some of these canoes with seventy and eighty men in them, each one with an oar (Ife 1992:55).

As with most indigenous populations in the New World, the Taino disappeared quickly when faced with institutionalized slavery and the numerous diseases introduced by the Europeans. The demise of the inhabitants of Marien -- the chiefdom in which Monte Cristi was
eventually established – came during the Spanish administration of Bartolomé Colón (brother of Cristóbal Colón), when native villages in the region of Monte Cristi were razed and the chiefs imprisoned (Ortega 1987:29).

The Contact and Pre-Colonial Periods

It is unclear if the Taino fisherman on the small island at the northern end of Monte Cristi Bay saw the approach of the Niña on 5 January 1493. More than likely, they did. For people who had never seen a seagoing vessel larger than one of their own canoes, the carabela must have been an awesome and frightening spectacle. Understandably frightened, they fled rapidly, not even taking the time to extinguish their small campfires where, presumably, they prepared their daily catch of fish. It is unknown if the Taino occupied the island or if they merely used it as a stopover on long fishing expeditions. Las Casas — the Catholic priest who accompanied Colón and chronicled the fate of the Taino — makes no mention of canoes anywhere on the shore, but they may have been beached on the western side of the island. The still-burning campfire indicated that these fishermen were either hiding or had escaped minutes before the Niña arrived. Las Casas' account reads:

Friday, Jan. 5th. Just before sunrise, they set sail with a land-breeze, which afterwards shifted to the east. They esped near Monte Cristi within an islet [Isla Cebra], a good harbour where they might anchor that night. Standing to the ESE., and afterwards to the SSE., they sailed six leagues towards that place and found seventeen fathoms water with a good bottom; they continued on three leagues farther with the same depth. Afterwards the depth diminished to twelve fathoms towards the highest part of the mountain, off against which they found nine fathoms, the bottom being all a fine sand. Keeping on in this direction, they arrived between the mountain and the islet, where they found a fine harbour of smooth water, have three fathoms and a half depth. Here they anchored, and the Admiral landed in a boat. They found on shore fire burning and other indications that fishermen had been there. Many stones of variegated colours were seen; these were similar to those found in San Salvador, and were fit from their beauty to be used in the construction of churches, or royal edifices. Trunks of the mastick tree were also met with (Columbus 1924:160).

It may rightly be imagined that Cristóbal Colón was in a quandary when the Niña dropped its anchor in the relatively narrow passage between the windward side of the island and the looming mountain on the mainland. The Santa Maria, flagship of the voyage, had wrecked in the shallows of present day Haiti just 13 days before. Thirty-nine crew members were left behind to build a small fortress from the remains of the stranded vessel, and thus to develop the first colony: Navidad. Although the Admiral promised to return and rescue them, later developments determined that he would never see these men alive again (see below). In addition
to the loss of the Santa Maria, the Pinta was also missing. Martin Alonzo Pinzón, captain of
the third vessel, had sailed away months earlier and, for all Colón could suppose, was headed
back to Spain to claim his own discovery of the Indies.

Despite the problems that surrounded Colón on that January day, he marveled at the
mountain he was to name in veneration of the Holy Savior. He declared it the most beautiful
mountain he had seen outside of Spain and wasted little time in announcing that he had, indeed,
found Cipangu (Japan), the mysterious island of which Marco Polo had written. Although the
erroneous declaration was made toward the close of his first voyage to the New World, it was a
belief he would carry to his grave some 13 years later.

Colón was to enter the bay of Monte Cristi twice during his first voyage to the New
World. After the investigation of Isla Cabra on 5 January 1493, he sailed eastward toward Cape
Bezerro where, the following day, he spied Martin Alonzo Pinzón and the Pinta approaching
from the east. The carabela had been missing since 21 November 1492, nearly seven weeks.
Pinzón had sailed to Great Inagua and was recently returning from a point east of Monte Cristi
when he met up with the Niña. Contrary winds from the east and shallow water prohibited the
two vessels from putting out anchors, so the decision was made to journey back to Monte Cristi
Bay. Arriving on 7 January, the Admiral noted that the Niña was leaking and ordered her
"pumped out and caulked" (Fuson 1987:167). Colón’s last reference to Monte Cristi was to
note that sailors captured turtles along the shore (Columbus 1924:165-166). The two carabelas
departed the bay on 9 January and sailed westward with a southeasterly wind to Punta Roza.
they then continued eastward as far as Cape Samaná, and on 15 January, the homeward voyage
began.

Colón’s second voyage to the New World began on 25 September 1493 with his
departure from Cadiz to the Canary Islands. Available evidence suggests that the trip had three
objectives: first, the Spanish Crown was eager to explore and exploit the resources of the newly
discovered lands; second, the Crown wished to encourage colonization (the most efficient means
by which the first goal could be accomplished); third, Colón was anxious to resupply the sailors
he had left behind at Hispaniola. He hoped, of course, that they had succeeded in establishing an
alliance with the Taino and that this, in turn, had resulted in their finding gold:
...I hope in God’s name that when I return the men I have left there will have found thousands more things of great value, because that is what I ordered them to do; and I left them a boat and tackle, and tools to make boats and galleys, and men experienced in all the arts of the sea... (Colón, The Letter to the Monarchs, 4 March 1493, in lfe 1992:35).

The contingent of at least 17 vessels arrived at Dominica on 2 November 1493. Within three weeks Colón and his fleet traveled through and named the numerous islands of the Lesser Antilles, arriving at Borinquen (Puerto Rico) on 23 November. From there they sailed directly to Monte Cristi, although not without a continual struggle against the southeasterly head winds. The small fleet entered the bay on 25 November.

For Colón, the strategic importance of Monte Cristi on the second voyage to the New World was its proximity to Navidad. Upon arrival, the Spaniards spent two days reconnoitering the outlying regions. Historian José Gabriel García (1979:125) comments that Colón arrived “con el corazón henchido de esperanzas que un fatal presentimiento no tardó en desvanecer” (with a hope-filled heart that would soon be broken). In a letter directed to the town officials in Seville, Doctor Diego Alvarez Chanca, physician of the fleet and an eye witness to the events surrounding Colón’s return to Monte Cristi, narrated the arrival in detailed fashion:

We did not cease to follow our course until we arrived at a harbour called Monte Christi, where we remained two days to examine the character of the land, because the place where he had left the men did not seem to the admiral to be suitable for making a settlement. We went on shore to make inspection. Near there was a large river with very good water, but all the land is waterlogged and very unsuitable for habitation. As we went about, looking at the river and the land, some of our men found in one spot near the river two dead men, one with a rope round his neck and the other with his feet bound. This was on the first day. On the next day following, they found two other dead men, farther on than the others, and of these one was in such state that it was possible to know that he had been heavily bearded. Some of our men suspected more evil than good, and with reason, since the Indians are all beardless, as has been said. This harbour is twelve leagues' distance from the place where the Christians were (Jaye 1988:46).

On 27 November, they set sail once again. Morison (1942:422) notes that “the fleet weighed [anchor] from the harbor inside Isla Cabra, Monte Cristi.” Failing to reach their destination in time to go ashore before nightfall, the Europeans anchored their vessels at Puerto Santo (Guanico), the protective reef leading into Caracoal Bay, entrance to the settlement at Navidad. What Colón witnessed when he went ashore was devastating: the remains of the fort built from the Santa María had been burned to the ground and the bodies of his former shipmates were scattered about. Guanacagari, the Taino cacique who had proved helpful when

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3 The small fleet comprised the flagship Moringalante, the nau Colina and La Gallega, as well as at least 12 carrabelas and an unspecified number of “small Cantabrian barques” (Morison 1939:100).
the flagship grounded, informed Colón that the Spaniards had fought amongst themselves. Additionally, they had enraged Caonabo, a neighboring chief, when they attempted to take women from his village. Together with Mayreni, another cacique, Caonabo was reported to have attacked the fort, burning it to the ground and killing the settlers. Colón, however, doubted Guacanagarix's story, especially when he found many of the settlers' goods scattered throughout his village. Furthermore, a serious wound that the chief had supposedly suffered in defense of the Europeans turned out to be nothing more than a clean bandage wrapped over his thigh.

Not everyone agrees with the accepted historical account concerning the demise of the small European contingent at Navidad. Tattersall (1993) suggested that the Spaniards themselves initiated the fighting and destroyed the fort. The 20 survivors, supposedly, then sailed away in a caravel constructed at Navidad. It is not unreasonable to propose that the crew members at Navidad had the capacity to construct a vessel, for in various letters (Ife 1992:35. 57), the Admiral stated that he had left behind a "boat and tackle," along with the tools and personnel (i.e., a shipwright) necessary for constructing "boats and galleys." Further support for this argument may be offered in the following account, given by Ferdinand Colón, the Admiral's son, as they sailed the waters of the Caribbean during Colón's second voyage:

That which caused our people to marvel the most was a large fragment of a ship with iron fittings which could have been taken from the wreck of the ship lost by the Admiral (the Santa Maria sunk off La Navidad the year before) or some other flotsam carried by winds and currents to that place (Paienwsky 1991:34, citing Caddeo, 1930, vol. 1 pp. 263-274, with translation by Paienwsky).

If Colón was, indeed, the first to sail to the New World, then this "fragment of a ship" must have come from his small fleet.

Regardless of who destroyed the fort and attacked the Europeans, one can hardly imagine a different fate for the Native Americans had they not waged war against the Spaniards. Nor can one necessarily blame them for their reaction to what was, most certainly, provocation by their guests. Morison summarizes the events that followed:

They [the Native Americans] told a part of the sad truth, that the first European Colony in the New World had perished. It was a story repeated again and again in the annals of European Colonization. The Spaniards had made off with the Indian’s gold and women, and then quarreled among themselves; the survivors marched up-country in search of more plunder, and there encountered a cacique [chief] who would stand no nonsense, and pursued them to Navidad and polished off the remainder.... Accordingly the fleet sailed from Navidad on December 7, and anchored under Monte Cristi the next day (Morison 1939:101-102).
This is our final reference to Monte Cristi in the Pre-Colonial Period. Although several authors record slightly different versions of the aforementioned events, there can be no doubt of the historic importance of Monte Cristi and the outlying regions in the early years following The Contact.

The Colonial Period

The Native Americans that Colón and his sailors encountered on their first voyage to the Americas were, in many cases, adorned with gold jewelry and little else. The perceived abundance of this precious metal whetted the Spanish imagination as did nothing else. Upon their return in 1494, wearied by their travels and discouraged by the destruction of Navidad, Colón and his sailors hastily selected a settlement site on the north coast of Hispaniola. It was given the name Isabela, after the Spanish queen; however, the colony fell into ruin within a few short years. When disease and despair all but wiped out morale, Colón sent a letter to Spain in 1496, instructing his brother to establish a new settlement on Hispaniola’s southern shore. This colony, named Santo Domingo (Holy Sunday), would quickly become the seat of the Spanish Empire in the New World.

The colonial history of Monte Cristi began some ten to 15 years after Colón first sailed into the bay. The island had witnessed a steady stream of Spanish emigrants, lured by the promise of a new start and the hope that they, unlike Colón and his sailors, might discover a quick fortune in gold. Because Hispaniola held such rich economic potential, the Spanish were hesitant to let stand the failures of Navidad and Isabella; even Santo Domingo, the capital city of the southern coast, had been encumbered with its share of political and economic problems. In response, the Crown sent Frey Nicolás de Ovando to rectify the extant situation and to restore the island to the glory it had experienced under the directorship of Francisco Roldán. Ovando reverted to the medieval encomiendas (commissions) which imposed taxation through gold payment, banned selected economic enterprises, and established a slave labor force. An urban mandate called for the creation of 13 villages and cities that extended across the length of the island; one of these was Monte Cristi. According to historian America Lugo, the city of Monte Cristi was founded between 1502 and 1509, and was to be “the intermediate seat between the cities of Bayahá and Puerto Plata” (cited in Ortega 1987 33).
The popular history of Monte Cristi begins with Juan Bolaños, a craftsman who left his livelihood to pursue a lifelong dream of being a captain. In 1533, Bolaños, along with 64 farmers and their families, left the Canary Islands under a contract with the Spanish government. Fernandez de Oviedo, although noting a smaller group, records the event:

In 1533, at the end of August, there came a nau to the city and port of Santo Domingo of the island of Hispaniola carrying 60 farmers, and the greatest part of them brought their wives and children, to populate the regions of Monte Cristo and Puerto Real. ... The land where they went to settle is the best and most fertile of the entire island, and close by are gold mines... (de Oviedo 1959:137-138, as cited in Ortega 1987:39).

The attempt by Bolaños and the Canary Islanders to settle Monte Cristi was, however, unsuccessful. The reasons for this were two-fold: first, the migratory labor force was too small to manage the farms; and second, there was a scarcity of natives who, presumably, were to be used as slave labor (Ortega 1987). Ortega suggests that the region was simply unable to support the size and type of city to which the Europeans were accustomed. Additionally, there was a high attrition rate within the European population, through both death and migration to Santo Domingo and the continents. States Ortega (1987:40), “this is what is recognized as Bolaños’ immense failure.”

The most significant documents concerning the town of Monte Cristi were the Capitulaciones, the Royal Decrees that mandated the establishment of this town. The first of these (No. 73), dated 12 September 1545, called for the development of the port of Monte Cristi on Hispaniola. The second (No. 74), made on 16 September of the same year, was a declaration by the officials of the Casa de Contratación in Seville to assist Francisco de Mesa in establishing a settlement at Monte Cristi. Francisco de Mesa was later appointed mayor (in Decree No. 77, dated 6 October 1545). On 5 October 1545 (in Decree No. 76) lands were granted to those capable of settling them. Finally, on 10 November 1646 (in Decree No. 78), Monte Cristi was granted “citihood” (Ortega 1987:39-40).

Between 1549 and 1554, Alonso Fuenbayor, President of the Royal Audience and Metropolitan Archbishop, noted that Monte Cristi contained 190 families (many of whom were from Castile), more than 160 residences, and a wooden church. Additionally, he reported salt, wool, and gold as the chief commodities of the region. Monte Cristi and its environs were also mentioned in the chronicles of historians de Las Casas and de Oviedo, usually in association
with some geographical feature such as the Yaqui River or the salt pans for which the region is famous (see below). Juan López de Velazco, in his *Geografía de la Isla Española*, written in 1571, remarked on both the port and the salt pans of Monte Cristi, as well as on the nearby Yaque River:


**The Post-Colonial Period: The Trade Years**

At the close of the sixteenth century and the early years of the seventeenth century, the north coast of Hispaniola was a staging ground for European hegemony in the Caribbean. The English, French, Dutch, and Spanish were all vying for control of commerce in the rich waters between the American continents. The stakes were high, for numerous riches spilled forth from the tropical cornucopia of the Caribbean and the Atlantic coast of South America. Salt, leather, sugar, pearls, dyewood, cochineal, cacao, indigo, ginger, sarsaparilla, and canafistula were all vital commodities for appetites on the other side of the Atlantic Ocean.

The Dutch came to the New World for several reasons during this time period. One was to disrupt Spanish shipping, a strategy to weaken the nation’s economic strength by interrupting the flow of precious metals and jewels that flowed biannually into Spain. For example, in 1628, Piet Heyn captured the *Nueva España* fleet off Cuba, reaping some 15 million guilders for the Dutch West India Company4 (Parry and Sherlock 1985: 50; Zumthor 1994: 298). Another motive for Holland to enter the Western Atlantic, and specifically the Caribbean Sea, was to search for a cheap, accessible source of salt, a commodity necessary for curing fish and meat, as well as for use in the production of cheese and butter (Romer 1985: 11). Finally, the Dutch came to the Caribbean to trade with the local settlers, smugglers, and with roving bands of *boucaniers*, an activity which was prohibited by Spain.

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4 Parry and Sherlock (1985: 50) note that the booty returned “a dividend of 50 percent to the Company’s shareholders.” Boxer (1990: 54) places the “bumper dividend” at 75 percent, stating that “the Company only distributed another one or two before its dissolution in 1674.”
Salt

As European settlements sprang up in the New World, numerous natural resources were sought, both for transport back to the homeland and for trade with the burgeoning colonies. First among these was salt. Early on, Dutch vessels traveled to the highly profitable salt pans of Punta de Araya in Venezuela to collect the precious substance. It was hard work and dangerous. The operation was executed at night to avoid the noonday sun and to avoid the Spanish, patrolling the area to protect their interests. Depending upon the size of the Dutch vessel, between four and 12 cannon were deployed on the ship, along with small arms which included "muskets and harquebuses" (Goslinga 1971:120). As soon as the ship dropped anchor in the bay, sentinels were posted and men disembarked. Cargo and personnel were ferried from the primary vessel to the pans by an access boat. Between 15 and 20 crew members at a time worked the pans, clad in wooden shoes, for the salt was highly corrosive to leather footwear. Teams dug trenches, broke up the salt surface with long iron bars, stacked the chunks of salt in wheelbarrows, and loaded the cargo into the ferries for transport back to the ship (Goslinga 1971).

Although little is known about the size of the fleet sent to procure salt in the Caribbean, it is reasonably estimated at 100 vessels per year after 1600 (Goslinga 1971). Salt carriers were also instrumental in waging war against the Spaniards in the region by aiding in the breakdown of Spanish intercolonial communication and harvesting resources (Goslinga 1971). The sloops and pinnaces that accompanied the salt ships to the pans at Punta de Araya would engage in a series of overt and covert operations, including smuggling, attacking coastal traders, and raiding nearby pearl fisheries.

In addition to the pans at Punta de Araya, salt was also collected at Bonaire, Curaçao, Tortuga, St. Maarten, and to a lesser extent, the islands of St. Christopher (St. Kitts) and Saba. Salt collection may also have occurred at Monte Cristi. Today, the small island of Isla Cabra, base camp of the Monte Cristi Shipwreck Project, is teeming with pans (Figure 6). The main road leading from El Morro to the center of town passes along Juan de Bolaños beach for several kilometers before it turns inland and continues to Monte Cristi (approximately 5 km). The entire area from the beach to the outskirts of town is now covered with salt pans and storage sheds. Salt collection today, as in the past, involves introducing seawater, via sluice gates, into the shallow pans, which measure approximately two feet (60 centimeters) in depth and are
Figure 6. The Isla Caba salt pans. Sea water enters through a sluice gate (below). Photo by Kyra Bowling.
reinforced with stone and wood. Once seawater fills these pans, the gates are closed and the pools are allowed to evaporate. Miners skim the salt from the pan bottoms and pile it alongside the salt works; it is then transported by hand to the wharf and loaded onto a waiting boat. On the mainland, it is purified and stored in sheds, then placed in bags and sent to refineries for further purifying and packaging. Today, the salt workers' wharf lies on the eastern side of Isla Cabra, in virtually the only location that provides access from the sea. The "Pipe Wreck" is just 80 m away.

Salt collection may have occurred in the area since the sixteenth century. Spanish historian de Oviedo (1959, 1:151, as cited in Ortega 1987) noted that natural pans near the mouth of the Yaque River produced "good salt." A map of the Monte Cristi region (Figure 7), which supposedly comes from the archives of Seville and seems to date to the eighteenth century, shows major features of the area, including the Bahía de Manzanillo (Manzanillo Bay) and the Cayos de Siete Hermanos (the Seven Brother Islands). Near the upper right corner of this map is a tiny islet labeled cayo del sal, or Salt Island, this is today's Isla Cabra. The interior oval probably represents a salt pan of considerable size. Therefore, Dutch vessels plying the Caribbean may have been lured into Monte Cristi Bay in search of salt. The map further seems to suggest the presence of a shallow reef encircling Salt Island. Certainly such a reef exists today, and thus ships approaching this islet to collect salt would have faced significant navigational hazards. It was in this location that the vessel now designated as the "Pipe Wreck" sank.

_Boucaniers_

Throughout much of the seventeenth century, the north coast of Hispaniola, as well as the nearby island of La Tortuga, became the domain of the _boucaniers_. Although their origin is uncertain, the _boucaniers_ (or buccaneers) were most likely an affiliation of shipwreck survivors, deserters, and the occasional "marooner" (Haring 1966:57). This rough and surly group of adventurers organized themselves into tightly-knit bands of five to six persons (although groups of 10 were not uncommon) and survived by hunting the wild pigs and cattle along the northern savannas of Hispaniola (Exquemelin 1678). Their diet was bland, consisting of smoked meat seasoned with lemon and pepper. Meat and hides were traded for necessities such as guns, ammunition, and clothing (Mota 1984). Some _boucaniers_ turned to planting tobacco and sugar.
Figure 7. An unidentified map depicting the northern coast of "Part of the Spanish Island of Santo Domingo." The compass sits in Monte Cristi Bay, near "cayo de sal" (Salt Cay), or modern day Isla Cabra, headquarters from the Monte Cristi Shipwreck Project. Note the Seven Brothers Islands outside the bay. Tracing by Richard K. Wills.
but the inferior quality of the soil resulted in relatively small returns (Haring 1966). Those who were successful, however, found their crops to be desired trade items among the European merchant seamen who visited the ports of the north coast. The lifestyle of the *boucanier* was simple, with emphasis placed on ease of mobility and personal protection. They chose to live in inaccessible surroundings -- in the mountains, or at the base of seaside cliffs -- as a means of protecting themselves against Spanish soldiers who sought to eradicate them. Charlevoix (1731) noted several principal *boucuns* or *boucanier* encampments that were in existence in 1665, including the *Savane Brulée*, near Gonaïves; the *Embarcadéro* of Mirbalet near the mouth of the Artibonite River; in the region of Isle a Vache; at Port Margo; on the *Isle des Boucaniers* in the Bay of Bayahá; and in the Samana Peninsula.

The Spanish wished to eradicate the *boucaniers* because it was impossible to tax their illegal trade. Large, organized campaigns involving hundreds of soldiers and incorporating ships as both transport and supply vessels were used against the *boucaniers*; however, such undertakings proved both costly and logistically difficult. Less expensive and more practical were the small groups of mounted lancers deployed to rove the savanna and destroy the renegades' encampments. These quasi-guerrilla units, comprising 50 soldiers and known as *cinquantaines*, were divided into smaller groups of about a dozen men. They relied on ambush tactics which, according to Charlevoix (1731), were effective in at least two instances. The first of these took place on the savanna near Bayahá, where a small group of *boucaniers*, headed by Charles Tore, was returning from l'Aul des Pins, near modern-day Fort Liberté in the northeast corner of Haiti. The Spanish, in a surprise raid, killed all of the hunters as they crossed an open tract of land, although Charlevoix noted that they fought valiantly (Charlevoix 1731). A second incident occurred not far from Monte Cristi, at the river that separates the modern-day Dominican Republic from Haiti: a hunting party of about 30 *boucaniers*, laden with hides, was trapped and killed by the Spanish as they crossed the river. To this day, the river is known as Rio Masacre, or Massacre River.

Only after their livelihood was destroyed by the Spanish, who systematically killed the cattle of the islands, did the *boucaniers* take to the high seas intent on disrupting shipping. It was then that the term "buccaneer" gradually lost its original meaning and became synonymous
with the corsarios (corsairs), filibusters\(^5\) (filibusters), aventereros (adventurers), and piratas (pirates) who plagued the Spanish in both the Caribbean and South Seas (Haring 1966:66)\(^6\)

**Contrabandistas**

The buccaneers were not the only inhabitants of Hispaniola's north coast: smugglers or contrabandistas kept foreign merchant ships well supplied with leather hides, lard, tallow, smoked meat, tobacco, sugar, and silver (Peña Battle 1974). In exchange, they received guns, ammunition, powder, knives, soap, wax, mercury, brandy, wine, liquor, dry goods,\(^7\) as well as sundry articles necessary for day to day existence (Haring 1966; Peña Battle 1974; Koski-Karell 1976; Burg 1983; Mota 1984). To facilitate this burgeoning trade, local merchants constructed warehouses at portside; here they could store great quantities of products that could be easily unloaded when European ships arrived (Peña Battle 1974). Ferias -- commercial centers akin to modern-day flea markets or swap meets -- were the sites of these activities. Traders traveled distances of up to 50 leagues and would often arrive by boat to buy, sell, and barter for goods brought by northern European merchant ships. Two of the most famous markets were those of Guanahibes (Gonaïves) and La Yaguana. Peña Battle (1974:46–47) has noted that some 50,000 cattle hides changed hands annually at such fairs.

The inhabitants of the north coast heartily supported the clandestine fairs, since goods they desired were slow to come through legal Spanish channels and were considerably overpriced when they finally arrived. Northern European merchants -- the majority of whom it seems were Dutch -- paid better prices, purchased in greater quantity, and provided a wider selection of goods than did their Spanish counterparts. So successful were these commercial ventures that by 1630 a trading post was established on Tortuga, a move that infuriated the Spanish. In 1635, soldiers attacked the settlement and destroyed virtually all of its inhabitants. The few who escaped, however, moved back to the mainland and soon resumed business.

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\(^5\) From vrijbuiters, or a “seeker of free booty” (Zumthor 1994:290).

\(^6\) Peña Battle (1974) divides the aventereros into three groups: the bucaneros, or those who cured the hides of wild cattle; the filibusters or corsairs, those who took to the high seas; and the habitantes or inhabitants, those who, although small in number, were in control of the island.

\(^7\) The word used by Peña Battle (1974:46) is “lenceras,” which may translate as “dry goods” or “linen goods.”
Numerous means of ending this contraband trade were proposed by the Council of the Indies. In 1577, Jerónimo de Torres, a royal scribe, suggested that justicias -- most likely the equivalents of customs agents -- be stationed at various ports throughout Hispaniola. Archbishop Augustín Dávila proposed that ships from Seville guard the coastal waters while simultaneously engaging in commerce. These vessels were also called upon to "liberate the towns from foreign trade, an indirect call to repel northern European merchant ships forcefully." In 1598, Baltasar López de Castro, who attributed the economic disintegration of Hispaniola to illegal trade, proposed depopulation of the major commerce centers as a means of undercutting "the Lutheran merchants who made powerful inroads against Christianity."¹⁸ Monte Cristi and Bayajá were among the cities targeted for a massive relocation campaign. As may well be imagined, however, the citizens reacted "rapidly and energetically" against these decrees and "banded together to form a single city" (all quotes from Domorizo in Incháustegui 1958, III:116-117, as cited in Ortega 1987:45, footnote 14). After relocation proved futile, King Philip II named don Domingo de Osorio as President of the Royal Audience, and charged him with the mission of eliminating the contraband trade. A Royal Decree, issued in 1606, called for the destruction of several centers of commerce, including Monte Cristi (Ortega 1987:45). This time period is commonly referred to as the Devastaciones de Osorio.

Between 1620 and 1670, as the bucaniers and contrabandistas flourished on Tortuga and Hispaniola, the Spanish Empire in the Caribbean faced serious problems (Koski-Karell 1976). Power and influence were on the decline. During the early part of the century, Spain and her creditors suffered severe financial setbacks when several of the King's treasure-laden galleons were lost at sea. Illegal trade with northern European interlopers undercut Spain's economic stronghold of her own New World colonies. And furthermore, these same groups proceeded to establish settlements throughout the Lesser Antilles and continued to challenge Spanish supremacy in what was once the Mare Clansum.

**The English Navigation Acts**

By the middle of the seventeenth century, the Dutch West India Company was a major sea power in the Caribbean. Although Dutch possessions in the Caribbean were primarily

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¹⁸ "Lutheran merchants" is a reference to Dutch traders.
limited to the Lesser Antillean Islands of Curaçao, St. Eustatius, Saba, St. Maarten, and Bonaire, the WIC was in constant communication with the Dutch-American colony at New Netherland. Ships were continually passing by the island of Hispaniola, especially privateers and smugglers, who were known to range throughout the Greater Antilles. This was a particularly tumultuous period of Anglo-Dutch relations, as illustrated by The English Navigation Acts and the Anglo-Dutch Wars.

During the first three quarters of the seventeenth century, relations between the Dutch and English were less than amicable, due largely to Holland's undisputed economic and maritime dominance. Because the United Provinces excelled in inexpensive and highly efficient methods of ship production and cargo transport, they gained supremacy in the carrying trade, and the profits that resulted from this lucrative industry fueled colonization. English hostility was aroused by the virtual monopoly the United Provinces held on the distribution of English imports. Schama (1988) notes that English clothiers were exceedingly resentful toward the Dutch, who would purchase wool from Wiltshire and Gloucestershire, only to finish them in Holland and pass them off as Dutch goods. The result was a fleet of Dutch ships, sailing between the continents, laden with English merchandise.

 Everywhere, it seemed, competition from the Dutch undercut the English economy. So large was this maritime iniquity that during the first half of the seventeenth century, England could do little more than "bluff," confining their activities to "diplomatic threats, privateering and isolated raids in the colonies" (Schama 1988:230). It was not until the reign of Charles I that England had sufficient naval power to challenge the Dutch.

The English Navigation Act of October, 1651, had a profound influence on Dutch commerce both in Europe and abroad. Passed by a "Rump Parliament largely composed of regicides, hard-line religious zealots, and practical-minded merchants" (Rink 1991:249), it was a measure aimed at restoring English sea power both in Europe and in the Americas by giving English ships a monopoly on foreign trade. It included a law that required all goods brought to the English colonies to be carried in ships from their country of origin, or in English-built

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9 Schama (1988:229) points out that the English, who "in matters of trade were poor losers," stood "unable to match the Dutch in resourcefulness, industry, or technical ingenuity," and therefore "were prepared to bludgeon their way to wealth by the assertion of deliberately bellicose principles and by interfering with the freedom of trade."
vessels. Obviously, this mandate was a figurative dagger aimed at the heart of the Dutch carrying trade. There were other points secondary to this economic insult, such as the requirement that Dutch vessels fire a “deferential salute” to all English vessels, that the English had the right to search Dutch vessels, and that the English be compensated monetarily for Dutch fishing activities. Although the Act of 1651 was hardly enforced, it did encourage informers to report violations, promising them a portion of the goods that were seized.

Despite general inefficacy of the Act of 1651, the Dutch were outraged by the effrontery and, in May, 1652, the first Anglo-Dutch War commenced; it ended with the Peace of Westminster, enacted in 1654. During this war, casualties were high. Both sides lost vessels through sinking and capture. Even after the war, notes Schama (1988:232), the English continued to seize Dutch ships for infringement of the Navigation Act, totaling no fewer than 300 vessels, both in Europe and abroad, between the years 1652 and 1658. Thus, Dutch-made ships often sailed under the English flag. Furthermore, and perhaps more relevant to this study, because of the spoils of the first Anglo-Dutch War, English ships occasionally were commandeered and used by the Dutch.

THE HISTORY OF EXCAVATION OF THE “PIPE WRECK”

In the middle of the seventeenth century, against a temporal backdrop of privateering, regulatory trade acts, and clandestine flea markets, the northern European merchant vessel now known as the “Pipe Wreck” sank in Monte Cristi Bay. Its long history of salvage probably began within hours after it ran into the shallows of Isla Cabra. If the hull and upperworks of the ship survived the wrecking, it is doubtful they remained undisturbed for long: salvors from nearby Monte Cristi and sailors from passing vessels likely picked the wreck clean of any valuables. The shallow grave in which it was to rest was not inaccessible to seventeenth-century divers who could easily have raised anchors, cannon, and small, valuable items such as metal goods and coins.

A story related to the author in the back of a bus en route to Santo Domingo reports the earliest known case of salvage, one that may actually have been substantiated within the archaeological record. Sr. Raphael Enrique Socías Grullón, the town historian for Monte Cristi.

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10 There were a total of three Anglo-Dutch wars in the seventeenth century: the first was from May, 1652, to April, 1653; the second, from June, 1665, to July, 1667; and the third from March, 1672, to February, 1674.
recalled hearing from his father that sometime during the first quarter of the century, a German visited Monte Cristi and spent many days collecting artifacts from the wreck (Socías, personal communication, 1991). Nothing is known of the methods that he used or the types and quantities of materials that were recovered. Although the story has never been verified, a large copper English penny with a date of 1923 was found on the wreck during the 1991 PIMA field campaign.

The popular history of the site — well known to virtually all Monte Cristiani and many Dominicans scattered about the island — begins with its rediscovery in 1966 by a local fisherman. Since then the “Pipe Wreck” has been visited repeatedly by treasure hunters, archaeologists, and countless souvenir seekers (Table 1). In fact, if all accounts related to the author are true, the majority of the vessel’s original cargo is displayed on bookshelves and coffee tables in all parts of the Dominican Republic, not to mention those artifacts that have been removed by foreign tourists.

Johnny Bigleaguer

An article appearing in the 5 September 1966 issue of Listín Diario, the Dominican Republic’s most widely-circulated newspaper, credited two Dominican divers — Dionisio de Jesus Vargas, also known as “Johnny Bigleaguer,” and Elpidio Arturo Francisco — with having discovered the site of the Monte Cristi shipwreck. It is Vargas’ testimony that, while spearfishing, he noticed a large grouper that sought cover beneath the concretions of the site. Not realizing that this coral island in the middle of the turtle grass bed represented a shipwreck, Vargas proceeded to search beneath the overhanging iron ledges for the fish, finding instead bits of scattered ceramic and clay pipe fragments (Vargas, personal communication, 1987).

The newspaper article included a photograph showing the location of the shipwreck, thus making it accessible to any curious town resident or tourist. Furthermore, the press was informed that should the “Dutch galleon” contain a cargo of gold, “part of it would be used for the economic development of the area” (Listín Diario, 5 septiembre 1966). Divers working for the government were reported to have raised the “majority of artifacts,” a collection that comprised items of “historical value,” including pipes, cooking pots, and an anchor, “among other things” (Listín Diario, 5 septiembre 1966). According to the article, these items were to be placed in a local museum to be built for tourists.

In 1991, Vargas indicated that for more than three decades he personally had taken more than 1,000 visitors to the site. “not all of whom,” he was quick to add, “removed artifacts” (Vargas, personal communication, 1991). Throckmorton (unpub. 1986) noted that Vargas
<table>
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<th>Inventory of Artifacts and Observed Features</th>
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<td>ca. 1967</td>
<td>Vargas</td>
<td>No artifacts removed; a tugboat cable was attached to the wreck for tearing away the hull bottom; venture was reported as unsuccessful. Observations: none.</td>
<td>Throckmorton (unpub. 1986).</td>
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<td>1979</td>
<td>Arache, Taylor Montes, and Popas</td>
<td>Removed: 71 pipes, 44 pipe stems, 2 Bellarmine neck sherds, 4 blue- and-white plate sherds, 2 white-glazed sherds, 10 brown sherds, 5 ballast stones, 5 flints (?), 1 brass ornament, 2 nails, 1 three-legged iron cooking pot, 1 unidentified iron object, 1 iron fitting. Observations: “encrusted iron objects, straps, rods, elongated planks, iron cooking pot, pipes, pipe stems, ceramic sherds.”</td>
<td>Taylor. (unpub. 12 January 1979)</td>
</tr>
<tr>
<td>1980</td>
<td>Coffey, Long, Silvero, and Popas</td>
<td>Removed: Bellarmine sherds, glass ware, 2 three-legged [pots or caldrons?], 1 [brass candle] holder (‘), &gt;25 musket balls, 1 silver spoon, 1 bent spoon, 1 brass handle, 2 hinges, 1 pestle or pistol [notes = pistol], various “clumps”, various unidentified “small items”, 1 brass key, 1 tip of powder horn, &gt;200 pipe bowls, &gt;500 pipe stems. Observations: “ribs and keel.” Site plan by D. Long indicated frames, bottom and ceiling planking, iron fasteners, brass tacks, lead (Pb) scupper, spoon, glass, pebble ballast, and large ballast stones (see Figure 10).</td>
<td>Coffey (unpub. 21 Feb. 1980).</td>
</tr>
<tr>
<td>Year</td>
<td>Expedition</td>
<td>Inventory of Artifacts and Observed Features</td>
<td>Source</td>
</tr>
<tr>
<td>------</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>1986</td>
<td>Throckmorton and</td>
<td>Removed: 23 clay pipe fragments, 1 gold-washed thimble, 1 Bellarmine sherd, samples of ship's planking and</td>
<td>Throckmorton (unpub. 1986).</td>
</tr>
<tr>
<td></td>
<td>NCR</td>
<td>treenails. Observations: none</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NCR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1987</td>
<td>Unidentified</td>
<td>Removed: unknown. Observations: numerous pipes strewn over site; many disarticulated timbers.</td>
<td>Observed by Hall, 1987, and</td>
</tr>
<tr>
<td></td>
<td>treasure hunters</td>
<td></td>
<td>reported herein.</td>
</tr>
<tr>
<td>1987</td>
<td>Swete and NCR</td>
<td>Removed: unknown, unsuccessful attempt made to lift large, triangular concretion at southern end of site.</td>
<td>NCR (unpub. 1987).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observations: none</td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>Unidentified U S.</td>
<td>Removed: numerous pipes and pipe stems; exactly how many artifacts, and for how many years, is unknown.</td>
<td>Artifacts seen displayed at</td>
</tr>
<tr>
<td></td>
<td>citizen</td>
<td>Observations: none</td>
<td>private home in Monte Cristi.</td>
</tr>
<tr>
<td>1991</td>
<td>Hall and PIMA</td>
<td>Removed: numerous pipes, pipe stems, ceramics, metals (including iron, copper alloy, lead, and silver),</td>
<td>Reported herein.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>glass, and organics (including seeds, bones, horn or antler, hair, rope, and textile). Observations:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>recorded ship's hull</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>Hall and PIMA</td>
<td>Removed: numerous artifacts as in 1991 and 1992. Observations: artifact scatter continues to southwest</td>
<td>To be reported at a later date.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>portion of site.</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>PIMA</td>
<td>Laboratory conservation work.</td>
<td>To be reported at a later date.</td>
</tr>
</tbody>
</table>
allegedly "attached a tugboat's...towing cable to the keel and went full ahead, hoping that the bottom of the hull would come off the bottom and expose treasure. Luckily," he added, "the tug was not strong enough."

Vargas compared the artifacts he had recovered from the site with pictures of similar items in a book and, based upon these observations, posited that the ship was a seventeenth-century Dutch merchantman. It was his opinion that the vessel engaged in trade with the Taino Indians (Vargas, personal communication, 1991), but this is virtually impossible since these Native Americans were all but extinct within 30 years of The Contact.

In 1987, Elpidio José Ortega Álvarez, in his volume titled *Ensayo Histórico Y Arquitectónico de la Ciudad de Montecristi* (Historical and Architectural Essay of the City of Monte Cristi), included a synopsis of archaeological work conducted in the region. A small appendix describing a "sixteenth-century Dutch shipwreck in Monte Cristi Bay" unmistakably refers to the "Pipe Wreck" (Ortega 1987:415-416, Appendix No. 5). Ortega credits 72-year-old Seferino Gómez -- an "old sea wolf" -- with the discovery of the site in 1966, while the aforementioned Dominican divers. Vargas and Francisco, are acknowledged as the first to explore the shipwreck and recover artifacts. Clay pipes, ashtrays, inkwells, candelabras, metal rings, anchors, bronze weights, small clay jars, crucifixes, nails, and glass bottles were among the items reportedly raised by Vargas and Francisco. Some of these goods were sold to tourists and some went to "a government commission," but the majority of the artifacts were apparently retained by Gómez (Ortega 1987:415-416).

Vargas and Francisco were unable to ascertain the exact orientation of the shipwreck, but they concluded that its remains "measured 15 meters in length and six meters in breadth" (Ortega 1987:415-416). They correctly determined that the majority of pipes were manufactured in Holland, though this was derived from faulty data, a heel stamp erroneously believed to bear the initials VH (Ortega 1987). Based upon the history of the region, specifically the devastation of several cities mandated by Royal Decree in 1606 (see above), Ortega suggested that the vessel met its demise in 1605. The wreck was thought to represent "one of many Dutch, Portuguese, English, [or] French ships that traded with the inhabitants of the north coast, especially those in Monte Cristi and Puerto Plata during the devastation period of 1605" (Ortega 1987:416).

Like the aforementioned article in the *Listín Diario*, Ortega concludes that the "Pipe Wreck" would offer Monte Cristi a means of economic recovery, in the form of "a cargo of millions of gold ingots" (Ortega 1987:416). The short appendix closes with the hopes that the municipal government might build a museum where the Monte Cristi artifacts could be
displayed. Finally, it is suggested that the “Pipe Wreck” could one day be the catalyst for a regional tourist center, thus putting the town of Monte Cristi back on the economic map of the Dominican Republic.

The Taylor Expedition

In 1979, a small contingent of Dominicans, headed by a military official and accompanied by the late Henry M. Taylor III, numismatist and conservator for the N.S. Pure y Limpio Concepción project, surveyed the “Pipe Wreck” (Taylor unpub. 1979). Among the small sample of diagnostic artifacts recovered from the site were 71 pipes, of which seven (9.9%) possessed what Taylor termed “conical bowls” (the funnel elbow-angled forms described in Chapter 3). The remaining 64 (90.1%) possessed bulbous bowls. These percentages compare well with the results of the 1991 and 1992 PIMA excavations (see Chapter III). To these two pipe forms Taylor assigned dates of ca. 1640 and 1645, respectively. Taylor designated the conical-bowed pipes as Type I and noted that they were closest in design to Noél Hume’s type 27 bowl, with a temporal range of 1640-1700. The bulbous-bowed pipes, referred to as Type II, were closest in design to Noél Hume’s types 9 and 10, with a temporal range of 1645 to 1680.

Among the ceramic artifacts recovered by Taylor and his crew were tin-glazed sherds of the white and the blue-and-white variety. Two Rhenish stoneware bottle necks, one of which bore a “grotesque mask,” were also raised (Taylor unpub. 1979). Taylor noted that “the wrecksite appeared virtually untouched, except for the fact that we had seen pipes from the site in November and had heard that intact majolica pieces had been recovered” (Taylor unpub. 1979). To date, no majolica sherds have been recovered from the site; most likely, Taylor is referring to blue-and-white tin-enamel ware (see Chapter III).

Taylor produced two important maps, the first of which clearly indicates the position of the wrecksite between Isla Cabra and the headland of El Morro (Figure 8). Also shown are the locations of Fraile Island, the shoreline cliffs at the base of Punta de Granja, a small wharf or piling, and the Dominican military post.

The second map (Figure 9) indicates the position of the wrecksite relative to the northeastern portion of Isla Cabra and to the reef that, at low tide, rises above the sea surface.

11 There is confusion as to whether the date of this expedition was 1978, 1979, or 1980. Taylor’s original correspondence is undated, with the exception of an addition in pen, reading “1978,” that was marked across the typewritten page. A photocopy of the same document, supplied to the author by Charles Beeker, has “1980” written across the top of the first page. Taylor has since stated that the date was most likely 1979 (Taylor, personal communication, 1993).
Figure 8. The position of the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic, relative to El Morro, the mountain of Monte Cristi. Illustration by Jerome Lynn Hall, from the original by the late Henry Taylor.
Figure 9. The position of the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic, relative to Isla Cabra. Note the enlargement of the wreck site. Illustration by Jerome Lynn Hall, from the original by the late Henry Taylor.
(indicated by “ripples”). Taylor placed the site within 100 yards (91.4 m) of the northwestern shore of the island, and 75 yards (68.6 m) southeast of the reef. The enlargement of the wreck clearly shows two portions surrounded by sand, grass, and scattered bits of iron. Presumably, these two sections represent the break in the large concretions (III and IV), corresponding to the structures on either side of grid squares X and XV on the PIMA site plan (see Methods, below).

Taylor (unpub. 1979:3) proposed that the site represents a small merchant vessel, somewhere between 60 and 80 feet (18.3 to 24.4 m) in length, that sank ca. 1650. “Give or take 10 years.” He posited that the ship may have fallen victim to pirates. Furthermore, he was convinced that all “armaments and valuables were easily recovered when she sank or grounded,” due to the shallow depth of the site. He concluded that the chance of recovering “any treasure... is extremely slim” and recommended that “at best, it would be a good wreck to work for artifacts with a small group on a small budget” (Taylor unpub. 1979:3), a prescription for the PIMA investigations that would follow 14 years later.

The Institute of Nautical Archaeology

In 1980, a group of archaeologists from the Institute of Nautical Archaeology (INA), in College Station, Texas, briefly surveyed four wreck sites in Monte Cristi Bay and the adjacent area (Smith unpub. 1980). Hull features from the “Pipe Wreck” were noted and a small collection of pipes and ceramic sherds were recovered and taken to Texas A&M University for conservation. Thirty-one clay pipes were gathered either from “the surface or within a few centimeters below” (Smith unpub. 1980:15). Of the “eight potsherds, all in poor condition” noted by Smith (unpub. 1980:9), five were blue-and-white- or white-glazed delftware. Two Rhenish stoneware sherds were collected, one of which appeared to possess a portion of an armorial design, as well as a rim sherd of “coarse, dark earthenware” (Smith unpub. 1980:15).

Like Taylor, Smith suggested the vessel was most likely salvaged immediately after sinking. Twice Smith referred to the “the disturbed condition of the site,” once noting a “lack of archaeological materials,” and a second time to suggest that so few artifacts would “preclude accurate testing” (Smith unpub. 1980:9).

It was concluded that the hull remains and scattered cargo represent “a Dutch vessel of the first half of the seventeenth century which came to grief while conducting illegal trade with the Spaniards on the north coast of Hispaniola.” The site was therefore designated “The Dutch Wreck” (Smith unpub. 1980:8).
The Coffey/Long Expedition

Robert Coffey and the late Duke Long, members of the *Nuestra Señora de La Pura y Limpia Concepción* project, visited the "Pipe Wreck" in 1980. Based upon the artifacts, they concluded that the ship sank between 1620 and 1650. The site was one of twelve that the team examined along the north coast between 17 February and 15 March 1980. Field notes obtained by the author indicate that the site was salvaged between 20 and 24 February, although one day of work was lost to inclement weather. According to a journal entry, the wreck was located NNE by SSW in twelve feet (3.7 m) of water and was covered by approximately 3 to 4 feet (0.9 to 1.2 m) of sand. Coffey listed the bearings for the wreck as: "tip of Isla Cabra at 332° tip of rock west of El Morro (Fraile) 31°. Hotel [presumably Monte Chico] 171°" (Coffey unpub. 1980:4a).

On the first day of diving, their Dominican guide ("Johnny Bigleaguer" Vargas) pointed out an area where a past expedition had used a blower, leading Coffey and Long to conclude that the previous group "did a better job than we were led to believe" (Coffey unpub. 1980:4a), having "retrieved pipes only after using a blower on 3/4 of the wrecksite" (Coffey unpub. 1980:4b). Vargas informed the two that "he and other divers had been working this Pipe Wreck for years before any equipment was used" (Coffey unpub. 1980:4a).

A journal entry for 23 February noted that, "at this time we do not expect [a] large amount of artifacts" (Coffey unpub. 1980:4b), but the inventory suggested that many items were uncovered and possibly raised. Like Taylor (unpub. 1979) and Smith (unpub. 1980), Coffey indicated, although in a more indirect fashion, that the vessel was most likely salvaged immediately after it sank: "we have come to the conclusion," he wrote, "that any wreck along the coast, in shallow water, has been worked clean by survivors or fishermen. We have to find deeper wrecks" (Coffey unpub. 1980:4b).

Long, although working on the wreck a little less than seven days, produced a site plan divided into 96 squares (Figure 10). The extant hull and scattered cargo stretched 50 feet (15.2 m) in length by 20 feet (6.1 m) in width. In 1992, the author sent Long a list of questions in an attempt to clarify the interpretation of the various symbols placed on the site plan. As a result of this correspondence, it was determined that the northern end of the site was designated

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12 Figure 10 is a tracing of a photocopy of Long's original site plan. Eighty-eight of the 96 grid squares are pictured. The remaining eight squares possessed neither hull nor cargo remnants and were therefore not drawn. Unlike the PIMA excavations, these squares do not represent a physical grid system that was erected over the wreck. The drawing was supplied by the courtesy of the late Henry M. Taylor III. Notes taken by Robert Coffey, Jr. were provided to the author by Charles Beeker of Indiana University.
Figure 10. The Monte Cristi shipwreck site plan, drawn by the late Duke Long in 1980. Eighty-eighth illustration by Jerome Lynn Hall, after the original by Long (1980 unpub.).
By the late Duke Long in 1980. Eighty-eight of the original 96 squares are shown. (1980 unpub.)
the stern, based primarily on the assumption that the three-legged, iron pots found at the southern end (see squares 86 and 87 of Figure 10) were galley cookware as opposed to cargo.

Two areas were excavated in 1980, one of which was located at the northern extremity of the site (grid squares 3-6, 11-14, 19-22, and 27-30) and corresponds approximately to grids XXIV, XII, XVII, V, XI and XVI on the PIMA plan; the other, at the southeastern corner (grid squares 77, 78, 85, and 86), is analogous to grids XXIII and XXVIII on the PIMA map (see Methods, below). The majority of material culture excavated at the northern end appears to be iron fittings or pins (elongated black symbols), although several small brass rings and possible brass tacks were recovered, as indicated in grid 37. Larger ballast stones were recovered from the northwestern portion of the wrecksite, in the area immediately west of grid 25. Rhenish stoneware (Bellarmine) fragments were excavated from both sides of the keel, in squares 19 and 20 to the west, and in grid 15 on the eastern side of the keel. Black glass was found in grid 39. Clay tobacco pipes appear sparsely scattered across grids 37 and 38, with the suggestion that they were also found in grids 46 and 47; however, the major concentration appears in grids 77, 78, 85, and 86 at the southern portion of the site.

An assortment of artifacts was recovered at the southern end of the wreck, specifically off the southern tip of the large, triangular concretion. These included crystal in grid 77, possibly glass stemware in grid 85, a lead scupper and a “brass or bronze” spoon in grid 79, two pairs of scissors and a brass handle in grid 86, and iron fasteners in grid 87. Three kettles were also found, in grids 86 and 87 at the southeastern portion of the site.

The keel of the Monte Cristi shipwreck, according to Long’s site plan, is divided into three sections: a fragment crossing through grids 84, 76, and 68; a fragment in squares 52 and 44; and a fragment in squares 28, 20, and 12. A large timber emerging diagonally from beneath the concretion in grid 44 (corresponding to concretion III on the PIMA site plan) appears to be either a disarticulated frame, or perhaps a portion of the keel. Six strakes of ceiling planking run north-south through grids 21-23, 28, 29, 37 and 38. At least 11 frames extend eastward from the two northernmost concretions, corresponding to the port side of the vessel, according to Long. Bottom planking can be seen beneath the frame elements. At least 12 projections, 11 of which touch or cross the keel, run north-south through grids 20, 28, and 36. These appear to be floor timbers, as indicated by their regularly spaced intervals and the fact that they are tangential to the northern portion of the keel. However, these elements lack any wood grain features in the drawing and may instead represent finger-like projections of the two northernmost concretions.
Unidentified Treasure Hunters

Site tampering has proved a problem over the past three decades. In spite of the fact that the shipwreck lies approximately 500 m due east of the Paroli Naval Station, the Dominican Navy has no vessel in the immediate area with which to enforce their cultural resource protection policies. Thus, several groups of treasure hunters have removed artifacts from the site.

The Yolo II expedition, known only to the author from notes compiled by Bob Coffey, apparently raised a box of pipes that were eventually deposited at the military headquarters in Monte Cristi. Nothing else is known of the group except that their reputation greatly interfered with efforts by the Coffey and Long expedition to locate wreck sites in the area of Puerto Plata (approximately 90 km east of Monte Cristi). In a journal entry marked 7 March 1980, Coffey writes: “Duke [Long] returned, bad weather, zero visibility, and unsatisfactory communication with fishermen. Fishermen in Puerto Plata do not trust us because of past relationship with the Yolo II expedition” (Coffey unpub. 1980:8b). Rick Berry, President of North Caribbean Research Ltd. (NCR, see below), has for years spoken of a large quantity of pipes left at the military station, by whom, however, has never been determined.

Brian Steinwand, an American currently residing in San Francisco, visited the site along with two friends on a snorkeling trip in 1980. Although on the site for little more than an hour, Steinwand collected 12 complete pipes and a number of pipe stems. Most interesting, however, were his observations that “thousands” of scattered pipes and numerous timbers were lying visible on the sea floor.

A group of American treasure hunters who reportedly salvaged the site in 1985 concluded, humorously enough, that the wreck was a “Dutch East Indiaman that had blown off course by more than 1,000 miles” (Throckmorton unpub. 1986:1). In 1987, the author made telephone contact with one of these divers, who apparently possesses a small horde of wreck materials collected on this venture. These artifacts, which were never conserved, are currently disintegrating in the basement of his home. The author has made several attempts to visit the collection and to document the artifacts, but has always met resistance.

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13 There is nothing in Coffey’s field notes to indicate that either he or Long was familiar with the Yolo II expedition. The only reference is an entry made on 24 February which reads: “We are informed of [a] box of pipes from the “Pipe Wreck” at [the] army headquarters, here at Monte Cristi, left by [the] Yolo II expedition. We’ll try to obtain them” (Coffey, unpub. 1980:8b). Therefore, it is not certain that the Coffey and Long expedition was mistrusted by the Dominican fishermen because of its “past relationship” with Yolo II; rather, it may be that Coffey meant to say the fishermen mistrusted them because of past experiences with the Yolo II expedition.
One afternoon in 1991, PIMA crew members were visited by an American who keeps a summer home near Paroli. His house, located at the foot of El Morro, looks directly over the northern part of the bay; from the patio looking westward, the wreck site is clearly visible. He remarked that for years he had been taking artifacts from the site, some of which were on display in his home. When archaeologists from PIMA explained their research interests and the importance of keeping souvenir-seekers from removing valuable information, he guaranteed his full cooperation, assuring that his pilfering of the site would cease. Unfortunately, reports made to the author since 1991 indicate that this individual continues to dive on the site and collect artifacts.

North Caribbean Research, Ltd.

A report filed by an NCR staff archaeologist, the late Peter Throckmorton, to the company investors, dated February, 1986, listed a number of sites that had been investigated in the outlying areas of Monte Cristi: the "Pipe Wreck" was among them (Throckmorton unpub. 1986). After a brief examination of the "Pipe Wreck," Throckmorton concluded that it represented an "English merchant ship on its way out from England which sank between 1630 and 1640" (Throckmorton unpub. 1986:1). He continued:

It is possible the ship could be Dutch, but the presence of pipes that are almost surely English, along with thimbles and needles, makes it more likely that the vessel is English. We will not be sure of the nationality of this vessel until we have thoroughly studied the hull and remaining cargo (Throckmorton unpub. 1986:1).

From 17 to 26 August 1987, NCR staff archaeologist Dick Swete and several divers \(^{14}\) studied a portion of the ship’s timbers. Their attempts to lift and remove the large triangular concretion at the southwestern end of the site, by the use of four 55-gallon steel drums buoyed with air, proved unsuccessful \(^{15}\). A drawing taken from the field notes indicates that the structure was thought to represent the stern of the vessel (Figure 11). In a journal entry dated 18 August, in which the clear objective was "to search for [the] extent of the keel," it was noted that "Dick [Swete] found [the] northern extremity which revealed a scarf joint, thus indicating the bow" (Swete unpub. 1987:13). Furthermore, "knowing the northern end is the bow, it appears that the port frames have collapsed onto the starboard frames" (Swete unpub. 1987:13). In the

\(^{14}\) The journal indicates that participants in this survey were Dick Swete, a graduate of the Nautical Archaeology program at Texas A&M University; Colin Milne and Christopher Weston, two British Royal Air Force servicemen; and Chris Berry, son of Richard Berry, President of NCR.

\(^{15}\) The author gratefully acknowledges the assistance of Gregory Thom, NCR staff conservator who, in 1991, graciously provided the field notes from the work conducted by NCR at the site in 1987.
Figure 11. The southern portion of the Monte Cristi wreck site, from the 1987 North Caribbean Research, Ltd. survey. Illustration by Jerome Lynn Hall from the original by NCR.
illustration, the keel can be seen protruding from beneath the triangular-shaped mass at the southern end of the site. Although the timber in Figure 11 (a copy made by the author from the original field notes) is not labeled as the keel, other diagrams in the journal clearly indicate that this was the interpretation of the structure. As with the Long site plan, the southernmost section of the wreck is clearly out of alignment with the rest of the keel, but in this instance it departs the axis to the west, instead of to the east. Six frames are pictured, four of which are apparently floors as they are tangential to the keel (numbers 1, 2, 4, and probably 5).

A report by Throckmorton to the partners of NCR stressed the importance of the site:

It is highly unlikely that there is anything of intrinsic value on this wreck. Furthermore, the absence of any anchors or cannon seems to say that the ship might have been salvaged shortly after she sank. However, the Pipe Wreck is an archaeological site of major significance to the colonial history of the Americas. A considerable portion of the hull of the ship remains. This alone would make an excavation and serious study worthwhile, as no hull of an English merchant ship of this period has ever been studied. It could be this is a ship almost contemporaneous with the Mayflower. Pipes are an important tool for dating archaeological sites of this period. The pipes in the museum alone form the largest group from the seventeenth century yet found, and if analyzed properly will be of great use to archaeologists studying the period. In spite of the extensive looting of this wreck, a great deal of it remains in place, and the site is worthy of a careful excavation from a purely archaeological point of view (Throckmorton unpub. 1986:8).

PIMA EXCAVATION OF THE "PIPE WRECK"

The site of the Monte Cristi "Pipe Wreck" apparently lay undisturbed from 1987 until the summer of 1991 when PIMA and Earthwatch® began to excavate. Long's site plan (see Figure 10) further indicated that the wreck had remained relatively intact since 1980. Thus, the team began work with high hopes that Throckmorton's estimation of the site's archaeological value could be realized. Primary objectives for the first two seasons included recording the extant hull, an area approximately 14 m by 4 m, and the excavation of the ship's cargo located in and around the structure. Secondary objectives included producing a set of ship's lines based on the extant timber measurements, with a scale model to follow.

Preliminary Findings

A comparison of the extant hull and cargo data gathered during the first two field seasons by PIMA archaeologists matched well the information collected by previous salvage and archaeological groups. A metal detector survey conducted at the onset of the first season indicated a large anomalous area to the southwest of the extant hull. This corroborated an earlier report by Throckmorton:
The visible part of the wreck...[is] exposed for about thirty by fifteen feet. A large coral head is growing in the middle of the wreck. Apparently on top of concreted ballast and cargo. What might be the stern of the ship extends for another twenty feet or so, under the sand. A metal detector search showed that the whole area is full of metal, perhaps three or four times the fifteen by thirty foot area that is exposed (Throckmorton unpub. 1986.2).

Throckmorton's reference to the stern of the ship probably corresponds to the southern end of the site. In this area, the keel extends beneath the sand, whereas at its northern extreme it terminates abruptly in a highly deteriorated scarf joint.

The artifacts found by PIMA archaeologists matched closely those recovered during the Coffey/Long expedition. Long noted that larger ballast stones were raised from the northwestern portion of the wrecksite, in the area immediately west of grid 25 (Long unpub. 1980; see Figure 10). During the 1992 excavation, PIMA crew members found fist-sized and larger cobbles of quartz and sedimentary rock in the area corresponding roughly to grid squares 17, 18, 25 and 26 on Long's site plan. Long's team also excavated three kettles, in grids 86 and 87 at the southeastern portion of the site, not far from where PIMA archaeologists uncovered an additional two. The kettle recovered in the 1991 excavation came from an area corresponding approximately to grid 69 on the Long site plan (see Figure 10). The other kettle, excavated in 1993, was from the southwestern portion of the site and coincides with an area west of grid 57.

The glassware on Long's site plan was very close to the area where PIMA excavators recovered blue facon-de-Venice glassware. Curiously, a solitary "X" on Long's plan marks the approximate spot in grid square 67 where, in 1992, PIMA archaeologists uncovered the muzzle of a cast iron cannon.16

Although Long's site plan appears to be relatively accurate, there are certain features that are clearly missing or differ considerably from the PIMA plan (see Figure 1): concretion II. present on the PIMA plan, is absent from Long's plan. The section of the keel extending through squares 44 and 52 of Long's plan is out of alignment with those portions directly north and south, whereas the PIMA plan shows that the keel is continuous. Floors and first futtocks projecting westward from concretion III of the PIMA plan are absent in squares 44 and 52 of Long's plan. A series of floors and first futtocks can be seen emerging from beneath the

16 The cast iron cannon is still undergoing conservation and analysis and discussion of this artifact has, therefore, been omitted from this document, except to show its location on Figure 14.
concretion in grids 28 and 36 on Long plan; these cannot be seen on the PIMA plan because they are obscured by concretion IV. Likewise, frame elements that can be clearly seen to emerge from beneath the eastern edge of concretion III on the PIMA plan are simply absent from corresponding grid squares 45, 46, 53, and 54 of Long’s drawing, although it appears that there was little, if any, excavation in these areas.

Hypotheses

A preliminary examination of the clay tobacco pipes in 1986 led the author to formulate the hypothesis that the wreck was the remains of a Dutch merchantman that sank sometime between 1630 and 1665. This initial hypothesis was based on pipe forms and a single maker’s mark (or heel stamp) common to pipes from Dutch-American sites, as well as Native-American sites in contact with Dutch-American entrepôts. Except for Throckmorton’s theory that the vessel was English, the idea was generally consistent with the conclusions of the previous salvage and archaeological groups that has visited the site.

After the 1991 field campaign, however, the original hypothesis was modified to accommodate the notion that the vessel may have been English, as purported by Throckmorton. A series of wars between the English and Dutch made it possible that the vessel had been built in England but captured by the Dutch. The location of the shipwreck within Monte Cristi Bay suggested that the crew was in search of salt, or perhaps had planned to conduct trade with the local inhabitants of the mainland, including the contrabandistas and buccaneers. Hypothetical causes for the wreck itself, although difficult to determine even after the first field campaign, included piracy, abandonment, navigational error, and shipboard fire. Detailed analyses of the hull and cargo were, therefore, undertaken to test many of these hypotheses.

Methods

The Wreck

The Monte Cristi “Pipe Wreck” lies at a depth of 4.4 m in a bed of sea grass (Thalassia testudinum).17 When excavation commenced in 1991, only small quantities of ballast, scattered pipe stems, ceramics, and concreted iron caldron fragments were visible on the sea floor.

17 19°53′.23 N, 071°39′.93 W.
A composite substrate profile from near the extant hull reveals five distinct zones or layers (Figure 12). Most artifacts were distributed within the first three layers (30 cm) of sediment. The first layer (0 to 15 cm) was characterized by Thalassia rhizomes that extended several centimeters into the substrate, beneath which lay small ballast and fine biogenic sand. Layer two (15 to 20 cm) comprised heavy concentrations of bivalve mollusk shells, echinoderm plates, and small bits of calcium carbonate; the latter were called “oatmeal” due to their flake-like appearance. The composition of the third layer (20 to 30 cm) was much the same as layer two, with the exception of coral rubble that was found atop the lens of hard-packed sand. Layer four (30 to 45 cm) was a continuation of hard-packed sediment with scattered coral debris and contained a minimal number of artifacts. Layer five (45 to 80 cm) was filled with worm holes, coral fragments, and large shells. Like layer four, it contained little, if any, cultural material.

The site is demarcated by five large concretions. Three of these appear to be conglomerations of iron and copper-alloy artifacts: two (concretions I and III) are most likely solid slabs of iron. All are covered with a thick layer of calcium carbonate and provide ample substrate for a thriving reef ecosystem. The majority of the extant hull is found directly beneath or in close association with these concretions, making it highly likely that their weight was sufficient to bury the bottom of the ship and protect it from extreme biological damage.

The Base Camp

The expedition base camp was located on the southern shore of Isla Cabra, a small spit of land some 480 m from the mainland at its closest point. A treacherous reef comprising elkhorn coral (Acropora palmae, Lamarck) and staghorn coral (Acropora cervicornis, Lamarck) rises to within a meter of the surface along the northern shore. One can only imagine that for a vessel entering the bay in inclement weather, this reef system presented a major navigational obstacle. The Monte Cristi “Pipe Wreck” lies approximately 80 m east of Isla Cabra.

The campsite was positioned in a small stand of trees that provided adequate shade for dormitory tents, a kitchen, conservation pools, and an outdoor laboratory (Figure 13). In the center of the island are numerous salt pans, fed by sea water introduced through narrow sluice gates. Local workers have access to these pans by means of a wharf or gantry, located on the eastern side. A three-second navigational beacon, erected in 1991 at the northwest end of the island, replaced the remnant tower seen in Figure 13.

18 19° 53' 16" N, 071° 40' 08" W. Bill Culp, M.D., determined the location of both the wreck and the base camp using a Garmin GPS (Global Positioning System).
Figure 12. General substrate profile of the site of the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Illustration by Jerome Lynn Hall.
Figure 13. Isla Cabra, the island base camp for the Monte Cristi Shipwreck Project. The site lies off the eastern shore at a depth of 1.4 m. Illustration by Jerome Lynn Hall.
Archaeological Methods

A wooden dive platform, the R.V. *Rummy Chum*, was anchored directly over the site and outfitted with two five-horsepower compressors (Figure 14). There are certain drawbacks to using a surface-supplied air delivery system, and most of the Monte Cristi Shipwreck Project divers had little, if any, previous experience with such equipment. Complications arise when many divers work in a relatively small area, such as a shipwreck, for hoses can become tangled if precautions are not taken. Also, mechanical difficulties with the compressor can keep four divers out of the water, as opposed to a single diver that might experience difficulty with SCUBA. However, under the proper environmental conditions (e.g., low energy zone, shallow water), it proves to be the most comfortable and economical method for excavating a shallow water site, allowing four divers to remain submerged for up to three hours on a single tank of gasoline (Figure 14 shows a single compressor with four divers). The daily schedule comprised two to three diver rotations; between 36 and 54 diver-hours were logged daily when both compressors were in use, except when weather altered or prohibited diving altogether.

A 16-foot inflatable boat served as diver transport and emergency vehicle. A 20-foot wooden Dominican *yola* was used to for carrying supplies. Debris and sand were lifted from the site by handfanning and removed by a small Venturi dredge, powered by a 4.5 horsepower water pump; the substrate was not “vacuumed” directly. However, given the possibility that small artifacts could pass into the mouth of the four-inch hose, a diver was positioned at the exhaust to monitor the spoil as it passed through a small-mesh wire screen. When an artifact was uncovered, its location was carefully noted (see Site Measurement, below); occasionally finds were photographed *in situ*. Then each artifact was placed in a plastic bag, raised in a lift basket, and sent ashore for preliminary treatment before being transported to Santo Domingo for final conservation (see Artifact Conservation, below).

Site Measurement

All timbers were measured with flexible plastic rulers and fiberglass tape measures. To determine the location of the numerous artifacts scattered about the site, 22 interconnected grid squares of 3/4-inch schedule 40 PVC pipe were placed over the hull and immediate areas (Figure
Figure 14. The dive platform, R.V. *Rummy Chun*, positioned over the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Nineteen of the 22 grid squares are shown. Illustration by Richard K. Wills.
Each square was 2 m by 2 m and was marked in alternating black and white decimeters. A set of simple cross lines was used to plot the X and Y axes coordinates for selected artifacts (Figure 16).

As with all aspects of this excavation, the cross line and plumb bob assembly was designed with accuracy and economy in mind. The lines, which could be moved easily about the grid square, were made from cloth twine tied to elastic hair bands which, in turn, were attached to coat hanger ends. These could clip easily over the PVC pipe. In the center of the cross line arrangement was a small PVC disc with copper wire cross hairs. A string with a lead (Pb) weight and a float at the opposite end served as a plumb bob. With the exception of late afternoon tidal scours, or on days when the shallow water site was affected by inclement weather, this method worked well.

During the 1991 and 1992 excavations, when the excavation strategy was to record timbers and collect artifacts near the extant hull, only two-dimensional measurements (X and Y coordinates) were taken. This was due to the relatively shallow distribution of the numerous artifacts to be collected, the labor intensity of making depth measurements, and the highly disturbed nature of the site. Depth (Z axis) measurements were made during the 1993 and 1994 field campaigns when archaeologists excavated areas away from the hull. Here, artifacts were buried more deeply and it appeared that previous salvage attempts, environmental exposure, and pedoturbation (biogenic modification) had not disturbed the site as they had near the extant timbers.

The problems of biogenic modification of marine sediments and archaeological deposits are discussed by Ferrari and Adams (1990). One problem encountered on the Monte Cristi shipwreck project had to do with several fish species that were observed moving small artifacts from their original positions. This occurred most often when divers had exposed a new area by handfanning away the sediment. Most problematic was the spotted goatfish (Pseudupeneus maculatus); this bottom feeder searches for food by placing its barbels (small, fleshy appendages beneath the mouth) into the substrate and overturning the sediment. Small

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19 Thirty grid squares were excavated during the 1991 and 1992 seasons, 22 of which were delimited by PVC pipe erected over the site. The remainder were partially defined by portions of existing squares (e.g., XXIV, XXVII).
Figure 15. Twenty-two interconnected grid squares positioned over the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Additional partial grid squares and test pits can also be seen. Datum poles, indicated by black circles, are visible at the grid corners as well as outside the grid complex. Illustration by Jerome Lynn Hall.
Figure 16. A diver measures the positions of artifacts on the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Note the use of cross lines and a plumb-bob. Illustration by Jerome Lynn Hall.
artifacts such as pipe stems or ceramic sherds were often pushed out of the way in the time it took a diver to set up the cross-line measurement system.

Six data poles of one inch diameter rebar were placed randomly around the site to enable accurate measurement of the grid assembly (see Figure 15). Each was driven approximately two meters into the substrate and was tagged with plastic strip cut from an opaque detergent bottle. A letter designation (A through F) was placed on each plastic tag. Three of these poles were placed west of the keel, two in the northwest quadrant and one in the southwest. Three were placed on the eastern half of the wreck (E through W datum line), with two in the northeast quadrant and one in the southwest.

One hundred and sixteen direct distance measurements were taken from these poles to 16 datum points that delimited the corners of the grid system. Data from the 1991 field campaign were plotted using the Direct Survey Method (DSM), a computer software program that allows the user to plot a series of points in three-dimensional space (Rule 1994). Through a series of iterations, data are manipulated to find a best fit, expressed in average absolute residual error, or the difference between the measurement taken underwater and the distance plotted on the plan. Ideally, distance calculations made on the site can be entered simultaneously into a surface-based computer, enabling both the computer operator and the archaeologist to verify whether an acceptable margin of measurement error has been achieved. Unfortunately, PIMA has only used the software at the close of the season to verify existing measurements. However, results from the first field season at Monte Cristi indicated that measurements had an average absolute residual of 9.0 mm, with a maximum average residual of 1.2 cm (Appendix A).

During the 1993 field season, a series of randomly placed datum poles (1/4-inch rebar) were distributed across the southwest portion of the site, in the spill area immediately off the extant hull (indicated in Figure 15 by the Cannon Test Pit and beyond). Artifacts were measured in relation to triangular areas delimited by three rebar datum poles.

A new method of site measurement was employed during the 1994 campaign, once again utilizing the DSM computer software program. Rather than constructing new triangular areas, a series of 2-by-2 m grid squares was set up using 1/4-inch rebar (one bar at each corner). A fiberglass tape was used to measure the distance from each pole to artifacts lying within the square. This has proven to be the most convenient system to date. It should be noted, however,
as in the 1991 season, no measurements were checked until after the dive, therefore negating.

once again, the intended value of the Direct Survey Method.

Meteorological Constraints of the Excavation

All excavation took place during the summer months (late May to early August). Atmospheric temperatures at Isla Cabra ranged from 47.2 to 52.8°C (85 to 95°F) throughout the day and dropped to 38.9 to 41.7°C (70 to 75°F) at night. Tidal rise in the bay was 0.46 m to 0.69 m, with a high water interval of approximately eight hours. The trade winds consistently blow in from the northeast throughout the summer, starting in the early afternoon and abating just before dawn. Combined with the tidal currents that often move rapidly through the passage between Isla Cabra and Punta de Granja, these winds can render excavation difficult.

Tidal currents flow around the numerous islands on the Monte Cristi Bank, which runs from Pepillo Salcedo (Manzanillo) to Punta de Granja20; the currents run southwestward on the flood and northeastward on the ebb at a rate of about one-half knot (Hydrographic Office 1959). During tidal flows, visibility on the wreck drops noticeably, especially when the Rio Yaque del Norte carries sediments from the interior of the island and deposits them into the bay. Mariners are cautioned that, unless a vessel is destined for Monte Cristi, it should avoid the bank altogether; those headed directly for the port are alerted to the possibility that “uncharted dangers may exist” (Hydrographic Office 1959:377).

Artifact Conservation21

Artifacts, once recorded in situ and raised, were transported to an outdoor laboratory on Isla Cabra for registration and preliminary conservation. Each was assigned an identification number, after which it was measured, drawn and, with the exceptions of pipes and pipe stems, photographed. Registration numbers were assigned following a scheme developed by the Institute of Nautical Archaeology, with certain modifications: complete or diagnostic artifacts were assigned a PW (“Pipe Wreck”) number; fragments, such as pipe stems or ceramic sherds with no diagnostic features, were given an L (Lot) number. By the end of the 1992 season, the

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20 The location of the bank is generally given as 19°58’N, 071°45’W.
21 Most information in this section is based on field reports submitted by Amanda Jane Sutherland, project conservator for the 1991 and 1992 field seasons, and Tina Ervin, conservator for the 1994 season. Most of Ervin’s treatments were taken directly from a laboratory manual used in archaeological conservation courses taught at Texas A&M University (Hamilton unpub. 1996).
artifact data base had swelled to over 20,000 entries, demanding that the lot system be changed to accommodate an entire group of artifacts raised from the same area on a single dive. With this scheme, 23 pipe stems from quadrant VIa would receive the same Lot number, even though each would be individually measured and catalogued.

After registration and recording, a series of black and white photographs, and occasionally color slides, was made to document artifacts further. In 1991, a plywood darkroom with a cement foundation was erected among a group of shade trees on Isla Cabra. Unfortunately, it was torn down for scrap lumber during the off season. A portable, folding darkroom of one-half inch plywood was brought to the island in 1992 as a replacement.

The majority of artifacts from the shipwreck comprised pipe fragments as well as stoneware and tin-glazed ceramic sherds. A variety of metals, including iron, copper-alloy, lead, and silver were also recovered, along with a small quantity of clear and opaque, colored glass. Numerous organic artifacts were also excavated, including rope, textile, and comb fragments. Various mammalian and fish bones and a few botanical specimens were also recovered. Although site potential was not monitored, Sutherland (unpub. 1992) noted that the fine condition of numerous artifacts could be attributed to a highly anaerobic burial environment.

Because the camp was located on a small, remote island, all materials excavated from the wreck were stored onsite for the duration of each season. The obvious advantage of this arrangement was that items were readily available for monitoring and study; however, outdoor storage presented certain challenges, since elevated light levels and temperatures posed a considerable threat to many artifacts. All were stored collectively and according to material type in large, lidded, plastic bins filled with sea water. Fragile or diagnostic artifacts, or those requiring special conditions, were stored separately; when necessary, these were kept in a plastic cooler. Concretions and wood bits were stored in a cinder block pool lined with plastic sheeting, or in a children’s plastic swimming pool. These were placed in the shade to minimize photo degradation and to maintain an ambient water temperature of less than 30° C (86° F). A mixture of clean sea water and drinking water was added twice a week to reduce salinity.

Unfiltered fresh water and purified drinking water, both of pH 6, obtained from Monte Cristi, were used for storage and rinsing of selected artifacts. Chlorides were present, but "not enough to cause alarm" (Erwin unpub. 1994:3). For field conservation on Isla Cabra, town
water was used for desalination of pipes and ceramics. Purified drinking water was used for mixing chemicals and treating glass and metal artifacts. Chlorides were measured with a 0.1N silver nitrate solution (AgNO₃). A limited quantity of distilled water available during the 1992 season proved extremely useful in alleviating corrosion in copper alloy artifacts.

Initial conservation treatment for selected artifacts was conducted inside a tent, offering both a modicum of comfort for the conservator and limited protection for the materials against harsh environmental factors (e.g., ultraviolet light, dust, wind). Preliminary evaluation and cleaning of artifacts were carried out by eye. A stereo-binocular microscope permitted further examination of finds and greatly facilitated material identification and cleaning. Additional examination and identification took place at the time of registration, although the majority of artifacts required further analyses (e.g., identification of alloy composition, differentiation between osseous and keratinous materials, etc.).

Some of the concreted artifacts were X-rayed at local hospitals in Monte Cristi and the nearby town of Dajabón, as well as at a private unit in Santo Domingo. Results varied; complications arose from fluctuations in line voltage and local water supplies, as well as from faulty film, cassettes, or photograph processing. In spite of these problems, Sutherland considered the initial X-ray results "promising" with regard to their diagnostic value (Sutherland unpub. 1992).

At the completion of each field campaign, artifacts were damp-packed and placed into fiberglass tanks mounted on an open-sided flat-bed truck, where they were transported to the Fortaleza Ozama Conservation Laboratory in Santo Domingo. Upon arrival in the capital, they were placed in cinder-block pools filled with tap-water. These tanks were maintained at an approximate temperature of 25°C (77°F) and the water was changed periodically. Although no provision existed for separate storage designated by material, this environment proved satisfactory as many of the artifacts stabilized rapidly, exhibiting little or no change.

Ceramic Artifacts

Most of the pipes had suffered extensive exposure damage, evidenced by the fact that the majority of fragments were pipe stems. Rarely were complete bowls found and heel stamps, when present, were difficult to discern. It appears that the scouring effect of moving sand grains
wore down many of the heel marks stamped in relief, with the exception of those covered by coral.

Insoluble salts such as calcium carbonate (CaCO₃) and calcium sulfate (CaSO₄) pose problems for ceramic materials recovered from tropical marine environments. Many pipes from the Monte Cristi shipwreck were partially covered with scleractinian corals. Pipes covered with calcium carbonate accretion were divided into three categories: 1) those with a 2.0 mm layer of accreted matter lying adjacent to the surface of the artifact; 2) those with a layer 0.5 to 1.0 mm thick of highly porous insoluble salts associated with coralline growth. A gap of 1.0 mm was present between the accretion and the artifact surface and was filled with sediment; and 3) pipes with a fine, smooth, hard layer 0.5 mm in thickness accreted to the ceramic fragment” (Sutherland unpub. 1992, as cited by Erwin unpub. 1994:3). These insoluble salts were removed mechanically, with tools, or chemically, through the use of carefully selected acids.

Mechanical tools used to remove coral concretion included dental scalers, pneumatic chisels (air scribers), and electric vibrating tools. Pipe bores were cleaned with pipe cleaners and saté sticks, but tightly packed sediments and shell debris often made it more practical to use a stiff, fine gauge wire. In some cases, pipes were soaked in a 5.0% bath of sodium hexametaphosphate (Na₃(PO₄)₂) for 24 hours prior to mechanical cleaning. Although this basic solution (pH 9.0) was used to loosen calcareous deposits, it also had a tendency to soften ceramic paste, and therefore was used sparingly.

When mechanical means proved insufficient to remove certain encrustations, chemical treatment was employed. Pipes covered with hard corals were cleaned in an acid bath comprising a 1:1 solution of 0.72 M hydrochloric acid (50% HCl) and distilled water. Although this worked well for most cases, certain fragments exhibited exfoliation of the baked-clay surface, so a weaker solution of HCl (10 to 20%) was used instead. After 15 minutes, the pipes were removed from the acid bath and dipped in a neutralizing solution of spent sodium hexametaphosphate.

Pipes also had to be properly desalinated prior to consolidation and display. Failure to do so could have resulted in residual salt damage: extensive salt crystallization is known to cause exfoliation of the surface and possible breakage of the artifact due to internal stress. After encrustations were removed, soluble salts (chlorides, phosphates, and nitrates) were easily
extracted through a series of fresh water rinses. The number and length of these rinses varied, and simple chloride monitoring (0.1 N silver nitrate) indicated when the procedure was complete. One to two days (per rinse) was usually sufficient. When chloride levels reached an acceptable level, rinsing was terminated and fragments were allowed to air dry.

A wide range of consolidants may be applied to clay pipes; the one selected depends most often on the aesthetic preferences of the conservator. Most of the Monte Cristi pipes were consolidated with polyvinyl acetate (PVA) in acetone, although ethyl alcohol was also used as a solvent. The choice of solvent must take into consideration cost, availability, and practicality. When working in a humid, tropical environment such as the Dominican Republic, quick evaporation is a problem, especially in an open air laboratory. Ethyl alcohol was preferred because it was less expensive than acetone and did not evaporate as quickly. Acetone, however, provided better penetration of pipe stems, dried clearer than alcohol, and left a pleasant sheen. Pipes consolidated in PVA with ethyl alcohol had a “flat” finish and often dried unevenly, leaving a white “ chalky” residue. The desired finish may be obtained by placing the consolidated pipe over a container of the solvent. Exposure to solvent fumes dulled the glossy finish usually associated with PVA, producing more of a matte appearance.

Various brands of “super glues” (cyanoacrylate) worked well for joining broken pipe fragments, although not all were alike, especially with regard to properties of reversibility, setting time, and adhesion. Viscous PVA was also used.

In addition to pipe fragments, three categories of ceramics were recovered from the Monte Cristi shipwreck. The first of these, tin-glazed ware, was found in two distinct varieties; white ware and blue-and-white ware. Both had a fine, buff-colored fabric without inclusions; in many instances, the glaze exhibited hair-line cracks (crazing). The majority of these pieces were covered with insoluble salts, although the degree of coverage varied considerably. Insoluble salts were removed mechanically, with the aid of a surgical scalpel. Artifacts requiring additional cleaning were treated with a weak solution of hydrochloric acid (HCl), but were first soaked in water to prevent the solution from being absorbed by the fabric. Extremely fragile sherds were first consolidated with Paraloid B-72 and then spot-treated with HCl. Samples were rinsed with fresh (tap) water. Those in need of further mechanical treatment were cleaned with a dental pick.
Sulfide stains were removed by a 10% (by volume) bath of hydrogen peroxide (H₂O₂). Sherds were carefully monitored so that friable glaze was not damaged by the effervescence of the treatment. They were then rinsed in running water.

A three-tiered, cascade rinse system was set up for the removal of soluble salts. Individual sherds with accompanying registration tags were placed in plastic netting and set in one of three large plastic coolers. A garden hose was placed in the uppermost cooler and the cascading rinse was sufficient to desalinate the artifacts. The same chloride monitoring system used for the pipes (0.1 N silver nitrate) was employed to test the ceramics. After three consecutive negative readings, sherds were removed and allowed to air-dry.

Tin-glazed sherds were consolidated with a 5% solution of Paraloid B-72 in a 75:25 acetone:toluene solution. Registration numbers were applied with permanent ink and coated with PVA. Each sherd was then placed in a plastic bag and packed in a cardboard box according to type.

Because they required minimal treatment, the other two ceramic types -- Rhenish stoneware and lead-glazed utility ware sherds -- were simply rinsed in fresh water and cleaned mechanically.

**Glass Artifacts**

Glass shards were cleaned with a soft-bristle brush to remove superficial contaminants and were placed in purified drinking water for desalination. The water was changed daily for five days and artifacts were removed when three consecutive chloride readings (0.1N silver nitrate test) registered negative. The glass was then dehydrated in two acetone baths and those sherds in need of consolidation were treated with Paraloid B-72. Each sherd was labeled with its corresponding registration number, placed in a vented plastic bag, and stored in a plastic box.

Erwin (unpub. 1994:7) noted that “glass should be stored in a dry environment with a relative humidity no higher than 40%.” However, as in the case of the Monte Cristi artifacts, glass stored in a tropical environment should be regularly evaluated for any signs of ‘weeping’ or devitrification.
**Metal Artifacts**

Cuprous metals were stored in fresh water prior to immersing in a heated 10% solution of EDTA, tetra-sodium (pH 11.5). They were then rinsed and placed in purified water for seven days until two chloride tests (0.1 N silver nitrate) registered negative. These artifacts were then immersed in a 1% benzotriazole (BTA) solution in ethanol for 24 hours. Pieces were polished with sodium bicarbonate prior to placing them in hot water rinses. After rinsing, they were dehydrated in acetone and were immersed in Paraloid B-72; a second coat of Paraloid with BTA was applied with a brush. Registration numbers were placed on each artifact with permanent ink, which was then covered with a layer of PVA. Finally, each item was placed in a vented plastic bag and stored in a cardboard box. Selected lead artifacts were cleaned mechanically by small scalers. Treatment of lead recovered from marine sites is simply for aesthetic reasons, since the metal is stable. Corrosion products consist of lead oxides, sulfides, and insoluble salts, none of which breaks down or reacts adversely with the remaining metal.

A cast iron cannon was raised at the close of the 1992 season and placed in wet storage along with two cast iron cooking pots. In 1993, all three artifacts began the process of electrolytic reduction. Each was cleaned mechanically and was surrounded by a mesh anode prior to placement in a 3 to 5% sodium hydroxide (NaOH) electrolyte solution. A small battery charger served as the DC power supply. The artifacts were scheduled to undergo electrolytic reduction for nine months, at which time further mechanical cleaning and assessment of their conditions were to take place. Unfortunately, a series of events during the winter and spring, including interruption of the power supply and subsequent corrosion of the anode and alligator clips, rendered the initial reduction process ineffective. Since no PIMA members remained in the Dominican Republic, laboratory employees were asked to monitor the power supply and change the electrolytic solution throughout the year. Chloride monitoring was to begin in 1994, after the second mechanical cleaning was completed. The cannon and cooking pots sat for seven months in the NaOH solution. In 1994, the tank was drained of solution, a new DC supply was purchased, and the process was reinitiated after further mechanical cleaning.

**Organic Artifacts**

Rope fragments were washed in purified water prior to placement in a 10% HCl solution to remove stains and encrustation. They were then rinsed in running water and soaked
in acetone to remove soluble contaminants. The artifacts were allowed to air-dry before consolidation with Paraloid B-72. Each piece was sprayed with Lysol fungicide and placed in a plastic bag prior to storage in a cardboard container.

Artifacts made from worked bone (e.g., a cutlery handle) were spot-treated with a 10% HCl solution to remove deposits of calcium carbonate (CaCO₃). They were then immersed in a 10% hydrogen peroxide solution (H₂O₂) to remove any sulfide stains. Although this treatment proved "extremely successful" for an ivory fan handle, it was only "moderately successful for the bone handle, and completely unsuccessful for all but one bone comb fragment" (Erwin unpub. 1994:10).

Fragments were rinsed in running water and subsequently placed in purified water for 12 days to allow diffusion of soluble salts. Bone and ivory artifacts were dried in successive acetone and water baths (50%, 90%, 100% acetone) and were consolidated by immersion in 5% Paraloid B-72. When dry, each was placed in a plastic bag for storage.

SUMMARY

Since Cristóbal Colón first visited the region, Monte Cristi has played an important role in the economic development of Hispaniola. Historical accounts attest to numerous merchant ships that engaged in illicit trade with the contrabandistas and houcaniers of the north coast. Furthermore, the area is currently renowned for its salt production, a resource that has likely attracted vessels and crews in previous centuries. However, the Monte Cristi Bank also offered risks to the unwary sailor. Capricious trade winds, extensive reef systems, and numerous small islands claimed many vessels. The remains of one such vessel, commonly referred to as the "Pipe Wreck," lie in the shallow waters of Monte Cristi Bay. Although salvaged by numerous treasure hunters, it was not until 1991 that researchers from the Pan-American Institute of Maritime Archaeology began an extensive excavation of the site. Data were collected to test the hypothesis that the remains were those of a Dutch merchantman that sank between 1630 and 1665. Further interpretation of the ship has developed from extensive analyses of the extant hull and cultural remains yielded by the "Pipe Wreck."
CHAPTER II
THE MONTE CRISTI SHIPWRECK

The Monte Cristi wreck site is especially significant in light of the paucity of data that exists for seventeenth-century New World shipwrecks. Numerous submerged sites from this era have produced a wealth of artifacts, but the majority have been salvaged by treasure hunters and information on hull structures is scarce. Even though excavation and conservation records are often kept by such organizations, collections are frequently divided up among limited partners or are sold at auctions through managing agencies. Rarely, if ever, are data on hull design published.

Documentation on hulls dating to the seventeenth century includes the Sea Venture, an English colonial passenger ship that sank off Bermuda in 1609 (Adams 1985; Steffy 1988, 1994; Wingood 1982, 1986); the Tyger, a vessel lost in New York in 1613 (Steffy 1994); the Sparrow Hawk, an English-built ship lost in 1626 off the coast of Cape Cod, Massachusetts (Holly 1969; Steffy 1988); the Stonewall wreck, which sank off Bermuda sometime around 1650 (Dethlefsen et al. 1977); the Virginia Merchant, which, in 1660, sank off the south coast of Bermuda on its way to Virginia from England (Steffy 1994); Santissimo Sacramento, a Portuguese galleon that came to grief in a storm as it entered the harbor at Bahia, Brazil, in 1668 (Pernambucano 1979; Smith 1988); the New Old Spaniard Wreck, tentatively identified as a seventeenth-century Dutch vessel that foundered on a reef at the western end of Bermuda (Watts 1993); the Hart’s Cove vessel, a shallow in New Castle, New Hampshire (Switzer 1991); the “Turtle Wreck” (LC002), a small sailing ship that wrecked in the Cayman Islands (Smith 1979); and the Port Royal wreck, which sank in Jamaica, probably in 1692 (Clifford 1991, unpub. 1993; Hamilton 1991, 1992).

Additional seventeenth-century New World shipwrecks for which little or no structural records exist include the Rincón Astrolabe Wreck in Puerto Rico (post 1616 and most likely ca. 1650) (Woods, personal communication, 1996; Hauck, personal communication, 1996); the Green Cabin wreck, believed to be the site of the San Martin, lost in 1618 off the Florida coast (Moore and Muir 1987); the N.S. Atocha and the Santa Margarita, both from the 1622 fleet that wrecked in the lower Florida Keys (Mathewson 1975, 1977, 1983; Lyon 1976, 1979; Burgess 1977; Treasure Salvor’s Inc. 1980, 1981; Daley 1986; Christie’s Catalog 1988); the N. S. Concepción, which ran aground on the Silver Shoals of the Dominican Republic in 1641 (Earle 1979; Grissom 1980; Borrell 1983a, 1983b, 1985); the Hatcher, a Manila galleon dated to 1643 (Sheaf and Kilburn 1988; Mathewson, personal communication, 1994); the Chanduy Reef Wreck, which ran aground near Guayaquil, Ecuador, in 1654 (Jupiter Wreck Inc. 1991);
Addario, personal communication. 1995): two possible mid-seventeenth-century small craft in the Cayman Islands. the South Hole Sound Wreck (Smith 1979) and the Kassa's Beach Site (Smith 1979); the N.S. Maravillas, which sank in the Bahamas in 1656 (Jupiter Wreck Inc. 1991. Muckleroy 1980; Tippin and Humphreys 1989; Christie's Catalog 1992); the Jupiter Wreck, a seventeenth-century Spanish galleon in Jupiter Inlet, Florida (Jupiter Wreck Inc 1991): Site PB-3, the "remains of a sailing vessel of considerable size," discovered on the Pedro Banks of Jamaica, that most likely predates 1700 (Hoyt 1984:104); the French Commercial Wreck in Samana Bay. Dominican Republic, tentatively dated to 1697 (Bowden, personal communication, 1994): and the Henrietta Marie, a slave ship lost off the Florida Keys in 1700 (Moore 1987; Shaughnessy 1995). The recent discovery of a shipwreck in Matagorda Bay, Texas. is thought to be the remains of La Belle, a French ship that sank in 1686. The vessel belonged to Rene-Robert Cavelier, 'sieur de la Salle. A large portion of the hull is apparently intact. but has yet to be studied (Houston Chronicle, 14 July 1995: Arnold 1996).

THE HULL REMAINS OF THE MONTE CRISTI SHIPWRECK1

The objective of PIMA's investigation at Monte Cristi was to test the hypothesis that the wreck represents a seventeenth-century Dutch merchantman. Initial goals were to record the extant hull of the vessel, to identify the types of wood used in its construction, and if possible, to date that wood through dendrochronological analysis.

The extant hull of the Monte Cristi vessel comprises the keel, frame timbers, fasteners, ceiling planking, bottom planking, and deals, or bottom sheathing (see Figure 1). These constructional elements are generally absent on the western side of the wreck but extend eastward from the keel a distance of 2.6 m. They are found in varying degrees of preservation, depending on the depth at which they were buried and, it seems, whether they had previously been exposed in salvage attempts. The majority of better preserved timbers are buried 15 to 30 cm beneath the turtle grass. Analyses indicate that the keel, frames, planking and treenails are made of oak (Quercus sp.) (Newsom, personal communication. 1989; Christiansen, personal

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1 Ralph K. Pedersen, currently a doctoral student at Texas A&M University, began a study of the ship's hull in 1991. A more detailed description of the hull remains of the Monte Cristi shipwreck is to be found in a forthcoming M.A. thesis by Jamison Beshears, titled Dutch Maritime Trade in the Caribbean and Related Shipwreck Sites. Mr. Beshears. who worked with the Monte Cristi Shipwreck Project during the 1991, 1992, and 1994 excavation seasons, is currently a student of Maritime History and Underwater Archaeology at East Carolina University in Greenville, North Carolina.
communication, 1992). A softwood sheathing, tentatively identified as either spruce (Picea sp.) or larch (Larix sp.), measuring an average of 1.5 cm thick, is fastened to the bottom planking.

Thirteen timber samples were analyzed and dated by the Dutch Dendrochronology Center in the Netherlands (Table 2) (Spoor and Jansma, personal communication, 1992). Of these, nine had between 62 and 149 growth rings and, therefore, met the criteria for analysis. Four proved unsuitable due to insufficient ring count or damage. Timber D4 (MPW011) was the only sample in which the sapwood was complete, indicated by a summerwood ring directly beneath the bark. The tree that yielded this timber was cut down between October, 1642, and March, 1643. Samples did not match available Dutch, German, Belgian, French or Baltic chronologies. Spoor and Jansma (personal communication, 1992) concluded that the wood most likely grew in England. As there was no timber trade between the Netherlands and England during the middle of the seventeenth century, the “Pipe Wreck” was probably not constructed in the Netherlands but in England (Spoor and Jansma, personal communication, 1992).

The Mechanics of Deposition

Exactly how the ship came to rest in the shallows of Monte Cristi Bay remains a mystery. There is currently no structural evidence to indicate the orientation of the shipwreck relative to the geography of the bay. However, certain artifacts described below (see Chapter III) suggest that the southern end of the site represents the stern of the vessel. As previously discussed, two salvage groups that worked on the site (NCR and the Coffey/Long expedition) disagree as to the orientation of the wreck on the sea floor. Swete (NCR) asserted that the northern end of the site represented the bow, basing his assessment on a highly degraded vertical scarf joint on that end of the keel (see Figure 15, PIMA grid square XXIV). He failed to note, however, the vertical keel scarf beneath concretion I at the opposite end of the wreck, in grid square I. Conversely, Long (unpub. 1980) suggested that the bow was at the southern end of the site; this conclusion was based on the distribution of three-legged cooking caldrons recovered from grid squares 86 and 87 on his site plan (see Figure 10). The assumption was that these items were intended for use by the crew, as opposed to trade items carried as cargo; their presence at the southern end of the site indicated the location of the galley, which was generally positioned forward of midships in a seventeenth-century vessel.

Knowledge of which end of the shipwreck represents the bow may indicate the direction that the vessel was headed at the time of its demise. If the northern end of the wreck is the bow,
Table 2. Results of dendrochronological analysis of 13 wood samples from the seventeenth-century northern European shipwreck in Monte Cristi Bay, Dominican Republic.

<table>
<thead>
<tr>
<th>Find number</th>
<th>File name</th>
<th>Sapwood/bark</th>
<th>Number of Rings</th>
<th>Reference Chronology</th>
<th>Date of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Unsuitable</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>D2</td>
<td>MPW031</td>
<td>---</td>
<td>113</td>
<td>England</td>
<td>1497-1610 AD</td>
</tr>
<tr>
<td>D3</td>
<td>Unsuitable</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>D4</td>
<td>MPW011</td>
<td>28 sapwood rings including ring directly under bark</td>
<td>135</td>
<td>England</td>
<td>1508-1642 AD</td>
</tr>
<tr>
<td>D5</td>
<td>Unsuitable</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>D6</td>
<td>MPW021</td>
<td>---</td>
<td>149</td>
<td>England</td>
<td>1485-1633 AD</td>
</tr>
<tr>
<td>D7</td>
<td>MPW051</td>
<td>---</td>
<td>88</td>
<td>England</td>
<td>1516-1603 AD</td>
</tr>
<tr>
<td>D8</td>
<td>MPW041</td>
<td>3 sapwood rings</td>
<td>120</td>
<td>England</td>
<td>1505-1624 AD</td>
</tr>
<tr>
<td>D9</td>
<td>MPW071</td>
<td>--</td>
<td>98</td>
<td>England</td>
<td>No date</td>
</tr>
<tr>
<td>D10</td>
<td>MPW061</td>
<td>---</td>
<td>89</td>
<td>England</td>
<td>1508-1596 AD</td>
</tr>
<tr>
<td>D11</td>
<td>MPW091</td>
<td>---</td>
<td>62</td>
<td>England</td>
<td>1560-1621 AD</td>
</tr>
<tr>
<td>D12</td>
<td>Unsuitable</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>D13</td>
<td>MPW081</td>
<td>6 sapwood rings</td>
<td>68</td>
<td>England</td>
<td>1563-1630 AD</td>
</tr>
</tbody>
</table>
as both NCR and PIMA researchers have posited, it may indicate that the ship was departing the bay when it ran aground in the shallows of Isla Cabra. Did the crew of the vessel see the island? If they were approaching from the south in inclement weather or at night, possibly not. What the relic beach was like three-and-a-half centuries ago is unknown. Perhaps the island was smaller and the channel deeper. Neither is it known if the reef surrounding the island was as extensive in the seventeenth century as it is today; a map from the archives in Sevilla (see Figure 7), presumably dating from the eighteenth century, suggests that the reef has changed considerably over time. Regardless of the configuration of the reef system surrounding Isla Cabra in the seventeenth century, sailing guides through history have clearly cautioned mariners about the bay’s navigational hazards. Conversely, the vessel may have been entering the bay when it ran aground. Strong trade winds, or perhaps a violent storm or hurricane could have repositioned the vessel in the shallow water near Isla Cabra.

Archaeological evidence in the form of charred wood bits, as well as blackened and melted artifacts, suggests several possibilities about the ship’s demise: perhaps a fire on board the ship, resulting from carelessness or deliberate attack, caused the ship to sink. Alternatively, if the vessel ran aground and could not be refloated, the crew, in an attempt to destroy any evidence of their presence on an illegal trading venture, may have burned the vessel to its waterline. The nearby island may have provided temporary shelter for survivors who waited to move salvaged cargoes to the mainland. Numerous artifacts that appear to date to the seventeenth and eighteenth centuries have been recovered during the digging of latrine pits on Isla Cabra. Although none of these items can be attributed to the shipwreck based on the current archaeological record, future excavation of the southeastern part of the island may prove helpful in supporting or refuting the survivor hypothesis. Because of its proximity to the mainland, however, Isla Cabra is likely replete with artifacts dating from the present back to the Pre-Columbian Era.

Although there are scant archaeological data to suggest why the ship grounded, the mechanics of deposition are more clear. The scenario illustrated in Figure 17 is based upon archaeological evidence. With the exception of a few scattered and deeply buried bottom planks, no timbers were found west of the keel. This suggests that the hull may have torn away as the vessel wrecked or, more probably, disintegrated after having rocked for days or weeks in the shallow water of the bay. In either event, it appears that, as the western side of the vessel broke apart, some of the hull timbers lodged beneath the keel, as indicated by an inverted bottom plank that was found under the keel in grids I and VI (see Figure 1). Arguably, the weight of large iron slabs now forming concretions I to V was sufficient to bury the bottom of the vessel in the
Figure 17. Hypothetical breakup of the seventeenth-century northern European vessel in Monte Cristi Bay, Dominican Republic. (A) The vessel comes to rest in the shallow water and the upper works disappear; (B) the western half of the vessel disintegrates and washes away or is buried deeply in the sediment; (C) the extant hull of the Monte Cristi shipwreck as encountered by PIMA archaeologists in 1991. Illustration by Jerome Lynn Hall after original by Alejandro Selmi Colominas.
soft sand. The floors and first futtocks east of the keel are preserved beyond the edge of concretions III, IV, and V. They do not, however, extend beyond concretion I, due, most likely, to the fact that the mass did not press directly on the ship's timbers, but rested a short distance above them. As exposure claimed the upper works east of the keel, the remaining hull, cargo, ballast, and iron settled into the sea floor and survived until the present day.

Parameters of the Extant Hull

The Keel

Of the remaining hull elements that were visible when the excavation began, the keel was the most prominent (Figure 18). Averaging 30.0 cm molded by 33.0 cm sided, it extended from north to south for a distance of 14.3 m. Because the majority of its length was exposed prior to excavation, the timber is poorly preserved. The exact shape of the rabbet, which measures 5.0 cm by 5.0 cm, is difficult to determine even though it is visible for nearly the entire length of the western side of the keel, except in those places where it is obscured by overlying concretions (see Figure 1). No trace of a keelson remains.

The extant keel possessed two vertical scarf joints that were separated by a distance of 9.4 m. The northernmost joint, located in grid square V, was partial and badly eroded. The second joint, located at the southern end of the site, is intact but is virtually inaccessible due to concretion I which covers it entirely.

The Bottom Planking

At least nine and possibly ten outer planking strakes were excavated east of the keel, presumably representing the extent of the preserved planking on this side of the wreck. Additional planking may exist east of the keel but scantlings in this area are obscured by concretions III, IV, and V. Late in the 1993 campaign, a single 5.0-cm-thick bottom plank was found west of the keel. The timber was positioned in an east-west direction directly outside grid square II. As there was insufficient time remaining in the season to excavate its entire length, only 1.5 m were exposed before it was reburied. The presence of this timber suggests that disarticulated plank and frame fragments may remain on the western side of the site, buried deeper than researchers have yet excavated.

External planking ranged between 5.0 and 6.4 cm thick and 28.0 to 34.0 cm wide. A single butt joint in strake 9 (grid XVII) suggests that hull planks were at least 4.1 m in length. A small filler plank or “Dutchman,” 1.3 m in length, was found in grid square XVI and indicated
Figure 18. The keel of the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. The rabbet is L-shaped and measures 5.0 cm by 5.0 cm. It is uncertain, however, if this is its original form (lower left). A portion of the keel, near grid square X, may possess a rabbet shaped in the manner pictured in the lower right. Photo and drawings by Jerome Lynn Hall.
that bottom plank P9 had been repaired on its inboard edge. The garboard, no longer positioned in the rabbet, was adjacent to, but not touching, the east side of the keel. Inverted bottom planking, complete with deals, was found beneath the keel at the southwest corner of the site; no articulated planks were visible west of the keel. The garboard and second plank at the southern end of the site (grid VII, quadrant A) were broken and lying loosely in place, suggesting that this part of the ship impacted hardest when it ran aground. It is the only portion of the extant hull where complete breakage of the planking is visible, perhaps due to the grounding or the weight of concretions I and III, or both.

From the onset of the 1991 season, efforts were made to identify any construction features that might clearly indicate the nationality of the shipwreck. The hypothesis that the remains represented a Dutch vessel was predicated on preliminary analysis of artifacts recovered during previous excavations, particularly the cargo of Amsterdam-manufactured pipes (see Chapters I and III). Areas near planking seams in grids VIII, IX, X, XI, and XII were carefully examined to discern if spijkerpennen, or small wooden dowels, were present. In the bottom-based shipbuilding tradition of the northern Netherlands, bottom planks were attached to the keel prior to the insertion of frame timbers. To hold these planks in place until the mastercouple could be inserted, shipwrights utilized a variety of specialized tools. These included chains (hel) and large, wooden, planking tongs (boetang) (Witsen 1671:169, and illustration on page 168; Hoving 1988:216 and 215, Figure 3). After planking was extended to the bilge, the remaining floors and futtocks were inserted. When assembly was complete, the temporary cleats were removed and spijkerpennen were placed in the remaining holes to make the planking water-tight. No small dowels were found on the extant timbers of the Monte Cristi wreck, suggesting that the vessel was not constructed in the northern Dutch bottom-based tradition.

The Ceiling Planking

Six strakes of ceiling planking, ranging between 20.0 and 39.0 cm in width and averaging 5.0 cm in thickness were uncovered in the central and northeastern portions of the site. The extant length of these planks, as with other hull timbers, was not determined because they were obscured by overlying concretions.

The Sheathing Deals

When the single bottom plank on the western side of the keel was first uncovered, its position suggested it was a disarticulated garboard strake. Puzzling, however, was the
comparably thin veneer of softwood sheathing on top of the plank. After several days of excavation, it became clear that this timber was not necessarily the garboard, but an unidentified strake that had been inverted and pushed beneath the keel, perhaps during the initial wrecking process (Figure 19). Protective covering boards, known as deals, were attached to the underside of the bottom planking.

Sheathing boards, or deals, averaging 1.5 cm in thickness, were attached to the outer hull. These were most noticeable where planks had torn away or deteriorated, such as the seventh and eighth planks (P7 and P8) in grid XIV, and the ninth and tenth bottom planks (P9 and P10) in grids XVII and XVI (see Figures 1 and 15). The highly deteriorated condition of these timbers prohibited positive identification of wood type; however, Donna Christiansen of the Center for Wood Anatomy Research, U S. Forest Products Laboratory, Madison, Wisconsin, has suggested they are most likely spruce or larch.

Separating the deals from the bottom planking was a thin layer of organic material, which was first thought to be plant fiber (Hall 1992) (Figure 20). Over time, this material was recovered from various locations around the wreck site (Figure 21). Subsequent tests, conducted by Chris Allen at the Hair and Fiber Unit of the Federal Bureau of Investigation, Washington, D.C., identified the samples as cattle hair mixed in an unidentified matrix (Allen, personal communication, 1992). Kevin Rittenhouse, a graduate student in the Texas A&M University Veterinary Pathobiology Department, is currently conducting a study of the mitochondrial DNA of these hair fibers. Recent test results agree with Allen's microscopic analysis: 421 of 792 bases have been sequenced to date, with all but four matching perfectly those prescribed for mitochondrial sequences in cattle (Rittenhouse, personal communication, 1995).

Rittenhouse's ultimate objective is to determine hair type with greater specificity. The breed of cattle cannot be identified by simple visual analysis. There may eventually be a way to distinguish between breeds based on nuclear DNA distributions, but genome mapping is a relatively new field and several years are needed before most facilities will be equipped to make such determinations. Furthermore, according to Larry Cundiff, scientist at the Meat Animal

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2 Most helpful in this study were John Krouch, from the American Angus Association in Saint Joseph, Missouri; Tim Olson at the University of Florida; Jerry Caldwell of Immgen, Inc, of College Station, Texas; and James Womack at the Texas A&M University Department of Veterinary Sciences.
Figure 20. Bottom planking on the seventeenth-century merchant shipwreck in Monte Cristi Bay, Dominican Republic. Beneath the 5.0 to 6.5 cm planking is a thin veneer of softwood sheathing. A disarticulated treenail can be seen beneath the scale. Photo by Jerome Lynn Hall.
Figure 21. Locations of cattle hair samples collected from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 x 2 m. Illustration by Jerome Lynn Hall.
Research Station. Clay Center, Nebraska, there is currently an insufficient data base with which to compare breeds of cattle. Finally, this study will be hindered because, prior to the Industrial Revolution, there was little if any economic reason to distinguish cattle types. Under the manorial system, cattle were categorized as beasts of burden, or for milk or meat production. With the decline of the manor and the rise of the industrial market, specific cattle types or breeds acquired commercial value, but this likely occurred after the Monte Cristi ship sank.

Loose patches of hair found around the site and beneath the sand were first thought to be portions of cattle hides, reinforcing an initial theory that this vessel may have been engaged in trade with the *boucaniers*. However, it is more likely that the material was used to reinforce hull sheathing against destruction by marine fauna. Hair and tar were often applied to the bottom of a ship to protect it from shipworm (*Teredo navalis*). Smith (1627:16) described sheathing as “casing the Hull under water with Tar and Haire, close covered over with thin boards fast nailed to the Hull, which though the Worme pierce, shee cannot endure the Tar.” Marsden (1974:138) remarked that shipworm could “rapidly reduce timber to something that looks like gruyère cheese.” Sir Richard Hawkins (Appendix C), in his voyage to the “South Sea” in 1593, noted that the worm could enter the wood of a ship “no bigger than a small Spanish needle” but could soon reach a size “as bigge as the little finger of a man.” It could gouge a plank, leaving the outside “like to a gelly” (Hawkins 1593:78-80). Smith also cautioned the sailor against “weeds and barnacles,” the latter of which, he stated, “is a kinde of fish like a long red worme [that] will eat throw all the Plankes if she be not sheathed” (Smith 1627:15). Sutherland’s eighteenth-century treatise on shipbuilding (Appendix D), undoubtedly one of the most descriptive of his era, offered an eye-witness account to the ravages of shipworm:

And as for the Defence against the Worms eating, it’s Notional. since I have seen a Ship’s Sheathing perfectly Honey-Com’d; for it’s the Opinion of most, that the Worms will eat through the Sheathing Board until they come to the Tar and Haire, which turns the Insect, as believing that Ingredient is offensive to the Worm, indeed then it must be the Hair, since the Creature must first eat through Pitch before it comes to the Board, which is all one as if he had eat through Tar (Sutherland 1717:217).

Sutherland pointed out the advantages of lead sheathing: it was lighter, thinner, malleable, and resistant to splitting by nails. The single advantage of wood, he noted, was that it did not corrode or destroy iron fittings as did lead. On average, the recommended length of time
that sheathing should remain on the hull until replacement, under the best conditions, was three years (Sutherland 1717:217).

The practice of protecting hulls with sheathing, hair and tar is well represented in the archaeological record of seventeenth- and eighteenth-century northern European shipwrecks. A compound comprising "animal hair and pitch" was used to seal the hull of the *Sea Venture* (Adams 1985:289-290). The *Dartmouth* (1690) was sheathed with 1.3 cm thick fir deals that covered a 0.0132 cm thick layer of hair and tar, following what Martin suggested was Mainwaring's mandate to cover a ship in "thin boards, fir, and tar" (Martin 1978:49-50, citing Mainwaring *ca* 1623:222). Likewise, the starboard side of the *Amsterdam* (1749) was covered with pine sheathing, "with a layer of tar and coarse animal hair between this and the planking beneath" (Marsden 1974:138). Bits of hair mixed in a yellow and brown mastic compound -- identified as a probable mixture of wood tar and sulfur -- was found among the sheathing fragments and hull planks of the Water Street ship (*ca*. 1750) (Rosloff 1986:72). The sheathing of the Monte Cristi vessel -- with tar, cattle hair, and softwood deals -- reflects a method of ship construction and maintenance characteristic of the seventeenth and eighteenth centuries.

The Frames

Seventeen frames, comprising floors and first futtocks, were located on the "Pipe Wreck." Of these, 15 floors and 13 first futtocks were observed and recorded. The majority were highly eroded, with the exception of first futtock ends that were covered and therefore moderately protected by concretions III, IV, and V. These timbers were offset from the keel between 36.0 and 39.0 cm, placing them near the seams of the second and third strakes. Frame elements ranged from 18.0 to 27.0 cm sided and 14.5 to 20.5 cm molded. Because of prolonged exposure, relatively few floors touched the keel3 (Figure 22).

Futtocks were set between the floors and were toed with polygonal (six-, seven-, or eight-sided) treenails averaging 3.5 cm in diameter. This construction feature was evident in frame 6 (see Figure 1 and Figure 22), indicating that futtocks were installed after the floors were placed. This limited evidence suggests that frames -- floors and futtocks -- were not placed as a set, since they would have been cross-pinned with horizontally placed treenails. Average frame

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3 The inboard ends of floors 6 and 7 (grid IV), although highly eroded, were tangential to the keel by 11.0 and 12.0 cm, respectively. Likewise, floor 4 (grid IX), a highly degraded timber, overlapped the keel by 10.0 cm but the other floors had eroded to approximately the middle of the garboard strake.
Figure 22. Grid squares II, III, VIII, IX, XIII, and XIV of the seventeenth-century northern European shipwreck in Monte Cristi Bay, Dominican Republic. The keel, rabbet, bottom (P) and ceiling (C) planks, floors (F), futtocks (Ft), treenails (●), softwood sheathing deals (S), and a rider (Ri) are visible. Illustration by Jerome Lynn Hall.
spacing was approximately 54.0 cm, center to center: the longest extant frame stretched 2.6 m from the outboard edge of the keel. Floors were spaced along the keel every 18.0 to 31.0 cm, with an average spacing of 27.0 cm.

It is difficult to use floor and futtock arrangement to determine ship alignment, as several variations existed during the seventeenth and eighteenth centuries. Placement of the futtock fore or aft of the floor varied depending on where the frame assembly was placed in the ship. Frames on the Port Royal shipwreck were arranged with the first futtock immediately forward of the floor (Clifford unpub. 1993:90). The first futtocks on the *Kraken* (1651) were placed aft of the floor on the starboard and forward of the floors on the port (Morris unpub. 1991:77). Furthermore, there were no transverse longitudinal fasteners between floors and first futtocks on either side of the vessel, a technique that was extremely common and continued in the Royal Navy into the first half of the eighteenth century. In merchant vessels, this practice continued to the nineteenth century” (Morris unpub. 1991:77). In light of this information, the arrangement of the frames on the “Pipe Wreck“ tells us nothing about the orientation of the hull on the sea floor.

A single, highly-degraded timber, tentatively identified as a rider, was perpendicular to the keel (Ri) at the northeastern end of concretion III. This transverse stiffening element sat atop ceiling strakes 3 and 4, as well as floor 5 and futtock 6.

The Fasteners

Treenails, used to attach planking and framing in the Monte Cristi vessel, ranged between 3.0 and 4.0 cm in diameter (Appendix B). These were present in the floors and futtocks, as well as in the keel, bottom and ceiling planking. Missing elements, especially the outboard ends of futtocks, were often suggested by the presence of treenails. That futtocks 11, 12, and 14 extended past their extant positions is indicated by treenails in bottom planks 8 and 9 (Figure 23). It appears that frames were often split -- transversally and longitudinally -- when treenails were inserted, as indicated by the outboard end of floor 4, as well as the outboard ends of floor 3 and futtock 4 (see Figure 22).

Concretions present on the keel and several extant frame ends suggest that iron fasteners were also used. Likewise, deals were attached to bottom planks by small, rectangular-headed nails. Although these fasteners were not recovered, tiny holes and surrounding impressions indicated their presence.

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4 Due to the poor state of preservation, none of the floor timbers crossed the keel. Occasionally, however, treenails visible in the keel were in line with these degraded floor timbers.
Figure 23. Grid squares X, XI, XII, XV, XVI, and XVIII of the seventeenth-century northern European shipwreck in Monte Cristi Bay, Dominican Republic. Bottom (P) and ceiling (C) planks, floors (F), futtocks (Ft), treenails (●), and softwood sheathing deals (S) are visible. Illustration by Jerome Lynn Hall.
It appears that the shipwright intended to place treenails every 10.0 to 15.0 cm in the frames; however, occasionally these spaces were less than 3.0 cm. These latter measurements suggest that the ceiling planking had been repaired or replaced, or that treenails used to attach bottom planking were driven up through the frames.

The Ballast

William Lamb, a graduate student at Texas A&M University, sought to determine a source area for ballast recovered from a sixteenth-century Iberian ship wreck site on Molasses Reef, Turks & Caicos (Lamb 1988). His research suggested that a ballast mound should be considered and analyzed as any other artifact. This was a novel concept aimed at maximizing the archaeological data gathered from a shipwreck. In a site with little to no postdeposition disturbance, the relative positions of individual ballast stones within the mound could theoretically reveal distinct lithological lenses. Careful study of these layers, according to Lamb, could suggest the sequence and locations in which ballast stones were loaded aboard the vessel.

Such was not the case with the Monte Cristi shipwreck: no well-defined ballast mound was found on the site. Instead, large cobbles were located at least two meters from the western side of the keel. Small-grade pebbles were most common near the keel and close to the extant structure. This distribution suggests that salvors removed large ballast from atop the hull in their search for artifacts, or that these large stones spilled from the western side of the ship when the vessel wrecked and subsequently disintegrated.

Wayne Ahr of the Texas A&M University Geological Sciences Department and Charlie Bristow at Birbeck College, University of London, analyzed a small collection of representative ballast from the Monte Cristi shipwreck. The study was undertaken to see if a geographical source of origin for the assemblage could be determined. The sample included pebble grade clasts of chert, vein quartz, metasedimentary rocks and volcanic rocks that ranged in size from 1.0 to 5.0 cm and varied in shape from "well-rounded to angular and of moderate sphericity" (Bristow, personal communication to Amanda Sutherland, 1992). These stone types, according to Bristow, "do not normally occur together and render a single source of origin as dubious" (Bristow, personal communication to Amanda Sutherland, 1992).
Although Lamb noted that "ballast is a highly underutilized archaeological resource" (Lamb 1988:1, 7), it seems a less than worthwhile study if the intent is to discover a geographical source of origin. Vessels frequently offloaded putrid ballast and continually added to their supply *en route* to their destinations, often purchasing it from ballast mongers who sold ballast discarded from other ships.

The relatively small number of stones on the "Pipe Wreck," combined with what Bristow characterized as the "fine grain size" of the individual samples (Bristow, personal communication to Amanda Sutherland, 1992), suggest they were not the only form of ballast used on the vessel. This supports the idea that the large concretions, possibly scrap iron to be sold in the New World, were serving the same purpose.

**Comparative Archaeological Material**

Within the archaeological record, the vessel most closely resembling the "Pipe Wreck" is the *Sea Venture*, an English merchant ship that sank off Bermuda in 1609. The extant hull of the *Sea Venture* comprised 18 frames, each with average molded and sided dimensions of 30.0 cm; these were placed, on average, at intervals of 61.0 cm, center to center.\(^5\) No keelson was present and the ship was fastened with trenails, some of which were wedged. Iron bolts were used to fasten floor timbers to the keel; the bottom planking averaged 6.4 cm in thickness and ranged between 26.0 and 49.0 cm in width. Like the "Pipe Wreck," the first futtocks on the *Sea Venture* were offset from the keel an average distance of 36 to 39 cm. Goodwin (1987:15-17) and Lavery (1984:32) note that this was common for seventeenth- and eighteenth-century English-made vessels. According to Clifford (unpub. 1993:103), both Lavery and Goodwin specify that the offset distance was 18 to 24 inches (45.7 to 61.0 cm). Morris (unpub. 1991:78, as cited in Clifford unpub. 1993:103) notes that this characteristic was common among merchant ships well into the nineteenth century.

Further investigation of a Cromwellian shipwreck located off Duart Point, Mull, Scotland, may produce construction features similar to those found on the Monte Cristi wreck (Martin 1995:15-32). A plan of the Duart Point site, produced in 1994, indicates the presence

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\(^5\) Steffy (1988) notes that this measurement is 31 cm x 31 cm, or one English foot.
of numerous frames, as well as ceiling and bottom planking, but no structural details are
discernible. General descriptions of the hull have yet to be published.

COMPARATIVE HISTORICAL WATERCRAFT

What type of vessel is represented by the seventeenth-century shipwreck in Monte Cristi
Bay? The aforementioned preliminary wood study suggests an English-built trader, but what of
its size? Was it, in fact, in service of the English, or are there sufficient archaeological data
contained within the cargo to implicate a Dutch registry? These questions may never be
answered, especially if the vessel changed hands through piracy or military capture. In light of
such possibilities, an examination of both Dutch and English vessel types known to be present in
the Caribbean during the seventeenth century is warranted.

The English in the New World

According to port records from Bristol, England -- from May through October, 1682 --
ships, ketches, and pinks were the primary vessel types bound for English New World
settlements during the latter part of the seventeenth century (Appendices E, F, G, and H). They
carried trade goods among the Caribbean islands of Jamaica, Barbados, Nevis, and Montserrat.
On the northern continent, New England (comprising present day Maine, New Hampshire,
Vermont, Massachusetts, Rhode Island, and Connecticut), Pennsylvania, Carolina, Maryland,
and Virginia were the primary destinations. Often, vessels sailed to these ports by way of
Holland or Ireland, carrying an assortment of foodstuffs, as well as household, cloth, and metal
goods.

The first Caribbean Islands colonized by the English were St. Kitts and Barbados,
settled in 1624. Both the Dutch and English occupied the island of St. Croix in 1625. The
English went on to colonize Nevis in 1628 and Antigua and Montserrat in 1632 (Parry and
Sherlock 1985:52). By 1644, English merchants were engaged in tripartite trade with the North
American colonies and the Caribbean islands. New England merchants also found the Africa-
Caribbean trade lucrative: ships departing for Africa regularly traveled to the Madeira Islands
to purchase wines to be sold in Barbados. By 1650, New Englanders were exporting Barbadian
sugar. During the second half of the seventeenth-century, when the vessel represented by the
Monte Cristi shipwreck was plying the waters just north of the Caribbean, the English were still
active in their program of colonial expansion, occupying Anguilla and Surinam in 1650. Jamaica in 1655. and Antigua, Barbuda, Campeche, Carolina, and the Bahamas between 1661 and 1666 (Bridenbaugh and Bridenbaugh 1972).

Clifford (unpub. 1993:55-70) examined “port records, probate inventories, wills, and various other colonial records” in an attempt to describe vessel types that may have entered the harbor at the English settlement of Port Royal, Jamaica, during the seventeenth century. The study confirmed that a variety of crafts were “employed in the legal and illegal seaborne trade throughout the Atlantic and Caribbean” (Clifford unpub. 1993:55). These included “yachts, fluitships (flyboats), barks, frigates, sloops, ketches, snows, pinneys, caraveloes, pinks, and shallows” (Clifford unpub. 1993:55). In addition to pinneys, barks, and ketches, the English at Jamestown, Virginia, employed vessels ranging from small, flat-bottomed boats to moderately-sized sailing vessels, including small rowboats, bilanders, and schooners (Cotter 1994).

The Dutch in the New World

The Dutch employed many types of vessels in trade between Europe, Africa, and the Americas. They often carried goods to New Netherlands, supplying Dutch wares to the “Indians... English colonies and... Caribbean markets” (Wilcoxen 1991:67). The collection of resolutions and letters contained in the Curacao Papers describes 11 vessel types (Appendix I). Only six of these, however, are relevant to the study of the Monte Cristi shipwreck, based on tonnage and function. These include the schip (ship), the jacht (yacht), the fluyt (flute or flyboat), the barck, the fregat (frigate), and the galatooh (galiot). Five varieties not discussed here (but included in Appendix I) are the scheepie (small ship), the kits (ketch), the sloop (sloop), the dagboot (dogger), and the piragie (pirogue).

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6 Again, the difficulty of translating seventeenth-century Dutch nomenclature is encountered. Is a smalschip the same as scheepie, the latter term being used in the letters of Curacao to refer to small ships? Gehring (personal communication. 1994) notes the difficulty in knowing if “scheepie,” as used in the Curacao letters, is a reference to the vessel size, or, in fact, a term of endearment or familiarity. Wilcoxen (1991:55) suggests that the term “little ship” is used repeatedly in the public records of New Netherlands in reference to a size range generally between 80 and 200 tons burthen. DeGroot and Vorstman (1980) note that ships with a beam less than 4.68 m were characterized as smalschips and were able to pass through the Donkere Lock in the center of Gouda: broader-beamed vessels (wijdenschips), however, had to bypass the center and use the Mallegat Lock to the west of town. They note that, according to Witsen, the smalschip was employed “as a lighter for loading and unloading ships and for carrying cargo out to ships in the roads” (De Groot and Vorstman 1980:81. Plate 80).
Dutch colonization characteristically began with a trading voyage that resulted in the establishment of a factory, followed by a trading post, a fort and, ultimately, territorial acquisition (Janowitz, personal communication, 1995). In 1602, the States-General of the Netherlands established the Vereenigde Oostindische Compagnie (VOC), or the Dutch East India Company. The charter sought to regulate and protect Dutch commerce and colonization in Asia; however, it simultaneously promoted war with Spain. With Europe’s penchant for exotic commodities, the United Provinces, operating at lower costs than their competitors, soon dominated the Eastern trade in spice, silk, ivory, porcelain, precious metals, gems, and lacquerwork.

The islands and continents of the Pacific and Indian Oceans opened to the United Provinces with rights awarded to the VOC. Nineteen years later, the Atlantic followed suit. On 3 June 1621, the West-Indische Compagnie (West India Company, or WIC) was incorporated by a charter of the States-General. With this edict (the Octroy, or Charter of 1621) the WIC was granted a 24-year monopoly on trade and navigation for the Atlantic coasts of North and South America, the Caribbean Islands, coastal West Africa and the “vaguely-conceived D’Australian or Southlands” (Bachman 1969:25). Under this document, the WIC was granted authority “to make war or establish peace, whichever the case might warrant, maintain naval and military forces, and exercise judicial and administrative functions in those regions” (Boxer 1990:27).

Next to the East Indies and Brazil, the Caribbean was an extremely attractive prospect for the Dutch. Potential investors were enticed not only with economic gain, but also with the desire to strike a blow to the heart of the Spanish Empire in the New World. The Americas were distant and alluring; however, the time needed to travel there was 1/7 that of voyaging to the Indian and Pacific Oceans. Furthermore, the Caribbean was replete with natural resources. When Spain closed the Iberian peninsula to Dutch shipping at the end of the sixteenth century, the United Provinces turned to the Caribbean for salt to sustain their burgeoning fishing industry. The Amsterdam leather trade flourished during the seventeenth century due to high demand from the military, tool, transportation, and fashion industries. Hides often came from Cuba and Hispaniola in a trade that amounted to some 800,000 guilders annually (Goslinga

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7 A noticeable exception to this pattern was the Dutch involvement in West Africa.
1971). The Dutch also brought tobacco to Europe from North and South America, and from the Caribbean Islands. Dyewood, frequently mentioned in the seventeenth-century Curaçao documents, was in high demand among the Dutch-Americans at New Amsterdam, as well as by the English-Americans in Jamaica.

Cacao and indigo were secondary products that were shipped to Europe. Ginger, canafistula, pearls, sarsaparilla, and cochineal also spilled forth from the tropical cornucopia of the Caribbean islands and the Atlantic coast of South America (Goslinga 1971). In spite of the great commercial wealth and economic potential that the Caribbean held for the Dutch, the WIC turned out to be a major disappointment: "the Netherlands seemed to be more attuned to Asia than to the Americas" (Zumthor 1994:298). The WIC's eventual downfall was tied to a series of military and economic blunders that culminated in the errant belief that privateering would, in the long run, supersede colonization and trade (Beshears unpub. 1992).

Northern European Vessels in the New World: Functions and Cargoes

Efforts to interpret the "Pipe Wreck" may be advanced by analysis of Dutch and English shipping vessels. In particular, there may exist a correlation between vessel type and the cargo it carried. On the other hand, conclusions based upon such correlations must carry the caveat that any recognizable trend may be fortuitous: merchants may simply have loaded cargoes into any available vessel, regardless of whether it was a ship, yacht, fluyt, barck, frigate, or galiot. This discussion focuses on the period between 1643 and 1665, a temporal framework within which the Monte Cristi vessel, theoretically, was constructed and sank.

Before embarking on this analysis, consideration must be given to two ideas put forth by Wilcoxon (1991): first, the Dutch assigned vessel nomenclature loosely, or as Wilcoxon states, in a manner to be regarded as "careless and unreliable" (Wilcoxon 1991:67). This is evident in the resolutions and letters from the seventeenth-century Dutch-American settlement at Fort Amsterdam on Curaçao. Vessels referred to as barks in one transcript are called sloops in another (RLC* 4 November 1659). Likewise, the category "ship" is sometimes, but not always, subdivided into yachts, fluyts, barks, and frigates. Second, terminology used to describe specific

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8 The following abbreviations are used within this document: RLC, or the Register of the Letters from Curaçao, No. 60; RBC, or the Resolution Book of Curaçao, 1643 and 1644, No. 58; M&L; and PRO, or the Public Office Records (Bristol Shipping Records), 30 May to 31 October 1682.
vessel types in the seventeenth century may not necessarily apply to nineteenth-century craft bearing the same names: they may, in fact, differ considerably with respect to any number of features.

The Schip (Ship)

Typically, the ship was the largest and grandest of all sailing vessels. The name, derived from the Old English scip, generally designated a sea-going vessel with a bowsprit and at least three masts with squaresails (Blackburn 1978:314). Den Eykenboom (The Oak Tree), a ship of the West India Company, was described by Henrich Schaef, a seventeenth-century notary public from Amsterdam:

Den Eykenboom: length 122, width 25 1/2, hold 11 1/2, above 5 1/2 and 6 feet with a forecastle and half deck on either side...the aforesaid skipper [Jan Janssen Eykenboom] shall be bound immediately to deliver his aforesaid ship here in the city fitted out, tight, well-caulked and provided with good and sufficient anchors, cordage, tackle, sails, running and standing rigging and all other necessities and appurtenances belonging thereto; and the same mounted with ten good pieces of cannon, with the powder and shot required thereto, and other ammunition in proportion, but that the necessary consumption of powder and shot aforesaid shall be made good by the Company, which shall also put on board the aforesaid ship, in addition to the aforesaid ten pieces, as many other guns as they please and can be properly mounted, and shall itself provide and pay the expense of the powder and shot therefore (RLC: 5 April 1659).

The sheer plan of such a vessel began with a ram-like beakhead at the upper stern. There was a forecastle, as noted in the description of Den Eykenboom, and the midships area, or waist, was comparatively low. From this region to the stern, the sheer extended upward, its fair profile broken by the presence of high, narrow decks. Above the waterline, the flat stern swept upward to a reasonably large sterncastle. below, the hull was rounded (Baker 1983:17) (Figure 24). Seen from either end, the upper works tumbled home to high, narrow decks, that is, the sides sloped or curved inward from the waterline (Baker 1982:267).

Den Eykenboom had a length to beam ratio of 4.78:1, which might relegate it to the subcategory fluyt, though this is confirmed in neither the resolutions nor letters from Curaçao. 9

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9 De Weerdt (1992:5-6) states his “strong impression” that, in spite of the numerous vessel types used by the Dutch, there were, in fact, only two categories: those bearing flat transoms and fluyts. Within the first group he includes the “jacht, spiegelschip, pynas and fregat,” asserting that there were “no real differences...in their construction and the length-width ratio was always about 4:1.” The fluyt, on the other hand, had a length-to-beam ratio of 4.5:1 or 5:1.
Figure 24. An early seventeenth-century Dutch merchant ship, after Culver (1922:87).
The ship carried minimal ordnance (only ten cannon), further suggesting a *fluyt*, or perhaps a frigate, but again, this cannot be substantiated.

The ship was a large, multipurpose vessel that carried numerous provisions both from Europe to the Americas, and among the New World settlements themselves. Cargo manifests from the 1689 port records of Bristol, England, indicate that ships bound for the New World were often laden with an assortment of foodstuffs. Among these were grains, vegetables, meats, dairy products, and beverages (*PRO* 30 May to 31 October 1682). Dutch-Americans in the Caribbean and northeastern part of North America also relied on the ship to transport tobacco (*RLC* 4 March 1660) and livestock (*RLC* 12 June 1655). Cargo manifests of ships that arrived at New England, New Netherland, and the Caribbean listed assorted haberdash wares, leather goods, textiles, riding accouterments, and numerous items intended for use at home or in cottage enterprise.

Ships were also used to transport troops, immigrants, and slaves (*RBC* 1 January 1644, *RLC* 2 April 1654, 21 July 1661, 4 March 1664. Rink 1986:166-7, Table 6.4). The Spanish had no slave outposts in Africa and were thus reliant on the Dutch and English for this commodity. In addition to Africans, Native-Americans were also enslaved and transported about the Caribbean by ship (*RLC* 4 February 1660; Rink 1986).

Numerous salt pans, situated among the Lesser Antillean Islands, drew the Dutch to the Caribbean and became strategic locations for encounters between rival European powers. When the ship *Het Hof von Cleef* (*The Court of Cleef*) was captured by the English during the First Dutch-Anglo War, it was carrying a load of salt to New Netherland (*RBC* 23 August 1659, *RLC* 18 May 1654, 7 July 1654, 24 August 1659, 4 February 1660; see 12:256, translated in NYCD 14:263, as noted in Gehring 1987:224).

In order to protect their precarious investments, which included trading colonies, forts, salt pans, and uninhabited islands for grazing livestock, European powers contending for dominance within the Caribbean were constantly on patrol. Troop movements and merchant shipments were routinely monitored. Essential to these intelligence activities was the ship utilized as a vehicle of reconnaissance within the WIC. The ship *Swaal* was dispatched from Fort Amsterdam to Cartagena with a mandate to cruise (*cruijzen*) "for the most profits and service of the Company" (*RBC* 25 May 1644). The ship *Den Blouwen Haen* (*The Blue Cock*) was ordered to sail to Hispaniola to gain intelligence (*comschap hecmen*), presumably on the activities of
the Spanish (RBC 1 January 1644): while at anchor with the squadron behind Ile-a-Vache, the vessel received a mandate to probe (een proef) the island of St. Martijn (RBC 14 January 1644). Thus, the ship performed a variety of tasks and was a common sight in the seventeenth-century Caribbean.

**The Jacht (Yacht)**

The yacht was an extremely versatile vessel employed by both the English and Dutch in the Caribbean and along the eastern seaboard of North America. The name has its origin in the German word *jaeger*, or hunter, a reference to its speed on the open water. Yachts were characterized by rounded bows and high, flat sterns. Lightly armed, they mounted between four and 14 guns and averaged approximately 100 tons, with a range generally between 60 and 120 tons burthen (Figure 25).

As a supply vessel, the yacht was used primarily to transport foodstuffs and wood for use in construction. In 1658, the WIC yacht *Diemen (Demon)* unloaded wheat, rye, peas, bacon, meat, butter, flour, wine and mun into the Company’s magazine at Fort Amsterdam (RLC 29 August 1658). Six years later, *De Musch (The Sparrow)* was expected to arrive in Curaçao from New Netherland carrying many of the same items (RLC 26 April 1664). Both yachts also carried wood planks, and *De Musch* transported an assortment of lumber to be used for construction projects.

In the service of the WIC, the yacht hauled not only cargo but also animals, troops and slaves. According to the documents emanating from Curaçao, only yachts were associated with the transport of “exotic animals,” or pets. *Diemen* carried five parrots and 36 parakeets, along with two skipples of groats to feed them (RLC 13 September 1658). *Diemen* also bore salt, though this is the only Dutch yacht to do so between the years 1658 and 1660. In 1659, the yacht *De Vrede* was dispatched to assist in the slave trade (RLC 4 March 1659).

The versatility of the yacht is clearly illustrated in the many tasks performed by *De Paroquet (The Parakeet)*. In 1643, this vessel was ordered to *Clein (Small)* Curaçao in order to “fetch some seals” so that the island’s diminishing train oil supply could be replenished (RBC 13 February 1643). Half the fort’s garrison sailed from Curaçao to St. Croix, La Margarta, and Hispaniola aboard *De Paroquet* to obtain livestock (RBC 15 October 1643). This same yacht was dispatched to reconnoiter Aruba, following instructions to “maintain good intelligence
Figure 25. A Dutch yacht, after Reinier Nooms' etching titled, "Two frigates and a transom yacht," in De Groot and Vorstman (1980:Plate 93).
with the Indians" (RBC 29 August 1643). Later, it was employed as a "cruising yacht,"

presumably to defend the fort at Curaçao and the outlying territories (RBC 22 August 1644).

For a time, De Paroquet was stationed "as a remote guard" to protect the "gantry, materials,
salt, and workers" at the pans of Bonaire (RBC 14 April 1643). Joined by De Neptunus (The
Neptune), it was ordered to the islands of Moena and Savona (Mona and Saona) to patrol the
area between Hispaniola and Puerto Rico (RBC 18 May 1644). These two yachts, together with
De Melekmeyt (The Milkmaid), were also sent "to promote the Company's profit and gain at the
expense of the common enemy" (RBC 16 June 1644). Finally, De Paroquet, Nassou and 7
Stael were dispatched to Hispaniola to "gather prisoners" (RBC 1 January 1664). The
multiplicity of tasks assigned to this vessel indicates the versatility of the yacht and the reliance
placed on it by the Dutch in their military and economic exploitation of the Caribbean.

The Fluyt (Flute)

The fluyt was the supreme cargo ship within the Caribbean and along the Eastern
seaboard of North America. Its design was the direct result of competition among shipwrights
who sought to accommodate the "flourishing sixteenth-century trade with the Baltic countries
revolutionary success of the fluyt in the scheme of Dutch colonialism was centered in economy
of design, construction, and operation. It was mass-produced and used interchangeable parts,
and thus was easily repaired both at sea and abroad (Wilcoxen 1991).

Known by various names, the fluyt, vlieboot, fluitschip, flute, flight, or flyboat was
characteristically long and narrow; while most classes of watercraft used in seaborne trade and
cabotage had a length-to-beam ratio of 4:1, the fluyt measured 4.5:1 or 5:1 (de Weerdt unpub.
1992). It had a rounded transom, or "pear-shaped" stern (Wilcoxen 1991:57) (Figure 26); it
was narrowly waisted at the deck level amidships and had a "very broad buttock below"
(Wilcoxen 1991:57). Also characteristic of the fluyt was a "very high and ornate stern" (Kemp
1976:318) that often resembled "a Gothic turret" (Falconer 1780:132). The fluyt typically had
one or two masts that were square-rigged on both or with a spritsail on the mainsail; however,
Kemp (1976) suggests that they were rigged as a pink, or ship-rigged on three masts. Initially
they were lightly armed, with emphasis placed on carrying capacity over defense. They were not
as light or fast as the frigate (see below); their functional design as a storeship rendered them
Figure 26. A Dutch *fluyt*, after Culver (1992:103).
"slow sailing, vulnerable vessels" (Clifford unpub. 1993-60). With increasing commerce and piracy in the seventeenth century, flyts acquired more artillery to protect their vital cargoes.

Flyts cost relatively little to produce but were extremely capacious. The following note, made by Mathias Beck, Lord Vice-Director of the WIC, gives an indication of the carrying capacity of the flyt:

I had as much dyewood cut and made available as was possible, hoping to be able to fill the main hold of his [Skipper Anna Deuvensz] aforesaid ship [the flyboat De Liefde] with wood, together with what was cut by the Indians on Aruba, which I however doubt. The commander on Aruba has told me that he believes about three barks full of dyewood will be ready there; and I shall send an officer there with the flyboat in order to load the same, together with a scale and weighs to weight it (RLC’ 24 December 1655).

It would appear from this letter that the flyt was capable of transporting three barks’ worth of cargo. Flyts employed in cabotage ranged in size from 80 to 90 tons burthen up to an impressive 400 to 600 tons (Kemp 1976). Hepper (1994) noted that three flyboats, listed as missing in the Northeast Atlantic during the seventeenth century, ranged in size from 191 to 233 tons, with an average of 211.6 tons burthen. It would appear that the 200- to 300-ton class was employed frequently in the Caribbean and New Netherland trade.

Despite the flyt’s enormous size, it required only a small crew, usually some nine to 15 men. Botting (1978) noted that only 12 crewmen were needed to operate a vessel of 80 feet (24.4 m) and 300 tons, considerably fewer than the 50 men suggested to outfit an equivalently-sized English vessel. This gave the Dutch an additional advantage over the English in the shipping industry. Arguably, the flyt was one of the factors contributing to the issuance of the First Navigation Act, which subsequently led to the first Anglo-Dutch War (see Chapter I).

The flyt was an essential tool for the survival of the Dutch colony at Fort Amsterdam, where it was utilized extensively in the transport of both supplies and passengers. Foodstuffs needed to sustain the soldiers were brought by flyts from New Netherland, the cargo included meal, cassava, farina, and beans (RLC’ 24 December 1655), along with wheat, rye, French wine, vinegar, mum, and salt (RBC’ 6 June 1644; RLC’ 24 December 1655, 26 March 1658). In the interisland trade of the Caribbean, Dutch-American flyts carried livestock, including horses (RLC’ 26 May 1644), sheep, and goats (RLC’ 24 December 1655). Finally, various hard commodities were transported by flyt: dyewood (RLC’ 24 December 1655, 11 June 1657, 26
March 1658: hides and tobacco \(RLC\ 11\ June\ 1657\): copper slag, gold, and silver \(RLC\ 28\ June\ 1657\).

The \textit{flyvt} was occasionally used as a "cruising vessel." For example, \textit{De Liefde (The Love)} participated in the 1655 invasion of New Sweden. Such activities were infrequent, however, as the \textit{flyvt} was first and foremost Holland's primary shipping vessel.

**The Fregat (Frigate)**

The frigate, perhaps more than any other vessel type, was the quintessential sailing ship in the Caribbean. A massive spread of canvas, coupled with considerable firepower, rendered it a quick and lethal maritime presence. As Botting (1978:40) remarks, "her appearance on the scene was usually enough to send the brigand fleeing." The frigate was equally reliable as a scout in military action, an escort for large convoys, and was sent on seek-and-destroy missions aimed against privateers, especially within the Atlantic (Kemp 1976). Within the Caribbean, the Dutch employed the frigate "against the Portuguese, the Spanish and later the English" (Wilcoxen 1991:59). According to Falconer (1780:134), it was a "light, nimble ship," built for speed and capable of mounting between 20 and 40 guns on a single deck. As seen in Figure 27, the frigate was a three-masted vessel, fully-rigged vessel with a flat stern and a V-shaped hull, all features that made it an excellent cruiser.

Frigates did more than protect Dutch interests at sea; they were also principle vessels engaged in privateering. So vital was the frigate to the WIC in the Caribbean that a letter sent forth from Fort Amsterdam in 1665 noted that partners in Zeeland held the "common purse of 18 ships or frigates for privateering against the English" \(RLC\ 16\ April\ 1665\). Additional duties included cargo transport \(RLC\ 1\ November\ 1664\); occasionally the frigate carried passengers (Rink 1986:166-167, Table 6.4).

**The Barck (Barca, Berek, Bark)**

The term "bark" is broadly defined; it describes an array of vessels, from a small ship with minimal rigging to a five-masted vessel in which the aftermast alone was fore-and-aft rigged (Kemp 1976). Falconer, in the late eighteenth century, characterized the bark as a three-masted vessel that lacked a mizzen topsail (Falconer 1780). It appears that, originally, barks
Figure 27. A Dutch Frigate, after Reinier Nooms' etching titled "Two Frigates," in De Grout and Vornmann (1986:Plate 92).
were relatively small sailing ships with single decks, often square-stemmed or double-ended and similar to ketches (Figure 28) (Baker 1983).

In the employ of the WIC, and specifically within the service of Fort Amsterdam, the bark was a multipurpose vessel that transported a variety of cargoes, but principally livestock and dyewood (RLC 24 December 1655, 21 March 1656). Barks also carried copper, tobacco, and hides (RLC 11 June 1657). Occasionally, soldiers were sent upon Company barks to catch turtles (RLC 11 June 1657); indirectly this made the vessel a vehicle of troop transport. Barks were also used by the Dutch to transport slaves to various work locations throughout the Caribbean. When the ship St. Jan was stranded on the reef at Rucus, the Company dispatched two barks, *Den Jongen Vogelstruys* (*The Young Ostrich*) and *Den Jonge Bontecoe* (*The Young Bontecoe*), to recover the slaves that were left when the crew abandoned the vessel (RLC 11 June 1657).

Because of its shallow draft and superior maneuverability, the bark was an appropriate vessel for use in precarious logistical situations. It was therefore an essential member of the Dutch West India fleet in the Caribbean.

The *Galiot* (*Galioth*)

The term "galiot," as applied through the seventeenth and eighteenth centuries, referred to several different vessels with various functions, from small, coastal traders to larger, offensive warships. Most often, however, the seventeenth-century Dutch galiot ranged between 50 and 300 tons burthen. It was rounded, almost perfectly circular, at both the bow and stern, and the bottom was flat to accommodate coastal trading (Figure 29). Although they were originally outfitted with leeboards, galiots were later equipped with a set keel (De Groot and Vorstman 1980:280; Culver 1992:94). A seventeenth-century etching, entitled *A galiot at sea, with a whale spouting* (De Groot and Vorstman 1980:Plate 58), depicts a vessel with three masts, the main being square-rigged; however, it appears that the majority of seventeenth-century galiots carried two masts. Typically, the main and maintopsail were square-rigged, although the main could be gaff-rigged (De Groot and Vorstman 1980:Plate 58). Because there was no foremost, a forestay running from a long, lightly steered bowsprit to the mainmast

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10 This ship was named for the famous Dutch naval hero, Willem Ysbrantzoon or (IJsbrandsz) Bontecoe: the name also translates as "young brindled cow" (Gehring, personal communication, 1994).
Figure 28. A bark, after Culver (1992:136).
Figure 29. A Dutch galiot, after Culver (1992:93).
carried a forstaysail and jibs (Kemp 1976; Wilcoxen 1991). During the seventeenth century, the term “galiot” could also be applied to a small galley propelled by a single sail and 16 to 20 oars, generally employed to pursue and capture enemy ships. In the eighteenth-century, a galiot was usually three-masted, used as a trading vessel.

In the employ of the WIC, the galiot served to transport troops and immigrants, conduct reconnaissance, and haul supplies and livestock. The Nieuwe Amsterl (New Amstel) was under charter to the WIC between 1659 and 1662, and was apparently the most heavily used galiot within the Caribbean trade (Wilcoxen 1991; RLC 2 May 1659, 16 May 1659, 16 June 1659, 8 May 1660, 18 May 1660). When the Nieuwe Amsterl offloaded foodstuffs into the Company magazine at Fort Amsterdam on 2 May 1659, it was carrying bacon, meat, wheat, white and gray peas, beer, and brandy (RLC 2 May 1659; 16 May 1659). Seven barrels of Caribbean Muscovy sugar, as well as lemon juice, salt, and conch were loaded aboard the galiot to be sent to New Netherland several days later (RLC 16 May 1659). Also included in this shipment were dyewood, cotton, bedding, as well as hides from bear, fox, lion, beaver, deer, and elk. In the following year, Nieuwe Amsterl carried beams, timbers, hoopsticks, crooked timber, wagons, and pipes (most likely for water) (RLC 8 May 1660). Additional supplies carried aboard galiots included mackerel, salted meat, cheese, syrup, plums, preserved lemons, and sweets (RLC 8 May 1660, 16 April 1664, 6 December 1664, no date 1665), and hard commodities such as cloth, barrels, and pots (RLC 16 April 1664, no date 1665).

Galiots occasionally provided transport for passengers: the Nieuwe Amsterl carried one young girl and two Indians from Curaçao to “Amsterdam in N. Nederlant” (RLC 8 May 1660). However, the galiot’s principle duty was shipping. The enormous capacity of the fluyt (see above) appears to have made it the choice for loading bulk cargoes. The galiot tended to transport a greater variety of goods and supplies, but occasionally carried bulk items. When the Nieuw Amstel arrived in Curaçao to take on a load of salt and dyewood, it was referred to as a “freight galiot” (RLC 16 May 1659).

CONCLUSIONS
The Building of the Ship

Dendrochronological analyses of timbers taken from the Monte Cristi “Pipe Wreck” indicate that this vessel was constructed sometime after 1642. Based on the remains — the keel.
frames, and planks -- the ship was made of English oak. In addition, the hull was coated with
tar and cow hair and covered with softwood deals, probably made of spruce or larch; this
sheathing was intended to protect the hull against biological degradation. The Monte Cristi
vessel probably reached 25 to 30 m in length, with a beam of no less than 6.0 m. It was likely
ship-rigged (i.e., with three masts) and in excess of 200 tons burthen.

The use of English oak strongly suggests that the vessel was constructed in England.
Furthermore, careful examination of the extant hull revealed no spijkerpennen, or small dowels.
on the planking. This demonstrates that the vessel was not constructed in the northern Dutch
bottom-based tradition. Moreover, certain construction features (e.g., placement of first futtocks
relative to the keel) compare well with the Sea Venture, a similar, early seventeenth-century
English merchant vessel. Of course, none of these factors totally precludes the possibility that
the vessel was Dutch-built. It could have been made of imported timber, for example; however,
Spoor and Jansma (personal communication, 1992) have indicated that this was highly unlikely
during the middle of the seventeenth century.

The Owners of the Ship

Piracy and privateering were rampant throughout the Caribbean during the seventeenth
century. Military confrontations between the English and Dutch also resulted in seizure and
subsequent use of enemy ships (see Chapter I). It is therefore reasonable to propose that the
Monte Cristi vessel changed hands at least once during its lifetime. Although built in typical
seventeenth-century English fashion, the Monte Cristi vessel could have flown the Dutch
tricolor, perhaps sailing for the West India Company. Likewise, given the threat of piracy in the
northern Atlantic, it is possible that the vessel and its cargo could have been captured at separate
times. In sum, there is considerable room for speculation about who was in possession of both
ship and cargo at the time of sinking. speculation that may have little to do with the country of
origin for the merchandise carried as trade goods.

The Type of Vessel

The foregoing discussion of seventeenth-century European shipping has been an attempt
to determine the type of vessel represented by the Monte Cristi shipwreck. The historical record
describes 11 vessel types employed by the WIC and engaged in various activities including the
transport of diverse cargo (Table 3), as well as military operations and coastal exploration (Table 4). Of these, six may represent the vessel type of the “Pipe Wreck.” Although the ship, yacht, fluyt, bark, frigate, and galiot are all of a size comparable to the Monte Cristi vessel, it appears that the most versatile and frequently mentioned vessel type employed by the WIC within the Caribbean was the yacht.

The cargo of the “Pipe Wreck” may shed further light on the vessel type. The Monte Cristi ship may have been carrying logwood (dyewood) and salt. During the 1994 excavation season, a single log, suggestive of dyewood in both size and appearance, was recovered from the site; however, tests have yet to conclude a specific wood species. West India Company fluyts and barks frequently engaged in the logwood trade, and all but the fregat were involved with salt transport. A variety of other goods were excavated from the shipwreck, including clay tobacco pipes, ceramics jars, copper kettles, candle holders, curtain rings, thimbles, Venetian crystalware, and glass beads (see Chapter III). Thus, the Monte Cristi ship was laden with a significant cargo of supplies and trade goods. All of the six WIC vessel types are known to have carried supplies, both foodstuffs and hard commodities, and so this factor does little to elucidate the type of vessel. Based upon the size of the shipwreck, the cargo recovered from the site (especially dyewood), and the historical record of known vessel types in the Caribbean, the vessel at Monte Cristi probably represents a ship, yacht, fluyt, or bark.

The Vessel in Monte Cristi Bay

During the seventeenth century, English ships and barks routinely traveled from Europe to New England, often by way of one of the West Indian islands. These vessels often carried cargo to English settlements at Barbados, Nevis, and Jamaica, cargo that was similar to the artifacts excavated from the “Pipe Wreck.” The English were certainly familiar with the island of Hispaniola. In fact, the English Pilot — a seventeenth-century navigational guide — provides a detailed description of the Monte Cristi shoal, the bay, and the outlying regions. Thus, it is not unreasonable to suggest that the “Pipe Wreck” represents an English ship, laden with various trade goods, which met its demise within Monte Cristi Bay.

Vessels sailing for the WIC were also known to stop at Hispaniola. Historical records indicate that ships, yachts, and barks all had business at or near the island between 1640 and 1665 (Table 5). These documents specifically mention the ship Den Blouwen Haen; the yachts
Table 3. Vessel type and conveyance from *The Resolution Book of Curacao. No. 58, MM 1643-1644* and *The Register of the Letters from Curacao. No. 60, 1640-1665*.

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Supplies</th>
<th>Groceries</th>
<th>Livestock</th>
<th>Animals</th>
<th>Immigrants</th>
<th>Troops</th>
<th>&quot;Negroes&quot;</th>
<th>&quot;Indians&quot;</th>
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<tbody>
<tr>
<td>Schip</td>
<td>✔</td>
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<td>Jacht</td>
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<td>Frigate</td>
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<td>Kits</td>
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</tbody>
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*Dogboat*
Table 4. Vessel type and method of utilization from *The Resolution Book of Curacao, No. 58, MM 1643-1644* and *The Register of the Letters from Curacao, No. 60, 1640-1665*.

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Coastal Exploration</th>
<th>Dispatch</th>
<th>Cruiser</th>
<th>Salvage</th>
<th>Rescue</th>
<th>Turling</th>
<th>Fishing</th>
<th>Reconnaissance</th>
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<tbody>
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<td>Schip</td>
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Table 5. Vessel type, presence in Hispaniola, and cargoes from *The Resolution Book of Curacao, No. 58, MM 1643-1644* and *The Register of the Letters from Curacao, No. 60, 1640-1665.*

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Present in Hispaniola</th>
<th>Salt Transport</th>
<th>Livestock Transport</th>
<th>Dyewood Transport</th>
<th>Trade goods</th>
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<td>Kits</td>
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<td>Dogboot</td>
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De Paroquet, Nassou, and 7 Staer, and the bark Curacao. There is thus considerable support for a Dutch WIC presence in the region of Hispaniola during the middle seventeenth century.

One attraction may have been the salt pans (see Chapter I):

And whereas we have been informed that sometimes some salt can be obtained on the island Espaniola, particularly in the Bay of Hato de Cavelliero, we have decided to dispatch the yachts Den Neptunus and De Paroquet in order to investigate this with certainty and to inform us if this is so (RBC 16 June 1644).

Another attraction may have been the trade in hides offered by the boncanners (see Chapter I) WIC documents refer to a shipwreck in Hispaniola from which hides were offloaded onto a rescue ship. A letter dated 11 June 1657 mentions 't Scheipien (the small ship) St. Nicolaes that arrived at Fort Amsterdam on 27 June, after "a long and extremely difficult voyage." While passing by Santo Domingo -- probably an allusion to the eastern half of Hispaniola rather than a specific reference to the capital city of the same name -- St. Nicolaes came upon a ship "of two hundred lasten" that had "run aground." Jan Mortier, captain of the small ship, recovered "pockwood, in addition to anchors, guns and cordage" from the sinking vessel. The vessel's "skipper and pilot, both from Hamburg, came over with him [Mortier]. They also traded for a few hides and other small items from the butchers on the voyage" (RLC 11 June 1657). In the original Dutch, the word "butcher" reads as keukkellers, which literally translates to "cowkillers." Could these be the boncanners of Hispaniola? Such an explanation is promising, given the time frame, the geographic region, and the historical record of illegal trade with the boncanners.

The events outlined in the letter of 11 June 1657 reflect many facets of the Monte Cristi "Pipe Wreck." The intriguing possibility exists that the shipwreck described is, in fact, the "Pipe Wreck" itself. The vessel in question is a merchant ship of 200 tons burthen. It ran aground somewhere in Hispaniola. The wreck occurred not long before June of 1657, which matches closely the time frame prescribed by the Monte Cristi artifacts (see Chapter III). The cargo of hides, along with other goods, was offloaded by the captain and crew of a Dutch small ship. Furthermore, anchors and guns were salvaged from the shipwreck, items which, with the exception of a single cannon, have never been recovered by PIMA archaeologists, nor have they been reported among the salvage of previous visitors. The presence of this single cannon on the site prompts the question of what happened to the rest of the ordnance aboard the vessel. The
similarities between the “Pipe Wreck” and the vessel mentioned in the Dutch letter demand further investigation. Additionally, these findings indicate the importance of studying both archaeological and historical data in the interpretation of shipwreck sites.
CHAPTER III

THE ARTIFACTS

Despite years of heavy salvage, the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay has yielded a surprising number and variety of artifacts. Along with the extant hull described in the previous chapter, these items have permitted archaeologists to answer many of the questions proposed in the original research design (see Chapter I). The artifacts offer clues for each phase of the vessel’s last voyage, from its port (or ports) of lading, to its final resting place in Monte Cristi Bay. One artifact has established a terminus post quem for the shipwreck; others corroborate this known date and clearly suggest that the vessel sank within a five year period during the second half of the seventeenth century. Several artifacts indicate that the vessel carried goods destined for affluent European Americans, and a small portion of cargo was intended for Native North American settlements. Some artifacts suggest a specific geographic destination for the Monte Cristi vessel. Certain artifacts speak of shipboard activities and indicate, to a degree, the level of shipboard sanitation. The curious condition of one cluster of artifacts has even offered clues about the demise of the vessel. The data also indicate the orientation of the vessel on the sea floor, a fact that currently is indeterminable from the surviving hull timbers.

For the purposes of this document, these materials have been divided into four categories: the ceramic artifacts, including clay smoking pipes, as well as sherds of Rhenish stoneware and tin-glazed earthenware\(^1\); the metal artifacts, including items manufactured from copper alloy (most likely brass), lead, pewter, silver, and iron; the glass artifacts, comprising glass shards and beads; and the organic artifacts, including bone, seeds, textile, possible shell beads, and rope.

CERAMIC ARTIFACTS - THE PIPES

The collection of pipe fragments from the Monte Cristi site represents the largest aggregation of smoking-related artifacts ever recovered from a shipwreck. A comparable quantity of pipes and pipe fragments has, however, been excavated from the submerged city of

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\(^1\) Sherds of green as well as yellow lead-glazed utility ware, most probably possessions of the ship’s crew, were also excavated from the site. Information on these ceramics does not appear in this document as a more complete study must first be conducted.
Port Royal, Jamaica. (Hamilton 1984, 1988; Marx 1968a, 1968b). Excavations at Jamestown, Virginia, have produced the largest collection of pipe fragments to date, in excess of 50,000; the author postulates that this quantity will be surpassed when the Monte Cristi shipwreck excavation is completed.

The Role of Tobacco in the Seventeenth Century

Smoking as a medicinal treatment or simple pastime was unknown in Europe until Colón returned from his first voyage to the New World. From the cultivation of the leaf to the variety of ways that it could be ingested, tobacco was a Native American tradition. John Josselyn Gent. writing in the third quarter of the seventeenth century, made the following observations concerning the use of tobacco by the inhabitants of the Americas:

The Indians in New England use a small round leafed Tobacco, called by them, or the Fishermen Poke. It is odious to the English. The virtues of Tobacco are these: it helps digestion, the Gout, the toothache, prevents infection by scurvy, it heats the cold, and cools them that sweat, feedeth the hungry, spent spirits restoreth, purgeth the stomach, killeth nits andlice, the juice of the green leaf healeth green wounds, although poysed: the syrup for many diseases, the smoak for the phthisick, cough of the lungs, distillations of Rheume, and all diseases of a cold and moist cause, good for all bodies cold and moist taken upon an empty stomach, taken upon a full stomach it precipitates digestion, immoderately taken it dryeth the body, inflameth the bloud, hurteth the brain, weakens the eyes and the sinews (Gent 1675:76-77).

The early European literature concerning tobacco use by Native Americans repeatedly emphasized the medicinal effects of the plant. This preoccupation may have been due, in part, to the unsanitary climate of some of Europe's more populous regions, especially where the threat of plague was rampant.

Monardes (1577:87) reported that Native Americans, when tired by work, inhaled tobacco to induce a peaceful rest, after which "thei doe receive their strength, and bee muche the lastier." Native Americans also chewed tobacco, mixed with a "certaine powder, made of the shellles of Cockles burned," to "suffer the drieth, and also to suffer hunger, and to passe daies with out havynge none to eate or drinke..." (Monardes 1577:90). Goslinga (1971:83) noted that the pearl divers from the island of Margarita, "did not work as fast nor as efficiently as they had when they had been given tobacco."

Even though the vectors of disease in seventeenth-century European society were often easily identified, the mechanics of infection were poorly understood. It was common for town physicians and ship's surgeons to treat disease by attempting to balance irregularities in the
blood, phlegm, and bile, collectively referred to as the body's "four humors." Experimental combinations of purging, bleeding, and dieting were prescribed, along with an assortment of tonics, enemas, and other medicines, not least of which was tobacco (Marsden 1974:36). Both the smoke and juice of the plant could be used to cure what Edmund Gardiner, in his medical treatise published in 1611, described as "an infinite number of diseases" (Gardiner 1611:5). Among these maladies were tooth ache, headache, "starkness & stifffnesse" of the neck (tetanus), body pains, catarrh, and "rheumes that fall downe to the eyes." Several recipes for tobacco smutatories (treatments inhaled through the nostrils) were known to induce "snoesing, consuming and spending away grosse and slimie humors from the ventricles of the braine" (Gardiner 1611:25). Other disorders for which tobacco offered relief included rheumatism, venereal diseases, stomach cramps, headaches, asthma, coughing fits, and goiter (Brongers 1964). In addition to being a prophylactic for the plague, it was considered an excellent curative for a plethora of skin disorders, especially lupus, herpes and similar maladies (Laufer 1924). Wounds were often treated with fresh tobacco leaves, and topical application of tobacco juice applied to venous and pestilent carbuncles, botches, or sores...[brought] a hard crust upon the place, and so absolutely cureth them. And against the bitings or stingings of poysonous beasts, or any venomous living creature they [were] a present remedie (Gardiner 1611:38).

The English prescribed tobacco for "rewmes and some other diseases ingendered in the longes and inward parts" (Laufer 1924, citing Furnivall 1573:7). As in modern times, its reputation as an anorexiant was noted, for John Marbecke recorded that tobacco made "the grosse, and foggy, to be leane. &e" (Marbecke 1602:21). Additionally, Europeans were quick to recognize the psychological benefits of the plant, which allowed the smoker to be "drawne up: and separated from all grosse, and earthly cogitations. and as it were caried up to a more pure and cleare region. of fine conceits & actions of the mind" (Marbecke 1602:58). Tobacco was also attributed with the power to induce "visions and trances." no doubt references to the commonly ascribed narcotic effect that the plant provided the smoker.

The joy of tobacco, however, was not restricted to its medicinal applications, for there exists ample evidence, both archaeological and literary, to support its use as a pastime during the seventeenth century. References in contemporary documents to smoking in road and ale houses are numerous, as are the archaeological excavations that have produced spent tobacco pipes. Dutch and Flemish paintings, most notably those of Jan Steen, Rembrandt van Rijn, and David Teniers, also depict the convivial atmosphere of tavern life, where townsfolk surrounded
themselves with camaraderie, ample drink, and the seemingly ubiquitous consumption of tobacco.

**European Clay Pipe Manufacture**

The technical aspects of the manufacture of seventeenth-century European clay pipes are well documented (Walker 1977; Duco 1980; Ayto 1987). Carefully selected clays were brought to the factory in large pieces and measured into storage barrels. William Hendrecson, a seventeenth-century pipe maker (see below), and Hendrik Claesz, a potter, both made declarations concerning clays used in their respective industries (Duco 1981). Included among Hendrecson’s inventory were Syberchsche, Frettensche, and Sutberchsche clays from Köln, as well as Luyschesche, Namensche, and Fransche clays. English poelselty (possibly referring to Plymouth or Poole), English Eiflenties (Isle of Wight) clay, Frederichshe clay (from Münster), and “clay from the country of Hesschen” were also noted (Duco 1981:401-402). After a specific mixture was selected, the clay was broken into small pieces with a mallet and soaked in a barrel of water. This not only made the clay pliable, it also separated inherent impurities by floating them to the surface where they could be removed by skimming. The softened clay was then shoveled into a grinding mill tub and mixed again. When removed from the tub, the clay was cut into right-angled blocks that were then ground two or three times and rubbed with fine, sharp sand. These were stored in a clay cellar for approximately two months. The processed clay was transferred from the factory to a shop for forming and molding. There, a “roller” — usually a young boy or an old man — rolled a small piece of clay lengthwise with the palms of his hands until a noticeable stem and bowl were fashioned. This formed clay was then placed into a mold.

The two-piece mold was introduced shortly before 1600, with early prototypes made of brass (Ayto 1987). A piece of iron wire with a button at one end, commonly called a piercing rod or molding wire, was dipped in a lubricant of rapeseed oil and paraffin and carefully inserted into the pipe so as not to puncture the stem wall. This simple procedure produced the stem bore, through which tobacco smoke was inhaled. The mold, also lubricated with oil, was closed and placed in a parallel vise. An “acorn-shaped” iron hand stopper, used for the forming of the bowl reservoir, was dipped in oil and pushed several times into the mold, forcing the excess clay out the sides. The mold was then closed, often with the use of a gin press. When the bowl had been formed, the molding wire was further inserted until the stem bore hole joined the bowl interior.

The molded pipe was taken from the press and a finisher’s knife was used to trim flashes, or bits of excess dried clay, that accumulated around the bowl and stem. The molding
wire was removed and a finishing wire was inserted to ensure that the bore ran through the stem "from bit to bowl" (Alexander 1983:237). The pipe was set aside to dry to a specified consistency. When hardened, the exterior of the pipe was trimmed again and the bowl was properly aligned with the stem. The entire piece was placed back into the mold for straightening. After drying, the pipe was polished and often stamped with a maker's mark. A serrated edge, or roulette, was sometimes added to the circumference of the bowl lip as decoration. The pipes were then packed in a cylindrical up-draught kiln fueled with charcoal or wood. When pipes were removed, they were dipped in a liquid slip composed of fine clay. After drying, they were polished with a rough cloth and then varnished. The finished products were packed into containers for transport to market. When shipped overseas they were usually placed in wooden boxes filled with a protective packing agent such as grain husks to minimize breakage (see below).

**Characteristics of the Seventeenth-Century European Clay Pipe**

Several morphological features are characteristic of the seventeenth-century European clay pipe (Figure 30). Early bowls were relatively plain, having lost the grossly bulbous characteristics of their sixteenth-century counterparts. Although this design was more elongated than its predecessor, it retained a shape that was characterized as a "double cone," or one in which the bowl broadest at the center, narrowed sharply at both top and bottom (Duco 1981:374). In the early part of the century, the top of the bowl was set at an angle relative to the stem. This angle decreased gradually through time until it became parallel in the later years (Oswald 1951; Hagerty 1985). Around 1630, the still somewhat angular appearance was replaced by a smoother silhouette featuring a longer bowl. By midcentury, however, the larger bowl assumed a profile described by Hagerty (1985:215) as "barrel-shaped." From the middle to the close of the century, pipe bowls became not only more slender and beautiful in form, but they also increased in size, "curving gracefully as they blended into the stem" (Hagerty 1985:215). Bowl diameters generally ranged to 0.90 cm in the early part of the century, but extended to 1.30 cm in later years.

A plain line or ring of small hash marks around the bowl rim, called rouletting or milling, began to appear in the middle of the seventeenth century (Ayto 1987). Grossman (1985, citing Davey et al. 1982) proposed that rouletting may have indicated a higher quality pipe, since its application was time-consuming and tedious. Grossman further noted that haphazardly applied rouletting, found on pipes from New York sites, possibly indicated that Dutch
Figure 30. Morphological features of the seventeenth-century European bulbous-bowed pipe. Illustration by A. Roberts.
manufacturers were sending their lower quality products abroad to be sold in Nieuw Amsterdam (Grossman 1985).

Some of the stylistic changes that pipes underwent toward the middle of the seventeenth-century (e.g., thinner-walled bowls) may have been the result of fashion tempered by economy, as deteriorating relations with England made imported clay more difficult to obtain. Regardless of the limitations that inferior clays imposed on Dutch manufacturers, clay pipes exhibited a variety of shapes and sizes around the middle of the seventeenth century.

Although exceptions have been reported, pipe stems were characteristically straight and generally measured between 14.0 and 26.0 cm in length at the onset of the seventeenth century. This increased to between 28.0 and 30.5 cm -- and often up to 40.0 cm -- by the close of the century (Duco 1981). Harrington tried to use this trait -- the characteristic elongation of the pipe stem over time -- as a tool for dating pipes. However, as noted by Alexander (1983), there is considerable variation and this dating method should be used cautiously (see below).

Stem bore diameters for seventeenth-century pipes ranged between 5/64 inch and 8/64 inch. Occasionally, those from the Monte Cristi wreck possessed larger diameters (9/64 and 10/64 inch), but these were considered anomalous.

**Seventeenth-Century Clay Pipes and Dating Methods**

Pipes, either entire or partial, have long been regarded as valuable tools for dating archaeological sites, for they were "manufactured, imported, smoked, and thrown away, all within a matter of a year or two" (Noel-Hume 1985:296). Fragility was, no doubt, the reason for their relatively short life span; long stems and thin, brittle bowls were easily broken. Numerous studies have focused on the use of pipes or pipe fragments to determine occupation dates of historical sites. These include the placement of pipe forms into known typologies (Oswald 1951; Duco 1981), the identification of known maker's marks (Oswald 1961), calculation of pipe bowl volume (Friederich 1975), matching pipe forms with contemporary art works (Friederich 1975), studying the stratified association of pipes with dated artifact groups (Oswald 1951), and statistical measurements of bore diameter (Harrington 1954; Binford 1971; Hanson 1971; Heighton and Deagan 1971; Walker 1965, 1967; Belehar and Jarrett 1972; Noel-Hume 1963, Barber 1966).

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2 McCashion (1975:11) noted that several funnel elbow-angled pipes exhibited “warping or bowing 18.0 mm from the bowl.” This tendency has also been observed among several pipe stems from the Monte Cristi shipwreck.
Pipe Stems and Their Use in Dating

Statistical measurements of pipe stem bore diameters to determine occupation dates for archaeological sites is perhaps one of the most popular and frequently employed methods when pipe bowls are unavailable (see below). During the first two excavation seasons, PIMA archaeologists recovered and recorded 11,472 stem fragments (Table 6). Stem concentrations were greater in the southern portion of the site on both sides of the keel; this distribution pattern may have been determined by the wind and waves that move in a southwesterly direction over the wreck (Figure 31). The appearance of two definable clusters suggests that crates of pipes were loaded opposite each other on either side of the keel, or that crates placed elsewhere in the ship's hold moved uniformly during wrecking.

The majority of pipe fragments on any site, terrestrial or aquatic, comprises stems, due mainly to the fact that bowls are easily destroyed or, as with salvaged sites, are often removed by souvenir hunters. For years, a variety of site dating techniques using formulae developed from pipe stem bore diameter calculations have plagued the literature of archaeology. Rarely have these produced acceptable occupation dates and numerous variables surrounding both clay pipe manufacture and bore diameter measurement bring into serious question their reliability as archaeological dating tools. Most notable of these are J.C. Harrington's histogram (1954) (Appendix J) and Lewis Binford's subsequent regression formula (1962) (Appendix K). 3 Numerous lesser known regional formulae exist and all must be used cautiously and only when a locus of manufacture -- usually a country -- can be reasonably surmised. Furthermore, in the absence of corroborating artifact studies, reliance on data generated from these formulae should be regarded as highly speculative.

The most common method for measuring stem bore diameter has been by the insertion of drill bits, graduated in sixty-fourths of an inch (0.4 mm), into the bore. Measurements have also been made by the use of light microscopy (Green 1977). Duco (1981:387), however, has suggested that measuring pipe stem bores, no matter which method is employed, is "useless" as a dating tool, since several unrealistic assumptions must be made. All of these criticisms

---

3 Using Harrington's bar chart as a predictive tool for the period represented by the Monte Cristi wreck, theoretical bore diameters would generally fall between 5/64 and 8/64 of an inch, with the majority measuring 8/64 of an inch. Forty-seven percent of the Monte Cristi pipes possessed bore diameters of 8/64 of an inch and 37% measured 7/64 of an inch. In 1962, anthropologist Lewis Binford developed a straight line regression formula predicated on Harrington's histogram (Binford 1962). When this formula was applied to nine groups of pipes from the Monte Cristi shipwreck, it yielded a mean date of 1641.25 (Appendix K). Geiger Omwake generated a "computer-determined" version of the Binford formula (McCashion 1975:8) which produced a temporal range of 1641.31 to 1679.6, with an average date of 1652 for the Monte Cristi pipe data (Appendix L).
Table 6. Pipestem distributions by grid square, from the 1991-1992 excavations of the northern European merchant vessel in Monte Cristi Bay, Dominican Republic.

<table>
<thead>
<tr>
<th>Grid Square</th>
<th>Number of Pipe Stems</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1,176</td>
<td>15.48</td>
</tr>
<tr>
<td>II</td>
<td>1,252</td>
<td>10.91</td>
</tr>
<tr>
<td>III</td>
<td>214</td>
<td>1.87</td>
</tr>
<tr>
<td>IV</td>
<td>119</td>
<td>1.04</td>
</tr>
<tr>
<td>V</td>
<td>9</td>
<td>0.08</td>
</tr>
<tr>
<td>VI</td>
<td>2,237</td>
<td>19.50</td>
</tr>
<tr>
<td>VII</td>
<td>658</td>
<td>5.74</td>
</tr>
<tr>
<td>VIII</td>
<td>566</td>
<td>4.93</td>
</tr>
<tr>
<td>IX</td>
<td>180</td>
<td>1.60</td>
</tr>
<tr>
<td>X</td>
<td>50</td>
<td>0.44</td>
</tr>
<tr>
<td>XI</td>
<td>107</td>
<td>0.93</td>
</tr>
<tr>
<td>XII</td>
<td>7</td>
<td>0.06</td>
</tr>
<tr>
<td>XIII</td>
<td>812</td>
<td>7.08</td>
</tr>
<tr>
<td>XIV</td>
<td>920</td>
<td>8.02</td>
</tr>
<tr>
<td>XV</td>
<td>315</td>
<td>2.75</td>
</tr>
<tr>
<td>XVI</td>
<td>91</td>
<td>0.79</td>
</tr>
<tr>
<td>XVII</td>
<td>5</td>
<td>0.04</td>
</tr>
<tr>
<td>XVIII</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>XIX</td>
<td>14</td>
<td>0.12</td>
</tr>
<tr>
<td>XX</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>XXI</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>XXII</td>
<td>15</td>
<td>0.13</td>
</tr>
<tr>
<td>XXIII</td>
<td>763</td>
<td>6.65</td>
</tr>
<tr>
<td>XXIV</td>
<td>1</td>
<td>0.01</td>
</tr>
<tr>
<td>XXV</td>
<td>106</td>
<td>0.92</td>
</tr>
<tr>
<td>XXVI</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>XXVII</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>XXVIII</td>
<td>230</td>
<td>2.01</td>
</tr>
<tr>
<td>XXIX</td>
<td>254</td>
<td>2.21</td>
</tr>
<tr>
<td>XXX</td>
<td>105</td>
<td>0.92</td>
</tr>
<tr>
<td>Test Pit AB</td>
<td>62</td>
<td>0.54</td>
</tr>
<tr>
<td>Test Pit CD</td>
<td>21</td>
<td>0.18</td>
</tr>
<tr>
<td>Test Pit EF</td>
<td>3</td>
<td>0.03</td>
</tr>
<tr>
<td>Jemison’s Pit</td>
<td>28</td>
<td>0.24</td>
</tr>
<tr>
<td>Bigleagucr’s Pit</td>
<td>110</td>
<td>0.96</td>
</tr>
<tr>
<td>Western Test Pit</td>
<td>56</td>
<td>0.49</td>
</tr>
<tr>
<td>Cannon Pit</td>
<td>309</td>
<td>2.69</td>
</tr>
<tr>
<td>No Provenience</td>
<td>77</td>
<td>0.67</td>
</tr>
<tr>
<td>Total</td>
<td>11,472</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Figure 31. Distribution of pipe stems recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynne Hall.
concern the use of a piercing wire, the device used by the pipe maker to create the stem bore. Additionally, pipe bore diameters exhibit variation in size depending at which point along their length a measurement is made (McCashion, personal communication, 1991). Harrington (1954) suggested that the bore enlarges at the point where the molding or piercing wire is withdrawn. Pipes recovered from seventeenth-century sites in Pennsylvania and Maryland indicated just the opposite, as they exhibited smaller bore measurements at the mouth piece or bit end (Alexander 1983).

Additional caveats must be considered when applying dating formulae based on pipe stem bore diameter measurements. Many of the Monte Cristi pipe stem bores were accreted with calcium carbonate. These deposits ranged from a light, flake-like veneer in the bore, to heavy coralline growth that completely covered both the exterior and interior of the stem. A variety of tools, including dental picks, saté sticks, copper wires, and pipe cleaners were used to remove these accretions. Although these means proved effective on all but a few artifacts, they are abrasive and, therefore, render subsequent measurements questionable, as there is little guarantee that some degree of bore enlargement will not occur.

Additionally, the large quantities of pipe stems raised by each diver on every dive sequence deemed it necessary to assign all team members the duty of cleaning and measuring stem bores. Obviously, lack of measurement uniformity -- and it must be assumed that it existed -- could skew results generated by one of the several regression formulae. Such miscalculations are easily incorporated, especially since gradations are measured in units as slight as 1/64 of an inch. Therefore, by using more than one artifact registrar, it cannot be assumed that uniformity of measurement necessarily exists.

The unreliability of bore diameter data is further exacerbated by the propensity for fragile stems to continue breaking. The destruction of the ship or any of the subsequent disruptive processes that commonly occur on shallow water sites (i.e., high energy waves, tropical storms, destruction of resources by sport divers) can increase the number of stem segments present on the site. Thus, the proportions of specific bore diameters are continually changing, unless all pipe stems are of the same bore size, or if stems with differing diameters are breaking simultaneously and in equal quantities. This probably has little effect on large samples such as the Monte Cristi deposit, but in smaller quantities, even a few broken stems could skew the data considerably when stem bore formulae are incorporated.

Lastly, no known regression formula or stem bore dating method exists for Dutch-manufactured pipes, nor have any of the existing formulae rendered successful results when
applied to pipes of Dutch origin. Therefore, it is the author’s opinion that the successful application of stem bore dating formulae to any site should be considered fortuitous.

Perhaps Alexander (1983:242) put it best when he related Noel Hume’s concern over “the ever increasing tendency to let statistics substitute for logic.” Likewise, in the same document, he raised Adrian Oswald’s all too cogent admonition:

>Bore-diameter dating formulae are all right as far as they go – one simply has to use them intelligently and remember that the formula does not prove a dating for the pipes; the datable evidence of the pipes (i.e., marks, bowl shape) tend to prove (or disprove) the formula (Oswald, as cited by Alexander 1983:24).

**Bowl Volume Calculation and Its Use in Dating**

Regional typologies that are based on bowl size and shape have proven moderately reliable in dating European pipes when both bowl and stem portions are recovered. Pipe form exhibits not only temporal variation but also, to a lesser extent, variation based on geographical production. Relative morphological features may prove helpful in instances when neither maker’s marks nor production dates are present. This is most common in the seventeenth century, when major changes occurred in the pipe silhouette.

For pipes of Dutch manufacture, the most reliable morphological statistic is the measurement of bowl volume (McCashion, personal communication, 1991). F.H.W. Friederic’s simple technique is considered one of the most reliable among those who work exclusively with Dutch clay pipes, yet even it has produced results that are often incompatible with consensual archaeological data (Duco 1981; Krommenhoek and Vrij 1990; McCashion, personal communication, 1991). The method, a derivation of an old English system, was the result of years of statistical measurements of over 10,000 pipe bowls gathered from Dutch genre paintings, along with artifacts recovered from archaeological contexts. In this procedure:

\[ H \times B \times O = \text{date} \]

where \( H \) is the height or the distance from behind the heel to the top of the bowl, \( B \) is the widest expansion of the bowl, and \( O \) is the greatest diameter of the bowl opening. The resulting volume calculation is then plotted on a graph to arrive at a date (Appendix M); an accompanying typology of pipes is also provided.

Friederich’s formula has been applied with little success to clay pipes from seventeenth-century New York sites. The reasons for such a “patently obvious” discrepancy, included an
insufficient database and the fact that Dutch export pipes possessed larger bowls than their
domestic counterparts, thereby adding a minimum of five to 10 years to the results (McCashion
and Robinson 1977:15).

By the close of the 1992 season, 1.194 pipes had been excavated from the Monte Cristi
shipwreck (Table 7), the majority of which were recovered from grids I, II, VI, VII, VIII, IX,
and XIV at the southern end of the extant hull. This quantity increased to over 2,500 pipes and
in excess of 25,000 pipe stems when the 1994 campaign was completed. ¹ Except for artifact
PW 1678, described below, all pipes appear to have been manufactured in Holland and may be
divided into two morphological types: barrel-shaped or bulbous-bowled forms in which there is
a distinct narrowing toward the junction of the stem and bowl (Figure 32. A); and funnel elbow-
angled pipes (Figure 32. B), described below. Although bulbous-bowled pipes are commonly
found within the context of European, colonial American, and Native American sites, funnel
pipes were manufactured for the New World trade and appear on colonial and Native American
sites almost exclusively.

Bowl volume calculations were made for each of the pipe groups recovered from the
Monte Cristi shipwreck (Table 8). These groups included pipes bearing the heel stamps EB
(two sizes), WH, D*C, P*C, a Tudor rose, a fleur-de-lys centered in a diamond, and a floral
design designated FOT 49, all of which are described below in greater detail. Volumetric
measurements were made as follows: to plug the stem bore, a small piece of masking tape was
rolled into a ball and placed in the opening at the junction of the bowl and stem. The bowl was
then filled to the rim with table salt, which was then emptied into a graduated cylinder for
measurement (in ml).

Results indicate that large-bowled pipes with an EB heel stamp possessed, on average,
at least 30% greater capacity than other bulbous-bowled varieties. The second largest bulbous
bowl belonged to the funnel elbow-angled pipes, followed by the small bulbous-bowled EB pipes
and those stamped with the fleur-de-lys heel mark. These latter bowls had volumes of 2.6 ml.
The remaining bowls ranged in size from 2.2 ml (Tudor rose) to 1.84 ml (bulbous-bowled FOT
49).

¹Additionally, 530 small pipe bowl sherd were recovered. Four hundred and twenty-one (79.4%) were
portions of bulbous bowls. 51 (9.6%) belonged to funnel elbow-angled pipes. Fifty-eight (10.9%) were
unassigned to either category because their size rendered them virtually unidentifiable, although ten
exhibited curvatures suggestive of bulbous bowls.
Figure 32. Bulbous (A) and funnel elbow-angled (B) pipe forms recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Illustrations by Alex Roberts.
Table 7. The distribution of pipes according to grid square, recovered during 1991 and 1992, from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic.

<table>
<thead>
<tr>
<th>Grid Square</th>
<th>Number of Pipes</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>110</td>
<td>9.21%</td>
</tr>
<tr>
<td>II</td>
<td>131</td>
<td>10.97%</td>
</tr>
<tr>
<td>III</td>
<td>27</td>
<td>2.26%</td>
</tr>
<tr>
<td>IV</td>
<td>11</td>
<td>0.92%</td>
</tr>
<tr>
<td>V</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>VI</td>
<td>188</td>
<td>15.75%</td>
</tr>
<tr>
<td>VII</td>
<td>64</td>
<td>5.36%</td>
</tr>
<tr>
<td>VIII</td>
<td>47</td>
<td>3.94%</td>
</tr>
<tr>
<td>IX</td>
<td>6</td>
<td>0.50%</td>
</tr>
<tr>
<td>X</td>
<td>1</td>
<td>0.08%</td>
</tr>
<tr>
<td>XI</td>
<td>3</td>
<td>0.25%</td>
</tr>
<tr>
<td>XII</td>
<td>1</td>
<td>0.08%</td>
</tr>
<tr>
<td>XIII</td>
<td>91</td>
<td>7.62%</td>
</tr>
<tr>
<td>XIV</td>
<td>112</td>
<td>9.38%</td>
</tr>
<tr>
<td>XV</td>
<td>17</td>
<td>1.42%</td>
</tr>
<tr>
<td>XVI</td>
<td>2</td>
<td>0.17%</td>
</tr>
<tr>
<td>XVII</td>
<td>1</td>
<td>0.08%</td>
</tr>
<tr>
<td>XVIII</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>XIX</td>
<td>8</td>
<td>0.67%</td>
</tr>
<tr>
<td>XX</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>XXI</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>XXII</td>
<td>3</td>
<td>0.25%</td>
</tr>
<tr>
<td>XXIII</td>
<td>76</td>
<td>6.37%</td>
</tr>
<tr>
<td>XXIV</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>XXV</td>
<td>5</td>
<td>0.42%</td>
</tr>
<tr>
<td>XXVI</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>XXVII</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>XXVIII</td>
<td>4</td>
<td>0.34%</td>
</tr>
<tr>
<td>XXIX</td>
<td>10</td>
<td>0.84%</td>
</tr>
<tr>
<td>XXX</td>
<td>40</td>
<td>3.35%</td>
</tr>
<tr>
<td>Jemison’s Test Pit</td>
<td>4</td>
<td>0.34%</td>
</tr>
<tr>
<td>Bigleagger’s Test Pit</td>
<td>23</td>
<td>1.93%</td>
</tr>
<tr>
<td>Western Test Pit</td>
<td>6</td>
<td>0.50%</td>
</tr>
<tr>
<td>Test Pit AB</td>
<td>10</td>
<td>0.84%</td>
</tr>
<tr>
<td>Test Pit CD</td>
<td>5</td>
<td>0.42%</td>
</tr>
<tr>
<td>Test Pit EF</td>
<td>1</td>
<td>0.08%</td>
</tr>
<tr>
<td>Cannon Test Pit</td>
<td>158</td>
<td>13.25%</td>
</tr>
<tr>
<td>No Provenience</td>
<td>29</td>
<td>2.43%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,194</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>
Table 8. Bowl volume in ml for pipes collected from the seventeenth-century northern European merchant vessel in Monte Cristi Bay, Dominican Republic.

<table>
<thead>
<tr>
<th>Bowl Form</th>
<th>Heel Stamp</th>
<th>N</th>
<th>Bowl Volume in ml</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulbous (Large)</td>
<td>EB</td>
<td>1</td>
<td>3.90</td>
<td>Taylor notes 4.60 ml</td>
</tr>
<tr>
<td>Bulbous (small)</td>
<td>EB</td>
<td>5</td>
<td>2.64*, 2.40**, 2.60**, 2.60**</td>
<td>*average of 3 samples by Hall</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.60</td>
<td></td>
</tr>
<tr>
<td>Bulbous</td>
<td>WH</td>
<td>3</td>
<td>2.15*, 2.10, 2.20</td>
<td>*average of 2 samples by Hall</td>
</tr>
<tr>
<td>Bulbous</td>
<td>D*C</td>
<td>3</td>
<td>2.07*, 2.00, 2.00, 2.20</td>
<td>*average of 3 samples by Hall</td>
</tr>
<tr>
<td>Bulbous</td>
<td>P*C</td>
<td>4</td>
<td>2.10*, 1.80, 2.00, 2.20, 2.40</td>
<td>*average of 4 samples by Hall</td>
</tr>
<tr>
<td>Bulbous</td>
<td>Fleur-de-lys</td>
<td>2</td>
<td>2.60, 2.60</td>
<td>2 samples</td>
</tr>
<tr>
<td>Bulbous</td>
<td>Tudor rose</td>
<td>1</td>
<td>2.20</td>
<td></td>
</tr>
<tr>
<td>Bulbous</td>
<td>FOT 49</td>
<td>2</td>
<td>1.84*, 1.83, 1.85</td>
<td>*average of 2 samples by Hall</td>
</tr>
<tr>
<td>Funnel</td>
<td>FOT 49</td>
<td>3</td>
<td>3.17*, 3.00, 3.10, 3.40</td>
<td>*average of 3 samples by Hall</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When Friederich's formula was applied to the representative sample of pipes mentioned above, the ordinal ranking of bowl volumes changed (Table 9). Although the large EB-stamped pipe still had the greatest bowl volume,\(^5\) *fleur-de-lys*-stamped pipes are second in size when Friederich's formula was applied to the sample. Bowl volumes decreased for the WH-, small EB-, Tudor rose-, D*C-, and P*C-stamped pipes. When line 8 of Friederich's graph was used to calculate dates based on pipe bowl volumes, the temporal window ranged from approximately 1641 (bulbous bowl pipes with the FOT 49 heel stamp and those with the P*C heel stamp) to approximately 1688 (Large EB-stamped pipes) (Table 10).\(^6\) The interpretation of volume data using line 2 of Friederich's graph resulted in a broader range, from approximately 1632 to approximately 1730. The average date for the entire sample collection (N=24) was 1654, regardless of which set of Friederich's graph lines (2 or 8) was used. This time frame agreed strongly with other artifact data, especially bowl morphology and identifiable heel stamps. Likewise, other artifacts such as ship's tools and metal trade goods (described below) fit well into this chronological period.

As a final consideration, Duco (1981:386) interjected several variables that precluded the "quiet evolution" of clay pipe morphology as a "reasonable model." Raising the question of whether the researcher dates the pipe, or the mold in which it was produced, he noted that two-piece brass molds were often used for years and, in at least one case, centuries. Additionally, bowl and stem thickness were reliant on clay quality, and bowl size had more to do with the affordability of tobacco than with all else. Pipe quality must also be considered for it reflects technical details such as the manner in which the clay was prepared, as well as the care with which the milling was applied. All of these factors, states Duco (1981:387), "are good indicators of date" and one should consider the quality of the pipe in relation to its form: the better quality products would have been more up to date, while the shapes of lower quality ones can be less securely tied to the fashion of the period. The better the quality the better the dating (Duco 1981:387).

Ideally, bowl typology and stem bore diameter data can be coordinated with other, more specific, means of dating, (e.g., the identification of maker's marks), to produce an increasingly reliable date of deposition or settlement.

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\(^5\) When Friederich's formula was used to calculate bowl volume, the large bowed (EB-stamped) pipes were approximately 25% larger than any of the other bulbous varieties.

\(^6\) Such an anomaly was noted with a large, bulbous-bowed, EB-stamped pipe from the Sullivan Moot Site, an Oneida occupation in New York that dated between 1660 and 1677. This pipe bowl had a volume of 13.625 mm\(^3\) (McCashion 1979a). The application of Friederich's formula produced a date of 1700, which, McCashion posited, was "inconsistent with the style or the site" (McCashion 1979a:94).
Table 9. Pipe bowl volumes in mm$^3$ for representative samples from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Volumes are calculated using Friederich’s formula (H x B x O), where H is bowl height, B is the widest expansion of the bowl, and O is the greatest diameter of the bowl opening.

<table>
<thead>
<tr>
<th>Quantity, Bowl Form, and Heel Stamp</th>
<th>H (mm)</th>
<th>B (mm)</th>
<th>O (mm)</th>
<th>Product in mm$^3$ (H x B x O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Large Bulbous EB</td>
<td>41.86</td>
<td>22.58</td>
<td>15.80</td>
<td>14,934.14</td>
</tr>
<tr>
<td>(5) Small Bulbous EB</td>
<td>36.78</td>
<td>20.37</td>
<td>12.87</td>
<td>9,642.32</td>
</tr>
<tr>
<td></td>
<td>38.25</td>
<td>18.98</td>
<td>12.46</td>
<td>9,045.77</td>
</tr>
<tr>
<td></td>
<td>39.26</td>
<td>19.12</td>
<td>13.00</td>
<td>9,758.47</td>
</tr>
<tr>
<td></td>
<td>39.86</td>
<td>19.46</td>
<td>13.74</td>
<td>10,657.78</td>
</tr>
<tr>
<td></td>
<td>39.73</td>
<td>20.59</td>
<td>13.29</td>
<td>10,871.76</td>
</tr>
<tr>
<td>average</td>
<td>38.78</td>
<td>19.70</td>
<td>13.07</td>
<td>9,995.22</td>
</tr>
<tr>
<td>(3) Bulbous WH</td>
<td>40.68</td>
<td>19.68</td>
<td>14.32</td>
<td>11,464.34</td>
</tr>
<tr>
<td></td>
<td>40.90</td>
<td>19.43</td>
<td>12.66</td>
<td>10,060.74</td>
</tr>
<tr>
<td></td>
<td>40.85</td>
<td>20.02</td>
<td>12.64</td>
<td>10,337.06</td>
</tr>
<tr>
<td>average</td>
<td>40.81</td>
<td>19.71</td>
<td>13.21</td>
<td>10,620.71</td>
</tr>
<tr>
<td>(3) Bulbous D*C</td>
<td>38.40</td>
<td>17.17</td>
<td>12.58</td>
<td>8,294.35</td>
</tr>
<tr>
<td></td>
<td>40.12</td>
<td>17.90</td>
<td>12.89</td>
<td>9,256.93</td>
</tr>
<tr>
<td></td>
<td>41.09</td>
<td>17.41</td>
<td>12.61</td>
<td>9,020.90</td>
</tr>
<tr>
<td>average</td>
<td>39.87</td>
<td>17.49</td>
<td>12.69</td>
<td>8,837.39</td>
</tr>
<tr>
<td>(4) Bulbous P*C</td>
<td>38.74</td>
<td>17.54</td>
<td>11.43</td>
<td>7,766.68</td>
</tr>
<tr>
<td></td>
<td>38.29</td>
<td>17.46</td>
<td>12.41</td>
<td>8,296.62</td>
</tr>
<tr>
<td></td>
<td>36.33</td>
<td>17.26</td>
<td>12.79</td>
<td>8,020.04</td>
</tr>
<tr>
<td></td>
<td>36.89</td>
<td>16.43</td>
<td>12.01</td>
<td>7,279.29</td>
</tr>
<tr>
<td>average</td>
<td>37.56</td>
<td>17.17</td>
<td>12.16</td>
<td>7,840.66</td>
</tr>
<tr>
<td>(2) Bulbous <em>Fleur-de-lis</em></td>
<td>41.60*</td>
<td>20.09</td>
<td>13.20</td>
<td>11,031.82</td>
</tr>
<tr>
<td></td>
<td>42.25*</td>
<td>20.36</td>
<td>13.37</td>
<td>11,501.01</td>
</tr>
<tr>
<td>average</td>
<td>41.93</td>
<td>20.73</td>
<td>13.29</td>
<td>11,266.42</td>
</tr>
<tr>
<td>(1) Bulbous Tudor rose</td>
<td>41.02</td>
<td>19.94</td>
<td>11.83</td>
<td>9,676.22</td>
</tr>
<tr>
<td>(2) Bulbous FOT 49</td>
<td>34.81</td>
<td>17.33</td>
<td>12.66</td>
<td>7,637.24</td>
</tr>
<tr>
<td></td>
<td>36.71</td>
<td>18.17</td>
<td>11.46</td>
<td>7,644.06</td>
</tr>
<tr>
<td>average</td>
<td>35.76</td>
<td>17.76</td>
<td>12.06</td>
<td>7,640.65</td>
</tr>
<tr>
<td>(3) Funnel FOT 49</td>
<td>40.71</td>
<td>18.66</td>
<td>15.95</td>
<td>12,116.40</td>
</tr>
<tr>
<td></td>
<td>41.83</td>
<td>19.52</td>
<td>15.55</td>
<td>12,696.91</td>
</tr>
<tr>
<td></td>
<td>41.00</td>
<td>19.86</td>
<td>15.73</td>
<td>12,808.31</td>
</tr>
<tr>
<td>average</td>
<td>41.18</td>
<td>19.35</td>
<td>15.74</td>
<td>12,540.54</td>
</tr>
</tbody>
</table>
Table 10. Monte Cristi pipe bowl volumes in mm\(^3\) and their corresponding dates according to lines 2 and 8 of Friederich’s chart.

<table>
<thead>
<tr>
<th>Quantity, Form, and Heel Stamp</th>
<th>N</th>
<th>Product in mm(^3) (H x B x O)</th>
<th>Line 2, Friederich’s Graph (Date)</th>
<th>Line 8, Friederich’s Graph (Date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Bulbous EB</td>
<td>1</td>
<td>14,934.14</td>
<td>1730</td>
<td>1688</td>
</tr>
<tr>
<td>Small Bulbous EB</td>
<td>5</td>
<td>9,642.32 9,045.77 9,758.47 10,657.78 10,871.76</td>
<td>1645 1642 1646 1655 1660</td>
<td>1650 1649 1650 1656 1659</td>
</tr>
<tr>
<td></td>
<td></td>
<td>average 9,993.32</td>
<td>average 1649.6</td>
<td>average 1652.8</td>
</tr>
<tr>
<td>Bulbous WH</td>
<td>3</td>
<td>11,464.34 10,060.74 10,337.06</td>
<td>1670 1650 1653</td>
<td>1662 1653 1655</td>
</tr>
<tr>
<td></td>
<td></td>
<td>average 10,620.71</td>
<td>average 1657.7</td>
<td>average 1656.7</td>
</tr>
<tr>
<td>Bulbous D*C</td>
<td>3</td>
<td>8,294.35 9,256.93 9,020.90</td>
<td>1636 1643 1648</td>
<td>1643 1649 1648</td>
</tr>
<tr>
<td></td>
<td></td>
<td>average 8,857.39</td>
<td>average 1640.0</td>
<td>average 1646.7</td>
</tr>
<tr>
<td>Bulbous P*C</td>
<td>4</td>
<td>7,766.68 8,296.62 8,020.04 7,279.29</td>
<td>1632 1636 1633 1629</td>
<td>1640 1643 1642 1638</td>
</tr>
<tr>
<td></td>
<td></td>
<td>average 7,840.66</td>
<td>average 1632.5</td>
<td>average 1640.8</td>
</tr>
<tr>
<td>Bulbous Fleur-de-lys</td>
<td>2</td>
<td>11,031.82 11,501.01</td>
<td>1661 1663</td>
<td>1663 1671</td>
</tr>
<tr>
<td></td>
<td></td>
<td>average 11,266.42</td>
<td>average 1663.0</td>
<td>average 1667.0</td>
</tr>
<tr>
<td>Bulbous Tudor rose</td>
<td>1</td>
<td>9,676.22</td>
<td>1642</td>
<td>1648</td>
</tr>
<tr>
<td>Bulbous FOT 49</td>
<td>2</td>
<td>7,637.24 7,644.06</td>
<td>1633 1633</td>
<td>1641 1641</td>
</tr>
<tr>
<td></td>
<td></td>
<td>average 7,640.65</td>
<td>average 1633.0</td>
<td>average 1641.0</td>
</tr>
<tr>
<td>Funnel FOT 49</td>
<td>3</td>
<td>12,116.40 12,696.91 12,808.31</td>
<td>1681 1692 1692</td>
<td>1669 1672 1673</td>
</tr>
<tr>
<td></td>
<td></td>
<td>average 12,340.54</td>
<td>average 1688.3</td>
<td>average 1671.3</td>
</tr>
<tr>
<td><strong>Average all Pipes</strong></td>
<td>24</td>
<td></td>
<td><strong>1654.2</strong></td>
<td><strong>1654.3</strong></td>
</tr>
<tr>
<td>excluding Large EB</td>
<td>23</td>
<td></td>
<td>1650.9</td>
<td>1652.8</td>
</tr>
<tr>
<td>excluding Funnel</td>
<td>21</td>
<td></td>
<td>1649.3</td>
<td>1651.9</td>
</tr>
<tr>
<td>excluding Large EB and Funnel</td>
<td>20</td>
<td></td>
<td>1645.3</td>
<td>1650.1</td>
</tr>
</tbody>
</table>
Heel Stamps

Maker's marks are extremely helpful to the archaeologist. The practice of advertising one's work through the use of a discriminate stamp began in Europe at the onset of the seventeenth century, when incuse marks generally appeared as initials, names, or symbols (Noel-Hume 1985). Such emblems were placed on the back or side of the pipe bowl, the base of the pipe foot, on one or both sides of the spur (a derivation of the foot), in various positions on the pipe stem, or in any one of several combinations of the aforementioned locations (Oswald 1975) (see Figure 30). Marks were considerably less common in the third quarter of the century, but their popularity reemerged in the final quarter, as was evidenced by the trend of placing emblems on the side of the bowl base. In prescribing a date for a maker's mark, consideration must also be given to bowl typology, since many generic designs (e.g., the fleur-de-lys in a diamond) not only had a wide geographical distribution, but were known to stay in circulation for generations. Personalized stamps, such as those bearing the initials of an individual, were often used by a family member (usually a wife or son) or became an official shop trademark long after the original maker had passed away.

In the absence of consensual archaeological data, reliance on a maker's mark alone can easily mislead the researcher (Atkinson and Oswald 1972). Likewise, information gathered without consideration of subtleties of the historical record may be equally disastrous. Minute differences in similar heel stamps may offer clues to the time period in which a pipe was manufactured. Some pipe makers, such as Edward Bird (discussed below), used more than one stamp; often, archaeologists are able to arrange such marks in a speculative chronological order based on archaeological data. Badly stricken or off-center marks may indicate the work of an apprentice. Such knowledge may help to narrow the manufacturing date of a pipe, or group of pipes, if documents reveal when the apprentice was active. Pipe makers occasionally placed their stamp on more than one style of bowl. Existing typologies testify to the fact that several styles were popular during any given period of the seventeenth century. Often, the same maker would use several different stamps, perhaps to distinguish between products for domestic sale and those intended for the export market (van Duuren 1989).

Of the 1,194 pipes excavated from the Monte Cristi shipwreck, 528 (44.2%) had no heel stamps, most likely due to water currents and the scouring effects of sand. Atkinson and Oswald (1972), however, noted that many seventeenth-century Dutch pipes were manufactured with no
identifying marks. The remaining 666 pipes bore one of seven stamps mentioned above: EB, WH, D*C and P*C. a Tudor rose, a *fleur-de-lys* set in a diamond, and a decorative flower designated by the author as FOT 49 (Table 11 and Figure 33).

In addition to heel stamps, pipes often possessed elaborate stem decorations. Diamond and *fleur-de-lys* patterns are commonly found on pipe stems recovered from Dutch, Dutch-American, or Native American sites in contact with Dutch *entrepôts* (McCashion 1979a; Pernambucano 1983; Huey 1988). A simple series of roulettes, or incised bands, were the only stem decorations on pipes from the Monte Cristi shipwreck, appearing on those artifacts bearing the P*C and D*C heel stamps (see Figure 33).

The heel stamps from the Monte Cristi pipes were the first evidence, apart from the dendrochronological study of the hull timbers, to imply a temporal range for the shipwreck. The Tudor rose, *fleur-de-lys*, and FOT 49 emblems were well-represented in comparable collections from seventeenth-century terrestrial sites. However, the time frame can be further narrowed: three heel marks found on Monte Cristi pipes were attributable to Edward Bird, an Englishman who manufactured his wares in Amsterdam, Holland, between 1635 and 1660 (see below). This range was consistent with the information from the hull timber study that suggested the vessel sank sometime after 1642. Simply decorated pipe stems, characteristic of Dutch manufacture, as well as the EB heel stamps, inferred that a portion of the cargo originated in Holland.

**Edward Bird - Portrait of a Pipe Maker**

Until recently, little was known of Edward Bird, undisputedly one of the most prolific pipe manufacturers of the seventeenth century (Pernambucano 1983; Baart *et al.* 1992; McCashion 1975). Prior to 1975, the majority of EB-stamped pipes recovered from archaeological sites were attributed to several English pipe makers, including Edward Battle of Bristol (*ca.* 1650), Edward Biggs of Henley (*ca.* 1653), and Edward Beesten (or Beaste) of Marlborough (*ca.* 1700). Pipe specialist Ian Walker noted, however, that most of the EB-stamped pipes from archaeological sites in central New York were of Dutch manufacture (Walker, personal communication with Bradley and D'Angelo, 1971. cited in Bradley and D'Angelo 1981:111). The continued discovery of EB-stamped pipes on Dutch sites in both Europe and the Americas, as well as on Native American occupations in contact with the Dutch, prompted researchers to identify a Dutch pipe maker. As with the English, several seventeenth-
Table 11. Heel marks and percentages for pipes excavated during the 1991 and 1992 seasons from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic.

<table>
<thead>
<tr>
<th>Bulbous-Bowled Pipes</th>
<th>Quantity</th>
<th>Percent of Total (1,194 Pipes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No heel stamp visible</td>
<td>528</td>
<td>44.22%</td>
</tr>
<tr>
<td>EB heel stamp</td>
<td>399</td>
<td>33.42%</td>
</tr>
<tr>
<td>D*C heel stamp</td>
<td>76</td>
<td>6.37%</td>
</tr>
<tr>
<td>WH heel stamp</td>
<td>35</td>
<td>2.93%</td>
</tr>
<tr>
<td>Fleur-de-lis heel stamp</td>
<td>22</td>
<td>1.84%</td>
</tr>
<tr>
<td>Tudor rose heel stamp</td>
<td>17</td>
<td>1.42%</td>
</tr>
<tr>
<td>P*C heel stamp</td>
<td>17</td>
<td>1.42%</td>
</tr>
<tr>
<td>Flower heel stamp (FOT 49)</td>
<td>12</td>
<td>1.01%</td>
</tr>
</tbody>
</table>

**Funnel Elbow-Angled Pipes**

| FOT 49 stamp at bowl/stem juncture | 88 | 7.37% |

Total | 1,194 | 100.00% |
Figure 33. Bulbous-bowled pipes from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Seven distinct heel marks have been identified: (A) EB, the mark of Edward Bird; (B) WH, a stamp suspected of belonging to William Hendricks Heptenstal (PW 1933); (C) P*C, an unidentified mark; note that the six-pointed star appears worn (PW 1494); (D) a Tudor rose (PW 2227); (E) D*C, an unidentified mark with a six-pointed star (PW 485); (F) a fleur-de-lys centered in a diamond (PW 2441); and (G) a floral design designated as Fort Orange Type 49 (PW 1381). Heel stamps are enlarged (2x). All illustrations by Alex Roberts.
century Dutch manufacturers were known to use the initials EB, among them Jacobus de Vrient (Bradley and D'Angelo 1981:111, citing Omwake 1959:132) and Adrian Van Der Cruys.

It was Simon Hart, Director of Gemeentelijke van Amsterdam (The Amsterdam Community), who first suggested that EB-stamped pipes from numerous Dutch sites were the workmanship of Edward Bird. Through Hart's correspondence with the late John McCashion, an amateur archaeologist who recovered numerous EB-marked pipes on New York sites, Bird's name entered the popular and scholarly literature of seventeenth-century clay pipe production. Further research by Duco (1981) and De Roever (1987) within the Amsterdam public records produced a wealth of biographical material about Edward Bird (Appendix N).

Edward Bird was an expatriated Englishman who, after a brief stint in the military, settled in Holland. There, in 1630, he began manufacturing pipes and continued to do so until his death in 1665. So successful was he that his factory is considered to have been "by far the biggest and best known in Amsterdam" (Baart 1992:142). His pipes are known from archaeological sites in both Holland and England, as well as on Dutch- and Anglo-American sites in the New World. It is apparent that his wares were also popular with Native Americans, for they appear on Mohawk, Onondaga, Oneida, Seneca, Cayuga, Wampanoag, Corchaug, Susquehannock, and Mohican sites in what is now the northeastern United States. Based on the extensive distribution of Bird's pipes on New York sites, it has been suggested that he probably worked for one or more large international merchant pipe exporters (Duco 1981).

**EB Heel Stamps and Comparative Archaeological Material**

Evidence from Fort Orange, a Dutch-American settlement in what is now Albany, New York, (1624 to 1675) indicates that there were at least five variations of the EB mark during the seventeenth-century (Huey 1988). During the 1991 and 1992 excavations, the Monte Cristi "Pipe Wreck" yielded three hundred and ninety-nine pipes bearing EB heel stamps (Figure 34). With all stamped pipes from the site, the term "suggested" refers to the author's best interpretation of the remnant mark. Occasionally, these emblems are distinct, but most often they are obscured, likely due to prolonged exposure on the seafloor. In several examples, the mark, when partially absent, is implied by a specific characteristic (e.g., a beaded ring or a floral

---

7 Although not specified, it was most likely the English military.
Figure 34. Distribution of hull-hunged piles bearing the EB headstamp recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
ray). Not indicated on Figure 34 are the pipes from test pits AB, CD, EF, B (Bigleaguer's), J (Jemison's), and W (Western), which collectively accounted for 10 pipes, or 2.5% of the total. All of these test pits are on the southwest portion of the site. Nine (2.3%) of the 399 pipes were unprovenienced. Only three of the five stamps attributable to Edward Bird were represented. 8

**EB in a Beaded (or Pellet) Ring**

Many of Edward Bird's pipes excavated from the Monte Cristi shipwreck bore a heel stamp characterized by the letters EB centered in a beaded ring (Figure 35). This mark is well-represented on at least 25 terrestrial archaeological sites, of which 13 were Native American settlements in the Hudson River Valley (Appendix O). Likewise, it has been found on pipes from Dutch-American settlements with known occupation dates of 1624 to 1710, as well as from the Anglo-American colony at Jamestown, Virginia (1620 to 1690). This mark has also been found on pipes excavated from Plymouth, England.

**EB in a Plain Ring**

An EB centered in a single ring was another heel stamp common to pipes from the Monte Cristi shipwreck (Figure 36). Such pipes are known from Fort Orange, where Huey assigned them a Type 30 heel stamp (Huey 1988:786). Of 22 sites where this maker's mark has been reported, 14 were Native American, including the Mohawk and Seneca of New York and the Susquehannock in Pennsylvania. At Fort Corchaug, a seventeenth-century Native American fort on eastern Long Island, New York, this stamp was identified as the mark of Edward Battle of Bristol, England (Solecki 1950). The author contends, however, that it may be more correctly interpreted as belonging to Edward Bird. Although Fort Corchaug was known to have been visited by both Dutch and English traders, it is uncertain whether Battle's wares were ever exported to the Americas. The EB in a plain ring is common to pipes recovered from Dutch-American settlements in Northeast Brazil (Pernambucano 1983:284. Figure 8) and New York (Fort Orange and Broad Street). Jamestown, Virginia, was the only Anglo-American site where

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8 Huey (1988:786) notes at least five varieties of the EB stamp which are classified as follows: Type 14, an EB in a sawtooth or denticulate ring; Type 27, an EB in a hatched-line ring; Type 29, an EB within a beaded circle; Type 30, an EB in a plain, single ring; and Type 34, an unringed EB. Types 34, 29, and 14 are classified by Bradley and DeAngelo (1981:111-112) as Types 1, 2, and 3, respectively.
Figure 35. A bulbous-bowled pipe with a heel stamp comprising an EB in a beaded ring recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Photo courtesy of PIMA archives.
Figure 36. A bulbous-bowled pipe with a heel stamp comprising an EB centered in a ring recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Photo courtesy of PIMA archives.
pipes bearing this stamp were recovered (Huey 1988). The mark has not been reported from English sites.

**Borderless EB**

Pipes bearing EB heel stamps with no encircling rings, the simplest of Bird’s five known heel marks, were also recovered from the Monte Cristi shipwreck (not pictured). This mark has the widest distribution on contemporary Dutch-American, Anglo-American, and Native American settlement sites. Of at least 25 archaeological sites that have produced pipes bearing this mark, 14 were Native American settlements, including those occupied by the Mohawk, Onondaga, Mohegan, Oneida, Cayuga, Seneca, and Wampanoag (Huey 1988; McCashion 1975, 1979b; Bradley and DeAngelo 1981; Gibson 1980). This heel stamp has been identified from Dutch sites and yet, like the plain-ringed EB, is unknown from pipes recovered in England.

**Summary**

Three heel stamps identified as the trade mark of Edward Bird of Amsterdam were associated with pipes recovered from the Monte Cristi shipwreck. These marks were also commonly found on pipes from sites representing the Mohawk, Onondaga, and Oneida tribes which were known to trade with Dutch Americans during the seventeenth century. Likewise, pipes with these stamps were associated with Anglo-American, Dutch-American, and Dutch settlements. These data lend further support to the hypothesis that the Monte Cristi merchantman carried a cargo of Dutch-manufactured clay pipes intended for European-American and Native American settlements in North America. A temporal window of 1642 to 1665 was established with analysis of these heel stamps, beginning with the date of the ship’s manufacture or repair (based upon dendrochronological study of the hull, see Chapter II) and ending with Edward Bird’s death.

**WH Heel Stamp and Comparative Archaeological Material**

Thirty-five pipes bearing the initials WH stamped into the heel were recovered from nine grid squares and the cannon test pit (Figures 37 and 38).9 The distribution pattern for these pipes spreads diagonally across the extant grid system, from the northeast to southwest.

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9 Three pipes (8.6%) were unprovenienced and, therefore, are not pictured in Figure 38.
Figure 37. A bulbous-bowled pipe with a WH heel stamp, recovered from the seventeenth-century, northern European merchant shipwreck in Monte Cristo Bay, Dominican Republic. Photo courtesy of PIMA archives.

Figure 38. Distribution of bulbous-bowed pipes (other than those bearing the EB heel stamp) recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
generally corresponding to the direction of the wind and waves: these pipes, however, are concentrated most heavily in grid square XXIII.

In a summary of the "Pipe Wreck" written in 1987, E. J. Ortega Alvarez suggested that a specific group of pipes provided evidence that it was a Dutch vessel that came to grief in Monte Cristi Bay:

The ship was identified as Dutch because the majority of clay pipes were manufactured in Holland. Some investigators affirm that it represents Ver Haver, arriving at this conclusion because of the initials V. H. that were found on some of the pipes (Ortega 1987:416).

It is unclear if Ortega meant that the vessel, captain, or pipe maker was named Ver Haver. Nevertheless, it would appear that both Ortega and his "researchers" mistook the initials VH for the letters WH. The author contends that these pipes represent the work of William Hendricks Heptenstal; thus, a connection is established not only with Amsterdam pipe making in general but with the pipe maker Edward Bird specifically.

Hendricks owned one of the largest workshops in the city, but little is known of the wares he produced. He was the "third most important name in the Amsterdam pipe industry" (Duco 1981:401) and was a friend of Edward Bird during the period from ca. 1640 to 1650 (McCashion 1991). In fact, it is believed that Bird fired his pipes in Hendricks' kiln (De Roever 1987; McCashion, personal communication, 1991). Duco (1981) has suggested that Hendricks' pipes were of low quality. This is partly the result of his association with Bird, whose products were considered to be of lesser quality than the average Amsterdam wares. Additionally, Hendricks manufactured industrial earthenware, a lower quality ceramic "used in the sugar industry" (Duco 1981:403).

Hendricks' association with Bird is well documented in a seventeenth-century legal case, although the actual events remain ambiguous (De Roever 1987). In April, 1654, Edward Bird purchased a consignment of inferior quality clay. To what extent Hendricks was involved is unclear. But, at the very least, it appears that he testified on behalf of Edward Bird in the claim against Walewijn van der Veen, the clay salesman (Huey 1988). It is not certain if a similar mishap occurred previously to Hendricks, as suggested through testimony in an affidavit (De Roever 1987), or if the single event duped both Hendricks and Bird (Duco 1981). The latter was most likely true, for Duco mentions that van der Veen came to Hendricks' house promising to deliver a shipment of Hessen (Hessian) clay. When the barrels arrived, not only was the clay not Hessen, it was of such inferior quality that it could not be used. "Buying the clay together," states Duco, "would have been much easier and cheaper," an argument that the fraudulent clay was intended for both workshops (Duco 1981:402).
Comparative examples of Hendricks' pipes are scant, but possibly include a stem fragment from the Oneida Stone Quarry Site in New York (McCashon 1991). occupied between 1645 and 1655. Likewise, two pipes with WH heel stamps were recovered from the Indian Castle Onondaga Site in New York, occupied between 1655 and 1663. The Compton Site in Maryland, an Anglo-American site that was occupied from 1651 to 1684, also produced pipes with the WH heel stamp (King 1989). A pipe from Amsterdam bears a heel stamp similar to the WH found at Monte Cristi, but Duco cautions against assuming that it necessarily represents the work of Hendricks (Duco 1981:257, Figure 185, and page 463). This pipe is provisionally dated from ca. 1630 to 1650.

Although few, William Hendricks' pipes have been recovered from Native American and European-American settlements. The sites are well dated to the middle-seventeenth century. The presence of WH-stamped pipes on the Monte Cristi shipwreck supports the proposition that the vessel carried a cargo of Dutch-manufactured trade pipes for both Native and European-American markets. Furthermore, comparative data support the theory that the vessel sank between 1642 and 1665.

**D*C and P*C Heel Stamps**

Pipes from the Monte Cristi shipwreck bearing the heel stamps D*C and P*C have six-pointed stars centered between and elevated above the initials (Figures 39 and 40). The stems of these pipes, characterized by groups of roulette bands, make these the only decorated pipes from the shipwreck. No pipes bearing these heel stamps have been reported from contemporary European or American sites.

Seventy-six pipes bearing the D*C heel stamp were distributed across 15 grid squares (see Figure 38).\(^{10}\) Nearly half were recovered from grid square XIV (31, or 40.8%); the second greatest concentration was found in grid XIII (12, or 15.8%). Seventeen pipes with the P*C stamp came from five grid squares (see Figure 38). As with the D*C-stamped pipes, the greatest number was in grid square XIV (10, or 58.8%). Spatial distributions of these two pipe forms suggest that they were packed together, or that their crates were near each other.

Pipes bearing the P*C heel stamp may be the work of Pieter Claess, who manufactured his wares in Amsterdam sometime around the middle of the seventeenth century (Duco 1981:307). Claess was the son of Claes Pieterszoon, also a pipe maker. Little else is known.

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\(^{10}\) Three of these pipes, or 4.0%, were unprovenienced.
Figure 39. The D*C heel stamp on a bulbous-bowled pipe from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Photo courtesy of PIMA archives.
Figure 40. The P*C heel stamp on a bulbous-bowled pipe from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Photo courtesy of PIMA archives.
except that Pieter was born around 1630 and was active in his trade between 1651 and 1654, a
date range that fits the established temporal framework for the Monte Cristi shipwreck.
Presently, there is no suggestion for the identity of the pipe maker using the D*C heel stamp.

P*C- and D*C-stamped pipes remain unidentified with respect to their specific makers
and locations of manufacture, but bowl forms and stem decorations suggest a seventeenth-
century Dutch design. Despite numerous uncertainties about these pipes, their presence on the
shipwreck supports the hypothesis that the Monte Cristi pipe cargo originated in Amsterdam
between 1642 and 1665.

_Fleur-de-Lys Heel Stamp and Comparative Archaeological Material_

Another maker's mark, less common among the Monte Cristi pipes, was a _fleur-de-lys_
centered in a diamond and pressed into the circular-oval heel (see Figure 33. F). Twenty-two
were recovered from six grid squares and the cannon test pit (see Figure 38). In some instances,
it appears that the diamond comprised numerous small beads. As with the Tudor rose (described
below), the stamp was common to both seventeenth-century English and Dutch pipes. Thought
to represent an iris, the _fleur-de-lys_ was a heraldic symbol popularized by French monarchs; it
predated the pipe making industry in both Holland and England (Omwake 1969).

Pipes bearing this heel stamp have been recovered from English and Irish sites, from
Dutch-American settlements in North and South America, and from Anglo-American and Native
American sites (Appendix P). The latter groups include the Mohawk, Oneida, Onondaga, and
Susquehannock. The temporal range for these numerous sites extends from 1624 (Fort Orange,
New York) to 1710 (Stadt Huys, New York), both of which were Dutch-American settlements.
No maker has ever been suggested for any pipes bearing the _fleur-de-lys_ heel stamp, but it was
apparently a widely used and very popular mark. Its presence on the Monte Cristi pipes lends
further support to the hypothesis that the ship carried a cargo of Dutch goods to both Native and
European-Americans in North America sometime between 1642 and 1665.

_Tudor Rose Heel Stamp and Comparative Archaeological Material_

Seventeen pipes bearing the Tudor rose heel stamp were scattered across seven grid
squares and the cannon test pit, confined mostly to the southern portion of the site (see Figure
38). The five-petal rose had its origin in England during the reign of Elizabeth (see Figure 33.
D). It quickly became a recognized mark of English pipe makers in Holland who had fled England for religious and economic reasons when James I sat on the throne. Many Protestant pipe makers adopted the symbol as a sign of their allegiance to the House of Tudor. Omwake (1969) has suggested that it is the oldest of all Dutch pipe marks, adopted in 1617 by Willem Barentsz, founder of the pipemaking industry in Holland. Solecki (1950:32, citing Sheppard 1902:23) states that the mark was “in vogue during the latter half of the seventeenth century” and, according to Pernambucano (1983), was rivaled only by pipes stamped with the seemingly ubiquitous EB.

Pipes bearing the Tudor rose have been recovered from numerous sites both in the Old and New World (Appendix Q). Native American tribes that used such pipes include the Pennsylvania Susquehannocks, the Corchaug of Long Island, the Onondaga Iroquois, and the Oneida (Solecki 1950; Omwake 1969; McCashion 1979b; Huey 1988). Their sites have a collective temporal range from ca. 1640 (Corchaug) to 1685 (Oneida). The Susquehannocks are known to have traded with the Dutch, Swedes, and English, but their relations with the latter group were less than “cordial” during the period from 1650 to 1675 (Omwake 1969:129). Thus, it is likely that such pipes were acquired through the Dutch; this is probably true for most Tudor rose pipes appearing at Native American sites.

Dutch-American sites have yielded numerous varieties of the Tudor rose pipe stamp. Perhaps the most impressive collection is from Fort Orange,11 where the Type 20 mark best matches the Monte Cristi rose. Several variations of the rose are also reported from the Broad Street excavations (Grossman 1985), and from the fort of Pontal de Suape in northeast Brazil (Pernambucano 1983). Hagerty (1985) has proposed a Dutch origin for the numerous pipes bearing the Tudor rose heel stamp that have been recovered from various seventeenth-century New York sites.

Pipes excavated from the wreck of the Kennemerland, a seventeenth-century Dutch East Indiaman, bore “a rosette in relief” (Price and Muckleroy 1974:266), but since no illustration is provided in the publication, it is difficult to determine whether this represents a Tudor rose.

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11 See the following Fort Orange marks in Huey (1988:786-787): Types 1, 5, 16, 17, 20, 21, 23, 25, 26, 28, 31, 32, 37, 42, 51, 57, 62, 63, 69, and 73.
At least four Anglo-American settlements in Maryland and Virginia, with a collective occupational range of 1620 to 1700, have yielded pipes with the Tudor rose (Cotter 1958; Henry 1979; Crass 1988; King 1989).

Pipes bearing the Tudor rose heel stamp from the Monte Cristi shipwreck support the theory that an English-built trader was headed for the eastern coast of North America when it sank in Monte Cristi Bay sometime between 1642 and 1665. Furthermore, the fact that the stamp is an English symbol later adopted by Dutch pipe makers lends strength to the hypothesis that the pipes were of Dutch manufacture. It is known that two of the pipe makers whose wares are represented on the Monte Cristi shipwreck -- Edward Bird and William Hendricks -- were emigrant protestant Englishmen, perhaps even supporters of the House of Tudor.

Floral Design (FOT 49) and Comparative Archaeological Material

Twelve bulbous-bowed pipes from the Monte Cristi shipwreck bore a flower heel stamp characterized by small teardrop-shaped petals positioned between six rays (see Figure 33, G). This design is identical to one found on a pipe excavated from Fort Orange at Site 66, dated 1648 to 1676. Researchers from the Monte Cristi Shipwreck Project refer to the flower stamp as FOT 49, or Fort Orange Type 49, since it is the forty-ninth heel stamp listed by Huey (1988:740). Pipes bearing the FOT 49 stamp are dispersed throughout several grids at Monte Cristi (see Figure 38). The largest assemblage (3. or 25.0%) was found in grid square VI; eight pipes were distributed on both sides of the keel. in four grid squares and two test pits; one pipe was unprovenienceed.  

The single pipe from Fort Orange that bore the FOT 49 heel mark was a funnel elbow-angled form (described below). FOT 49-stamped pipes have also been found at the Van Buren site in New York, a Dutch-American settlement from 1634 to 1686 (Huey 1988). According to Huey (1988), bulbous-bowed pipes marked in such a manner are known only from London, England. No additional information is available regarding date, occupation, or stratigraphy of this site, except that the bowl on which this heel mark appeared was not elbow-shaped, thus indicating it was a bulbous-bowed pipe.

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12 One pipe, not pictured in Figure 38, was excavated from Test pit AB, at the southwestern portion of the site.
Various similar marks are known from pipes excavated in England and Holland, where they are usually described as spoked wheels instead of floral designs (Oswald 1969; Atkinson and Oswald 1972; Rutter and Davey 1980; Duco 1981; Grant and Jemmet 1985) (Appendix R). Floral motif FOT 49 appears to be the most ambiguous pipe mark with respect to a locus of manufacture. Still, the stamp has appeared within a Dutch-American settlement in the northeastern United States, with a temporal range of 1624 to 1675. It therefore agrees with the prescribed date range of 1642 to 1665 for the Monte Cristi shipwreck.

Funnel Elbow-Angled Pipes and Comparative Archaeological Material

Eighty-eight funnel elbow-angled pipes were distributed across 12 grid squares and four test pits (Figure 41). These were generally located at the southern end of the extant hull on the western side of the keel; some, however, were excavated from as far north as grid square XXII, at the extreme northeast corner of the site. The distributions of funnel pipes and EB-stamped pipes are strongly correlated, suggesting that the two forms may have been packed together, or were stored nearby in separate crates.

Funnel elbow-angled pipes are characterized by an inverted conical bowl that joins the stem at an obtuse angle (see Figure 32, B). Unlike bulbous-bowed pipes, there is no distinct heel. All of the funnel pipes from the Monte Cristi shipwreck have a single floral stamp — the previously described Fort Orange Type 49 — at the junction of the bowl and stem (Figure 42). This collection of pipes specifically suggests that the Monte Cristi vessel was headed for the northeastern region of what is now the United States, since funnel pipes were manufactured but not used in Europe. Furthermore, because of their popularity among Native Americans, these pipes suggest (along with other trade goods discussed below) that a portion of the cargo aboard the Monte Cristi vessel was destined for distribution at Native American settlements.

The funnel pipes from the Monte Cristi shipwreck represent the largest known assemblage from any archaeological site. Additionally, they are the only pipes of this type ever to have been recovered from a submerged site. Commonly referred to as Dutch bowls, trade pipes, and, in some instances, export pipes, they were manufactured in Holland. Interestingly, however, only one such pipe has been excavated and reported in all of the Netherlands (McCashion 1991; Huey 1988; van Duuren 1989). That pipe bore a stamp, on the lower stem-side at the stem-bowl

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13 Not pictured in Figure 41 are two pipes (2.3%) from test pit AB. 1 pipe (1.1%) from Bigcagger's test pit, and 1 pipe (1.1%) from the western test pit. Four of these pipes (4.6%) were unprovenienced and, therefore, do not appear in the illustration.
Figure 41. Distribution of funnel elbow-angled pipes bearing the FOT 49 heel stamp at the bowl/stem junction recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
Figure 42. A funnel elbow-angled pipe bearing the FOT 49 stamp at the bowl/stem junction recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Photo courtesy of PIMA archives.
junction, which was described as a “spoked wheel,” a mark that McCashion identified as similar to the FOT 49 mark from the Monte Cristi shipwreck pipes (McCashion 1991:50).

Van Duuren (1989) proposed that the FOT 49 stamp on funnel elbow-angled pipes may be an alternative mark of Edward Bird:

The article in SCPR [Society For Clay Pipe Research] 23 by Jerome Lynn Hall about the pipe wreck at Monte Christi can be supplemented with information about a find in the Netherlands. In the September 1981 Newsletter of the Pipelogenie Kring van Nederland, a find of a clay pipe is described and illustrated that has the same form as the funnel-elbow pipe (Figure 4 in Mr. Hall’s article) from the wreck at Monte Christi. These Dutch funnel-elbow pipes bear the heelmark EB. Pipes with this form are seldom found in Holland. In my opinion they were specially made for the export market. The Dutch find also makes it more likely that the pipe with the wagon-wheel heelmark is a product of the pipemaker Edward Bird (van Duuren 1989:21-22).

Mr. van Duuren’s reference to the “wagon-wheel heelmark” (sic) was in response to the FOT 49 stamp which, when originally published by the author (Hall 1989), was thought to be a Dutch rad, or wheel. Although nothing in the existing literature validates van Duuren’s suggestion, pipes bearing EB heel stamps and those with flower heel marks have been recovered from middens in New York (Hagerty 1957). Morphologically, these were similar to pipes manufactured from 1630 to 1650; geographically, they were located in areas under the influence of Dutch and French traders. Could this “flower” of which Hagerty speaks be the FOT 49 heel stamp? Does this match the data compiled at Monte Cristi, where EB- and FOT 49- stamped pipes are found together? Might these flower-stamped pipes have originated in the workshop of Edward Bird as has been propounded by van Duuren?

Edward Bird is credited as the inventor of the funnel pipe form; he exported them in large quantities to the New World. Huey (1988:594) posits that Bird's source of inspiration for the development of this pipe “probably consisted of an Indian pipe brought to the Netherlands from America as a model. It came probably from the lower Susquehanna River or Chesapeake Bay region.” Although several factories appear to have produced these pipes during the seventeenth century, they were undeniably copying preexisting Native American forms, as discussed below.

McCashion (1991:50) has suggested that “since the funnel elbow-angled trade pipe seems unique to the Americas, it seems logical that the Monte Christi ship was inbound to New
Netherland and sank before it reached there." Likewise, he proposed that the lack of EB-stamped funnel pipes on the CNJ-3 (White Orchard) site in New York may or may not have to do with wreck of an unknown inbound merchant vessel which sank at Monte Cristi in the Dominican Republic. Aboard the ship was a considerable number of clay tobacco pipes of both funnel and bulbous variety fabricated by Edward Bird, William Hendricks, and others (McCashion 1992:7).

McCashion correctly stated that both funnel elbow-angled and bulbous-bowled pipes were recovered from the Monte Cristi shipwreck. However, only the latter form bore the heel marks of Bird and, presumably, Hendricks; none of the funnel pipes could positively be associated with either pipe maker.

Elbow pipes with varying maker’s marks have been recovered from at least 25 Native American sites, representing the Oneida, Mohawk, Seneca, Susquehannock, Wampanoag, Onondaga, Cayuga, Mohogan and Massapequa tribes (Appendix S). These sites were collectively occupied from 1635 to 1696.

Likewise, funnel pipes have been found on Dutch-American settlements in New York. The temporal occupation range for these sites is from 1624 to the close of the century, including Fort Orange, the Van Buren Site, Fort James, the Broad Street Site, and the U.S. Customs House on Manhattan Island. They are also known from Anglo-American sites in Virginia, Maryland, and Massachusetts, with occupation dates of 1620 to 1699 (Miller 1983; Huey 1988, King 1989).

Locally manufactured varieties of funnel pipes also appear at the St. John’s Site at St. Mary’s City, and at “other European sites in Virginia,” where they date after 1650 (Huey 1988:595; see also Buchanan and Heite 1971; Henry 1979; Miller 1983). Numerous examples of locally made, red clay, funnel pipes have also been recovered from Port Royal, Jamaica (Heidtke unpub. 1992).

Native American Prototypes for European-Manufactured Funnel Pipes

The seventeenth-century calumet, or peace-pipe, descended from Pre-Columbian pipes, may have been the direct progenitor of the Dutch-manufactured funnel form (Figure 43). To what extent the calumet itself held symbolic importance is poorly understood, for in many instances the role of tobacco inhalation was minimal. Formed by inserting a reed or cane into a short stem, this pipe was an "extremely important institution" among the Native Americans of the
Figure 43. Native American pipes, prototypes for the European funnel elbow-angled form. (A-C) L-shaped catlinite pipes, from the Tunica collection (Trudeau, Louisiana), portions of calumets, or peace pipes (Brain 1979:248; Brown 1989:325, Figure 6); (D) an L-shaped pipe from the Cherokee culture in Tennessee (Wauchope 1966:204, Figure 138a, after Kneberg 1952, Figure 111k); (E) a T-shaped pipe from the Tunica collection, possessing a handle, or prow. Illustrations by Jerome Lynn Hall.
southeastern United States (Brown 1989:311). The highly symbolic calumet ceremony had many practical applications within Native American communities and among competing tribes. It was associated with adoption, mourning, as a protective device in the midst of social conflict, and to initiate peaceful relations in commerce. Interestingly, the social aspects of tobacco consumption are often depicted in convivial European tavern scenes created by seventeenth-century Dutch and Flemish painters. Associations not so distant from the calumet ceremony of Native Americans. The fact that the Dutch could successfully manufacture and market funnel pipes for export to Native Americans was a testimony to Holland’s capitalistic ingenuity.

An Anomalous English Pipe

A single anomalous pipe, artifact PWA 1678, was recovered during the 1994 campaign; the author suspected it was English (Figure 44). This artifact was sent for analysis to David Higgin at the School of Archaeology, Classics, and Oriental Studies at the University of Liverpool. Months later, Higgins examined two bulbous-bowed pipes and two funnel elbow-angled pipes that were recovered from the Monte Cristi shipwreck some twenty years earlier. His analyses confirmed that PWA 1678 was English, and suggested that the pipe compared well with at least one sample recovered from the H.M.S. Dartmouth, which sank in 1690 (Higgins, personal communication, 1995: see also Martin 1987). Higgins concluded that the other four pipes were

clearly of Dutch origin and likely to date from ca. 1650-1670. This ties in well with the other evidence for the date of the wreck and contrasts with the late seventeenth century date of the English pipe examined in February of this year [PWA 1678]. The English pipe seems most likely to relate to attempted salvage from the wreck at the end of the century (Higgins, personal communication, 1995).

The author concurs with Higgins on the suggested date range for the English pipe (ca. 1680 to 1710). Bowl volume (as measured by the method described above) is 3.6 ml, smaller than the large variety bulbous-bowed pipe (with an EB heel stamp), yet larger than all of the

\[14\] For more information on the H.M.S. Dartmouth, see Adams (1974), Martin (1987), and Martin (1978).
other types recovered from the shipwreck. Bowl morphology reasonably fits into Noël Hume’s chronology\(^{15}\) and matches the samples recovered from the *H.M.S. Dartmouth*.

![Diagram of a bowl-shaped artifact](image)

**Figure 44.** Artifact PWA 1678, recovered from the seventeenth-century northern European shipwreck in Monte Cristi Bay, Dominican Republic. The pipe most likely dates from between 1680 to 1710 and is probably English. Illustration by David Higgins.

A similar pipe, described by McCashion (1977:116 and page 117, Plate 29) as “probably English,” was recovered from FDA-20, a Native American (Mohawk) site in New York. The settlement was occupied from 1667 to 1693. No heel mark was present and, although the maker is unknown, it was suggested by McCashion that the pipe was manufactured in London.

The presence of artifact PWA 1678 on the Monte Cristi shipwreck suggests three explanations: first, the author has misdated the site by 30 to 40 years. This would also contradict the conclusions of previous salvage and archaeological groups that have visited or worked on the site, all of whom have ascribed an earlier date range. Second, the date for PWA

\(^{15}\) According to Noël-Hume’s simplified evolutionary series of English clay tobacco pipes, Artifact PWA 1678 appears similar to types 13 and 14, dating 1680 to 1710 and 1700 to 1770, respectively (Noël-Hume 1985:303).
1678. arrived at by both Higgins and the author, is incorrect. Third, as suggested by Higgins, artifact PWA 1678 is intrusive.

If the third alternative is correct and PWA 1678 is intrusive, then apart from its anomalous form there is no corroborating archaeological evidence to indicate that it was deposited after the vessel sank. The bowl interior is not charred, evidence that would imply it had been smoked prior to being discarded. Arguably, a late seventeenth- or early eighteenth-century salver could have dropped it overboard before its contents were lit, perhaps while packing tobacco into the bowl. Although the artifact was located well within the wreck level, it is likely that site stratigraphy has been altered during previous salvage attempts; in fact, the area from which the artifact was recovered is known to have been heavily salvaged previously by at least one group of treasure hunters (see Figure 10, Chapter I).

More than 4,000 pipes have been collected by PIMA archaeologists and volunteers during four excavation seasons. Remarkably, this is the first identifiable English pipe that has been recovered. If other such pipes were originally present, it is conceivable that they were removed by treasure hunters and souvenir seekers; however, this is an unlikely explanation for the presence of only one English pipe in the midst of thousands of Dutch pipes. It is equally unlikely that many more English pipes remain on the site. It is therefore concluded that PWA 1678 represents an intrusive artifact.

The Transport of the Monte Cristi Clay Pipes

Twelve bulbous-bowl pipes, each bearing an EB heel stamp, were found beneath the keel at the southwestern portion of the Monte Cristi shipwreck. Nearly entire and arranged head-to-tail, these pipes suggested the original order in which they were packed within their protective container (Figure 45). Further evidence of the manner in which they were shipped was revealed when Philippa Tomlinson, of the Environmental Archaeology Unit at the University of York, examined several small leaves found packed in the pipe bowls. These were conclusively identified as husks of buckwheat (*Fagopyrum esculentum*) (Tomlinson, personal communication, 1992). Similarly, the Dutch East Indiaman *Amsterdam* (1749) yielded pipe bowls “filled with a large quantity of the loose husks of buckwheat” (Marsden 1974:89-90). Pipes excavated from the wreck of the *Vergulde Draeck* (1656) were also “packed head-to-tail”
Figure 45. Seven of the ten bulbous-bowled pipes found lying head-to-tail beneath the keel in grid square VIb of the seventeenth-century northern European shipwreck in Monte Cristi Bay, Dominican Republic. (A) pipe stem; (B) pipe stem; (C) PW 305; (D) PW 310; (E) PW 309; (F) PW 306; (G) PW 307; (H) PW 304; (I) PW 316. All possess the EB heel stamp, have bore diameters of 8/64", and several contained husks of buckwheat (Fagopyrum esculentum) in their bowls. Not pictured are PW 303 (7/64"), PW 311 (8/64"), and PW 319 (7/64"). The orientation is northward from beneath the keel. Illustration by Jerome Lynn Hall.
in what appeared to be buckwheat (Green 1977:152, 161); however, conclusive analysis of the organic material was never published. Eighteenth-century pipe makers in Gouda were known to insulate their shipments with straw or buckwheat husks (Walker 1977:11a). From the seventeenth to the nineteenth centuries, pipes were packed not only in buckwheat and straw but also in a variety of organic materials, including sawdust, paper, chaff, wood shavings, and hay.

What type of containers held the Monte Cristi pipes? Protecting fragile products during shipment, especially overseas, was a serious undertaking, for ceramic wares damaged in transit were the liability of the retailer: it was he, alone, who suffered the loss (Walker 1977 11a). To insulate clay pipes against the ravages of transport, a variety of containers was used, including wicker baskets, cases, casks, kegs, and chests. Boxes or casks were the preferred receptacles for transoceanic shipment between the seventeenth and nineteenth centuries (Walker 1977:11a). In a letter from 1739, the Governor and Committee of the Hudson’s Bay Company were informed that only two-thirds of the pipes shipped from London to York Fort (Manitoba, Canada) were usable, since six gross had broken in transport. The company representative in Manitoba suggested that had they been packed more carefully, such loss could have been prevented:

> In eighteen gross [pipes] received from England, we shall not have much above twelve gross, the rest being so short that they are of no service. With submission to your honours, if they was [sic] put in a cask or larger boxes with more straw between each lay, it would preserve them very much from being broke [sic] (Walker 1977[11a]:151. citing Nicks 1970:44n).

Walker (1977[11a]:149-150, citing Fleming 1923:244-245) noted the disenchantment of one Mr. Thomas Carlyle, of London, who suffered the loss of an order of pipes sent to him from Glasgow, Scotland. It is uncertain whether they were shipped by land or sea, but most likely the latter. Only 45 pipes of the five gross survived the voyage, even though they were shipped in deep boxes filled with sawdust.

Small pieces of wood were found in and around grid squares I, VI, and XIV, where the majority of pipes and pipe stems were recovered. Although similar in thickness, color, and texture to the softwood deals that covered the bottom of the shipwreck, these pieces appeared to have been worked as if for a box or crate. These fragments remain unidentified, yet they are a variety of softwood, perhaps pine or spruce. In the early eighteenth century, shipping boxes

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16 This business tradition was known as "caveat emptor" (Walker 1977[11a]:152).
were often constructed from firwood and beechwood (Walker 1977:11a), suggesting that these remnants may represent the remains of the crates in which the Monte Cristi pipes were transported.

Conclusions

Bulbous pipes bearing the EB heel stamp — the trade mark of Edward Bird — suggest that the vessel represented by the Monte Cristi shipwreck sank no earlier than 1630 and no later than 1665, or shortly thereafter. Pipes marked with WH stamp corroborate this temporal range. They likely represent the work of Willem Hendricks, a personal friend of Bird’s, who was known to produce his wares sometime around the middle of the seventeenth century. Furthermore, the Tudor rose, *fleur-de-lys*, and FOT 49 heel marks were popular decorations during this time period.

The archaeological record suggests that European-manufactured funnel elbow-angled pipes were not known in the New World until 1640, when they appeared at the Dutch-American settlement of Fort Orange. Together with the dendrochronological study of the hull timbers (see Chapter II), data from both the bulbous-bowled and funnel elbow-angled pipes support the proposition that the Monte Cristi vessel sank between 1642 and 1665. Likewise, the assemblage of pipes (except for PW 1678, an intrusive English pipe) indicates a manufacturing center in Amsterdam, Holland. Although pipes like those from the Monte Cristi shipwreck are found on Native, English-, and Dutch-American sites along the eastern seaboard of the present-day United States, the entire collection supports a Dutch-American entrepôt as the final destination of this cargo (Table 12). On the other hand, this conclusion must be considered carefully in light of data from the Compton Site. This Anglo-American occupation in Maryland has yielded an array of pipes that resembles closely the “Pipe Wreck” collection. This comparison suggests that Dutch-manufactured pipes were carried to the New World aboard an English vessel, perhaps to Anglo-American settlements (see Chapters I and IV). Finally, the presence of funnel elbow-angled pipes implies that a portion of the cargo was destined for trade with Native Americans, possibly in the Upper Hudson River Valley of present-day New York.
Table 12. A comparison of pipe types from the northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic with contemporary sites. Type of pipe and heelmark are indicated at the top of each column. Sites with four or more pipe types are highlighted with a box.

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<th>Dutch Sites</th>
<th>Funnel</th>
<th>EB (Bulbous)</th>
<th>WH (Bulbous)</th>
<th>Fall (Bulbous)</th>
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<td>Damariscovey, Me. (1622 to 1725)</td>
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<td>Edward Winslow, Ma. (1632 to 1699)</td>
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<td>Hallowes, Va. (1651+)</td>
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<td>Olustead-Goffe, Ma. (ca. 1632-1674)</td>
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Unknown American Site

Winnie’s Island, NY | •

Native American Sites

Oak Hill (Mohawk 1640 to 1650) | •

FDA 18 Printup (Mohawk 1640 to 1658) | •

Yates (Mohawk 1650 to 1660) | •

Mitchell CNJ 49 (Mohawk 1650 to 1666) | •

Freeman (Mohawk 1658 to 1666) | •

\(^1\) Huey (1988) dates the site 1640-1650.
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<th>Native American Sites (continued)</th>
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<td>FDA 14 (Mohawk 1667 to 1688)</td>
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<td>FDA 20 (Mohawk 1667 to 1693)</td>
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<td>CNJ 3 (Mohawk 1667 to 1688)</td>
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<td>Castle Caughnawaga</td>
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<td>(Mohawk 1667 to 1693)</td>
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<td>Carley (Onondaga 1640 to 1650)</td>
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<td>Lot 18 (Onondaga 1650 to 1655)</td>
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<td>Indian Castle (Onondaga 1655 to 1663)</td>
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<td>Indian Hill (Onondaga 1663 to 1682)</td>
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<td>Jamesville (Onondaga 1682 to 1696)</td>
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<td>Bloody Hill II (Onondaga 1675 to 1685)</td>
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<td>Stone Quarry (Oneida 1640 to 1650)</td>
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<td>Dungey/Lemery (Oneida 1660 to 1677)</td>
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<td>OND 5-3 Upper Hogan (Oneida 1677 to 1685)</td>
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<td>Native American Sites (continued)</td>
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<td>Dann (Seneca 1650 to 1675)</td>
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<td>Gannagarro (Seneca 1645 to 1687)</td>
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<td>Rochester Junction (Seneca 1675 to 1687)</td>
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<td>Snyder-McClure (Seneca 1675 to 1700)</td>
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<td>Salmon Valley (Cayuga 1635 to 1655)</td>
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<td>Culley's Tile Kiln (Cayuga ca. 1650)</td>
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<td>Young Farm (Cayuga 1660 to 1760)</td>
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<td>Burr's Hill (Wampanoag 1655 to 1676)</td>
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<td>Fort Corchaug (Corchaug 1640-1650)</td>
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<td>Oscar Liebhardt (Susquehannock 1650 to 1675)</td>
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<td>Fort Shantok (Mohegan 1635 to 1675)</td>
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<td>Fort Massapeag (Massapequa 1656 to 1664)</td>
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CERAMIC ARTIFACTS - STONEWARE AND EARTHENWARE

Rhenish Stoneware

Throughout the Ages of Discovery, Conquest, and Colonization, shipboard provisions were most commonly transported in barrels and ceramic storage jars. One of the most reliable containers in which to carry liquids was the stoneware bottle. Rhenish wines were transported from the Rhineland to Great Britain and beverages such as cider and spirits, as well as molasses, vinegar, and mercury were frequently shipped in stoneware jars (Wilcoxen 1987). Rhenish wares were also used frequently in homes and industries. Numerous sherds of Rhenish stoneware, many of which bore artistic designs common to the mid-seventeenth century, were recovered from the Monte Cristi shipwreck; their contents, however, are currently unknown.

The popularity of stoneware vessels was no doubt found in their durability, as attested to by their presence on numerous terrestrial sites as well as shipwrecks from the seventeenth and eighteenth centuries. Rhenish bottles have been recovered from the Dutch East Indies "Witte Leeuw" (1613) (van der Pijl-Ketel 1982), "Batavia" (1629) (Green 1975), "Lastdrager" (1653) (Stenuit 1974), "Vergulde Draeck" (1656) (Green 1973), "Kennemerland" (1664) (Price and Muckleroy 1974), "Princes Maria" (1686) (Muckleroy 1980), "Sante Dorothea" (1693) (L’Hour 1993), "De Liefde" (1711) (Muckleroy 1980), "Slot ter Hooge" (1724) (Muckleroy 1980), "Zweeijk" (1727) (Muckleroy 1980), "Hollandia" (1743) (Gawronski et al. 1992), and "Amsterdam" (1748) (Marsden 1974). Although no intact bottles were found on the wreck of the Dutch East Indiaman "Curacao" (1729) (Stenuit 1977), numerous sherds were recovered. Likewise, sherds were found on an unidentified Dutch galioe that sank near the island of Kvitsøy in 1677, as well as on the Jutholmen Wreck (ca. 1700) (Cederlund 1982).

Rhenish stoneware bottles were also popular aboard English vessels, as reported from the wrecks of the "Sea Venture" (1609) (Wingood 1982), "Dartmouth" (1690) (Holman 1975), "Sapphire" (1696) (Barber 1977), and "Hazardous" (1706) (Owen 1991). They have also been discovered on the Manila Wreck (mid-eighteenth century) (Karklins 1991), an unidentified Portuguese shipwreck (mid-sixteenth century) in the Seychelles (Blake and Green 1986), and at the submerged English-American settlement of Port Royal, Jamaica (second half of the seventeenth century) (Hamilton 1984).

Rhenish or German stoneware ceramics appeared in many forms during the seventeenth century. In taverns where beer was the popular drink among all classes of German society.

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17 In 1957, a tribe in Surinam was found to be using a stoneware bottle dating to ca. 1700 (Noël-Hume 1958). A jug, dated 1694, was found in Viet Nam. still in use in the 1970s (Eliot 1986:89, citing von Bock 1980).
"mugs, jugs, bottles, fountain types, and various other vessels" were used (Gusset 1980:141). The classic stoneware bottle or jug is known by many names, including Rheinsches Steingut, Tigernware, Frechen ware, German stoneware, and Cologne ware. The characteristic stoneware glazes were the result of adding salt to the firing process, which resulted in a coating that was "thin and colorless" (van der Pijl-Ketel 1982:246). The familiar "Cologne brown" was the product of ferrous oxides present in the clay (van der Pijl-Ketel 1982:246).

The high quality of Rhenish stoneware was attributable, in part, to the geography of the Rhine River Valley, bordered by the Westerwald and Eifel mountain ranges. The valley met all necessary criteria for building and sustaining potteries with its "clean, very fine fusible clays, inexhaustible wood fuel, and sea salt" (Eliot 1986:85). Furthermore, the Moselle and Rhine Rivers provided a conduit for distribution of finished products to commercial centers, such as Cologne, which had a staplemarket (market) for ceramics (van der Pijl-Ketel 1982).18

A sprig-molded, bearded face commonly appears on the neck of a Rhenish stoneware bottle. This motif had many names, most all derivations of haardman, or "bearded man" (van der Pijl-Ketel 1982). The most popular, "Bellarmine," supposedly referred to the sixteenth-century Roman Catholic theologian, Cardinal Roberto Bellarmino. It is generally agreed by most scholars, however, that the name Bellarmino, although fashionable in its use during the seventeenth century, actually had no true association with the Cardinal since the earliest known production date for these containers is at least 1550, when Bellarmino was only eight years old.

Perhaps the most interesting use of haardman jugs was in witchcraft, attributable, no doubt, to the grotesque and somewhat frightening masks that adorn the vessel necks. Witching bottles -- stoneware jugs containing such ingredients as fingernail clippings, urine,19 bent iron nails, and human hair -- are known to have been buried under hearths, suspended from chimneys, or placed in stream beds as a means of protecting their owners against evil spells.20 or

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18 The most famous production center was at Siegburg, but the valley supported many, including Frechen, Grenzhausen, Cologne, Hogr, and Raeren (Beebe 1980).

19 Seventeenth-century accounts clearly indicate that urine was one of the most important ingredients in counteracting a witch's spell. Citing Blagrave (1671), Merrifield (1987) notes: "Another way is to stop the urine of the Patieent close up in a bottle, and put into it three nails, pins or needles, with a little white salt, keeping the urine always warm. if you let it remain long in the bottle. it will endanger the witches life: for I have found by experience that they will be grievously tormented making their water with great difficulty. if any at all. and the more if the Moon be in Scorpio in Square or Opposition to his Significator, when its done" (Merrifield 1987:169).

20 Although the contents of witching bottles suggest that magic was practiced for "malevolent purposes," contemporary accounts often reveal that they were commonly nothing more than "countermeasures to witchcraft, with the purpose of saving the victim by throwing back the evil spell on the witch who cast it" (Merrifield 1987:167).
to bewitch an enemy (Noel-Hume 1958; Beebe 1980; Merrifield 1987). Additionally, pieces of cotton felt, shaped like hearts, have also been found pierced with brass pins and placed inside these stoneware jars (Merrifield 1987).

Two additional attributes of a heerdman bottle are the sprig-molded medallion that embellishes the grossly swollen body of the jug (described in greater detail below) and the maskaroon (mask) of the bearded man that appears on the vessel’s neck. Holmes (1951) has described stoneware masks as ranging from natural, with highly detailed facial structures and flowing hair, to animal-like, with sharp teeth and exaggerated mouths resembling those of lions. Holmes (1951) attempted to formulate a chronology of heerdman jugs based on sprig-molded designs, but Thwaite (1973) discounted the results, contending that the typology disregarded more important aspects of morphological detail. Thwaite (1973) suggested that additional research of German and Low Countries kiln sites, and of the documentation in English record houses, was necessary before an adequate chronology could be developed. His call for “further study” included “accurately stratified finds and...wrecks such as the Vergulde Draeck of 1655 and the Amsterdam of 1748” (Thwaite 1973:255).

Numerous Rhenish stoneware sherds have been recovered from the Monte Cristi “Pipe Wreck,” the majority of which were located in the southwestern corner of the site (Figure 46). During the 1991 and 1992 campaigns, when the excavation objective was to uncover and record the ship’s timbers, most of the fragments that were recovered were comparatively small body sherds found in or near the extant hull. In the following two seasons, however -- as the excavation moved toward the southwest “spill and drift” area -- bottle bases, handles, necks, and body sherds increased in both size and number with distance from the wreck. Still, no intact vessels have been found on the site, a testimony either to the violence of the wrecking process or to the successful attempts of later salvage divers and souvenir seekers.

A variety of masks decorated the stoneware bottles recovered from the “Pipe Wreck” (Figures 47 and 48). Variations in the mouths of these faces ranged from straight and segmented (Figure 47 and 48, A, F) to hour-glass shaped (Figure 48, B). Perhaps the most interesting of the masks is displayed by PW 1510 (Figure 48, E). This particular style remains unidentified in the comparative literature, but it resembles two artifacts recovered from the wreck of the Vergulde Draeck (Green 1977:98, 117, 127). The mouth of PW 1510 comprises

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21 The Vergulde Draeck sank in 1656, not 1655 (Green 1977).
22 Artifacts GT 846 and GT 837 from the wreck of the Vergulde Draeck bear U-shaped mouths with “three feline-like pads” (Green 1977:98).
Figure 46. Distribution of Rhenish stoneware sherds recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
Figure 47. Two views of PWA 429, a haardman jug neck sherd recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Illustration by Jerome Lynn Hall.
Figure 48. *Baardman* sherds recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. (A) PW 1253; (B) PW 809; (C) PW 2464; (D) PW 2381; (E) PW 1510; (F) PW 723. Illustrations by Jerome Lynn Hall.
three roundels, making it by far the most unnatural baardman mask recovered from the “Pipe Wreck.”

Medallions, most commonly comprising heraldic escutcheons or floral patterns, were the centerpiece of the baardman vessels. However, not all jugs with the bearded face on the neck bore an emblem on the belly (Green 1977). By the middle of the seventeenth century, both the mask and the medallion had begun to degenerate into more stylized forms, with the latter losing its heraldic significance (Holmes 1951; Noel-Hume 1938; Wingood 1982). These were replaced by meaningless decorations, likely the products of unskilled mold makers who found it easier to apply simple sprig-molded designs rather than invest the time necessary to reproduce a shield of arms. Some heraldry on stoneware vessels is unrecognizable, due entirely to the “ineptitude of the artisans” (van der Pijl-Ketel 1982:246).

Two complete and four partial stoneware medallions have been recovered from the Monte Cristi wrecksite. Although none has been positively identified or dated, each bears a familiar seventeenth-century motif. The most commonly encountered design was that of a soldier hoisting what appears to be either a drinking glass, a bell, or what Holmes (1951:175) has characterized as a “musket rest” (Figure 49, A. E. and F). 23 The soldier’s appearance is accentuated by a five-button doublet, slashed breeches, a rapier slung behind his hips, a feathered hat, and a small Vandyke beard. The figure also wears what Treolar (1972:175), referring to a similar image, described as “a cartwheel ruff of the late sixteenth century.” Five-petalled flowers or roses, identical to those found on stoneware jugs recovered from the wrecks of the Vergulde Draeck 24 (Green 1977), the Lastdrager (Green 1977), and the Batavie 25 (Stanbury 1974), are positioned on either side of the figure, at the level of his breeches.

Two stoneware bottles bearing a “sportsman” motif suggestive of the Monte Cristi soldier were recovered from English sites at Clare Market and Kingsway (Holmes 1951:175). Pictured in Plate XXIII (Figures a & b) of Holmes’ document, each has a baardman mask, but, unfortunately, the pieces are of poor quality and unsuitable for reproduction. Although barely visible, the figures can be seen extending both arms in the fashion of the Monte Cristi figure. States Holmes:

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23 Charles Fithian, Curator of Archaeology at the Delaware State Museum, viewed a single sherd sent to the author by Mr. Henry Taylor and described the object as a drinking glass.

24 See artifacts GT 087, GT 87, GT 755, GT 815, GT 817, GT 825, GT 826, GT 834, GT 835, GT 837, GT 846, and GT 868.

25 See artifacts BAT 353, BAT 602, BAT 2007, BAT 2010, and BAT 2240.
In each example the lower part of the medallion is occupied by lines depicting brickwork on which, among grass and flowers, stands a man wearing the doublet, breeches, and cartwheel ruff of the late sixteenth century and carrying a musket-rest in his left hand. On the Kingsway bottle the man is bareheaded, wears a rapier, and holds a matchlock in his right hand: the Clare Market man has neither sword nor gun, but war a broad-brimmed hat and triumphantly holds up the carcass of a barn-door cock (Holmes 1951:175).

Reference is made to another example, housed at the Guildhall Museum in Golden Lane, that exhibits the same "sportsman motif." and also has a beardman mask.

Brown (1979:36 and 74, Figure 162) presents a similar image described as a "full length figure dressed in slashed breeches and wearing a hat...a decorative star [appears] between his feet" (Figure 49, B). The figure resembles the Monte Cristi image with respect to the flat, angular hat, doublet, and breeches. Both images have hair flowing out from under their hats, and small, Vandyke beards. Both are set inside denticulate rings.

A tankard bearing three sprig-molded panels was excavated in Norwich, England (Norwich Survey 1981). Two of these panels depict bearded soldiers wearing breeches and wide-brimmed hats, a motif suggestive of the image on the Monte Cristi sherds (Figure 49, C, D) (Norwich Survey 1981).26 Both hold weapons in their hands: one a staff or lance, the other a broadsword, drawn and pointing downward. Each is standing against the backdrop of a highly stylized pastoral scene. Instead of being surrounded by a denticulate ring, as is the Monte Cristi figure, these two images are enclosed in what appear to be roped borders.

Numerous other stylized emblems appear as medallions on the Monte Cristi stoneware sherds. These include crowns, quartered arms, vertical pales, stylized roses, denticulate borders, spirals, and chevrons (Figure 50). Most appear to have no armorial significance and are therefore, purely decorative.

The English relied heavily on the Dutch carrying trade for the popular stoneware jugs, as attested to by Dr. Robert Plot who, in 1676, stated that Rhenish stoneware bottles had "hitherto been made only in Germany and by the Dutch brought over into England in great quantities" (as cited in Noël-Hume 1958:440). During the second quarter of the seventeenth century, and continuing up through 1660, few beardman containers were to be found. Thwaite (1973) attributes this to the Thirty Years War and the negative consequences it held for the Rhineland industries.

26 The tankard is described as having "Greyish-buff fabric, thin grey margins, unglazed greyish-yellow interior, thin semi-matt light brown glaze on exterior, three individual applique panels between pairs of cords, wire and stacking marks on base. 36SN" (Norwich Survey 1981:117).
Figure 49. Full-length human figures on Rhenish stoneware medallions. (A) The Monte Cristi soldier hoisting what appears to be a drinking glass, bell, or musket rest; this figure is a composite of artifacts E-I, illustrated by Alex Roberts. (B) After Brown (1979:36 and Figure 162, page 74); both (C) and (D) are from a single tankard, after the Norwich Survey (1981:117-118). Like the Monte Cristi image, each is bearded and wares breeches and a wide-brimmed hat. A botanical motif is visible in all of the backgrounds. No scale is available for Figures B-D, which were illustrated by Jerome Lynn Hall.
Figure 50. Rhenish stoneware medallion sherds recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Heraldic crest fragments (A) L 1723; (B) PWA 1482; (C) PW 3277; (D) PW 2569; (E) PW 1265; (F) PWA 1487; (G) PW 63. Illustrations by Jerome Lynn Hall, after field notes.
The Dutch Bottle

An intact stoneware jug was reported to have been raised from the Monte Cristi shipwreck in 1967 (Cruxent 1967:24). Referred to as a Vasi[a] de Gres (and called by the press a potiza de barro or clay pot), the jar is a classic salt-glazed baardman, gray with a cobalt glaze (Figure 51). The neck of the vessel features a bearded mask with the hourglass-shaped mouth, the rotund belly displays a medallion bearing the heraldic crest of the city of Amsterdam, characterized by three X’s arranged vertically beneath a crown. Rampant lions appear on either side of the armorial. The jar was most likely made during the middle of the seventeenth century (Cruxent 1967:26). Unfortunately, no one currently employed at the Museo de la Fortaleza Ozama in Santo Domingo knows anything of the vessel’s whereabouts. Since none of the sherds recovered thus far by PIMA researchers bear any of the spring-molded features present on this jug, its provenience must be regarded as suspect.

Similar baardman jugs bearing the Arms of Amsterdam have been recovered from the seventeenth-century Dutch shipwrecks Witte Leeuw (1613) (van de Pijl-Ketel 1982) and Vergulde Draeck (1656) (Green 1977). The latter artifact was ascribed a date of 1654. Additionally, such bottles have been recovered from Fort Orange. Schuyler Flatts, and the Van Buren Site, all of which were seventeenth-century Dutch-American settlements located in New York state (Wilcoxen 1987).

Tin-Glazed Earthenware

Tin-glazed earthenwares of both the white-glazed and the blue-and-white-glazed varieties were also excavated from the “Pipe Wreck” (Figures 52 and 53). Often referred to as delftware, this elegant ceramic type owes its pedigree and popularity to both Italian majolica and Chinese porcelain. The former was introduced to the United Provinces in the sixteenth century. When Chinese porcelain first gained inroads into Holland is uncertain, but dates of 1620 to 1640 are generally accepted. Roughly concurrent with the arrival of these artistic forms was the discovery of tin-oxide (SnO₂), an opacifier used in liquid slips. This additive produced wares that appeared much whiter than majolica. With such an ingredient platelbakkers, or specialized Dutch potters, were able to produce a ceramic ware that was more affordable than costly Chinese porcelain, yet resembled it in both whiteness and artistic motifs. These Dutch wares came to be known as faience (Wilcoxen 1987). Chinese motifs appear to have been even
Figure 51. An intact stoneware jug, reported to have been raised from the Monte Cristi shipwreck in 1967 (Cruxent 1967). Note the three X's arranged vertically in the center of the armorial design, the heraldic crest of the city of Amsterdam. Note also the hourglass-shaped mouth. No scale is available for these figures. Illustrations by Aida Bélen Rivera and Jerome Lynn Hall.
Figure 52. Distribution of tin-glazed white sherds recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
Figure 53. Distribution of tin-glazed blue-and-white sherds recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
more commonplace than scenes depicting Dutch daily life. The Wan-Li flower pattern, which emerged from the Ming Dynasty in China (1368 to 1644), was an especially popular design.

Tin-glazed earthenware was produced in all of southern and western Europe, but it appears that the Dutch became the true masters in the replication of Chinese porcelain. In their attempts to copy the large blue-and-white Wan-Li dishes of China, Dutch plateelbakkers acquired three important skills: first, they refined their wares to recapture the texture of porcelain; second, their designs became more delicate; and third, they covered both the obverse and reverse of their wares with tin-glaze which they decorated with patterns of the originals. In addition to the Wan Li flower, the contemporary bird-on-rock design and assorted floral patterns were also popular.

The majority of blue-and-white ceramic sherds recovered from the Monte Cristi shipwreck represent portions of bowls and plates and bear an array of artistic patterns including birds, insects, Wan-Li flowers and geometric designs (Figure 54). Artifact PW 3590, a tinglazed, tripod salt dish, is the most nearly intact ceramic piece yet recovered from the wrecksite (Figures 55 and 56). The design on the column body represents two human figures, apparently Chinese, standing in an evergreen forest: one of them is bending down; the other looks backward. The shallow salt bowl is decorated with a leaping fish or possibly a dolphin. Mountains are visible in the background. Additional sherds bearing Chinese figures were also recovered (Figure 54, G. H).

Conclusions

Stoneware and earthenware artifacts from the Monte Cristi shipwreck strongly reinforce the theory that the vessel sank sometime between 1642 and 1665. Rhenish stoneware storage jars, represented by numerous neck and body sherds bearing sprig-molded designs, are well documented on shipwrecks and colonial settlements contemporary with this suggested time frame.

Likewise, artistic patterns such as the Wan-Li flower, insects, birds, and Chinese human figures -- all found on the Monte Cristi sherds -- were characteristic decorations on tin-glazed earthenware ceramics during the seventeenth century. Thus, the presence of these designs in the Monte Cristi collection supports the prescribed time frame of 1642 to 1665. However, since such wares were manufactured at various centers throughout Holland and England, and were
Figure 54. Blue-and-white, tin-glazed earthenware sherds recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Stylized patterns include birds [(A) PWA 2240 and (B) PWA 2243], insects [(C) PWA 688, (D) PWA 791, (E) PWA 798, and (F) PWA 1065], and human (Chinese) figures [(G) PWA 742 and (H) PWA 2241]. Illustrations by Jerome Lynn Hall, taken from field notes.
Figure 54, continued. Stylized floral patterns [(I) PWA 490, (J) PWA 673, (K) PWA 674, (L) PWA 675, (M) PWA 2239, and (N) PW 3287]; a rim sherd with a mountain design [(O) PWA 671] a geometric design [(P) PW 672]; a portion of a house, boat, or pagoda [(Q) PWA 1048]; and a rim sherd with a pasture scene and possible insect [(R) PWA 1066]. Illustrations by Jerome Lynn Hall, taken from field notes.
Figure 55. A blue-and-white, tin-glazed ceramic salt dish with tripod base, recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Two Chinese figures are seen amid a forest panorama. The upper interior face bears a stylized fish or dolphin jumping over what appears to be a floral arrangement. Photo by Lillian Ray. Illustration by Jerome Lynn Hall, taken from field notes.
Figure 56. Detail of the forest panorama with human figures, from the ceramic salt dish recovered from the seventeenth-century northern European shipwreck in Monte Cristi Bay, Dominican Republic. Illustration by Jerome Lynn Hall.
popular at trade centers worldwide, they do little to indicate specific regions of origin or destination.

**METAL ARTIFACTS**

**Artifacts Associated with Lighting**

Of the artifact groups excavated from the Monte Cristi shipwreck, none has exhibited such variety of form and function as those used in lighting the seventeenth-century home. Several items have counterparts on contemporary terrestrial sites; some, such as the candlestick holder and the wick tweezers, are well documented from seventeenth-century shipwrecks. Copper-alloy artifacts associated with lighting suggest that a portion of the cargo carried aboard the Monte Cristi vessel was destined for affluent European settlers in the Americas.

**Chandelier Base or Top**

Two types of artifacts from the Monte Cristi shipwreck that remained unidentified for nearly a year were affiliated with lighting. Although the artistic record is replete with examples of chandeliers, relatively few comparative examples exist within the archaeological, historical, or artistic records. First published as a copper alloy instrument of undetermined function (Hall 1993), the chandelier base or top recovered during the 1992 season was initially thought to be a chronometer or navigational tool (Figure 57). This theory was based upon the dimpled numbers sequentially arranged on the artifact's two collars. Though this hypothesis has since been discarded, compare the similarities between the artifact and the upper portion of a cosmolabe. a short-lived sixteenth-century instrument invented by Jacques Besson (Figure 58, B) (Besson 1567; Randier 1980; Keller 1973).

The cosmolabe was employed in shipboard astronomical calculation, where it was mounted in front of a gimbaled chair, presumably aiding the ship’s navigator to determine latitude. However, its exact purpose and function remain unclear. Unfortunately, the instrument rapidly proved unsuccessful as a navigational device, calling into question the probability that one would be recovered from a seventeenth-century site. There is, however, no denying the similarities between the copper-alloy artifact and the tool depicted in the lithograph. Heart-shaped thumbscrews, bearing close resemblance to those on the lower portion of the cosmolabe.
Figure 57. Detail of the copper-alloy column, showing the hypothetical use of a candlestick holder and a supporting column arm. Note also the degraded column arm, below. Photo by Lillian Ray.
Figure 58. A copper-alloy column, thought to be a portion of a chandelier (A). Note the two collars bearing alternating teeth and notches. The cosmolabe (B), a sixteenth-century device supposedly used for celestial navigation. Copper-alloy finials (C, with centimeter scale) from the Monte Cristi shipwreck, perhaps portions of decorative thumbscrews such as those pictured on the cosmolabe. Illustrations by Jerome Lynn Hall with the exception of the cosmolabe, after Besson (1570:35).
were recovered during the 1991 campaign (Figure 58 C, D). This further supported the author's original, errant hypothesis.

Experts were consulted to verify or reject the proposition that the copper alloy column was a navigational tool (Appendix T). Although no consensus was reached concerning its function, most respondents were hesitant to identify it as a cosmolabe: opinions ranged from a globe chair (or stand) to a calculator.

As a result of these comments, the short-lived working hypothesis of a cosmolabe was tentatively abandoned in 1993. Not long thereafter, the author received a facsimile transmission from Alejandro Selmi Colominas, a participant on the 1991 Monte Cristi shipwreck excavation. Colominas suggested that the artifact was the terminus of a chandelier column. Accompanying his communication was an illustration showing how candle holder arms could be inserted into the notches: “a mi parecer es una lámpara de tipo araña muy utilizada en esa época en los países bajo” (“in my opinion it resembles a chandelier used during this time period in the low countries”) (Colominas, personal communication, 1993).

Heidi Miksch, Decorative Arts Conservator from the New York State Office of Parks, Recreation and Historic Preservation at Peebles Island, confirmed Colominas’ opinion.

According to Miksch, the practice of marking objects to be assembled with complementary “punches, notches, or stamped numbers” was common in the seventeenth century, a tradition that survived to the early part of this century27 (Miksch, personal communication, 1993). In fact, it was unusual for lighting devices not to have such stamps. Furthermore, every example Miksch could recall was of brass.

Convinced that this artifact was a chandelier column, Miksch predicted that candle arms with “wedge-like tongues” would eventually be found on the site (Miksch, personal communication, 1993). Several months later, Francis Tejeda, Director of the Fortaleza Ozama Conservation Laboratory in Santo Domingo, retrieved from the museum a small collection of artifacts that had been salvaged from the Monte Cristi shipwreck years earlier. Among these

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27 Accompanying Miksch’s letter were two slides of an early twentieth-century colonial revival rendition chandelier from the Schuyler Mansion in New York. The artifact is approximately 24 inches in length and, as with the Monte Cristi artifact, bears two horizontal rings or discs to which candle arms could be attached. The smaller set of arms were attached to the upper tier with the larger and more elaborate arms on the bottom. Punch marks are visible on the column and the corresponding marks on the tabs of the arms facilitated their insertion into the appropriate receptacle on the column.
items was a curved, brass ornament bearing a wedge-shaped base. It was similar to artifact PW 676 which was excavated from the southern end of the site in 1991, not far from where the chandelier column was later found. Originally, it was thought that this highly deteriorated artifact might have been part of a stamp used to impress wax seals with a symbol of personal identification. However, it was discovered that the flat surface of the base contained three small dimples that matched perfectly those on the upper ring of the copper-alloy column. Furthermore, the ornamental arm fit nicely into the column (see Figure 57), as Miksch had predicted, thus confirming that this set of artifacts represent part of a chandelier.

Pan Lamp Brackets

Two copper-alloy artifacts shaped like fish hooks, along with four fragments of same, were recovered from the southeastern portion of the site. Like the chandelier column, the identity of these artifacts baffled researchers for the better part of a year. When entire, or partial and bearing the tip, these artifacts resembled fish hooks or harpoons (Figure 59 A, C). Burt Webber, director of the salvage of the N.S. De La Pura Y Limpia Concepción, hypothesized that they were harpoons used for fishing (Webber, personal communication, 1992). Alternatively, when partial and possessing only the eye, they strongly resembled keys (Figure 59, B). Bob Coffey and Duke Long, who salvaged the Monte Cristi shipwreck in 1980 (see Chapter 1), recorded in their log entry for 23 February that they had found "...1 Key, 2 1/2", brass..." (Coffey 1980:7). This artifact may have actually been the eye and shank portions of a pan lamp bracket. Also known as staples or spindles, these items were used to suspend oil lamps from ceiling beams, chair backs, and fireplace stones (Hayward 1962, Perry 1969, Woodhead et al. 1984) (Figure 59, B). Pan lamps -- open, shallow vessels -- have changed little since early times; they were commonly filled with liquid fuels such as grease, fats, and oils (Woodhead et al. 1984). The hooked end of the bracket may well have been used to pull up a lamp wick, serving the same function as the tweezers described below (Hayward 1962). The eye at the opposite end accommodated a suspension pin from the oil lamp.28

28 For additional illustrations, see Hayward (1962), Baart et al. (1977) and Hebard (1983). See Woodhead et al. (1984:30, Figure 29) for a depiction of how this instrument works in concert with an oil lamp (original source for Figure 59, B). A two-piece assembly for suspending an oil lamp, artifact number PR89 6810-10, was recovered from excavations at Port Royal, Jamaica. The artifact is analogous to the pan lamp brackets from the Monte Cristi shipwreck.
Figure 59. PW 486, a pan lamp bracket recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic (A). Also known as staples, these instruments were used to suspend pan lamps (B). Partial brackets were thought to be portions of fish hooks or harpoons (C), and a key (D). Illustrations by Alex Roberts (A) and Jerome Lynn Hall (B-D). Pan lamp and bracket illustrations by Jerome Lynn Hall, after Woodhead et al. (1984:30, Figure 29).
Pan lamps have been recovered from the wreck of the *Zeewijk*, an eighteenth-century Dutch East Indiaman that sank off Western Australia (Ingleman-Sundberg 1977). Trifoil and square oil lamps have been recovered from the seventeenth-century settlement at Port Royal, Jamaica (Hamilton, personal communication, 1993). No pan lamps have yet been recovered at Monte Cristi, only the six brackets. Three of these excavated from grid square XIV, the remainder from squares IV, XIII, and XIX, all of which are tangential to grid XIV.

Candle Holders

A copper-alloy candle holder recovered at the close of the 1992 season was described by Francis Tejeda, Director of the Fortaleza Ozama Conservation Laboratory in Santo Domingo, as “the most beautiful candle holder ever recovered from a shipwreck in Dominican waters” (Tejeda, personal communication, 1993). Comparable artifacts are known from several seventeenth-century shipwrecks, including the *Campen* (Larn et al. 1974), the *Batavia* (Stanbury 1974), and the *Vergulde Draeck* (Green 1977). Additionally, they were found in quantity on the site of the *Slooter Hooge* (1724) (Green, as cited in Muckleroy 1980:127), as well as the submerged city of Port Royal (Hamilton, personal communication, 1993).

Wick Tweezers (Tongs)

Three pairs of copper-alloy tweezers, or tongs, of varying sizes were recovered in 1992, but remained unidentified until the 1993 study season. While *in situ* and covered by a thin layer of calcium carbonate, at least one pair resembled a Jew’s harp. After cleaning, it was thought that the artifact was part of a medical or grooming kit. A literature review of comparable artifacts, however, suggested that these were wick tweezers, instruments used for pulling up a lamp wick. One pair has a forked blade attached by a heavy wire (Figure 60).

A similar pair of tongs has been recovered from the Dutch East Indiaman *Hollandia* (1743) where they were identified as a wick trimmer. These were described as “consisting of a folded strip with a circular loop at the upper end and having both lower ends pointed” (Gawronski et al. 1992:429). Brass wick tweezers, nearly identical to those from the Monte Cristi wreck and dated between 1500 and 1600, are also known from the Museum Boymans Collection in Amsterdam, Netherlands. These also have a blade attached by a wire to the tweezers. Green (1977:197) described tongs and a “fork” from the wrecksite of the *Vergulde Draeck*, but there is no indication that the two were attached by a wire. Tongs similar to those
Figure 60. Wick tweezers recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. (A) PWA 1365, with a forked blade attached by a wire. (B) Detail of the wire used to attach the forked blade to the tweezers. Photo courtesy of PIMA archives.
recovered from the Monte Cristi shipwreck have also been excavated from colonial Jamestown (Cotter 1958).

Baart et al. (1977, as cited in Green 1977:197) suggest that the forked blade of a pair of tweezers recovered from excavations in Amsterdam may have been used for “loosening the hook when stuck in the mouth of the fish.” The wire loop at the end of the instrument is identified as a device for attaching the tool to a belt. This, however, was disputed by Green (1977:197), who suggested that it was “more likely associated with fire or smoking.” Presently, the function of the forked blade from the Monte Cristi shipwreck tweezers remains unidentified.

The Nested Weight Set

While surveying the “Pipe Wreck” in 1986, the author recovered a copper-alloy, nested weight set (Figure 61). This heavily corroded artifact was found resting atop a planking timber in grid square VIII, at the southern end of the wreck. In light of the highly disturbed nature of the site, it was unlikely that such an artifact, which was found sitting in plain view, was discovered in situ. Underwater, its appearance was that of a small rock, for that reason alone it may have been overlooked by divers who thought it part of the scattered ballast. Had it previously been moved, however, it is unimaginable that someone would not have known that it contained an item of solid brass or bronze. The weight of the concretion as well as its shape and deep blue-green patina were clues that it was a well-preserved artifact. More than likely, a salvor or souvenir-seeker recognized its value and, placing it aside while searching the wreck, simply overlooked it at dive’s end. While still covered with concretion, it was thought by Throckmorton to be a pocket sun-watch similar to those found on the wrecks of the Lastdrager (Stenuit 1974) and the Maidstone (de Maisonneuve 1992).

The design of the cup-shaped weights of the Monte Cristi collection indicates that they were manufactured in Nuremberg, Germany, sometime around the middle of the seventeenth century. It was during this period that the master coppersmiths of Nuremberg, “perhaps the most famous and sought after,” held a virtual monopoly across Europe on the production of nested weights (Turner 1980:143). Spain, England, and Holland were reliant on Nuremberg weights for their commercial practices for nearly 500 years, from 1375 to 1850 (Smith unpub. 1993). 29

29 Danforth (1988) extends this date to 1875.
Figure 61. The nested weight set recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each component weighs twice that of the one preceding it, with the exception of the smallest disk or end piece (A), which is equal to the first weight (B). The outer cup, or house (I), is highly degraded as a result of exposure to the marine environment. The lid (J), now detached, bears a V-shaped hinge element, as well as a portion of a locking device, all visible in profile (K). Illustrations by Alex Roberts.
In the fashion of brass nested weights manufactured in Nuremberg, the cup rims of the Monte Cristi set are flush, with the sides “slightly concave to ensure both a good fit and an easy release” (Danforth 1988:10). The set also follows the classic Nuremberg binary system, with each cup twice the weight of the one preceding it and nesting snugly inside the next larger cup. The collection comprises a small disk, seven interior cups, an outer cup known as the “house,” a lid, a portion of a hinge, and a partial clasping element. The smallest weight (Figure 61. A) or disk, is often referred to as the “endpiece,” and is described by Danforth (1988:9) as “a solid, flat-topped weight with sloping sides of the same degree as the cups.” Danforth (1988) further notes that it should weigh the same amount as the smallest cup weight; this is true for the Monte Cristi set. Because this artifact contains a disk, it is among the few complete sets in existence. The Edward Clark Streeter Collection (housed at Yale University Medical and Historical Library) includes 80 weight sets from Belgium, France, Germany, and Northern Italy; of these, only 18 are complete (Danforth 1988).

The exteriors of the fourth through eighth cups of the Monte Cristi set are all engraved with decorative concentric circles. At the bottom of each of the weights (excluding the outer cup) are deeply-grooved file prints, a trademark of Nuremberg manufacture. These marks suggest that each component was altered in order to bring it to standard, a process that simultaneously removed the external casting sprue (Smith unpub. 1993).

The outer or master cup of the Monte Cristi set has several small holes for the hinge and clasp that secured the lid. Visible atop the lid is the V-shaped hinge component that joined it to the outer cup, a portion of what was once a simple lock piece can be seen attached to the lid by two fasteners (now missing). Maker’s marks, usually the first letter of a country or city name, were often stamped into the lid of a set intended for export. Likewise, inspector’s marks, verifying the authenticity of a set of weights, were also punched into the lid (Danforth 1988). Unfortunately, as seen in Figure 61 (I), the lid of the Monte Cristi set is badly degraded and no sign of any identifying marks is present. Two large holes, designed for what was probably an elaborate set of decorated pillar-handles, are visible on the perimeter of the lid. The lid may well have been lavishly decorated, for seventeenth-century nested weight sets were often embellished with “cherubs, dolphins and elaborately carved lid hinges” (Smith unpub. 1993:72).

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10 A set that has all its original cups but is missing the small disk is considered incomplete (Danforth 1988).
A second weight set, supposedly recovered from the wreck in the early 1970s by the nephew of the current secretary for the Comisión de Rescate Arqueológico Submarino, was examined and measured by the author. No information was available concerning its provenance on the site; however, an additional V-shaped lid hinge was recovered by PIMA archaeologists from grid square XIV during the 1991 excavation. The two sets are similar in size, the number of weights, and the weight of each component. In fact, in its original form, the second set was probably identical to the one recovered by the author in 1986. Based on these attributes and the credible source providing the information, it is the author’s opinion that the weight set found in the 1970s was almost certainly removed from the “Pipe Wreck.”

The total weight of the set recovered in 1986 is 343.95 grams (Table 13); the set salvaged in the 1970s weighs 302.9 grams (Table 14). The original weight of each set (prior to exposure in seawater) was extrapolated to 450 grams by C. Wayne Smith (personal communication, 1990). Research Scientist at Texas A&M University. This information may indicate the standard to which these weight sets were calibrated. It is known that two German marks constituted a pound of 467 grams: the livre, or French pound, was equivalent to 489.5 grams. The English, however, employed two weight systems: the Troy pound of 373.2 grams, used to measure bullion, and the pound avoirdupois of 453 grams, generally used for weighing precious metals. It appears that the two weight sets recovered from the “Pipe Wreck,” although manufactured in Germany, were calibrated to the English pound avoirdupois.

It is not known if the weights were used for conducting the official business of the ship, or if they were trade goods. If carried as cargo, the fact that they were calibrated in the English pound avoirdupois suggests that they were destined for Anglo-American settlements, or entrepôts in contact with such communities.

31 The decision to include this weight set in this document, or to consider its association with the site, was difficult. Many people from the Monte Cristi area bring artifacts to the campsite, claiming that they were removed, many years previous, from the “Pipe Wreck.” Occasionally, these items do appear to have been removed from the site; most often, however, they are from one of the many wrecks within the area of Monte Cristi. PIMA has established a policy whereby artifacts are examined and then returned to the “owner” with little or no interest shown. This is to discourage anyone from tampering with the submerged archaeological sites during the off season. Occasionally, if there is strong evidence to indicate that an artifact was indeed removed from the wreck, then photographs and drawings are made and an interview is conducted.
Table 13. The nested weight set recovered in 1986 from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic.

<table>
<thead>
<tr>
<th>CUP</th>
<th>Top width (mm)</th>
<th>Bottom width (mm)</th>
<th>Wall width (mm)</th>
<th>Height (mm)</th>
<th>Weight (g)</th>
<th>Original weight (g)</th>
<th>Original weight (pounds/avoirdupois)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer cup</td>
<td>47.00</td>
<td>32.20</td>
<td>2.20</td>
<td>47.30</td>
<td>106.40</td>
<td>225.00</td>
<td>0.496 or 1/2 lb.</td>
</tr>
<tr>
<td>1</td>
<td>43.80</td>
<td>31.00</td>
<td>2.60</td>
<td>25.90</td>
<td>113.00</td>
<td>113.00</td>
<td>0.249 or 1/4 lb.</td>
</tr>
<tr>
<td>2</td>
<td>35.51</td>
<td>25.05</td>
<td>2.60</td>
<td>17.90</td>
<td>69.0</td>
<td>56.00</td>
<td>0.123 or 1/8 lb.</td>
</tr>
<tr>
<td>3</td>
<td>29.97</td>
<td>21.40</td>
<td>2.60</td>
<td>13.45</td>
<td>28.10</td>
<td>28.00</td>
<td>0.062 or 1/16 lb.</td>
</tr>
<tr>
<td>4</td>
<td>24.10</td>
<td>18.20</td>
<td>1.80</td>
<td>10.40</td>
<td>13.80</td>
<td>14.00</td>
<td>0.031 or 1/32 lb.</td>
</tr>
<tr>
<td>5</td>
<td>20.00</td>
<td>15.65</td>
<td>1.65</td>
<td>7.70</td>
<td>6.95</td>
<td>7.00</td>
<td>0.016 or 1/64 lb.</td>
</tr>
<tr>
<td>6</td>
<td>16.25</td>
<td>13.30</td>
<td>1.20</td>
<td>5.25</td>
<td>3.50</td>
<td>3.50</td>
<td>0.008 or 1/128 lb.</td>
</tr>
<tr>
<td>7</td>
<td>13.70</td>
<td>11.40</td>
<td>0.95</td>
<td>3.85</td>
<td>1.60</td>
<td>1.75</td>
<td>0.004 or 1/256 lb.</td>
</tr>
<tr>
<td>8</td>
<td>11.60</td>
<td>10.20</td>
<td>N.A.</td>
<td>2.35</td>
<td>1.60</td>
<td>1.75</td>
<td>0.004 or 1/256 lb.</td>
</tr>
</tbody>
</table>

Table 14. The nested weight set reputed to have been recovered ca. 1970 from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic.

<table>
<thead>
<tr>
<th>CUP</th>
<th>Top width (mm)</th>
<th>Bottom width (mm)</th>
<th>Wall width (mm)</th>
<th>Height (mm)</th>
<th>Weight (g)</th>
<th>Original weight (g)</th>
<th>Original weight (pounds/avoirdupois)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer cup</td>
<td>47.00</td>
<td>n.i</td>
<td>1.00</td>
<td>31.50</td>
<td>81.50</td>
<td>225.00</td>
<td>0.496 or 1/2 lb.</td>
</tr>
<tr>
<td>1</td>
<td>44.50</td>
<td>n.i</td>
<td>4.00</td>
<td>25.00</td>
<td>110.0</td>
<td>113.00</td>
<td>0.249 or 1/4 lb.</td>
</tr>
<tr>
<td>2</td>
<td>36.50</td>
<td>n.i</td>
<td>3.00</td>
<td>19.00</td>
<td>56.0</td>
<td>56.00</td>
<td>0.123 or 1/8 lb.</td>
</tr>
<tr>
<td>3</td>
<td>30.00</td>
<td>n.i</td>
<td>2.50</td>
<td>13.50</td>
<td>27.8</td>
<td>28.00</td>
<td>0.062 or 1/16 lb.</td>
</tr>
<tr>
<td>4</td>
<td>25.00</td>
<td>n.i</td>
<td>2.00</td>
<td>10.00</td>
<td>13.8</td>
<td>14.00</td>
<td>0.031 or 1/32 lb.</td>
</tr>
<tr>
<td>5</td>
<td>20.50</td>
<td>n.i</td>
<td>2.00</td>
<td>7.50</td>
<td>6.9</td>
<td>7.00</td>
<td>0.016 or 1/64 lb.</td>
</tr>
<tr>
<td>6</td>
<td>16.50</td>
<td>n.i</td>
<td>1.50</td>
<td>6.00</td>
<td>3.4</td>
<td>3.50</td>
<td>0.008 or 1/128 lb.</td>
</tr>
<tr>
<td>7</td>
<td>14.00</td>
<td>n.i</td>
<td>1.00</td>
<td>4.00</td>
<td>1.7</td>
<td>1.75</td>
<td>0.004 or 1/256 lb.</td>
</tr>
<tr>
<td>8</td>
<td>11.0</td>
<td>n.i</td>
<td>1.00</td>
<td>2.00</td>
<td>1.8</td>
<td>1.75</td>
<td>0.004 or 1/256 lb.</td>
</tr>
</tbody>
</table>
Components of nested weights similar to the two sets recovered at Monte Cristi are known from the Sea Venture (Adams 1985; Wingood 1986), the Batavia (Stanbury 1974), the Maidstone (de Maisonneuve 1992), the Whydah (Hamilton and Binders 1992), and an unidentified galleon that sank off the coast of Bermuda (The Illustrated London News, 21 January 1956). Nested sets have also been recovered from the submerged city of Port Royal, Jamaica (Marx 1968b; Smith unpub. 1993).

Small Copper-Alloy Artifacts

Numerous small yet noteworthy copper-alloy artifacts were found scattered about the wreck (Figure 62). Although many of these were most likely intended for European-American colonies, similar pieces have also been found on Native American sites.

Thimbles

In addition to the single "gold-washed thimble" recovered by Throckmorton in 1986 (Throckmorton, unpub. 1986; see Table 1 and Figure 61), three partial, copper-alloy thimbles have been raised by the PIMA team since 1991. These were excavated from the southern portion of the site, spread across grid squares I and II: an additional iron fragment, thought possibly to represent a thimble, was recovered from the eastern side of the keel in grid square XV.

Brass thimbles have been recovered from the remains of the Kennemerland (Price and Muckleroy 1977) and the Sacramento (Pernambucano 1979), both seventeenth-century vessels, as well as from a mid-sixteenth-century wreck in the Seychelles (Blake and Green 1986).

Thimbles may have been carried as trade goods, or as part of the crew's personal gear. Correspondence from Fort Amsterdam on Curaçao not only itemizes thimbles as cargo aboard a ship, but also relates their relative trade value during the seventeenth century: an account by Mrs. Joshua and Mordakay Emriches, dated to the "first of the month of January, 1656," listed "100 thimbles that cost...a 150 lb. sack of sugar a hundred. That comes to be a one and one-half lb. sack of sugar per thimble" (RLC 1 January 1656).
Figure 62. Distribution of small copper-alloy artifacts recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
Tacks

Fifty-six copper-alloy tacks were recovered during the 1991 to 1994 field campaigns (see Figure 62), adding to the collection salvaged by the Long and Coffey expedition (see Table 1). Tack head diameters were clustered in four groups: 0.8 cm, 1.2 cm, 1.8 to 2.0 cm, and 2.4 cm. Like many of the artifacts recovered from this site, tacks were probably intended for colonial households and assorted industries rather than for use aboard ship.

Copper tacks excavated from the herring works in Maine were associated with furnaces and were most likely used to attach leather bellows to wooden frames (Faulkner 1986). As furniture tacks, they were used to attach leather coverings to the wooden frames of chairs or divans, adding a special decorative flair to the finished product. Archaeological evidence from the seventeenth-century Jamestown settlement suggests that tacks were used both in the manufacture of furniture and to attach interior liners in coffins. They were also used to form letters on coffin plates (Cotter 1994).

Curtain Rings

Six small rings, identified by Charles Fithian of the Delaware State Museum as curtain rings, were excavated from the site of the “Pipe Wreck” between 1991 and 1994. Five of these were recovered from the northern end of the site (grid squares XII and XVII), one was found in grid square II (see Figure 62). An additional dozen are indicated in grid square 37 of Long’s 1980 site plan (see Figure 10), corresponding to grid X on the PIMA plan.

During the seventeenth century, rings such as these were used in colonial households to suspend curtains from windows and beds (Fithian, personal communication, 1993; Wilcoxen 1984). Curtain rings are not common to seventeenth-century archaeological sites, but a few have been recovered; Fithian is quick to state that “at the present time no analysis of this artifact group exists in any archeological publication” (personal communication, 1993). Furthermore, he notes that “even if found, they frequently go unrecognized” (Fithian, personal communication, 1993).

The Monte Cristi curtain rings are circular with an external diameter that ranges between 2.2 and 2.6 cm (Table 15). These compare well with 17 rings from St. Mary’s City, Maryland, whose measurements range from 2.3 to 2.8 cm in diameter (Table 16). Like the St. Mary’s artifacts, those from the Monte Cristi shipwreck were manufactured by casting in a two-
Table 15. Copper-alloy rings recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic.

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Provenance</th>
<th>External diameter in cm</th>
<th>Internal diameter in cm</th>
<th>Thickness in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>PW 35</td>
<td>XIIc 61. 110</td>
<td>2.50</td>
<td>2.00</td>
<td>0.20</td>
</tr>
<tr>
<td>PW 76</td>
<td>IIc</td>
<td>2.40</td>
<td>n.i.</td>
<td>n.i.</td>
</tr>
<tr>
<td>PW 495</td>
<td>XVIIa 95. 20</td>
<td>2.60</td>
<td>n.i.</td>
<td>0.16</td>
</tr>
<tr>
<td>PW 547</td>
<td>XIIc 70. 180</td>
<td>2.45</td>
<td>2.10</td>
<td>0.18</td>
</tr>
<tr>
<td>PW 562b</td>
<td>XIIc 70. 180</td>
<td>2.60</td>
<td>2.20</td>
<td>0.20</td>
</tr>
<tr>
<td>PW 660</td>
<td>XIIID</td>
<td>2.20</td>
<td>2.00</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Table 16. Curtain rings recovered from the St. John's and Smith's Townlands Site, Delaware (Courtesy of Charles Fithian).

<table>
<thead>
<tr>
<th>Artifact</th>
<th>External diameter in cm</th>
<th>Internal diameter in cm</th>
<th>Thickness in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST1-23-8B/RQ</td>
<td>2.56</td>
<td>1.94</td>
<td>0.25</td>
</tr>
<tr>
<td>ST1-23-1A/6B</td>
<td>2.75</td>
<td>2.12</td>
<td>0.32</td>
</tr>
<tr>
<td>ST1-23-30D/LK</td>
<td>2.66</td>
<td>2.03</td>
<td>0.27</td>
</tr>
<tr>
<td>ST1-23-80G/JE</td>
<td>2.36</td>
<td>1.85</td>
<td>0.20</td>
</tr>
<tr>
<td>ST1-23-80H/UJ</td>
<td>2.42</td>
<td>1.87</td>
<td>0.23</td>
</tr>
<tr>
<td>ST1-23-11M/AT</td>
<td>2.83</td>
<td>2.23</td>
<td>0.23</td>
</tr>
<tr>
<td>ST1-23-17/MK</td>
<td>2.61</td>
<td>2.00</td>
<td>0.29</td>
</tr>
<tr>
<td>ST1-23-50P/DXR</td>
<td>2.54</td>
<td>2.07</td>
<td>0.37</td>
</tr>
<tr>
<td>ST1-23-2A/DHN</td>
<td>2.52</td>
<td>1.98</td>
<td>0.20</td>
</tr>
<tr>
<td>ST1-23-5/AAH</td>
<td>2.52</td>
<td>2.00</td>
<td>0.22</td>
</tr>
<tr>
<td>ST1-23-3A/UX</td>
<td>2.57</td>
<td>2.00</td>
<td>0.29</td>
</tr>
<tr>
<td>ST1-23-30/BBQ</td>
<td>2.73</td>
<td>2.23</td>
<td>0.25</td>
</tr>
<tr>
<td>ST1-23-SA/BEA</td>
<td>2.46</td>
<td>1.83</td>
<td>0.20</td>
</tr>
<tr>
<td>ST1-23-12/APV</td>
<td>2.66</td>
<td>2.22</td>
<td>0.17</td>
</tr>
<tr>
<td>ST1-13-2127D</td>
<td>2.71</td>
<td>2.00</td>
<td>0.35</td>
</tr>
<tr>
<td>ST1-13-2549F/AD</td>
<td>2.33</td>
<td>1.70</td>
<td>0.21</td>
</tr>
<tr>
<td>ST1-13-2549F/AE</td>
<td>2.34</td>
<td>1.70</td>
<td>0.20</td>
</tr>
</tbody>
</table>
piece mold. This is indicated by sprue scars on some of the rings, and by a casting flash, a small seam or ridge that appears when the mold is improperly closed and molten metal is allowed to seep out. Fithian concluded that

the most significant finding [in the study of the St. Mary’s rings] is the lack of functional variability. The uniformity of the dimensions suggests that bed hangings and window hangings did not have rings specific to their respective functions. One ring form sufficed for both (Fithian, personal communication, 1993).

Additional sites where similar rings have been found include the Burr’s Hill Site, dating from 1655 to 1676 (Gibson 1980), the John Hicks’ Site in St. Mary’s City, dating from ca. 1720 to 1740 (Carr et al. 1971, as cited in Fithian, personal communication, 1993), and the King’s Reach Plantation in Maryland, with an occupation date of 1690 to 1715 (Pogue 1990). Like the copper-alloy artifacts associated with lighting and the blue-and-white earthenware ceramics described above, these rings were likely intended for upper class European-Americans who could afford luxury goods such as valences and curtains.

**Straight Pins**

A total of 14 copper-alloy straight pins, probably made from brass, were recovered from the wrecksite. The majority of these were excavated from the northeastern corner of the extant hull, in grid squares XII and XVII (see Figure 62), where they were often found between planking seams, or at the junction of a frame and bottom plank.

The manufacture of brass pins was a cottage industry during the fourteenth and fifteenth centuries; by the sixteenth century, however, specialized workshops began to appear. The typical brass pin of the seventeenth century had a spiral head, formed by twisting a piece of brass wire two or three times and attaching it to the pin. The pins from the “Pipe Wreck” were produced in this fashion. The spiral-headed design was replaced in the next century with a simple flat head (Baart et al. 1977). Thus, the style of the brass pins from the Monte Cristi vessel further indicates its origin in the seventeenth century.

Large and small bronze pins were recovered in large quantities from the excavations at Jamestown. Cotter (1994) suggests that the small variety was used for hand and needle work, while larger pins served as clothes fasteners. Copper-alloy pins are common components of seventeenth-century shipwrecks as evidenced by the *Sea Venture* (Wingood 1986), the
Lastdrager (Green 1977), and the Whydah (Hamilton 1992). McBride et al. (1972) assert that hand-made, spiral-headed, brass pins were one of the most common items recovered from a late seventeenth-century merchant shipwreck off Mullion Cove, Cornwall. At this site, the pins were packed in casks; the same may have been true aboard the Monte Cristi vessel.

Flushloop Bell

A single, small, copper-alloy bell (Figure 63. A) was recovered from grid square VI in the southern portion of the site (see Figure 62). Although bells of this type are commonly referred to as hawk's bells and jingle bells, the correct designation is flushloop bell. The name originates with the method used to manufacture the bell: two sheet-brass hemispheres are soldered or brazed "flush" against each other. The upper portion of such a bell contains an attachment loop that allows for suspension. The two ends of this suspension loop were generally pushed through an opening in the top of the bell and then separated. Solder was used to attach the loop to the upper half of the bell. The lower half has an opening consisting of two holes connected by a slit. A small pellet, most often made of iron, served as a clapper. It appears that the clapper of the Monte Cristi bell was either frozen onto the interior of the bell or, if made of iron, likely deteriorated quickly after deposition in salt water.

Since European contact with the New World at the close of the fifteenth century, bells such as flushloops formed a staple in European trade with Native Americans (Brown 1980). Bells held a spiritual and often ceremonial significance for Native Americans; they were worn into battle, attached to war pipes, and were associated with various dances. Worn as body adornments, they were placed on the ears and around the neck, waist, knees, and ankles. As grave goods in Native American burials, they adorned the deceased as pendants or necklaces and are often found in association with copper or glass beads, as well as thimbles. Thus, the Monte Cristi flushloop bell may have been carried as a trade item for the Native American market.

Book Clasp

A copper-alloy artifact, tentatively identified as a book clasp (see Figure 63. B. C), was recovered from grid square VIII at the southern end of the site (see Figure 62). The thin brass sheet has a small hook at one end. The obverse is decorated with a series of thinly incised lines
Figure 63. The flushloop bell (A) and hook clasp (B, C) recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Photos courtesy of PIMA archives.
that run diagonally across the upper portion: a series of near-vertical rays adorn the panel immediately beneath. Two small rivets are also visible. Comparable artifacts have been recovered from excavations at Amsterdam (Baart et al. 1977). The function of this item is still under investigation.

**Dividers**

A single pair of copper-alloy navigational dividers, used for measuring distances on maps and sea charts, was recovered from grid square VI of the Monte Cristi shipwreck (see Figure 62). During the seventeenth-century, these instruments were most often made of brass, and fitted with attachable iron points. Such points were not recovered from the copper-alloy frame of the Monte Cristi dividers, probably because iron quickly deteriorates in salt water. Although conserved, the Monte Cristi dividers remain frozen in the closed position due to their highly degraded state. These items were, and are still today, essential components of a sailor’s kit. The dividers may have been a trade item, but it is more likely that they were used aboard the ship.

**Silver Coins**

At least 27 coins were excavated from the “Pipe Wreck” during the 1991 and 1992 seasons; some of these are considered uncommon and one is classified as extremely rare (Appendix U). The majority comprised silver *ocho reales*, or pieces of eight, recovered from the central and southern portions of the site; two, however, were found in the northern grid squares XVI and XVII (Figure 64). The late Henry M. Taylor (see Chapter I) conducted the preliminary analysis of these coins and concluded that at least two Spanish New World mints were represented as centers of production.

The first Spanish silver coins -- issued as pieces of eight, four, two, one, and one-half -- were crudely struck cobs cut from silver bars and flattened to an appropriate thickness. Between 1535 and 1729, Spanish mints were ordered to produce reales with a purity of 93.051%. It was technologically possible to achieve a level of 99.99%, but coins this pure were too soft for circulation. To achieve a lower purity, soft metals such as copper, tin, and zinc were added. Cobs were trimmed with shears to the correct weight, then placed between dies and stamped. Although the coins differed in shape, each was of standard weight and purity. As a guarantee,
Figure 64. Distribution of coins recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
an assayer placed an identifying mint mark and his own personal stamp — usually an initial — on each coin.

The standard Spanish ocho reales was characterized by the Arms of the Great European houses emblazoned on its obverse (Figure 65). This symbol, commissioned to be struck in various New and Old World mints, declared the king’s dominion in Castile, Leon, Aragon, Naples, Sicily, Austria, the Spanish Netherlands, Burgundy, Brabant, Flanders, Tyrol, and Grenada. The words *PHILLIPVS • IIII • D • G • + •*, or “Philip IV, by the grace of God,” were stamped around the periphery of the coin. The reverse of the cob bore the Jerusalem cross, surrounded by the date of manufacture and the words *REX • HISPANIARVM • ET • INDIARVM*, or “King of Spain and India,” the latter a reference to the East and West Indies. Since coin blanks were generally smaller than the dies, it was uncommon for more than half of the die design to impress the silver. Thus few ocho reales — and none of the Monte Cristi cobs — maintain a visible date.

Little remains of the inscriptions from the Monte Cristi reales, and so Taylor had to rely on small but important emblematic clues to identify the mints of origin. Luckily, this evidence was sufficient to establish a *terminus post quem* that supersedes previous dates suggested by the clay pipes (1630) and the hull timbers (1642). Among the reales recovered from the Monte Cristi shipwreck that bore discernible identifying marks, six were from the Potosi mint in Peru (now a part of Bolivia). One, however, is known to have been produced at the Santa Fe de Bogotá mint in Columbia.

**Potosi Coins**

Silver coin production in the Americas began at the Mexico City mint in 1536; however, it was the accidental discovery of silver ore at Potosi that “transformed the nature of the Spanish Empire in the New World” (Walton 1994:37). The town of Potosi was founded in 1546, two years after the discovery of silver by a Native American llama herder. Spanish treasury agents were dispatched in 1556 and the mint at Potosi was established 19 years later. The town that sprang up around the richest silver deposit ever discovered in the Americas comprised “80 churches...14 dance halls...36 gambling houses...700 professional gamblers...and 120 prostitutes” (Menzel 1992:50). So prosperous was the mint that the town was christened Villa Imperial in honor of its wealth. By 1611, Potosi boasted a population of 160,000 inhabitants.
Figure 65. The Arms of the Great European Houses as they appear on the obverse of Spanish silver coins. In the small engrailment between the first and second quarters lies a pomegranate, the symbol of Granada. Below the pomegranate is the escutcheon of pretense, with the Arms of Flanders (rampant lion, dexter) and Tyrol (imperial eagle, sinister). Illustration by Amilcar García Torres, after Green (1977:294).
making it the largest city in the New World and "larger than most contemporary European cities" (Murray 1986:2477).

A scandal, rooted in "loose conscience along with the rising cost of extracting and refining silver," was to befall the Potosí mint at the end of the first half of the seventeenth century (Menzel 1992:50). Silver used to manufacture reales was found to be adulterated with copper or iron. By Royal Decree, silver coins were to contain 93.055% silver and 6.9444% copper (Taylor, personal communication, 1995). For years, the governments of Europe, as well as assayers from the Lima mint, had complained to the Spanish King that silver currency used to settle continental debt was of inferior quality. However, royal response to the situation was slow. Tests conducted in Seville in 1626 indicated that large quantities of copper and "other impurities" were used as contaminants at the Potosí mint, accounting for between 25 and 50% of the total volume (Taylor, personal communication, 1995). In 1644, the Peruvian Viceroy, Marques de Manexera, noted "fraud and malfeasance" at Potosí, but accusations were summarily dismissed for economic reasons: an investigation of such impropriety could shut down the mint, or at least seriously interrupt the flow of silver to Spain (Menzel 1992:55).

In November, 1647, Dr. Francisco de Nestares Marin was appointed to lead the inquisition that would eventually bring credibility to the mint. He arrived at Potosí in December, 1648; his investigation to root out the corruption commenced early the following year with the summons of the royal assayers. Nestares' inquest resulted in disciplinary action for 80 persons. The Potosí magistrate was expelled; the mint treasurer was expelled and fined. Two former treasurers were executed. The mayor of Potosí as well as a former mint assayer were fined hefty sums and later executed for their parts in the scandal. Moreover, all Potosí coins in circulation were to be devalued: those made between 1649 and 1651 were devalued from eight to seven-and-a-half reales and counterstamped with one of at least 23 marks (Appendix V); those made prior to 1649 were marked down to six reales but were not counterstamped.

Three of the Monte Cristi coins bear a counterstamp randomly pressed into the reverse (Figure 66). This emblem, originally comprising a crown placed above a letter or symbol, was a Royal Treasury house counterstamp. Of greater interest is the obverse of artifact PW 923a, an ocho reales from the Potosí mint. Although poorly preserved, this coin exhibits a small Ø that appears barely visible to the right of the Great Shield (Figure 67). The mark is that of Juan Rodriguez de Roas, a Spaniard brought to the Potosí mint in 1649. Rodriguez served as the
Figure 66. Two of three ocho reales bearing counterstamps from the Potosí mint, recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. (A) PW 923, (B) PW 422. Photos by Jillian Nelson.
Figure 67. PW 788a, a silver *ocho reales* coin from the Potosí mint bearing the assayer's mark of Juan Rodriguez de Roas, recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic.
chief assayer for two years, until he was replaced by Antonio Ergueta (assayer's mark E) in 1651. Counterstamped coins from the Potosí mint suggest that the Monte Cristi vessel could not have sunk prior to 1649. This decreases the temporal window from 35 years (1630 to 1665, based upon known dates for pipe manufacture) to 16 years (1649 to 1665).

Three ocho reales bearing Rodriguez’ counterstamp were found on the wreck of the Nuestra Señora de Las Maravillas, which sank off the Bahama Islands in 1656 (Taylor, personal communication, 1995). Counterstamped coins have been recovered from several other shipwrecks as well, including the Vergulde Draeck, which sank off Australia, also in 1656. A Spanish shipwreck believed to have foundered on Chanduy Reef, Ecuador, in 1654, has produced counterstamped coins from the Potosí mint, as has a Spanish wreck at Jupiter Inlet, Florida.32

The Santa Fe de Bogotá Coin

The Santa Fe mint was founded by D. Alvaro Turillo in 1622, under the reign of Philip IV. The mint adopted as its symbol the letters "N.R."signifying Nuevo Reino, or the new kingdom of Granada; a small pomegranate or granada was also placed on the obverse of each cob. Silver coins from Santa Fe are considered rare, as they were struck from silver acquired through the refinement of gold, the principal export from this region. Unlike the Potosí mint, historical records show no evidence of fraud at Santa Fe. However, the scandal at Potosí so upset the Spanish New World operation that the Jerusalem cross emblem was replaced with a pillar design on cobs issued at both Santa Fe and Cartagena after 1651. The motif was meant to invoke the Pillars of Hercules and symbolized the gate between the Old and New Worlds through Gibraltar. Rolling ocean waves beneath the pillars depict the junction of the Mediterranean Sea and the open Atlantic (Taylor, personal communication, 1992).

32 The Spanish vessel whose remains were salvaged at Jupiter Inlet, Florida, is believed to have sunk between late 1659 and 1660. This provisional conclusion, formulated by Dominic Addario, Jr., Project Director and Principal Investigator, was predicated on a study of numerous silver coins that were recovered. A single coin, found approximately 150 feet (45.72 m) from the original coin scatter, was a counterstamped cob from the Potosí mint, therefore dating between 1649 and 1651 (Addario, personal communication, 1995). It is theorized that the single artifact may have belonged "to a different sample or private holder." The former alternative is a suggestion that the coin was intrusive from the site of the N.S. Maravillas (Addario, personal communication, 1995).
A single silver *ocho reales* (PW 788b) from the Santa Fe de Bogotá mint in Colombia was recovered from the Monte Cristi “Pipe Wreck” (Figure 68). The obverse of PW 788b bears the shield of Castile and Leon, represented by the quartered castles and lions. A small triangle bearing the pomegranate of Granada pushes its way into quarters three and four. To the right of the shield is a group of five circles, arranged in a small rosette. The reverse, although heavily pitted and in extremely poor condition, bears the faint image of the two Pillars of Hercules, indicating it was manufactured sometime after 1651. Thus, PW 788b suggests the *terminus post quem* for the Monte Cristi shipwreck, reestablishing the previous date of 1649 (based upon Potosí counterstamped coins) to at least 1651, and more probably 1652. After analyzing the entire sample of Monte Cristi coins, Taylor’s provisional conclusion was that the vessel sank “no earlier than 1651...[and] probably in the period 1652 to 1654” (Taylor, personal communication, 1992).

**Lead Artifacts**

Numerous lead artifacts, the majority of which comprised fragments or small globules of melted “splatter,” were recovered from the site (Figure 69). These include lead shot, several pieces of a lead container, a patch or “tingle” with nail holes, and a flat sheet fragment with what appear to be the letters OVE scratched into the surface.

Twenty-six musket balls, ranging in diameter from 1.191 cm to 1.83 cm, were excavated between 1991 and 1994 (Appendix W). These were measured with a Pickett decimal circles template (#1206) to determine diameter. A Mettler P1000 electronic scale was used to determine weight. Artifact PWA 379 ranges between 11.112 and 11.906 cm in diameter. Most of the Monte Cristi shot have retained the sprue line and occasionally a clip mark. There is evidence to suggest that sailors aboard the Monte Cristi vessel were casting shot: in addition to the small pieces of melted lead splatter, artifact PWA 55 comprised two musket balls joined by a thick sprue ribbon. The diameter of each of these shot was 18.256 cm, with a compound weight (including the sprue ribbon) of 73.43 g. This suggests that the balls were cast in a “gang mold” that permitted several shot to be cast at once. Excavations at Fort Pentagoet, Maine (1635 to 1654), produced five lead balls still attached to the sprue (Faulkner 1986). Some of the lead balls recovered from Fort Pentagoet, however, were apparently cast individually in pliers-type molds.
Figure 68. The obverse of artifact PW 788b, a silver *ocho reales* from the Santa Fe de Bogotá mint, recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Note the VIII to the left of the shield, the rosette to the right, and the Arms of Granada (pomegranate) between quarters three and four. Photo by Jillian Nelson.
Figure 69. Distribution of lead (Pb) artifacts, recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
Analysis of the lead shot is of little help in establishing a date range for the demise of the Monte Cristi vessel. since size (diameter) was fairly consistent from the seventeenth to the nineteenth centuries. However, this single parameter is useful in identifying a weapon type from which the lead balls would be fired. According to the classification scheme presented by McBride et al. (1975), shot from the Monte Cristi shipwreck were intended for use in flintlock pistols (1.2 to 1.3 cm in diameter), carbines (1.6 cm in diameter), calivers (1.6 cm in diameter), and musketoons (1.8 cm in diameter) (Clifford unpub. 1993:132; McBride et al. 1975:248; McBride 1976:194). The lead balls recovered from the “Pipe Wreck” compare well with shot from contemporary shipwreck sites, as well as those from the eighteenth century (Appendix X).

Kettles

Two kettles, or three-legged caldrons, have been recovered from the site since 1992 (Figure 70). Reports from the Coffey and Long expedition (see Chapter I) indicate that four were removed in 1980, bringing to six the total discovered to date (see Figure 10). Currently, these artifacts are undergoing electrolytic reduction in the Fortaleza Ozama Conservation Laboratory in Santo Domingo.

Throughout the seventeenth century, kettles were prized articles in the colonial household as an all-purpose kitchen utensil used for roasting, boiling, and baking. They were also carried aboard sailing ships for use in the galley. Furthermore, they were preferred trade items: Native Americans used them as a medium of exchange, as well as a source of metal from which to manufacture other items, such as bells and trinkets, knives, spoons, and tubular beads. Kettles were manufactured from cast iron, copper, and brass. The value of kettles in seventeenth-century Dutch and Native American trade is seen in the minutes of an extraordinary court session held at Fort Orange on Friday, 17 July 1654. Sander Leendersten and Rutger Jacobsz offered 11 fathoms of seewant, four kettles, seven axes, and two pounds of powder as presents to pacify the Maquas (Fort Orange Court Minutes 17 July 1654:154). Like European-Americans, Native Americans used kettles in food preparation, often preferring them over ceramic vessels, presumably for their durability (Wray and Schoff 1953:58). Unlike Europeans, Native Americans apparently attached ceremonial significance to kettles, since they commonly appear in burials and often cover the head of the deceased.
Figure 70. Two divers from the Comisión de Rescate Arqueológico Submarino raise a cast-iron, three-legged kettle from the site of the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Photo by Pedro Borrell Bentz.
Pewter Bottle Tops

The Monte Cristi wreck site yielded a pewter screw top from a glass bottle. Similar bottle tops were frequently found on the seventeenth-century wrecks of the Batavia (Stanbury 1974) and the Vergulde Draeck (Green 1977).

GLASS ARTIFACTS

Numerous colored glass shards and black glass beads were recovered from the Monte Cristi “Pipe Wreck” during the 1991 and 1992 field seasons (Figure 71). These artifacts give clues concerning the destination of the ship’s cargo, and offer a suggestion about the ship’s demise.

Glass Shards

Glass shards excavated from the “Pipe Wreck” range in color from clear to green to black. They represent several vessel types, including fluted Venetian crystal ware. Most likely, the shards come from façan-de-Venice drinking glasses, reminiscent of vessels from Dutch and Flemish seventeenth-century still-life paintings. However, they might be the remains of fluted perfume bottles or flasks, also popular Italian-manufactured items during the seventeenth century. Some green glass shards have been identified as portions of square-paneled case bottles. According to Huey (personal communication. 1993), such bottles were recovered from the excavations at Fort Orange, New York, and “are typical of seventeenth-century Dutch sites.” Huey further noted that such bottles often had pewter screw tops, such as the one recovered found at Monte Cristi (see above).

A clear stem-fragment, described as “very fine, clear, hard, crystalline cristallo…and therefore, probably Venetian,” was examined under an ultraviolet light to determine if the glass contained lead: it did not (Huey, personal communication. 1993). Leaded glass came into use after 1690, and thus the absence of lead from this sample suggests a terminus ante quem for the vessel at Monte Cristi. Huey noted that beaker fragments of this same type of glass were recovered from excavations at Fort Orange, New York; a wine glass stem fragment found in the Van Doesburgh House was virtually identical in shape and size to the Monte Cristi piece. However, the Fort Orange material was pale green-yellow and not of the “fine quality of the Monte Cristi specimen” (Huey, personal communication. 1993).
Figure 71. Distribution of glass, recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
A small lump of smooth, green glass was also sent to Huey for classification. The artifact resembled a third of a marble and the author thought it was a degraded roemer print. Huey hesitantly acknowledged that it might at one time have been a print, but suggested that it might simply represent "a piece of melted glass such as might be found at a glass factory site" (Huey, personal communication, 1993).

Glass Beads

Approximately 700 glass beads, colored black with a lavender tint, were recovered from the site. They were classified by Karlis Karklins, Senior Material Culture Researcher at Parks Canada, as Kidd’s Type Ila6 and Ila7, a round to circular black bead (Karklins, personal communication with Carroll, 1994; see also Kidd and Kidd, 1983: 228, 238; reprinted from Kidd and Kidd 1970:45-89). Glass beads, and particularly those of this type, are frequently recovered from New World sites. They may have been carried for trade with Native North Americans. As with funnel elbow-angled pipes (discussed above), European goods often had little intrinsic value to Europeans, but assumed forms familiar and attractive to Native Americans, and were therefore produced specifically for this market.

Indians drew an association between native, symbolically-charged materials such as exotic stones, shell, crystal or quartz, and native copper, and the introduced but isomorphic European glass beads.... It was this view of European goods by Indians that made trade not only possible, but acceptable (George Harrell, as cited by Starna 1991:23).

During the seventeenth century, several methods were used for manufacturing glass beads. Drawn beads -- the type represented by the Monte Cristi artifacts -- were produced by drawing out a bubble of molten or viscous glass into a long, slender tube. The process involved two workers, one of whom would place a hollow iron rod in the molten glass. A bubble was created by blowing into the rod. The bubble was then reinserted into the molten glass to collect more material. The second worker touched another iron rod to the molten bubble. After the glass adhered to this second rod, it was gently pulled away, drawing the viscous mass into a long strand that could then be placed on wooden slabs or marvers to cool. When cooled and brittle, the glass was cut to size and tumbled in a metal box with charcoal and fine sand. This gave the beads a rounder shape and smoother surface. After the initial tumbling, the beads were washed and placed in bags of bran where they were tumbled once again, giving them a highly polished sheen. They were then removed and sorted according to size and quality, first with a sieve, then
by hand so that defective beads could be removed. Finally, the beads were strung into hanks and prepared for shipment (Kidd and Kidd 1983:222. reprinted from Kidd and Kidd 1970).

Because beads were popular production items among European manufacturers, and popular trade items in North America, it is difficult to determine a specific production center or an intended destination for the Monte Cristi shipwreck beads (Karklins, personal communication with Carroll. 1994). Nonetheless, in an attempt to determine the origin of the beads, chemical tests were conducted by Robert Brill at the Corning Museum of Glass in Corning, New York. Van der Sleen (1963) suggested that chemical additives used in bead production are geographically specific: the Dutch commonly used potash as a flux; the Italians added soda. Thus, reasoned van der Sleen (1963), the presence or absence of these ingredients might indicate whether beads were manufactured in Holland or Italy. However, this approach has been disputed since van der Sleen’s conclusions are “based on very limited test results” (Karklins 1983:115). Emigration of Italian workers to the Netherlands, the importation of glass beads from Italy to Holland, and the export of potash from Holland to Italy all complicate the hypothesis that European bead manufacturers were using “one or the other of these substances as fluxes in the production of their beads” (Karklins 1983:115). Additionally, some Dutch bead factories, such as the one at Middleburg, Holland, used soda instead of potash (van der Made 1978). Attempts by Brill to determine the amount of potash or soda within the Monte Cristi beads proved unsuccessful due to excessive leaching as the result of prolonged exposure on the sea floor.

Norine G. Carroll, graduate student at the State University of New York, is in the process of excavating, measuring, drawing, and conserving the Monte Cristi glass beads. Currently, however, most of the collection is represented by a single mass of beads, joined by “slumping and fusion” (Carroll, personal communication, 1994). Carroll’s tentative hypothesis is that this condition resulted from exposure to intense heat for a short period of time, followed by the physical pressure of a heavy object pressing into or lying against the beads. In order for fusion or slumping such as this to occur, the beads would have had to have been exposed to a temperature of approximately 1600° F. They could not have been exposed to this heat for very long, or the entire mass would have fused into one ball of glass. This intriguing artifact offers
the suggestion that the vessel represented by the “Pipe Wreck” met its demise through a shipboard fire or explosion, then sank rapidly into the waters of Monte Cristi Bay.

The beads within the fused mass retain a somewhat linear formation, suggesting to Carroll that they were strung into necklaces. Furthermore, several strands of a currently unidentified material pass through the centers of some of the beads. This accords with historical accounts of seventeenth-century bean manufacture and shipment (see above).

ORGANIC ARTIFACTS

Bones

One hundred and forty-three bones were collected from the “Pipe Wreck” during the 1991 to 1993 field seasons. Although they were distributed throughout most of the grid squares, the largest concentration was at the northeastern portion of the site; a second, smaller cluster was located at the southwestern corner (Figure 72). All bones were examined by Philip L. Armitage of Sanibel Island, Florida, who studied the collection in two sample groups: those from 1991 to 1992, and those from 1993. The sample included bones from domestic sheep (Ovis), domestic sheep or goat (Ovis or Capra), domestic cattle (Bos), domestic pig (Sus), and rat (Rattus). Several fish bones (Serranidae and Myliobatidae) were gathered from the wreck layers but, for obvious reasons, must be considered with caution since they are likely intrusive.

With the exception of rat and fish bones, bones from the Monte Cristi shipwreck represent preserved meat and possibly livestock carried on board the Monte Cristi vessel. All of the cattle and perhaps many or all of the pig bones belong to salted beef and pork, respectively. Sheep (mutton) and goat were less easily preserved than pork or beef and were, therefore, rarely salted. The presence of these bones suggests live animals that were carried aboard the vessel to provide fresh meat for the Atlantic voyage.

By studying historical and archaeological data, Armitage has noted several clues to interpreting seventeenth-century shipboard diet. Subtle differences in proportions of staple preserved meats (e.g., salted pork, salted beef, dried beef, and salted cod) as well as mutton and/or goat, may, in some instances, indicate the nationality of the ship and crew. Unfortunately, there is a shortage of archaeological material to support documentary evidence. Armitage’s provisional conclusions concerning shipboard dietary regimens during the sixteenth

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33 It is difficult to distinguish between the osteological remains of goats and sheep.
Figure 72. Distribution of bones, recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Black circles represent those bones that were charred. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
and seventeenth centuries may be summed up as follows: (1) a preponderance of pig and cattle bones, in the absence of sheep or goat bones, suggests a Spanish crew; (2) a preponderance of pig bones associated with both cattle and sheep or goat bones in equal or almost equal proportions implies a Dutch crew; (3) relatively large quantities of both cattle and sheep or goat bones, together with some pig bones, probably indicate an English crew (Armitage, personal communication, 1993). During the middle of the seventeenth century, however, piracy and military engagement were common in the Caribbean Sea. This provides an obvious caveat to each of the above provisional conclusions: the capture of an enemy vessel could invalidate these basic dietary assumptions.


The first sample studied by Armitage comprised 78 bones recovered during the 1991 and 1992 campaigns. With the exception of a single unidentified fish bone recovered from grid square XIIc, all samples were from mammals, including three bones from Rattus sp. (Appendix Y). No human, reptile, or bird bones were found in the collection. Fifty-six bones (72.7%) were catalogued to specific skeletal part and species, with 21 (27.3%) remaining unidentified (excluding the aforementioned fish bone). Fifty-three bones were from domestic livestock, eight of which (15.1%) represented cattle. Nineteen (35.8%) were assigned as sheep or goat bones. 18 (34.0%) were designated as pig, and eight (15.1%) belonged to either sheep, goats, or pigs. Based upon these data, Armitage (personal communication, 1993) proposed that the Monte Cristi vessel may have carried a Dutch crew: however, he questioned the validity of this assessment given the relatively small sample size.

Most of the bones from the 1991 to 1992 sample are broken, with knife marks and chop marks visible on several, probably indicating butchery. A more detailed study is needed to determine if distributions indicate that specific provisions were stored in barrels and casks as salted goods, or carried as livestock. Thirty-five bones (24.5%) showed evidence of having been burned, perhaps the result of overcooking or having been tossed into a galley fire (see Figure 72). Although these charred samples were scattered in two clusters, most were excavated from grid squares XII and XVII in the northern part of the extant hull. This suggests the location of the ship's galley which, on a seventeenth-century merchant vessel would have been located between midships and the bow.
A Plague of Rats

The perils of vermin infestation aboard a sailing vessel were numerous. Sir Richard Hawkins, writing at the close of the sixteenth century, noted in great detail the nuisance presented by shipboard rodents (Appendix Z). Not only did rats contaminate the ship’s stores, but their propensity for gnawing—the means by which they kept their teeth short and functional—posed a serious threat to equipment, especially sails and lines. It was not uncommon for a ship’s pumps to suffer damage. In at least one instance, rats gnawed through the ship’s “bulge” (bilge), placing the vessel in danger of sinking (Hawkins 1593:89-90). Fresh water supplies stored in barrels and casks were not exempt from these vermin which multiplied so rapidly that prophylactic measures such as cats and poison failed to eradicate them.

Whether these vermin posed a significant health risk onboard the Monte Cristi vessel is uncertain. It is known, however, that they were present aboard the ship as two tibia bones and one vertebra from at least two and possibly three rats were recovered from the shipwreck.34 It is also fairly certain that they found their way into the crew’s provisions. A portion of the orbital rim of a domestic cow skull bears numerous rodent incisor marks. Likewise, the inner surface of the acetabulum and a portion of the pubic branch of the right innominate of either a goat or a sheep had been gnawed. A third artifact, a sheep or goat femur, exhibits surface grooves characteristic of those left by incisor teeth when gnawing flesh from the bone.


In a second interim report, Armitage presented the results of his study of 66 bones excavated during the 1993 campaign (Appendix AA). Of these, 40 (60.6%) were identified to species and 26 (39.4%) remained unidentified. Like the first study, no human, reptile, or bird bones were found within the collection. Thirty-eight of the identifiable bones (95.0%) were from domestic livestock: 10 (26.3%) from cattle, nine (23.7%) from sheep or goat, 12 (31.6%) from pig, and seven (18.4%) from sheep, goat, or pig. Two (5.0%) bones belonged to fish. Of the 26 unidentified elements, 24 (92.3%) appeared to be mammalian and two (7.7%) belonged to fish.

34 These have been identified as Rattus sp. and probably represent R. rattus, also known as the ship rat, black rat, or roof rat.
With this second report, Armitage argued that the high percentage of sheep or goat rib fragments more appropriately suggested an English rather than a Dutch crew. Again, however, he cautioned against hasty identification based on the small sample size (N=143). Finally, he speculated that the ship was originally operated by English sailors and later taken over by the Dutch. Such a transfer, Armitage suggested, would account for the somewhat mixed faunal spectrum, or equal proportions of cattle, sheep or goat, and pig bones. This hypothesis is intriguing, given that the “Pipe Wreck” probably sank during or shortly after the first Anglo-Dutch War (1652, see Chapter I). If originally sailing under an English flag, the ship may have been captured by the Dutch and immediately put into service in the West Indian trade, perhaps under the auspices of the WIC.

Fish Bones

Several fish bones recovered from the wreck have yet to be examined in detail, but at least one serranid vertebra and one spotted eagle ray mouth plate have been identified. These are most likely intrusive artifacts, the remains of fish that died in or near the shipwreck. However, they may represent discarded food debris: it is known that the spotted eagle ray was occasionally used for human food in the West Indies (Armitage, personal communication, 1994). Furthermore, “sailors may have supplemented their daily rations by fishing when the vessel was at anchor in West Indian bays” (Armitage, personal communication, 1994).

Floral Remains

Floral remains were analyzed by Philippa Tomlinson of the University of York, England, and by Alison Lean and Peter Dodd of the National Fruit Collections, Wye College, Kent, England. According to their investigation, the Monte Cristi collection includes eight olive pits (Olca europaea L.), one peach or nectarine pit, a single clove, and five unidentified pits from a smooth-skinned fruit or nut. The unidentified samples comprise four of one type and one of another (Lean and Dodd, personal communication to Amanda Sutherland, 1992). Buckwheat was also present, undoubtedly as packing material for the cargo of clay pipes (as described

35 Although the specific type of serranid has yet to be determined. Armitage (personal communication, 1994) notes that grouper has been ruled out.
above). A portion of the floral remains, as well as other organic artifacts, are shown in Figure 72.

**Comb Fragments**

Nine piece of bone comb were excavated from the wrecksite (see Figure 73). At least one fragment was a basal portion bearing the remnants of approximately 40 teeth. Originally, these pieces likely belonged to rectangularly-shaped combs, with teeth of different sizes along their two opposite sides, known as “head combs, double-tooth combs, or close and narrow combs” (Noël-Hume 1985:174). Such combs were common from medieval times up through the eighteenth century. During the seventeenth century, combs were made from a variety of materials, including boxwood, black thorn, and cocus wood; ox and cow horn; tortoise and hawksbill turtle shell; ivory; and the “shank bones of horses and other large beasts” (Noël-Hume 1985:34, 174, citing Holmes 1682:12-13). These artifacts may represent trade items, but it is just as likely that they were part of the crew’s possessions, used to groom lice from untidy beards and hair.

**Miscellaneous Organic Artifacts**

The “Pipe Wreck” also yielded multiple pieces of an ivory fan; a small ivory disk, possibly a gaming piece; a concretion of hundreds if not thousands of small, disc-shaped shells, perhaps beads; and nineteen small linen fragments (see Figure 73).

**THE MONTE CRISTI “PIPE WRECK” ARTIFACTS: AN OVERVIEW**

Trade goods carried aboard the vessel that sank in Monte Cristi Bay represent production centers in Peru, Columbia, England, Holland, Germany, and possibly Italy. This heterogeneous cargo was likely destined for Native and European-American settlements along the northeastern coast of what is currently the United States. Although a single port of destination is not specified, archaeological data from contemporary sites strongly indicate that a portion of these trade goods was to be shipped to the upper Hudson River Valley, perhaps via the Dutch-American entrepôt of Fort Orange, or modern day Albany, New York.

Carried aboard the Monte Cristi vessel were copper-alloy wares associated with lighting, ornately designed tin-glazed earthenware, and Italian crystal containers. These were, no
Figure 73. Distribution of organic artifacts, recovered from the seventeenth-century northern European merchant shipwreck in Monte Cristi Bay, Dominican Republic. Each grid square is 2 m by 2 m. Illustration by Jerome Lynn Hall.
doubt, awaiting purchase by prosperous colonists. Funnel elbow-angled pipes, on the other hand, were undeniably intended for the Native American trade, perhaps with one of the tribes of the Iroquois Nation. Beads, kettles, combs, brass bells, and thimbles, although certainly used by European emigrants to the New World, were also in great demand by Native Americans.

A small assemblage of artifacts from the “Pipe Wreck” relate something of life aboard a merchant ship. The nested weight set was probably employed by the ship’s captain or surgeon to measure modest quantities of valuable metals or medicines. Navigational dividers were stretched daily across a mariner’s map in an attempt to reckon the vessel’s position in the open sea, or to mark a distance along a coast. Amid the routine of operating the ship, the crew was apparently casting a variety of lead shot. These lead balls were to be used in an assortment of firearms that, although not recovered from the site, were probably carried aboard the vessel.

Both weapons and shot, however, may have been for trade with the bocaniers of Hispaniola, since it is known that such goods were prized commodities at the ferias of the north coast. As the daily routine of sailing a ship was established, it appears that some sailors may have passed what little spare time they had engaged in sport, perhaps even the lucrative variety, as suggested by a small, ivory gaming piece.

The rations aboard the merchant ship were representative of those commonly found on a seventeenth-century northern European vessel. In addition to salted stores, the ship conceivably carried livestock that was butchered for fresh meat. Fruits, including olives and peaches, supplemented the mariners’ diet. Rats lived aboard the Monte Cristi vessel, and likely shared these provisions. Whether rodents spoiled the goods carried in containers, or simply scavenged food scraps tossed into the bilge, is not known. Proportions of faunal remains are perhaps more suggestive of an English rather than a Dutch diet, but an argument may be made for a vessel that had previously changed hands through capture or sale.

Perhaps the most interesting aspect of the Monte Cristi artifacts is that four individuals are represented in portions of the cargo. Edward Bird and Willem Hendricks were emigrant Englishmen who lived in Amsterdam and made clay pipes during the seventeenth century. Both left their tell-tale marks on the wares they manufactured. A Spaniard, Juan Rodriguez de Roas, was an assayer working in Peru who, likewise, placed his characteristic signature on silver ocho reales minted between 1649 and 1651. At least one of the coins he inspected was carried aboard the Monte Cristi vessel. Several silver cobs not only speak directly of Dr. Francisco de Nestares
Marin, the Spanish president of the royal tribunal, they testify to his ruthless mandates that purged corruption from the mint at Potosí.

Some artifacts from the shipwreck, such as the pipes, and possibly the copper-alloy lighting implements and glass beads, were of Dutch manufacture. Others, such as the German nested weights and stoneware jugs with the sprig-molded soldier or sportsman motif, are most commonly associated with English sites. In light of the fact that the vessel itself is most likely English, combined with historical accounts that smuggling, piracy, and enemy ships were common in American waters during the time that this trading voyage was made, the assemblage of trade goods from the Monte Cristi shipwreck gives only limited support to the hypothesis that the vessel was a Dutch merchantman.
CHAPTER IV
CONCLUSIONS

This document has proposed and attempted to test the hypothesis that the Monte Cristi shipwreck represents the remains of a Dutch merchant vessel that sank sometime after 1651 and most likely between 1652 and 1656. Additional objectives of this study included the determination of a specific vessel type, its destination, the reasons for its presence in Monte Cristi Bay, and the events leading to its demise. Methods for hypothesis testing included excavation, conservation, analysis, and interpretation of cultural materials recovered from the site. These data were integrated into a known historical framework with the goal of transforming a static compilation of facts and physical remains into what Lewis Binford describes as “accurate descriptions of a dynamic past” (Binford, personal communication, 1994).

The interpretation of data from the Monte Cristi shipwreck and their translation into temporal, regional, and political contexts is, however, shrouded in speculation. As with any inductive archaeological investigation, there remains the possibility that a confluence of material culture and historical documentation will never provide all of the information necessary to identify the vessel positively. Further excavation of the site and the study of numerous artifacts that await conservation may eventually suggest new interpretations. In light of these uncertainties, conclusions presented in this document are subject to revision when prescribed by the archaeological and historical records.

When Was the Vessel’s Last Voyage?

Dates for the last voyage of the vessel now known as the “Pipe Wreck” were established and continually revised through analysis of five distinct groups of artifacts (Table 17). The initial range was a temporal window of 35 years, based upon the identification of three varieties of the EB heel stamp present on Dutch clay pipes. Edward Bird, the pipe maker to whom this mark belonged, manufactured his wares between 1630 and 1665.

The late John McCashion (personal communication, 1991), renowned specialist on pipes manufactured by Bird, suggested that this time frame should be considered cautiously. Roughly
Table 17. Histogram of probable dates for events and artifacts relating to the seventeenth-century northern European merchant vessel in Monte Cristi Bay, Dominican Republic.

<table>
<thead>
<tr>
<th>Artifact Type</th>
<th>Date Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>EB pipes</td>
<td>1652-1656</td>
</tr>
<tr>
<td>Funnel elbow-angled pipes</td>
<td></td>
</tr>
<tr>
<td>WH pipes</td>
<td></td>
</tr>
<tr>
<td>FOT19 (bulbous bowl)</td>
<td></td>
</tr>
<tr>
<td><em>Fleur-de-lys</em> pipes</td>
<td></td>
</tr>
<tr>
<td>Tudor rose pipes</td>
<td></td>
</tr>
<tr>
<td>&quot;English pipe&quot;</td>
<td></td>
</tr>
<tr>
<td>Tin-glazed earthenware</td>
<td></td>
</tr>
<tr>
<td><em>Baardman</em> bottles</td>
<td></td>
</tr>
<tr>
<td>Potosi counterstamped coins</td>
<td></td>
</tr>
<tr>
<td>Santa Fe de Bogota coins</td>
<td></td>
</tr>
<tr>
<td>Dendrochronological hull study</td>
<td></td>
</tr>
<tr>
<td><em>Boncancer</em> in Hispaniola</td>
<td></td>
</tr>
<tr>
<td>Caribbean salt trade</td>
<td></td>
</tr>
</tbody>
</table>

*Date*  | 1630 | 1635 | 1640 | 1645 | 1650 | 1655 | 1660 | 1665 | 1670 | 1675 | 1680 →
ten percent of the pipes from the Monte Cristi site were European-manufactured funnel elbow-angled pipes. According to McCashion, this form is not known in New World archaeological contexts until 1640, when they first appeared at the Dutch-American settlement of Fort Orange. Thus, based upon McCashion’s suggestion, the time frame was revised to 1640 to 1665.

Further revision came from dendrochronological analyses of hull components. These established that at least one timber present on the “Pipe Wreck” was harvested from an English forest sometime in 1642 or shortly thereafter. These data narrowed the prescribed range to a 23-year period: from 1642 to 1665.

The presence of counterstamped coins from the Potosi mint in Peru indicate that the vessel could not have sunk prior to 1649, thus shortening the time frame to 16 years (1649 to 1665). Such coins have been recovered from several shipwrecks. Two of these — the Vergulde Draeck in Australia and the Nuestra Señora de Las Maravillas in the Bahamas — sank in 1656 (Green 1977; Christie’s Catalog 1992). A third, the Jupiter Inlet Wreck in Florida, has been tentatively dated at 1659 to 1660 (Jupiter Wreck Inc. 1991: Addario, personal communication, 1995). Finally, counterstamped Potosi coins have also been recovered from a 1654 Spanish shipwreck off Chanduy Reef in Ecuador (Schulman Coin and Mint. Inc. 1974; Jupiter Wreck Inc. 1991: Addario, personal communication, 1995). In light of the data from these shipwrecks, it is probable that Monte Cristi vessel also sank sometime around 1656.

Final revision came from a single coin from the Santa Fe de Bogotá mint. Bearing the New Style Pillar design, this coin established that the vessel could not have sunk prior to 1651, thus further narrowing the date range to 1651 to 1656. The late Henry Taylor, numismatist, was of the opinion “that the Pipe Wreck” sailed her last voyage “no earlier than 1651, but probably...in the period 1652 to 1654” (Taylor, personal communication, 1992).

Was the Vessel Sailing under an English or Dutch Flag?

Analysis of wood from the hull of the “Pipe Wreck” suggests that the vessel was constructed from English oak. Furthermore, the closest comparison within the archaeological record is the Sea Venture, an English merchant ship that sank off Bermuda in 1609. These data indicate that the Monte Cristi vessel was built in England. It is possible, of course, that the ship was Dutch-made from imported materials, but this is unlikely given restricted trade between
England and Holland during the middle of the seventeenth century (Spoor and Jansma, personal communication, 1992).

Although the Monte Cristi vessel was probably built in England, it did not necessarily sail its final voyage under an English flag. Piracy and privateering were rampant throughout the Caribbean during the seventeenth century. Furthermore, the English and Dutch engaged in numerous military confrontations -- in both European and American waters -- after the onset of the Anglo-Dutch Wars in 1651. It is therefore reasonable to assert that the Monte Cristi vessel could have changed hands at least once. Faunal remains from the "Pipe Wreck" suggest a diet characteristic of an English crew, but the sample is small and the results equivocal (Armitage, personal communication, 1993). Armitage (personal communication, 1994) concedes that the data could easily point to Dutch use at some time.

The artifacts recovered from the "Pipe Wreck" give no clear answer about the vessel's owners during its final voyage. Fragments from over 4,000 clay tobacco pipes have been excavated from the site; essentially all of these were made in Holland. However, there are currently no seventeenth-century Dutch shipwrecks in the New World with which to compare the "Pipe Wreck" and its material culture. Dutch-American settlement sites are replete with goods such as yellow bricks, Jew's harps and tubular glass beads which were brought by ship from the Netherlands. Thus, these items would likely be found on a seventeenth-century Dutch shipwreck in the New World. No such artifacts, however, have ever been recovered from the "Pipe Wreck." Thus, the cargo carried by the Monte Cristi vessel does not unequivocally point to a Dutch registry, contrary to the initial hypothesis.

Support for English registry is only slightly stronger. The array of artifacts yielded by the "Pipe Wreck" -- including ceramic and glass bottles, metal pins and thimbles, bone combs, and glass beads -- is similar to the materials recovered from seventeenth-century Anglo-American settlements such as the Compton Site in Maryland (ca. 1651 to 1684) (King 1989). Furthermore, sites such as Compton frequently yield Dutch-made wares, including clay tobacco pipes like those recovered from the "Pipe Wreck." Despite the Anglo-Dutch War, historical records and archaeological evidence demonstrate that trade in the New World between the Dutch and English was viable between 1650 and 1660. Therefore, it is difficult to determine the Monte Cristi vessel's registry based upon the cargo it carried.
What Type of Vessel Was It?
A survey of northern European vessel types utilized in the Caribbean during the seventeenth century suggests that the Monte Cristi shipwreck is likely the remains of a ship, yacht, fluyt, or bark. These vessels were of sizes comparable to the “Pipe Wreck” and frequently plied the waters of the Caribbean carrying trade goods like those recovered from this site. Furthermore, English-made craft of this size are known to have been ship-rigged, as were all four of these vessel types. Unfortunately, little of the Monte Cristi hull still remains for clear identification. Only the starboard side of the “Pipe Wreck” survived, most likely due to the large iron concretions that pushed the wood beneath the sand and protected it from biological degradation. Artifacts, not structural details of the extant hull, suggest the orientation of the vessel on the sea floor: dividers, coins, a nested weight set, and charred bones, all indicate that the bow of the vessel pointed northward.

Where Was the Vessel Headed?
Funnel elbow-angled pipes recovered from the Monte Cristi shipwreck indicate that the vessel was bound for the northeastern portion of what is now the United States. These items have been found on various Anglo-American and Dutch-American settlement sites, but they were especially prized by Native Americans of the Upper Hudson River Valley. The presence of these trade goods indicates that the vessel represented by the “Pipe Wreck” did not have a Caribbean island as its final destination.

Initially, it was hypothesized that the Monte Cristi vessel was bound for a Dutch-American port; however, the artifact data lend little support to this model. As discussed above, Dutch-American settlement sites yield a variety of goods which were never recovered from the “Pipe Wreck,” including Westerwald ceramics, ornate Dutch glassware, tubular glass beads, Jew’s harps, and yellow bricks (Huey, personal communication, 1992; Havisier, personal communication, 1993). Bricks were especially desirable in the colonies, needed for construction and street pavement (Huey, personal communication, 1995). They also served as useful ballast aboard ship. Furthermore, bricks are extremely durable and of little value to shipwreck treasure hunters. Therefore, if the “Pipe Wreck” were bound for a Dutch-American port, some
fragments of yellow brick should have been found.¹ Their conspicuous absence reduces the likelihood of a Dutch-American destination.

This leaves the possibility that the vessel in Monte Cristi Bay was bound for an Anglo-American port. As implied above, materials recovered from the Compton Site are extremely important to interpretation of the Monte Cristi shipwreck, for the two sites yield strikingly similar artifacts. Funnel elbow-angled pipes, as well as bulbous bowled pipes bearing the EB. WH. and Tudor rose heel stamps, have been recovered from Compton. English and Dutch ceramics, and stoneware jugs embellished with "incising and blue decoration." were also found (King 1989:57, 78). Additional artifact groups that compare well with the Monte Cristi shipwreck trade goods include pins, scissors, thimbles, a fine bone comb, glass beads, green glass bottles, and a small amber-colored piece of ornamental glass, described as a possible prunt. Data from the Compton Site suggest that the English Navigation Acts did little to discourage the trade of Dutch-manufactured goods at Anglo-American settlements.

If an Anglo-American colony was the destination of the Monte Cristi vessel, it was most likely a port south of New Netherland, such as Virginia or Maryland, rather than New England. Settlements like Compton, Jamestown, St. Mary’s City, and Martin’s Hundred offer numerous artifacts of Dutch manufacture, such as "ceramic wares of all types, trade goods, items of dress, clay tobacco pipes, delft tiles, glazed floor tiles, and other objects" (Huey 1988:600-601). Dutch influence in Virginia was considerable with the onset of the English Civil War in 1642 and remained so well into the 1650s. Furthermore, a "particularly strong relationship" existed between New Netherland and the Virginia and Maryland colonies (Huey 1988:600-601), while Dutch-American economic relations with New England were comparatively few.

Settlers at Anglo-American colonies are known to have assimilated Dutch-made goods. West India Company correspondence contains numerous references to commercial interaction with ports in Virginia and Connecticut (Rink 1986). Furthermore, WIC records document a constant flow of goods between Dutch and English colonies in the Caribbean, including Curaçao, Jamaica, and Barbados (RLC 21 February 1656, 21 March 1656, 4 March 1660). Again, despite the Anglo-Dutch Wars, these two countries and their colonies continued to capitalize upon trade opportunities.

¹Yellow bricks have been recovered from Dutch East India shipwrecks Kennemerland (1664) (Price and Muckleroy 1979: Martin 1987) and the fluit Risdam (1727) (Green 1986).
The tobacco trade provided one source of contact between the Dutch and colonists in Virginia. Such commerce helps to explain the presence of Dutch pipes at Anglo-American settlement sites. From the onset of the seventeenth century, the Dutch purchased tobacco from South America and the West Indies (Kupp 1973). Around 1620, when crop production began in Virginia, Holland was quick to make contact and exploit the North American market. Up until 1630, however, the North American tobacco trade was conducted in large part under the auspices of London merchants and their colonial associates. The WIC was successful in its attempts to gain a “commercial foothold in the Virginia” market because of their willingness to buy tobacco in bulk — at “relatively high prices” — while simultaneously selling goods on a credit basis (Pagan 1982: 485). By doing so, they avoided English custom’s duties, which “were considerably higher than those at Rotterdam” (Kupp 1973: 654). Virginians wholeheartedly supported this “evasion” (Kupp 1973: 654). Not long thereafter, when increased prices seriously affected England’s import and export of tobacco, Virginia planters turned to the Dutch to carry their product to London, Amsterdam, and Hamburg (Pagan 1982: 486). Cromwell’s parliamentary revolt against Charles I further disrupted the shipment of tobacco between Virginia and London, leaving the ever-vigilant Dutch to move in and exploit the available market. This meant that, for the better part of the decade — between 1640 and 1650 — the Dutch controlled a considerable portion of the Virginia tobacco trade. They were able to do so for three reasons: first, they had numerous “maritime assets”; second, they had established permanent trading bases in the Virginia colony; and third, they maintained close ties with leading colonists (Pagan 1982: 486-487). So successful was the Dutch carriage trade in Virginia that the governing class sought to enact legislation to protect the Dutch from any trade interference (Pagan 1982: 491). These interactions demonstrate the importance of tobacco to seventeenth-century traders, and establish that considerable cultural exchange occurred between the Dutch and English in both North America and the Caribbean.

**Why Was the Vessel in Monte Cristi Bay?**

Although the “Pipe Wreck” met its demise in Monte Cristi Bay, this was certainly not its final destination. This begs the question of why the vessel entered the bay. One possibility is that its crew was seeking shelter from a storm and believed that the cove would offer safe
anchorages. However, the bay was replete with navigational hazards, including small islands and submerged reefs (see Chapter I and below).

Another, more plausible hypothesis is that the crew came to trade with the *boucaniers*. These peripatetic tradesmen were common on the north coast of Hispaniola, and the wares they offered -- seasoned beef and tanned hides -- were sought after by their seafaring counterparts. Furthermore, the *boucaniers* were eager for guns, ammunition, and clothing brought by the northern European vessels. Goods that the Dutch and English offered at lower prices than did the Spanish. Trade between northern Europeans and the *boucaniers* was therefore mutually beneficial and would certainly have attracted a sailing vessel into Monte Cristi Bay.

A third hypothesis is that the crew of the “Pipe Wreck” came to collect salt. Monte Cristi’s Isla Cabra is, today, the site of sizable salt works, and historical records suggest that this has been the case for several centuries. Salt was a valuable commodity, in both Europe and the New World, and its presence may have drawn many ships into Monte Cristi Bay.

**How Did the Vessel Sink?**

Why the ship ran aground in the shallow water of Monte Cristi Bay has yet to be determined. The vessel may have had trouble navigating in the bay. Historical documents -- from the fifteenth-century journals of Cristóbal Colón to the twentieth-century directives of the U.S. Hydrographic Service -- clearly describe the navigational hazards of the Monte Cristi Bank and especially the entrance to the bay itself. Despite navigational literature, however, the pilot may have failed to see Isla Cabra or the submerged reef of Cayo Ahogado. Alternatively, the vessel may have grounded in inclement weather. Fast-moving tropical storms are common to the area, and hurricanes are a continual threat from late spring to late fall in Caribbean waters. Millás (1968:119-162) recorded 65 hurricanes for the Caribbean and adjacent areas during the seventeenth century. Between 1651 and 1656 -- the probable range for the sinking of the Monte Cristi vessel -- six hurricanes blew through the Lesser Antilles. Thus, navigation of the Monte Cristi Bay was a risky endeavor.

Another possibility is that the vessel experienced a shipboard fire or even an explosion. Several groups of artifacts from the site exhibit signs of having been burned. Melted lead globules and charred livestock bones are best explained through daily shipboard activities such as casting shot and cooking. Blackened wood bits may represent charcoal from the galley or
possibly a carge of charcoal at Bonaire. However, a clump of approximately 700 glass beads that are “slumped and fused” (Brill, personal communication to Norine Carroll, 1994) indicate exposure to extreme heat for a short period of time. This artifact cluster lends intriguing support to the hypothesis that the “Pipe Wreck” met its demise through some sort of disaster.

The Monte Cristi “Pipe Wreck”

The seventeenth-century northern European merchant shipwreck in Monte Cristi Bay shipwreck is an extremely enigmatic yet valuable archaeological site. After several years of excavation, there are still many unanswered questions about the “Pipe Wreck.” Although artifacts recovered from the site provide clues about the ship, its registry, its destination, and its demise, decisive conclusions remain elusive.

On the other hand, the extant hull and cultural materials provide considerable insight into seventeenth-century trade. Despite an abundance of shipwreck sites in the New World, no unequivocal Dutch or English vessel from the second half of the seventeenth century has been carefully excavated. The “Pipe Wreck” supports historical records that suggest there was a considerable exchange of goods between the New World colonies of Holland and England, despite the English Navigation Acts and the Anglo-Dutch Wars.

Furthermore, the cargo of funnel elbow-angled smoking pipes is the largest collection from any site in the world, and the only collection ever recovered from a shipwreck. These pipes, bound for the northeastern portion of what is now the United States, are virtually unique to the Americas. Their presence on the Monte Cristi shipwreck provides insight into the extent to which European manufacturers responded to the New World market -- and particularly Native Americans -- by tailoring goods to meet specific consumer demands.

Finally, the integrity of an archaeological site is always compromised by site tampering. However, the excavation of the Monte Cristi “Pipe Wreck” testifies to the fact that -- in spite of centuries of heavy salvage -- valuable information can still be garnered when careful archaeological techniques are employed.

Areas for Future Research

The uncertainties that surround the “Pipe Wreck” demand further research. Test pits excavated in previous years have indicated that numerous pipes and ceramic sherds lie scattered
far past the southwest corner of the extant hull. Thus, a significant proportion of the cargo probably has yet to be recovered. Three more years of excavation are needed to raise all of the available cultural material. Additional laboratory work is also necessary. Many artifacts, such as the cannon and glass beads, are currently undergoing conservation and analysis. More than 3,000 concretions await x-ray investigation and casting. Finally, future plans include construction of a three-dimensional model of the shipwreck.

Continuing excavation must also be supported by research in Dutch and English archives. Whether this vessel was in the service of the WIC or a London partnership, it is likely that the cargo was insured. There must exist records that implicate merchant vessels lost in Hispaniola. Historical documents from the WIC provide tantalizing information about a ship that foundered off the island sometime shortly before 11 June 1657 (see Chapter II). Further investigation may reveal that this event describes the loss of the Monte Cristi vessel itself.

In spite of an international trade ban and the first of three wars, a small merchant ship left Europe with a cargo destined for distribution in what appear to be Dutch-American, Anglo-American, and Native American settlements. Regardless of which provisional conclusion is offered to explain its presence and subsequent demise off the coast of Hispaniola, the northern European shipwreck in Monte Cristi Bay lies as a monument to European colonial expansion, maritime commerce, and the important role of tobacco in the New World during the second half of the seventeenth century.
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APPENDIX A

DIRECT DISTANCES (IN M) OF DATUM POINTS PLACED AROUND THE SITE OF THE SEVENTEENTH-CENTURY NORTHERN EUROPEAN MerChant ShipWreck in Monte CrIsTi Bay, Dominican RepubLiC. Data generation was by the Direct Survey Method Computer Program (DSM)

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<th>To Datum</th>
<th>Distance (m)</th>
<th>Residual</th>
<th>Comments</th>
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<tr>
<td>A</td>
<td>C</td>
<td>14.41</td>
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## APPENDIX B

**PLACEMENT OF VISIBLE TREENAILS IN FRAMING AND PLANKING OF THE SEVENTEENTH-CENTURY NORTHERN EUROPEAN MERCHANT VESSEL IN MONTE CRISTI BAY, DOMINICAN REPUBLIC**

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<th>Visible treenails</th>
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<td>F 1</td>
<td>floor 1</td>
<td>VIII</td>
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<td>floor extends from garboard to bottom plank 6 and is partially covered by concretion III; treenails on outboard end of floor.</td>
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<tr>
<td>Ft 2</td>
<td>futtock 2</td>
<td>IX and XIV</td>
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<td>futtock extends from bottom plank 2 to bottom plank 6 and is partially covered by concretion III; treenails on outboard end of futtock.</td>
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<td>floor 2</td>
<td>IX and XIV</td>
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<td>floor extends from garboard to bottom plank 6 and is partially covered by concretion III; treenail on outboard end of floor in line with treenails from futtocks 2 and 3.</td>
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<td>Ft 3</td>
<td>futtock 3</td>
<td>IX and XIV</td>
<td>3</td>
<td>futtock extends from bottom plank 2 to bottom plank 8 and is partially covered by concretion III; spacing between treenails 1 (inboard) and 2 is 11.0 cm; between 2 and 3 (outboard) is 4.5 cm.</td>
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<td>F 3</td>
<td>floor 3</td>
<td>IX and XIV</td>
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<td>floor around treenail split and heavily deteriorated; treenail in line with treenail 1 of futtock 4; floor extends from garboard to bottom plank 7 and is partially covered by concretion III.</td>
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<td>IX and XIV</td>
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<td>futtock extends from bottom plank 2 to bottom plank 8 and is partially covered by concretion III; futtock split at treenails 1 (inboard) and 2; spacing between treenails 1 and 2 is 12.0 cm; between 2 and 3 is 24.2 cm; between 3 and 4 is 12.4 cm.</td>
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<td>floor tangential to keel and extends from garboard to bottom plank 7; floor partially covered by concretion III.</td>
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<td>Ft 5</td>
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<td>IX and XIV</td>
<td>6</td>
<td>ceiling plank 5 fastened to futlock with treenails 1 (inboard) and 2, spaced 5.0 cm apart; spacing between treenails 2 and 3 is 15.0 cm; spacing between 3 and 4 is 19.5 cm; between 4 and 5 is 8.8 cm; between 5 and 6 (outboard) is 5.3 cm; futlock extends from bottom plank 2 to bottom plank 8 and is partially covered by concretion III; outboard edge of floor covered by a small concretion that also covers part of floor 5.</td>
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<td>floor 5</td>
<td>IV, 1X, and XIV</td>
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<td>floor extends from outboard edge of keel to bottom plank 8 and is partially covered by concretion III; outboard edge of floor covered by a small concretion that also covers part of futlock 5.</td>
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<td>IX, X and XV</td>
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<td>futlock, which is toed to floor 6, extends from inboard seam of bottom plank 2 to bottom plank 8 and is partially covered by concretion III; inboard edge of futlock is sawn flush, but deteriorated.</td>
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<td>floor tangential to keel; extant length not known as floor is partially covered by concretion III and ceiling planks 2 through 5; concreted mass on the northern edge of the inboard side of the floor.</td>
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<td>treenails at inboard end of futlock: spacing between treenails 1 (inboard) and 2 is 16.5 cm; between 2 and 3 is 17.0 cm; ceiling planks 2-5 cover futlock in grid X; ceiling planks 5 and 6 cover futlock in grid XV; ceiling plank 3 is fastened to futlock with 2 treenails; treenail 4 is near the inboard edge of the plank and is 22.0 cm from treenail 5, which is positioned near the outboard edge of ceiling plank 3; ceiling plank 4 is split where it crosses futlock 7.</td>
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<td>treenail in outboard edge of floor; floor covered by ceiling planks 2-5.</td>
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<td>partially covered by ceiling planks 5 and 6, floor spans from garboard to bottom plank 9, spacing between treenails 1 (inboard) and 2 is 16.0 cm; spacing between treenails 2 and 3 (outboard) is 16.8 cm.</td>
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<td>floor extends from garboard to bottom plank 7 and is covered by concretion IV.</td>
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<td>XVI</td>
<td>2</td>
<td>futtock extends from bottom plank 2 to bottom plank 8; 4 treenails are visible in bottom planks 8 (1) and 9 (3), both in line with futtock 11; spacing between treenails 1 (inboard end of futtock) and 2 is 14.8 cm; between 2 and 3 (outboard end of bottom plank 8) is 28.0 cm; between 3 and 4 (inboard end of bottom plank 9, near filler plank) is 11.0 cm; between 4 and 5 (inboard end of bottom plank 9, south of treenail 4) is 14.8 cm; between 5 and 6 (outboard edge of bottom plank 9) is 16.2 cm.</td>
</tr>
<tr>
<td>Ft 12</td>
<td>futtock 12</td>
<td>XVI</td>
<td>--</td>
<td>futtock extends from garboard to bottom plank 7, but planks 3 through 5 are obscured by concretion IV and ceiling planks 1-5; a single treenail on the outboard edge of bottom plank 9 is in line with futtock 12, 10.5 cm from its degraded outboard edge.</td>
</tr>
<tr>
<td>F 12</td>
<td>floor 12</td>
<td>XVI</td>
<td>--</td>
<td>floor extends from garboard to bottom plank 7, but is obscured by concretion IV and ceiling planks 1-5.</td>
</tr>
<tr>
<td>Ft 13</td>
<td>futtock 13</td>
<td>XVI</td>
<td>7</td>
<td>futtock extends from garboard to plank 9 (including filler plank) and is partially covered by ceiling planks 1-5; spacing between treenails 1 (inboard) and 2 is 8.7 cm; between 2 and 3 is 11.4 cm; between 3 and 4 is 7.2 cm; between 4 and 5 is 14.0 cm; between 5 and 6 is 16.2 cm; between 6 and 7 is 5.2 cm; treenail 7 is positioned near the outboard seam of bottom plank 8 and the inboard seam of the filler plank.</td>
</tr>
<tr>
<td>Feature</td>
<td>Element</td>
<td>Visible in grid(s)</td>
<td>Visible treenails</td>
<td>Comment</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td>F 13</td>
<td>floor 13</td>
<td>XI and XVI</td>
<td>4</td>
<td>floor extends from garboard to bottom plank 6; spacing between treenails 1 (inboard) and 2 is 15.8 cm; between 2 and 3 is 14.0 cm; between 3 and 4 is 64.5 cm; ceiling plank 3 crosses between treenails 3 and 4; ceiling plank 5 crosses at the outboard end of the floor and the southern end of concretion V covers the inboard end.</td>
</tr>
<tr>
<td>Ft 14</td>
<td>futtock 14</td>
<td>XII and XVII</td>
<td>8</td>
<td>futtock extends from bottom plank 2 to bottom plank 9 and is partially covered by concretion V and the northern end of ceiling plank 3; spacing between treenails 1 (inboard) and 2 is 21.3 cm; between 2 and 3 is 41.8 cm; between 3 and 4 is 11.2 cm (treenail 4 is south of treenail 3); between 4 and 5 is 58.8 cm; between 5 and 6 is 13.0 cm; between 6 and 7 is 10.6 cm; between 7 and 8 (outboard) is 15.6 cm; ceiling plank 3 crosses between treenails 2 and 3; 2 treenails (9 and 10) in bottom plank 9 are in line with futtock 14 and are spaced 12.4 cm, treenail 9 is 18.2 cm from treenail 8 (outboard treenail on futtock 14).</td>
</tr>
<tr>
<td>F 14</td>
<td>floor 14</td>
<td>XII and XVII</td>
<td>11</td>
<td>floor extends from garboard to bottom plank 9; spacing between treenails 1 (inboard) and 2 is 7.7 cm; between 2 and 3 is 13.3 cm; between 3 and 4 is 8.1 cm; between 4 and 5 is 14.3 cm; between 5 and 6 is 16.8 cm; between 6 and 7 is 13.6 cm; between 7 and 8 is 24.8 cm; between 8 and 9 is 5.3 cm; between 9 and 10 (outboard) is 10 cm; between 10 and 11 is 19.0 cm; treenail 12 in bottom plank 8 (outboard edge) is in line with floor 14 and is 38.6 cm from treenail 11; a small concretion that appears to bear the imprint of a box or crate bottom partially covers floor 14 (as well as futtock 15).</td>
</tr>
<tr>
<td>Ft 15</td>
<td>futtock 15</td>
<td>XII</td>
<td>2</td>
<td>futtock extends from bottom plank 2 to bottom plank 5; spacing between treenails 1 (inboard) and 2 is 18.8 cm; 2 treenails, 1 in bottom plank 8 and 1 in bottom plank 9 are in line with futtock 15; spacing between treenails 2 (outboard end of futtock 15) and 3 is 87.0 cm; between 3 and 4 is 11.8 cm; a small concretion partially covers futtock 15 (as well as floor 14).</td>
</tr>
<tr>
<td>Feature</td>
<td>Element</td>
<td>Visible in grid(s)</td>
<td>Visible treenails</td>
<td>Comment</td>
</tr>
<tr>
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</tr>
<tr>
<td>F 15</td>
<td>floor 15</td>
<td>XII and XVII</td>
<td>1</td>
<td>floor extends from garboard to bottom plank 8; a treenail in bottom plank 9 is in line with floor 15, spaced 32.0 cm from the single treenail in the outboard end of the floor.</td>
</tr>
<tr>
<td>Ft 16</td>
<td>futtock 16</td>
<td>XII and XVII</td>
<td>3</td>
<td>futtock extends from bottom plank 2 to bottom plank 7; spacing between treenail 1 (inboard) and 2 is 6.4 cm; between 2 and 3 is 16.6 cm; a total of 7 treenails are visible in bottom planks 7 (2), 8 (1), and 9 (4), all in line with futtock 16; spacing between treenails 3 (outboard end of futtock 16) and 4 (inboard end of bottom plank 7) is 20.6 cm; between 4 and 5 is 9.4 cm; between 5 and 6 is 14.6 cm; between 6 and 7 is 9.0 cm; between 7 and 8 is 9.6 cm; between 8 and 9 is 11.0 cm; between 9 and 10 is 12.8 cm; (treenail 8 is inboard on the butt joint of short bottom plank 9, to the north; treenail 9 is the outboard treenail; treenail 10 is the outboard treenail on long bottom plank 9, to the south).</td>
</tr>
<tr>
<td>F 16</td>
<td>floor 16</td>
<td>XII and XVII</td>
<td>2</td>
<td>robust floor extends to outboard edge of bottom plank 5; 5 treenails are visible in bottom planks 6 (1), 7 (1), 8 (1), and 9 (2), all in line with floor 16; spacing between treenails 1 and 2 is 25.0 cm; between 2 and 3 is 25.0 cm; between 3 and 4 is 10.0 cm; between 4 and 5 is 18.0 cm.</td>
</tr>
<tr>
<td>Ft 17</td>
<td>futtock 17</td>
<td>XII</td>
<td></td>
<td>futtock extends from bottom plank 2 to bottom plank 5; 2 treenails are visible in bottom planks 6 (1) and 8 (1), both in line with futtock 17 and spaced 53.4 cm; loose timber angled to the northeast and lying adjacent to floor 17 may well be a disarticulated portion of futtock 17.</td>
</tr>
<tr>
<td>F 17</td>
<td>floor 17</td>
<td>XII</td>
<td>--</td>
<td>floor extends from garboard to bottom plank 6.</td>
</tr>
</tbody>
</table>
APPENDIX C
OBSERVATIONS BY HAWKINS (1593) CONCERNING THE ROLE OF BOTTOM SHEATHING

In his voyage to the “South Sea” in 1593, Sir Richard Hawkins made numerous and cogent observations concerning the role of bottom sheathing in the construction and protection of sailing vessels:

“Hereof let others take warning, in no place to have caske on the shore, where it may be avoyded: for it is one of the provisions which are with greatest care to be preserved in long Voyages, and hardest to be supplied. These Arters or Broma, in all hot countries enter into the planks of Shippes, and especially where are Rivers of fresh water: (for the common opinion is, that they are bred in fresh water and with the current of the Rivers are brought into the Sea) but experience teacheth, that they breed in the great Seas in all hot climates, especially near the Equinoetial lyne: for lying so long under and near the lyne, and tawing a Shalop at our Sterne, coming to cleanse her in Brasi, we found her all under water covered with these wormes, as bigge as the little finger of a man, on the outside of the planke, not fully covered, but halfe the thickness of their bodie, like to a gelly wrought into the planke as with a Gounde. And natural reason (in my judgement) confirmeth this, for creatures bred and nourished in the Sea, comming into fresh water die; as those actually bred in Ponds or fresh Rivers die presently, if they come into Salt water.

But some man may say: this fayleth in some Fishes and Beasts. Which I must confess to be true: but these eyther are part terrestruell, and part aquatile, as the Mare-maide, sea-horse, and other of that kind, or have there breeding in the fresh, and growth of continuall nourishment in the salt water, as the Salmond, and others of that kind. In little time, if the Shipp be not sheathed, they put all in hazard: for they enter in no bigger then a small Spanish Needle, and by little and little their holes become ordinarily greater then a mans finger. The thicker the planke is, the greater he growth. Yea, I have seen many Shippes so eaten, that the most of their planks underwater have been like honeycombes, and especially those betweext wind and water. If they had not been sheathed, it had been impossible that they could have swomme. The entring of them is hardly to be discerned, the most of them being small as the head of a Pinne. Which, all such, as purpose long Voyages, are to prevent by sheathing their Slippes.

And for that I have seen divers manners of sheathing, for the ignorant I will set them downe which by experience I have found best.
In Spaine and Portingall, some sheath their Shippes with Lead: which, besides the cost and weight, although they use the thinnest sheet-lead that I have seen in any place, yet it is nothing durable, but subject to many casualties.

Another manner is used with double plankes, as thicke without as within, after the manner of furring: which is little better then that with Lead: for besides his weight, it dureth little, because the worm in small time passeth through he one and the other.

A third manner of sheathing hath been used amongst some with fine Canvas: which is of small continuance, and so not to be regarded.

The forth prevention, which now is most accompted of, is to burne the utter planke till it come to be in every place like a Cole, and after to pitch it, this is not bad.

In China (as I have been informed) they use a certaine Betane or Varnish, in manner of an artificiall pitch, wherewith they trim the outside of their Shippes. It is said to be durable, and of that vertue, as neither warme, nor water pierceth it: neither hath the Sunne power against it.

Some have devised a certain Pitch, mingled with Glass, and other ingredients, beaten into powder, with which if the Shippe be pitched, it is said, the worme that toucheth it, dyeth: but I have not heard, that it hath been usefull.

But the most approved of all is the manner of sheathing used nowadays in England, with thin boursds, halfe inch thicke: the thinner the better: and Elme better then Oake: for it dyeth not. it indureth better under water, and yeildeth better to the Shippes side.

The invention of the materialles incorporated between the planks and the sheathing, is that indeed which avayleth: for without it many planks were not sufficient to hinder the entrance of these worme: this manner is thus:

Before the sheathing board is nayled on, upon the inner side of it they smere it over with tarre halfe a finger thick, and upon the tarre, another half finger thick of hayre, such as the Whitelymers use. and so nayle it on. the nayles not above a spanne distance one from another: the thicker they are driven, the better.

Some hold opinion, that the tarre killeth the worm: others. that the worm passing the sheathing, and seeking a way through, the hayre and the tarre so involve him, that he is choked therewith: which me thinkes is most prable: this manner of sheathing was invented by my Father: and experience hath taught it to be the best. and of least cost.” (Hawkins 1593:78-80).
APPENDIX D

SUTHERLAND'S ACCOUNT (1717) OF THE RAVAGES OF SHIPWORM

Sutherland's eighteenth-century treatise on shipbuilding, undoubtedly one of the most
descriptive of his era, offers an eye-witness account to the ravages of shipworm:

"And as for the Defence against the Worms eating, it's Notional, since I have seen a Ship's
Sheathing perfectly Honey-Comb'd: for it's the Opinion of most, that the Worms will eat through the
Sheathing Board until they come to the Tar and Hair, which turns the Insect, as believing that
Ingredient is offensive to the Worm; indeed then it must be the Hair, since the Creature must first eat
through Pitch before it comes to the Board, which is all one as if he had eaten through Tar.

Others will tell you, that this said Animal will eat through the Ship's Plank, tho' it be 4 Inches
thick, and as soon as he finds himself through, he will naturally turn and eat in the Plank Length-ways;
but this is as long as the Ship continues in Salt Water: for if there should chance to be any Worms in a
Ship or Vessel, and the said Vessel happen to go into Fresh Water, they would immediately eat
through, and so sink the Ship or Vessel, as has been formerly experienc'd in Virginia, where
their Rivers consist chiefly of Salt Water and fresh; from which it may be observed, that these Insects
nausiate the fresh Water. Well then, if it be only the hair that stops the Animal it may be as well done
with 1/4 Board as 3/4 Board, since the Hair may be as well and better laid under thin Board, than it has
been general to lay it under thick; however, it has been experienc'd, that the Ship's Planks have been eat
in several Places under the Sheathing, where the Worm has eat much, and through the Board, which, if
the hair is offensive, and Proof against the Worm, the damnify'd Plank must be owing to Neglect, in not
laying sufficient Hair in the Wake of every Part of the Board.

Thus much I have observed in Virginia, where in the heat of summer the Worm eats terribly.
insomuch, that I was obliged to clean our Ship and Boats very often, and yet the Boats Bottoms were
perfectly eat to Pieces. and the Ship's Sheathing was miserably eat, not only at the Water's Edge but
quite to the keel, nay downwards most; for undeniably often cleaning the Ship upwards, and the
Advantage of a Flux. or the Motion of the Ship, is a great Preservative, which will effect the Ship most
near the Surface of the Water" (Sutherland 1717).
APPENDIX E

VESSEL TYPES SAILING BETWEEN ENGLAND AND THE ENGLISH-AMERICAN COLONIES OF NEW ENGLAND, MARYLAND, AND VIRGINIA, ACCORDING TO BRISTOL SHIPPING RECORDS (MAY TO OCTOBER, 1682)

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Type</th>
<th>Bound For</th>
<th>Cargo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samuell and Mary</td>
<td>Ship</td>
<td>Virginia</td>
<td>Foodstuffs (aqua vitae), household goods, including tobacco pipes, assorted wares, window glass, English soup, knives (?), briddles, small saddles, bodices, haberdash wares, wearing apparel, hats, sheepskin gloves, shoes, and wool cards; cloth goods, including serges, English fustian, blue linen, kerseys, worsted stockings, woolen stockings, and cottons; and metal goods, including brass manufacture, wrought pewter, shot, wrought iron, and wrought iron nails.</td>
</tr>
<tr>
<td>Unicorn</td>
<td>Ship</td>
<td>Virginia</td>
<td>Household goods, including tobacco pipes, window glass, gunpowder, small saddles, bodices, haberdash wares, garments, hats, felt hats, and shoes; cloth goods, including serges, fustian, meniken baize, blue linen, children's worsted stockings, woolen stockings, cottons, and short cloth; and metal goods, including copper and brass manufacture, wrought pewter, shot, wrought iron, and nails.</td>
</tr>
<tr>
<td>Agreement</td>
<td>Ship</td>
<td>Virginia</td>
<td>Foodstuffs (malt), household goods, including tobacco pipes, parcels of several sorts of wares, small saddles, grindstones, haberdash wares, wearing apparel, hats, leather gloves, and shoes; cloth goods, including serges, fustian, woolen stockings, worsted stockings, cotton, and silk manufacture; and metal goods, including shot, wrought iron, and nails.</td>
</tr>
<tr>
<td>Frances and Mary</td>
<td>Ship</td>
<td>Virginia</td>
<td>Foodstuffs, including cheese, beer in bottles, and aqua vitae; household goods, including tobacco pipes, general sorts of wares, glass bottles, window glass, English canvas, cordage, bodices, haberdash wares, hats, and shoes; cloth goods, including serges, English fustian, cotton fustian, baize, English-made linen, blue linen, worsted stockings, woolen stockings, Irish stockings, cottons, silk manufacture, and cotton short cloth; and metal goods, including pewter, shot, wrought iron, and nails.</td>
</tr>
<tr>
<td>Maryland</td>
<td>Ship</td>
<td>Virginia</td>
<td>Household goods, including parcels of wares and wearing apparel; and cloth goods, including fustian and silk manufacture.</td>
</tr>
<tr>
<td>Concord</td>
<td>Ship</td>
<td>Virginia</td>
<td>Foodstuffs, including cheese, malt, and aqua vitae; household goods, including tobacco pipes, parcels of wares, apothecary wares, window glass, briddles, bodices, haberdash wares, wearing apparel, hats, shoes, boots, and wool cards; cloth goods, including serges, fustian, short cloth, English linen, blue linen, German linen, kersey, worsted stuffs, worsted stockings, woolen stockings, Irish stockings, and cottons; and metal goods, including copper and brass manufacture, pewter, wrought pewter, wrought iron, cast iron, and nails.</td>
</tr>
<tr>
<td>Friendship</td>
<td>Ship</td>
<td>Virginia, Maryland</td>
<td>Household goods, including tobacco pipes, wearing apparel, shoes, parcels of ware, Irish wares, English earthenware, haberdash wares, small saddles, cordage, hats, and Irish wigs; cloth goods, including serges, fustian, stockings, woolen stockings, and woolen stockings for children; and metal goods, including wrought iron.</td>
</tr>
<tr>
<td>Vessel</td>
<td>Type</td>
<td>Bound For</td>
<td>Cargo</td>
</tr>
<tr>
<td>-----------------</td>
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</tr>
<tr>
<td>Bristol Factor</td>
<td>Ship</td>
<td>Virginia</td>
<td>Foodstuffs, including butter, cheese, oatmeal, and malt; household goods, including tobacco pipes, English-made soup, window glass, shot load, several sorts of wares, leather manufacture, small saddles, chair covers, gunpowder, grindstones, haberdash wares, garments of apparel, wearing apparel, hats, and sheepskin gloves; cloth goods, including serges; English fustian, English-made linen, kersey, worsted stuffs, woolen stockings, woolen stockings for children, cottons, Welsh plains, and short cloths; and metal goods, including brass manufacture, pewter, wrought pewter, shot, iron, wrought iron, and nails.</td>
</tr>
<tr>
<td>Industry</td>
<td>Ship</td>
<td>Virginia</td>
<td>Household goods, including tobacco pipes, wearing apparel, hats, shoes, bodices, and haberdash wares; cloth goods, including woolen stockings, children’s woolen stockings, worsted stockings, silk manufacture, kerseys, cottons, fustian, cottons, short cloth, and serges; and metal goods, including wrought iron, pewter, wares, and nails.</td>
</tr>
<tr>
<td>Reformation</td>
<td>Ship</td>
<td>Virginia</td>
<td>Household goods, including tobacco pipes, parcels of wares, haberdash wares, and shoes; and metal goods, including iron wares.</td>
</tr>
<tr>
<td>John</td>
<td>Ship</td>
<td>Virginia</td>
<td>Household goods, including tobacco pipes, Irish wigs, parcel goods, hats, small saddles, and haberdash wares; cloth goods, including Irish stockings, worsted stockings, woolen stockings, children’s woolen stockings, fustian, cotton, short cloth, serges, silk manufacture, and menkin baize; and metal goods, including shot, wrought iron, and nails.</td>
</tr>
<tr>
<td>Bristol</td>
<td>Ship</td>
<td>Virginia</td>
<td>Foodstuffs, including butter, cheese, peas, barley, beer, and aqua vitae; household goods, including tobacco pipes, small grindstones, cordage, parcels of wares, window glass, bridles, saddles, gunpowder, English earthenwares, wearing apparel, garments of apparel, bodices, haberdash wares, hats, and shoes, cloth goods, including serges, English fustian, menkin baize, English-made linen, kersey, woolen stockings, children’s woolen stockings, Irish stockings, Norwich stuffs, cottons, plaines, thorne silk, hair cloth, and short cloth; and metal goods, including pewter, pewter manufacture, brass manufacture, and nails.</td>
</tr>
<tr>
<td>Rainbow</td>
<td>Ship</td>
<td>New England</td>
<td>Household goods, including English glass bottles, plain glass, lease of drawers (?), sheep skins, hats, and silk stockings(?); and cloth goods, including serges, fustian, linen, cottons, Linsey wool, and short cloth.</td>
</tr>
<tr>
<td>Mary</td>
<td>Pink</td>
<td>New England</td>
<td>Household goods, including tobacco pipes, English glass bottles, lead bellows, and wool cards, cloth goods, including silk stores; and metal goods, including shot and wrought iron.</td>
</tr>
<tr>
<td>Mary (of Salem)</td>
<td>Ship</td>
<td>New England</td>
<td>Household goods (tobacco pipes); and cloth goods, including serges.</td>
</tr>
<tr>
<td>Vessel</td>
<td>Type</td>
<td>Bound For</td>
<td>Cargo</td>
</tr>
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<td>------------------------</td>
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</tr>
<tr>
<td>Mary (of New England)</td>
<td>Ship</td>
<td>New England</td>
<td>Foodstuffs, including butter, cheese, and peas; household goods (parcels of wares), cloth goods, including serge, linen, kersey, stuffs, and silk manufacture; and metal goods, including wrought pewter, shot, and wrought iron.</td>
</tr>
<tr>
<td>Sarah</td>
<td>Ship</td>
<td>New England</td>
<td>Household goods, including tobacco pipes, parcels of wares, bellows, girth web, English earthenware, glass bottles, hubbardasher wares, hats, hair stuffs, shod shoes, and wool cards, cloth goods, including serges, English fusian, kersey, Norwitch stuffs, cottons, playnes (plaines), cloth, throne silk, striped neck, and short cloth; and metal goods, including brass manufacture, lead shot, wrought iron, and nails.</td>
</tr>
<tr>
<td>Unicorn</td>
<td>Ship</td>
<td>Pennsylvania</td>
<td>Household goods, including cordage, leather manufacture, small saddles, shot loads, powder, chest glass, grindstones, wearing apparel, garments, bodices, hubbardasher wares, shoes, and wool cards, cloth goods, including serges, English fusian, English linen, Irish stockings, and short cloth; and metal goods, including copper and brass manufacture, pewter, wrought pewter, lead shot, steel, wrought iron, and nails.</td>
</tr>
<tr>
<td>Bristol Factor</td>
<td>Ship</td>
<td>Pennsylvania</td>
<td>Foodstuffs, including butter, cheese, oatmeal, malt, and beer; household goods, including parcels of wares, grindstones, window glass, cordage, shot load, leather manufacture, small saddles, bags, gun powder, wearing apparel, English soap, chair covers, woollen chair covers, garments, hubbardasher wares, sheepskin gloves, and shoes; cloth goods, including fusian, serges, kerseys, English-made linen, worsted stockings, woollen stockings, Norwitch stuff, cottons, Spanish cloth, and throne silk; and metal goods, including brass manufacture, pewter, wrought pewter, shot, iron, wrought iron, and nails.</td>
</tr>
<tr>
<td>Bristol</td>
<td>Ship</td>
<td>Pennsylvania</td>
<td>Foodstuffs, including butter, cheese, biscuit, malt and beer; household goods, including shoes, hubbardasher wares, tobacco pipes, parcels of several sorts of wares, gun powder, English soap, English glue, powder, leather manufacture, bridles, saddles, small saddles, English earthenwares, English glass bottles, window glass, grindstones, cordage, garments of wearing apparel, bodices, hats, shoes, and wool cards, cloth goods, including, serges, fusian, baize, cottons, kersey, worsted stockings, woollen stockings, cotton, plains, Linsey wool, hair cloth, and short cloth; and metal goods, including brass manufacture, wrought pewter, lead shot, wrought iron, and nails.</td>
</tr>
<tr>
<td>Agreement</td>
<td>Ship</td>
<td>Carolina</td>
<td>Household goods, including books, apothecary wares, soap, tallow candles, window glass, plain glass, hubbardasher wares, hats, and shoes; cloth goods, including serges, blue linen, English-made linens, worsted stockings, worsted stuffs, woollen stockings, l insy wool, silk, and throne silk; and metal goods, including brass manufacture, wrought pewter, shot, wrought iron, bar iron, and nails.</td>
</tr>
<tr>
<td>Jeremiah</td>
<td>Ship</td>
<td>Newfoundland</td>
<td>Foodstuffs (sugar?), household goods, including hats, and metal goods, including shot.</td>
</tr>
</tbody>
</table>
## APPENDIX F

**VESSSEL TYPES SAILING BETWEEN ENGLAND AND NEVIS, ACCORDING TO BRISTOL SHIPPING RECORDS**

**(MAY TO OCTOBER, 1682)**

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Type</th>
<th>Cargo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nevis</td>
<td>Ship</td>
<td>Foodstuffs, including cheese, bacon, biscuits, wheat meal, peas, and cider in bottles; household goods, including parcels of wares, English glass bottles, window glass, tallow candles, English soap, pipe and pipe hoops, small saddles, herodash wares, wearing apparel, sheepskin gloves, and shoes; cloth goods, including serges, fustian, worsted stockings, worsted stuffs, English linen, blue linen, German linen, cottons, ordinary pennistone, and silk manufacture, and metal goods, including copper manufacture, pewter, wrought iron, and nails.</td>
</tr>
<tr>
<td>Endeavor (^1)</td>
<td>Ship</td>
<td>Foodstuffs, including biscuits and aqua vitae; household goods, including parcels of wares, English glass bottles, tallow candles, leather chairs, shoes, and slippers; cloth goods, including worsted stuffs and cotton; and metal goods, including wrought pewter, wrought iron, iron, and nails.</td>
</tr>
<tr>
<td>Owner's Endeavor</td>
<td>Ship</td>
<td>Foodstuffs, including cheese, beef, bacon, peas, hops (?), beer drawn into bottles, and cider in bottles; household goods, including tobacco pipes, parcels of wares, English glass bottles, flint stones, gun powder, English soap, herodash wares, hats, and shoes; cloth goods, including serges, fustian, blue linen, English-made linen, kersey, worsted stockings, cottons, silk manufacture, thread silk, and short cloth; and metal goods, including copper manufacture, brass manufacture, wrought pewter, shot, wrought iron, and nails.</td>
</tr>
<tr>
<td>Owner's Aventurow</td>
<td>Ship</td>
<td>Foodstuffs, including cheese, bacon, and beer in bottles; and household goods, including tobacco pipes, tallow candles, English soap, and shoes.</td>
</tr>
<tr>
<td>Content</td>
<td>Ship</td>
<td>Foodstuffs, including butter, cheese, peas, beer, and aqua vitae; household goods, including tobacco pipes, parcels of wares, several sorts of wares, tallow candles, leather manufacture, leather chairs, herodash wares, hat wares, sheepskin gloves, shoes, and paving stones; cloth goods, including serges, worsted stockings, silk manufacture, and English sack cloth; and metal goods, including brass manufacture, pewter, iron, wrought iron, and nails.</td>
</tr>
<tr>
<td>Comfort</td>
<td>Ketch</td>
<td>Foodstuffs, including butter, cheese, bacon, and peas; cloth goods (English linen); and metal goods (wrought iron).</td>
</tr>
</tbody>
</table>

\(^1\) This may be the same vessel as the Owner's Endeavor.
APPENDIX G
VESSLE TYPES SAILING BETWEEN ENGLAND AND JAMAICA, ACCORDING TO BRISTOL SHIPPING RECORDS
(MAY TO OCTOBER, 1682)

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Type</th>
<th>Cargo</th>
</tr>
</thead>
<tbody>
<tr>
<td>American</td>
<td>Ship</td>
<td>Foodstuffs, including butter, cheese, bacon, beer, and cider, household goods, including tobacco pipes, English earthenware glasses, English glass bottles, window glass, chest glass, glue, books, tallow candles, powder horns, cordage, leather manufacture, bridles, saddles, horse whips, bellows, hubbardsh wares, wearing apparel, clothes, hats, and shoes; cloth goods, including serges, fustian, linen, stockings, and worsted stuffs; and metal goods, including wrought pewter, lead, lead shot, wrought iron, and nails.</td>
</tr>
<tr>
<td>Merchant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lamb</td>
<td>Ship</td>
<td>Foodstuffs, including butter, cheese, bacon, bread, flour, meal, oat meal, peas, bottles of beer, aqua vitae, and cider; household goods, including tobacco pipes, saddles, bridles, leather manufacture, cordage, bugs, nested (?) trunks, parcels of wares, books, English glass bottles, earthenwares, English earthenwares, cordage, imported hats, shoes, and hubbardsh wares, cloth goods, including English fustian, silk manufacture, linen, worsted stuffs, short cloth, and flannel; and metal goods, including copper manufacture, wrought pewter, wrought iron, and nails.</td>
</tr>
<tr>
<td>Nathaniel</td>
<td>Ship</td>
<td>Foodstuffs, including butter, cheese, bacon, biscuit, oat meal, beer in bottles, and aqua vitae; household goods, including all sorts of wares, parcels of wares, tobacco pipes, English earthenware, English glass, glass bottles, sturch (?), tallow candles, cordage, printed books, playing cards, ox bows, leather manufacture, small saddles, hubbardsh wares, hats, felt hats, gloves, sheepskin gloves, shoes, and shoemaker's lasts; cloth goods, including English fustian, blue linen, Norwich stuff, throne silk, silk manufacture, and short cloth; and metal goods, including brass manufacture, wrought iron, and nails.</td>
</tr>
<tr>
<td>Hopewell</td>
<td>Ship</td>
<td>Foodstuffs, including butter, cheese, flour, bread, and cider, household goods, including English glass bottles, wool cards, and bellows; cloth goods, including worsted stuffs; and metal goods, including wrought iron, brass manufacture, pewter, shot, iron, and nails.</td>
</tr>
<tr>
<td>Abraham and</td>
<td>Ship</td>
<td>Household goods (Cornish tiles).</td>
</tr>
<tr>
<td>Mary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# APPENDIX H

## BRISTOL VESSEL TYPES AND CARGOES SAILING BETWEEN ENGLAND AND BARBADOS, MONSERRAT, ISABELLA, AND THE BAHAMA ISLANDS, ACCORDING TO BRISTOL SHIPPING RECORDS (MAY TO OCTOBER 1682)

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Type</th>
<th>Cargo</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Jeremy</em></td>
<td>Ship</td>
<td>Foodstuffs, including butter, cheese, and malt; and household goods (coals? of London measure).</td>
</tr>
<tr>
<td><em>Dilligence</em></td>
<td>Ship</td>
<td>Foodstuffs, including butter, cheese, bacon, biscuit, beer in bottles, and aqua vitae; household goods, including tobacco pipes,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>general sorts of wares, apothecary wares, English glass bottles, tallow candles, gun powder, starch, bed tile (?), paving stones,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cordage, haberdash wares, hats, felt hats, sheepskin gloves, shoes, leather manufacture, bridles, small saddles, and wool cards;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cloth goods, including serges, fustian, baize, English-made linen, kersey, worsted stockings, worsted stuff, and single Norwicht</td>
</tr>
<tr>
<td></td>
<td></td>
<td>stuff; and metal goods, including brass and copper manufacture, pewter, wrought iron, metals, and nails.</td>
</tr>
<tr>
<td><em>Restoration</em></td>
<td>Ship</td>
<td>Foodstuffs, including beer and cider, household goods (English glass bottles), and metal goods (iron).</td>
</tr>
<tr>
<td><em>Martha and</em></td>
<td>Ship</td>
<td>Household goods, including leather manufacture and knit woolen caps for “Negroes”; cloth goods, including English-made linen</td>
</tr>
<tr>
<td><em>Sarah</em></td>
<td></td>
<td>and flannel; and metal goods, including copper manufacture, pewter, wrought iron, and nails.</td>
</tr>
<tr>
<td><em>Antego</em></td>
<td>Ship</td>
<td>Foodstuffs, including cheese and beer; household goods, including tobacco pipes, parcels of wares, parcels of assorted goods,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>shoes, and shoemaker’s thread; cloth goods, including serges, English fustian, worsted stockings, worsted stuffs, and cotton;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and metal goods, including brass manufacture, wrought pewter, ironware, wrought iron, and nails.</td>
</tr>
<tr>
<td><em>Margret</em></td>
<td>Ship</td>
<td>Foodstuffs, including butter, cheese, bacon, peas, oats, beer, cider, and aqua vitae; household goods, including tobacco pipes,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>parcels of wares, English earthenwares, English glass bottles, English drinking glasses, tallow candles, cordage, books,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>grindstones, haberdash wares, hats, plain Monmouth caps, shoes, leather manufacture, bridles, saddles, small saddles, and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>holsters; cloth goods, including serges, English sack cloth, cottons, English-made linen, and short cloth; and metal goods,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>including copper manufacture, wrought iron, bar iron, and nails.</td>
</tr>
<tr>
<td><em>Content</em></td>
<td>Ship</td>
<td>Household goods (shoes); and metal goods, including wrought iron and nails.</td>
</tr>
<tr>
<td><em>Mary</em></td>
<td>Ship</td>
<td>Household goods, including English glass bottles, cinders (sinders), potter clay, leather manufacture, and haberdash wares;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cloth goods, including worsted stuffs, calicoes, silk, English throne silk, and silver lace; and metal goods, including brass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>manufacture and wrought iron.</td>
</tr>
<tr>
<td>Vessel</td>
<td>Type</td>
<td>Cargo</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Friend's Adventure</em></td>
<td>Ship</td>
<td>Household goods (tobacco pipes), and cloth goods (serges).</td>
</tr>
<tr>
<td><em>Comfort</em></td>
<td>Ship</td>
<td>Household goods (leather manufacture), cloth goods, including English-made and colored linen, and metal goods, including brass manufacture.</td>
</tr>
<tr>
<td><em>Arthur and Mary</em></td>
<td>Ship</td>
<td>Household goods, including apothecary wares, English glass bottles, sinders, and leather manufacture; cloth goods, including worsted stuffs, silk manufacture, English throne silk, calicoes, and silver lace; and metal goods, including brass manufacture and wrought iron.</td>
</tr>
<tr>
<td><em>Sarah (Monserrat)</em></td>
<td>Ship</td>
<td>Household goods, including parcels of wares, apothecary wares, glass bottles, glasses (?), flintstones, and hats; and metal goods (brass manufacture).</td>
</tr>
<tr>
<td><em>New England (Monserrat)</em></td>
<td>Ship</td>
<td>Metal goods (wrought iron).</td>
</tr>
<tr>
<td><em>Abaco (Bahamas)</em></td>
<td>Ship</td>
<td>Household goods (calve skins); cloth goods, including double baize, worsted stockings, and worsted stockings for women; and metal goods (shot).</td>
</tr>
<tr>
<td><em>Bero? (Bahamas)</em></td>
<td>Ship</td>
<td>Household goods, including long (shot) load and calve skins; and metal goods, including iron beams and shot.</td>
</tr>
<tr>
<td><em>Isabella (Isabella?)</em></td>
<td>Ship</td>
<td>Foodstuffs, including butter and aqua vitae, household goods, including English earthenware, English glass bottles, shot load, haberdash wares, hats, and shoes; cloth goods, including serges, fustian, kersey, cloths, worsted stockings, worsted stuffs, cotton, and plains; and metal goods, including wrought pewter, brass manufacture, lead, wrought iron, and shot.</td>
</tr>
<tr>
<td><em>Mary</em></td>
<td>Ketch</td>
<td>Metal goods, including brass and pewter manufacture.</td>
</tr>
<tr>
<td><em>Vine</em></td>
<td>Ketch</td>
<td>Cloth goods, including worsted stockings, worsted stuff, Norwich stuffs, silk manufacture, and throne silk.</td>
</tr>
<tr>
<td><em>Jon</em></td>
<td>Pink</td>
<td>Household goods, including glass bottles and hats; cloth goods, including double baize; and metal goods, including iron, barrel hoops, brass manufacture, wrought iron, and wrought pewter.</td>
</tr>
<tr>
<td><em>John</em></td>
<td>Pink</td>
<td>Household goods (glass bottles).</td>
</tr>
</tbody>
</table>
### APPENDIX I

**SEVENTEENTH-CENTURY DUTCH VESSEL TYPES AND THEIR CARGOES AS COMPILED FROM THE RESOLUTION BOOK OF CURACAO NO. 58 MM AND THE REGISTER OF THE LETTERS FROM CURACAO, NO. 60, 1640-1655**

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Function</th>
<th>Specifies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ship</strong></td>
<td>Conveyance (troops, slaves, immigrants); reconnaissance.</td>
<td>Supplies, including paper, writing book, quills, ink, ruler, pen knives, whetstone, almanacs, sealing wax, smith's coal, tar, pitch, trane oil, harpuys, twine, sail needles, housing lines, marlines, seathread lines, white lines, thread, seine, sail thread, draw saw handles, peat moss, gunpowder, hawsers, belaying ropes, match, wooden milk measures, milk strainers, wooden butter bowls, wooden water conduits, hoopsticks, nails, pompatassens, spikes, files, planks, cloth, tobacco, dyewood, poekwood, elephant tusks, and silver coins, livestock, including goats, sheep, castrated bucks and rams, and horses; groceries, including strong drink, Brunswiek mum, biscuits, rye-meal, smoked meat, Edam and Leiden cheeses, mustard seed, groats, English cakes. English hardbread, meal, sugar, salt, white peas. dried cod. salted meat, bacon, bread, pottage, meat, and bacon; passengers, including Indians.</td>
</tr>
<tr>
<td><strong>Yacht</strong></td>
<td>Conveyance (slaves, passengers, troops, animals, cargo); coastal exploration, supply; dispatch; reconnaissance; cruising; workboat.</td>
<td>Supplies, including pine planks, beans, timbers, clapboards, wainscotting, horse mills, woodwork for a vessel, gunstocks, oxcarts, planes, wooden hoops, rope, hawsers, blocks, and an anchor; animals, including parrots and parakeets; groceries, including groats, vinegar, flour, pottage, butter, salt and scum salt, beans, mum. French wine, wheat, rye, peas, bacon, and meat.</td>
</tr>
<tr>
<td><strong>Fluytschip</strong></td>
<td>Conveyance; cruising vessel.</td>
<td>Supplies, including salt, tobacco, dyewood, copper, hides, timberwork, and gold or silver, livestock, including goats, sheep, and horses; groceries, including peas, meal, cassava, farina, beans, wheat, rye. French wine. vinegar, and mum; passengers, including &quot;Negroes.&quot;</td>
</tr>
<tr>
<td><strong>Bark</strong></td>
<td>Conveyance (passengers: cargo); rescue operations; turtleing.</td>
<td>Supplies, including rough copper or &quot;slags.&quot; dyewood, tobacco, and hides, livestock, including sheep and goats, passengers, including slaves.</td>
</tr>
<tr>
<td>Vessel Type</td>
<td>Function</td>
<td>Specifies</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Galiot</td>
<td>Conveyance (troops, passengers and supplies).</td>
<td>Supplies, including barrels, pots, pacs, cloth, hides (bear, deer, lion, fox, elk, beaver), hoopsticks, crooked timber, hammocks, conch shells, cotton, bedding, dyewood, and possibly poekwood; livestock, including horses, sheep, and castrated goats; groceries, including syrup, sugar, plums, lemon juice, conch, sweets, preserved lemons, salt, sugar, cheese, beer, brandy, peas (gray and white), wheat, and salted meat.</td>
</tr>
<tr>
<td>Frigate</td>
<td>Conveyance, salvage.</td>
<td>Supplies, including parcels of goods and hard currency, groceries, including cacao; passengers, including “Negroes.”</td>
</tr>
<tr>
<td>Small ship</td>
<td>Conveyance (immigrants, slaves, currency).</td>
<td>Supplies, including parcels of goods, hides, and dyewood; groceries, including Spanish wine, salted meat or bacon, salt (?), flour, brandy, and oil.</td>
</tr>
<tr>
<td>Sloop</td>
<td>Conveyance (slaves and equipment), turtleing.</td>
<td>Equipment for salt mining</td>
</tr>
<tr>
<td>Ketch</td>
<td>Conveyance (slaves, passengers, cargo)</td>
<td>Supplies, including linen, leather, boards, and tar; livestock, including horses, groceries, including peas, meal, salted meat, bacon, mackerel, codfish, and English cakes.</td>
</tr>
<tr>
<td>Dogger</td>
<td>Fishing.</td>
<td>--</td>
</tr>
<tr>
<td>Pirogue</td>
<td>Observation.</td>
<td>Spanish pirogue stationed to reconnoiter the Dutch West India Company.</td>
</tr>
</tbody>
</table>
APPENDIX J

HARRINGTON'S HISTOGRAM SHOWING VARIATIONS IN PIPE STEM BORE DIAMETERS OVER TIME. NUMBERS INSIDE BARS REPRESENT PERCENTAGES.
AFTER NOEL HUME (1985:298)

Stem Hole Diameters in 64ths of an Inch
### APPENDIX K
**PIPE STEM SAMPLES FROM THE SEVENTEENTH-CENTURY NORTHERN EUROPEAN MERCHANT SHIPWRECK IN MONTE CRISTI BAY, DOMINICAN REPUBLIC**

<table>
<thead>
<tr>
<th>Bore Diameter</th>
<th>Sample No.</th>
<th>% Total</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STUDY #1</strong></td>
<td>6/64&quot;</td>
<td>2</td>
<td>0.40</td>
</tr>
<tr>
<td>1986</td>
<td>7/64&quot;</td>
<td>195</td>
<td>38.46</td>
</tr>
<tr>
<td></td>
<td>8/64&quot;</td>
<td>308</td>
<td>60.74</td>
</tr>
<tr>
<td></td>
<td>9/64&quot;</td>
<td>2</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>507</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>X = 7.611</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Y = 1641.63</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bore Diameter</th>
<th>Sample No.</th>
<th>% Total</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STUDY #2</strong></td>
<td>5/64&quot;</td>
<td>1</td>
<td>0.20</td>
</tr>
<tr>
<td>1987</td>
<td>6/64&quot;</td>
<td>13</td>
<td>2.60</td>
</tr>
<tr>
<td></td>
<td>7/64&quot;</td>
<td>185</td>
<td>37.00</td>
</tr>
<tr>
<td></td>
<td>8/64&quot;</td>
<td>297</td>
<td>59.40</td>
</tr>
<tr>
<td></td>
<td>9/64&quot;</td>
<td>4</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>500</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>X = 7.58</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Y = 1641.83</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bore Diameter</th>
<th>Sample No.</th>
<th>% Total</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STUDY #3</strong></td>
<td>5/64&quot;</td>
<td>1</td>
<td>0.10</td>
</tr>
<tr>
<td>1987</td>
<td>6/64&quot;</td>
<td>15</td>
<td>1.48</td>
</tr>
<tr>
<td></td>
<td>7/64&quot;</td>
<td>380</td>
<td>37.74</td>
</tr>
<tr>
<td></td>
<td>8/64&quot;</td>
<td>605</td>
<td>60.08</td>
</tr>
<tr>
<td></td>
<td>9/64&quot;</td>
<td>6</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>1,007</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>X = 7.596</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Y = 1641.23</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

1 Estimated date of deposition (Y) was calculated using the Binford formula. Study number and date are listed in the column to the left.
<table>
<thead>
<tr>
<th>Bore Diameter</th>
<th>Sample No.</th>
<th>% Total</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/64&quot;</td>
<td>1</td>
<td>0.10</td>
<td>20</td>
</tr>
<tr>
<td>6/64&quot;</td>
<td>15</td>
<td>1.48</td>
<td>192</td>
</tr>
<tr>
<td>7/64&quot;</td>
<td>380</td>
<td>37.74</td>
<td>1.183</td>
</tr>
<tr>
<td>8/64&quot;</td>
<td>605</td>
<td>60.08</td>
<td>2.312</td>
</tr>
<tr>
<td>9/64&quot;</td>
<td>6</td>
<td>0.60</td>
<td>36</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>498</strong></td>
<td><strong>100.00</strong></td>
<td><strong>3,743</strong></td>
</tr>
</tbody>
</table>

**STUDY #4**
1987

X = 7.516

Y = 1644.29

<table>
<thead>
<tr>
<th>Bore Diameter</th>
<th>Sample No.</th>
<th>% Total</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/64&quot;</td>
<td>5</td>
<td>0.33</td>
<td>25</td>
</tr>
<tr>
<td>6/64&quot;</td>
<td>47</td>
<td>3.12</td>
<td>282</td>
</tr>
<tr>
<td>7/64&quot;</td>
<td>549</td>
<td>36.48</td>
<td>3.843</td>
</tr>
<tr>
<td>8/64&quot;</td>
<td>894</td>
<td>59.40</td>
<td>7.152</td>
</tr>
<tr>
<td>9/64&quot;</td>
<td>10</td>
<td>0.67</td>
<td>90</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,505</strong></td>
<td><strong>100.00</strong></td>
<td><strong>1,392</strong></td>
</tr>
</tbody>
</table>

**STUDY #5**
1987

X = 7.569

Y = 1642.24

<table>
<thead>
<tr>
<th>Bore Diameter</th>
<th>Sample No.</th>
<th>% Total</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/64&quot;</td>
<td>8</td>
<td>34.78</td>
<td>56</td>
</tr>
<tr>
<td>8/64&quot;</td>
<td>15</td>
<td>65.22</td>
<td>120</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
<td><strong>100.00</strong></td>
<td><strong>176</strong></td>
</tr>
</tbody>
</table>

**STUDY #6**
1986
*(Throckmorton)*

X = 7.652

Y = 1639.07
<table>
<thead>
<tr>
<th>Bore Diameter</th>
<th>Sample No.</th>
<th>% Total</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/64&quot;</td>
<td>113</td>
<td>18.59</td>
<td>791</td>
</tr>
<tr>
<td>8/64&quot;</td>
<td>492</td>
<td>80.92</td>
<td>3.936</td>
</tr>
<tr>
<td>9/64&quot;</td>
<td>3</td>
<td>0.49</td>
<td>27</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>608</strong></td>
<td><strong>100.00</strong></td>
<td><strong>4.754</strong></td>
</tr>
</tbody>
</table>

**STUDY #7**  
1987  
$X = 7.819$  
$Y = 1632.69$

<table>
<thead>
<tr>
<th>Bore Diameter</th>
<th>Sample No.</th>
<th>% Total</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/64&quot;</td>
<td>121</td>
<td>19.17</td>
<td>847</td>
</tr>
<tr>
<td>8/64&quot;</td>
<td>507</td>
<td>80.35</td>
<td>4.056</td>
</tr>
<tr>
<td>9/64&quot;</td>
<td>3</td>
<td>0.48</td>
<td>27</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>631</strong></td>
<td><strong>100.00</strong></td>
<td><strong>4.754</strong></td>
</tr>
</tbody>
</table>

**STUDY #8**  
1987  
$X = 7.534$  
$Y = 1643.60$

---

<table>
<thead>
<tr>
<th>Bore Diameter</th>
<th>Sample No.</th>
<th>% Total</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/64&quot;</td>
<td>3</td>
<td>0.03</td>
<td>12</td>
</tr>
<tr>
<td>5/64&quot;</td>
<td>22</td>
<td>19.00</td>
<td>110</td>
</tr>
<tr>
<td>6/64&quot;</td>
<td>583</td>
<td>5.08</td>
<td>3.498</td>
</tr>
<tr>
<td>7/64&quot;</td>
<td>4,291</td>
<td>37.40</td>
<td>30,037</td>
</tr>
<tr>
<td>8/64&quot;</td>
<td>5,380</td>
<td>46.90</td>
<td>43,040</td>
</tr>
<tr>
<td>9/64&quot;</td>
<td>111</td>
<td>0.97</td>
<td>999</td>
</tr>
<tr>
<td>10/64&quot;</td>
<td>7</td>
<td>0.06</td>
<td>70</td>
</tr>
<tr>
<td>No Measurement</td>
<td>1,075</td>
<td>9.37</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,472</strong></td>
<td><strong>100.00</strong></td>
<td><strong>77,766</strong></td>
</tr>
</tbody>
</table>

**STUDY #9**  
1991-92 (PIMA)  
$X = 6.779$  
$X' = 7.48$  
$Y = 1672.49$  
$Y' = 1645.67$

---

2 The Revised Total, $X'$ and $Y'$ are calculated excluding pipes for which no measurements were made. The assumption is that these 1,075 fragments have bore measurements that are representative of the entire distribution.
APPENDIX L

X-VALUE, PRODUCT, AND OCCUPATION DATE USING OMWAKE'S FORMULA FOR PIPE STEMS FROM THE SEVENTEENTH-CENTURY NORTHERN EUROPEAN MERCHANT VESSEL IN MONTE CRISTI BAY, DOMINICAN REPUBLIC

<table>
<thead>
<tr>
<th>Study Number</th>
<th>X value</th>
<th>Product</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.611</td>
<td>280.22180</td>
<td>1648.47</td>
</tr>
<tr>
<td>2</td>
<td>7.58</td>
<td>279.08044</td>
<td>1650.11</td>
</tr>
<tr>
<td>3</td>
<td>7.596</td>
<td>279.66953</td>
<td>1649.52</td>
</tr>
<tr>
<td>4</td>
<td>7.516</td>
<td>276.72409</td>
<td>1652.47</td>
</tr>
<tr>
<td>5</td>
<td>7.569</td>
<td>278.67544</td>
<td>1650.51</td>
</tr>
<tr>
<td>6</td>
<td>7.652</td>
<td>281.73134</td>
<td>1647.46</td>
</tr>
<tr>
<td>7</td>
<td>7.819</td>
<td>287.87994</td>
<td>1641.31</td>
</tr>
<tr>
<td>8</td>
<td>7.531</td>
<td>277.23954</td>
<td>1651.95</td>
</tr>
<tr>
<td>9a</td>
<td>6.779</td>
<td>249.58922</td>
<td>1679.60</td>
</tr>
<tr>
<td>9b</td>
<td>7.480</td>
<td>275.39864</td>
<td>1653.79</td>
</tr>
</tbody>
</table>

Mean deposition date excluding sample 9b: 1652.37

Mean deposition date including sample 9b: 1652.52
APPENDIX M

FRIEDERICH'S GRAPH AND TYPOLOGY FOR DATING DUTCH PIPE BOWLS USING THE H x B x O FORMULA (AFTER FRIEDERICH 1975)
APPENDIX N
A SHORT BIOGRAPHY OF EDWARD BIRD, PIPE MAKER

When Edward Bird\(^1\) died in May of 1665, an inventory of his estate revealed his success as a pipe maker. Among his possessions were several properties, including a two-room house in Jordaan, an upper-class district of Amsterdam. The home featured a fireplace, an attic, a small kitchen, and furnishings that included tableware, a cabinet replete with silverware, fifteen paintings and prints, numerous books, and two Bibles, one of which was printed in English. His workshop, divided into front and back sections, had a kitchen and two sheds, one of which was used specifically for keeping clays. De Roever (1987:58) reports that here in the workshop Bird left 66 cases of "glossy pipes," nine cases of "short, fine pipes," 12 ship's cases, twenty-three cases of "bulbous pipes," and a "ton of the longest pipes." Baart (1992:142), however, nearly doubles this number, listing "256,608 vol verglaesde taback pijpe" (double-polished tobacco pipes), 266,400 corte fijne taback pijpe (short length fine quality tobacco pipes), and 93,600 dikkop pijpe (pipes with thick strong bowls), totalling 616,608 pipes." The enormous quantity and wide distribution of Bird's pipes, especially in North and South America, further attest to the success of his enterprise.

Edward Bird was born in Surrey, England, but the year of his birth is unknown (De Roever 1987). Accounts vary as to exactly when Bird emigrated to the Netherlands. Grossman (1985) sets the date at 1624, but McCashion and Robinson (1977) suggest 1628. It is agreed, however, that he arrived in Amsterdam as a soldier and remained when his military service was complete. In 1638, he bought a burghership and received Dutch citizenship.

In 1630, Bird married Aeltje Govaert, an 18-year-old native of Amsterdam. Within two years, a child was born, the first of 11. Family records from the Oude Kerk (Old Church), Nieuw Kerk (New Church) and the Westerkerk (West Church) indicate at least ten infant baptisms (De Roever 1987). Unfortunately, however, all but one of the children died in infancy or shortly thereafter, a sad testimony to the harsh realities of life in seventeenth-century Europe, even among members of the middle and upper classes.

Edward undoubtedly began his career in one of the many pipe shops around Amsterdam. Following their wedding, the Birds began a pipe-making business of their own, marking their products with the distinctive EB heel stamp. Apparently they found success, for

\(^1\) Alternative spellings of the surname from Dutch registry documents include Bard, Bart, Bardt, Berd, Bert, Berdt, Bird, Birt, Birth, Birdt, Bord, Bort, Burd, Burt, Bijrd, Bijrt, Bieret, Bijtrd. The given names of Edward, Eduwart, Eduard, and Evert are also interchangeable (De Roever 1987; Duco 1981).
pipes with this stamp rapidly made their way into homes all over Europe and North America (Huey 1988; McCashon 1979a; De Roever 1987). By 1644, the Birds were instructing a 13-year-old indentured boy in the craft of pipe making. Soon after, the Bird family purchased the first of several fine homes (De Roever 1987; Duco 1981). When Aeltje died, in 1658, she left an estate that included eight houses, thereby contributing further to Edward's wealth (De Roever 1987).

Shortly after Aeltje's death, Edward remarried to a widow named Anna van der Heijden (Huey 1988). Anna and Edward lost a child early in their marriage. For a public record from 1662 mentions the death of a youngster; it is unclear, however, if the child was Aeltje's or Anna's. With the help of Anna and his only surviving son, Evert, Edward continued to pursue his successful career in pipe making. He lived out his final years near the Pijpenbrandersgang, or pipe maker's lane that, from 1635 to 1675, had the largest concentration of pipe makers in all of Amsterdam (Duco 1981). Edward Bird died in 1665 and was buried in the Wester Kerk on 20 May (De Roever 1987).

Evert Bird carried on the family business even after his father's death. At his wedding, in 1668, Evert listed his occupation as pipe maker. However, the younger Bird was never as successful in the trade as was Edward; between 1678 and 1683, unable to make payments, Evert had to sell two of the family properties (De Roever 1987). It is uncertain whether Evert continued to use the EB heel stamp originated by his father, but certain researchers have chosen to assign a temporal range of 1630 to 1683 for all EB-stamped pipes. Evert's son, Eduard, grew up to become a tavern owner and a wine merchant, thus ending a pipe-making tradition that spanned two generations.

---

2 Anna's name is also listed as Anna Marie van der Heijde. De Roever (1987) suggests May 1659 for the marriage, but both Duco (1981) and Huey (1988) refer to June 1661 as the wedding date.
APPENDIX O
SEVENTEENTH-CENTURY ARCHAEOLOGICAL SITES FROM WHICH BULBOUS-BOWLED PIPES BEARING AN EB HEEL STAMP HAVE BEEN RECOVERED

<table>
<thead>
<tr>
<th>Site Name and Location</th>
<th>Occupation</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amsterdam, Netherlands</td>
<td>Dutch</td>
<td>Seventeenth c.</td>
<td>See Ilney (1988).</td>
</tr>
<tr>
<td>Fort Orange, NY</td>
<td>Dutch-American</td>
<td>1624 to 1675</td>
<td>21 pipes recovered, including 13 (61.9%) dating ca. 1648 to 1676 (Ilney 1988).</td>
</tr>
<tr>
<td>Broad Street, NY</td>
<td>Dutch-American</td>
<td><em>ca. 1647 to 1710</em></td>
<td>Several pipes bear EB heel stamps in concentric circles, probably the same mark that Ilney (1988) described as a single ring (FOT 30). These include one (and possibly two) from the south barrel fill on van Tienhoven’s lot; one from Strata Group II A; another was excavated from Component 22 in the Haie/van Tienhoven lot (Lot 8) (Grossman 1985). Grossman further notes an unspecified number of pipes with the EB heel stamp in concentric circles in Temporal group 1680. Two pipes were excavated from Component 17. The 1640 temporal group also yielded an unspecified number of pipes bearing this mark. Pipes with an EB heel mark in with plain circles were located in Temporal group 1680.</td>
</tr>
<tr>
<td>Pearl Street, NY</td>
<td>Dutch-American</td>
<td><em>ca. 1647 to 1710</em></td>
<td>Four pipes recovered (McCashion 1991).</td>
</tr>
<tr>
<td>Site Name and Location</td>
<td>Occupation</td>
<td>Date</td>
<td>Comments</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------</td>
<td>-------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Fort James, NY</td>
<td>Dutch-American</td>
<td>1665 to 1685</td>
<td>See Huey (1988).</td>
</tr>
<tr>
<td>South Beach, NY</td>
<td>Dutch-American?</td>
<td>1675 to 1700</td>
<td>See McCushion (1975).</td>
</tr>
<tr>
<td>Chester, England</td>
<td>English</td>
<td>Seventeenth c.</td>
<td>See Rutter and Davey (1980).</td>
</tr>
<tr>
<td>St. Mary’s City, Md.</td>
<td>Anglo-American</td>
<td>1634 to 1680</td>
<td>Of the six pipes depicted in Miller (1983:71-2, 79, and 81), some appear to be ringed, although Huey (1988) assigns only one type -- Type 34, a borderless stamp -- to all of them.</td>
</tr>
<tr>
<td>Charlestown Harbor, SC</td>
<td>Anglo-American</td>
<td>Mid Seventeenth c.</td>
<td>See Bradley and DeAngelo (1981).</td>
</tr>
<tr>
<td>Port Royal, Jamaica</td>
<td>Anglo-American</td>
<td>1655 to 1692</td>
<td>See Jobling (personal communication 1995), see Marx (1968a).</td>
</tr>
<tr>
<td>Site Name and Location</td>
<td>Occupation</td>
<td>Date</td>
<td>Comments</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------</td>
<td>------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Compton, Md.</td>
<td>Anglo-American</td>
<td>1651 to 1684</td>
<td>See King (1989)</td>
</tr>
<tr>
<td>Caughnawaga, NY</td>
<td>Mohawk</td>
<td>1667 to 1693</td>
<td>See McCashion (1975).</td>
</tr>
<tr>
<td>FDA 20 Gandagarro, NY</td>
<td>Mohawk</td>
<td>1667 to 1693</td>
<td>Three bulbous-bowed pipes varying in size and shape were recovered. The suggested maker is Edward Bird, his widow, or Hendrick Gerdes (McCashion 1979). See also McCashion (1975) and Huey (1988).</td>
</tr>
<tr>
<td>Freeman, NY</td>
<td>Mohawk</td>
<td>1658 to 1666</td>
<td>See McCashion (1975) and Huey (1988).</td>
</tr>
<tr>
<td>FDA 18 Printup, NY</td>
<td>Mohawk</td>
<td>1640 to 1658</td>
<td>See Huey (1988) and Rumrill (personal communication, 1996).¹</td>
</tr>
<tr>
<td>Stone Quarry (MSV4-2, NY)</td>
<td>Onida</td>
<td>1640 to 1650</td>
<td>Large, bulbous-bowed pipe. See McCashion (1975 and 1979); Huey (1988).</td>
</tr>
</tbody>
</table>

¹ Rumrill (personal communication, 1996) notes an occupational range of 1646 to 1659.
<table>
<thead>
<tr>
<th>Site Name and Location</th>
<th>Occupation</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSV6-2 Dungey/Lemery</td>
<td>Oncida</td>
<td>1650 to 1660</td>
<td>See McCashion (1975).</td>
</tr>
<tr>
<td>OND3-4 Moot/Sullivan</td>
<td>Oncida</td>
<td>1660 to 1677</td>
<td>See McCashion (1975).</td>
</tr>
<tr>
<td>Bloody Hill II, Doxsteder, NY</td>
<td>Onondaga</td>
<td>1675 to 1698</td>
<td>See McCashion (1975).</td>
</tr>
<tr>
<td>Carley, NY</td>
<td>Onondaga</td>
<td>1640 to 1650</td>
<td>See Hucy (1988).</td>
</tr>
<tr>
<td>Lot 18, NY</td>
<td>Onondaga</td>
<td>1650 to 1655</td>
<td>See Hucy (1988).</td>
</tr>
<tr>
<td>Indian Castle, NY</td>
<td>Onondaga</td>
<td>1655 to 1663</td>
<td>See Hucy (1988).</td>
</tr>
<tr>
<td>Indian Hill, NY</td>
<td>Onondaga</td>
<td>1663 to 1682</td>
<td>See Hucy (1988).</td>
</tr>
<tr>
<td>Fort Corchaug, NY</td>
<td>Corchaug</td>
<td><em>ca. 1640 to 1650</em></td>
<td>24 pipe bowls and 111 stem fragments (Solecki 1950).</td>
</tr>
</tbody>
</table>
APPENDIX P
SEVENTEENTH-CENTURY ARCHAEOLOGICAL SITES FROM WHICH PIPES BEARING A *FLEUR-DE-LYS* HEEL STAMP HAVE BEEN RECOVERED

<table>
<thead>
<tr>
<th>Site/Location</th>
<th>Occupation</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Castle, NY</td>
<td>Onondaga</td>
<td>1655 to 1663</td>
<td>See Huey (1988).</td>
</tr>
</tbody>
</table>
APPENDIX Q
SEVENTEENTH-CENTURY ARCHAEOLOGICAL SITES FROM WHICH BULBOUS-BOWLED PIPES BEARING A TUDOR ROSE HEEL STAMP HAVE BEEN RECOVERED

<table>
<thead>
<tr>
<th>Location</th>
<th>Occupation</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broad Street, NY</td>
<td>Dutch</td>
<td>1630 to 1660</td>
<td>All but one were Dutch (Grossman 1985).</td>
</tr>
<tr>
<td>Fort Orange, NY</td>
<td>Dutch-American</td>
<td>1624 to 1675</td>
<td>Fort Orange Types 1, 5, 16, 17, 20, 21, 23, 26, 28, 31, 32, 37, 42, 51, 62, 63, 69, and 73 (Huey 1988).</td>
</tr>
<tr>
<td>Pontal de Suape, Brazil</td>
<td>Dutch-American</td>
<td>1630 to 1654</td>
<td>See Pernambucano (1983).</td>
</tr>
<tr>
<td>Jamestown, Va.</td>
<td>Anglo-American</td>
<td>1620 to 1675</td>
<td>Pipes are known from occupations dating 1620 to 1625 and 1650 to 1675 (Cotter 1958).</td>
</tr>
<tr>
<td>Compton Site, Md.</td>
<td>Anglo-American</td>
<td>1651 to 1684</td>
<td>See King (1989).</td>
</tr>
<tr>
<td>Plantation, Va.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ond 3 Sullivan-Moot, NY</td>
<td>Oneida</td>
<td>1660 to 1677</td>
<td>See McCashon (1979).</td>
</tr>
<tr>
<td>Upper Hogan, NY</td>
<td>Oneida</td>
<td>1677 to 1685</td>
<td>See Kondratowicz (1979; as cited in Bradley and DeAngelo 1981:113).</td>
</tr>
<tr>
<td>Lot 18, NY</td>
<td>Onondaga</td>
<td>1650 to 1655</td>
<td>See Bradley and deAngelo (1981).</td>
</tr>
<tr>
<td>Indian Castle Site, NY</td>
<td>Onondaga</td>
<td>1655 to 1663</td>
<td>See Bradley and deAngelo (1981).</td>
</tr>
<tr>
<td>Fort Corchaug, NY</td>
<td>Corchaug</td>
<td>ca. 1640 to 1650</td>
<td>See Solecki (1950).</td>
</tr>
<tr>
<td>Oscar Liebhart, Pa.</td>
<td>Susquehannock</td>
<td>1650 to 1675</td>
<td>The Susquehannocks traded with the Dutch, Swedes, and English. (Omwake 1969). Pipes bearing the English Tudor rose usually occur much earlier. The probability that these pipes belonged to Dutch makers &quot;outweighs the English possibility as the source of the Tudor rose pipes at the Liebhart Site&quot; (Omwake 1969:132).</td>
</tr>
</tbody>
</table>
## APPENDIX R

**SEVENTEENTH-CENTURY ARCHAEOLOGICAL SITES FROM WHICH BULBOUS-BOWLED PIPES BEARING HEEL STAMPS SIMILAR TO THE FLORAL (FOT 49) HEEL MARK HAVE BEEN RECOVERED**

<table>
<thead>
<tr>
<th>Location</th>
<th>Occupation</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amsterdam, Netherlands</td>
<td>Dutch</td>
<td>Seventeenth c.</td>
<td>&quot;Rad bestaande uit 8 spoken [eight-spoked wheel]. Mogelijk is dit merk gezet met een hard houten stempelje, dat aan de kopse zijde vier keer ingezaagd of ingesneden is.&quot; (Duco 1981:273).</td>
</tr>
<tr>
<td>Boston, Lincolnshire, England</td>
<td>English</td>
<td>ca 1600 to 1660</td>
<td>Pipes bear wheel stamps with between six and eight spokes. Some of the seven- and eight-spoked stamps have pellets in the design. &quot;The large proportion of wheel-stamps is notable and examples by both Dutch and London makers are known, although they cannot as yet be ascribed to individuals&quot; (White 1969).</td>
</tr>
</tbody>
</table>
| Chester, England          | English    | 1600 to 1630   | Eight-spoked wheel and pellets within a solid center. Comparable examples from London and Exeter. See Rutter and Davey (1980).
<table>
<thead>
<tr>
<th>Location</th>
<th>Occupation</th>
<th>Date</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnstaple Castle, England</td>
<td>English</td>
<td>1610 to 1650</td>
<td>Five dots are present in the stamp.</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>1620 to 1640</td>
<td>Damaged, seven-spoked stamp, possibly from the west country. See Grant and Jemmet (1985).</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>1640 to 1680</td>
<td>Seven-spoked wheel, possibly of local manufacture. See Grant and Jemmet (1985).</td>
</tr>
<tr>
<td>London, England (British Museum and GMH)</td>
<td>English</td>
<td>c. 1600 to 1640</td>
<td>Eight-spoked wheel in relief (Adrian and Oswald type 5), now in the British Museum in London and the GMH. See Oswald (1969).</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>c. 1640 to 1660</td>
<td>Ten-spoked wheel in relief, with similar examples in London, Gloucester, Hereford, and Abergavenny. Other duplicates on earlier bowls are known from the British Museum and the GMH in London. Oswald (1969:134-135) posits that these “may represent a maker who moved from London the Welsh Border, ca. 1640-1660.”</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>Seventeenth c.</td>
<td>Seven-spoked wheel in relief (Oswald 1969). There is one example in London (Atkinson and Oswald type 7) with duplicates in the British Museum and the GMH in London.</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>1630</td>
<td>Eight-petalled flower (1630) and eight-spoked wheel (1625) stamps (Atkinson and Oswald 1972).</td>
</tr>
</tbody>
</table>
APPENDIX S
SEVENTEENTH-CENTURY ARCHAEOLOGICAL SITES FROM WHICH FUNNEL ELBOW-ANGLED PIPES HAVE BEEN RECOVERED

<table>
<thead>
<tr>
<th>Site Name and Location</th>
<th>Occupation</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fort Orange, NY</td>
<td>Dutch-American</td>
<td>1624 to 1675</td>
<td>Fort Orange Types 14 (EB in denticulate or sawtooth circle), 29 (EB in a beaded ring), 30 (ringed EB), 34 (EB), 55 (goblet within a beaded ring), 60 (crowned HG within a beaded ring), and 66 (variation of Tudor rose) at bowl/stem junction. There was also a ringed HG stamp. See Huey (1988) and McCashion (1975).</td>
</tr>
<tr>
<td>Van Buren, NY</td>
<td>Dutch-American</td>
<td>1630 to 1696</td>
<td>Fort Orange Types 29 (EB in a beaded ring), 30 (ringed EB), and 49 (floral) marks at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>Stadt Huys, NY</td>
<td>Dutch-American</td>
<td>1641 to 1690</td>
<td>Fort Orange Type 34 (EB) mark at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>Schuyler Flatts, NY</td>
<td>Dutch-American</td>
<td>1642+</td>
<td>HG, EB, and EB in a dotted ring marks at bowl/stem junction (McCashion 1975 and 1979a).</td>
</tr>
<tr>
<td>Broad Street, NY</td>
<td>Dutch-American</td>
<td>ca. 1647 to 1710</td>
<td>Fort Orange Type 55 (goblet within a beaded ring) mark at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>Kingston Stockade, NY</td>
<td>Dutch-American</td>
<td>1660+</td>
<td>McCashion (1975) reports a ringed HG stamp at bowl/stem junction.</td>
</tr>
<tr>
<td>SDY 40, NY</td>
<td>Dutch-American</td>
<td>1660+</td>
<td>EB in a dotted ring at bowl/stem junction (McCashion 1979a).</td>
</tr>
<tr>
<td>Custom’s House</td>
<td>Dutch-American</td>
<td>1665 to 1685</td>
<td>EB mark at bowl/stem junction reversed (McCashion and Robinson 1977). Similar feature noted at CNJ-49 (Tionontogenen), corresponding exactly with specimen recovered at Caughnawaga. EB in a dotted ring, plain EB marks at bowl/stem junction (McCashion and Robinson 1977; McCashion 1979a).</td>
</tr>
<tr>
<td>Fort James, NY</td>
<td>Dutch-American</td>
<td>1665 to 1685</td>
<td>Fort Orange Types 29 (EB within a beaded ring) and 30 (ringed EB) marks at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>Site Name and Location</td>
<td>Occupation</td>
<td>Date</td>
<td>Comments</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------</td>
<td>---------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>South Beach, NY</td>
<td>Dutch-American?</td>
<td>1675 to 1700</td>
<td>McCashion (1975) reports a ringed Hb mark at bowl/stem junction.</td>
</tr>
<tr>
<td>Jamestown, Va.</td>
<td>Anglo-American</td>
<td>1620 to 1690</td>
<td>Fort Orange Type 29 (Hb within a beaded ring) mark at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>Edward Winslow, Ma.</td>
<td>Anglo-American</td>
<td>1632 to 1699</td>
<td>Fort Orange Type 29 (Hb within a beaded ring) mark at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>St. Mary's City, Md.</td>
<td>Anglo-American</td>
<td>cca. 1634 to 1680</td>
<td>At least six pipes recovered (Miller 1983; Huey 1988). Miller suggests a site date of 1640 to 1660; see Native American design inscriptions on bowls in Miller (1983) and Henry (1979).</td>
</tr>
<tr>
<td>Hallowes, Va.</td>
<td>Anglo-American</td>
<td>(1651+)</td>
<td>Marks on side of bowl at base (Buchanan and Heite 1971).</td>
</tr>
<tr>
<td>Compton, Md.</td>
<td>Anglo-American</td>
<td>1651 to 1684</td>
<td>At least 28 pipes recovered. The total may range as high as 37 (King 1988). The total number of pipes included &quot;...37 Dutch Hb's and Dutch elbows&quot; (King 1988). There were, in fact, 37 bulbous-bowled pipes bearing the Hb heel mark, suggesting that 28 is the minimum quantity for funnel elbow-angled pipes.</td>
</tr>
<tr>
<td>Port Royal, Jamaica</td>
<td>Anglo-American</td>
<td>1655 to 1692</td>
<td>See Heidtke (1980).</td>
</tr>
<tr>
<td>FDA 18, Printup, NY</td>
<td>Mohawk</td>
<td>1640 to 1658</td>
<td>Fort Orange Type 34 (Hb) mark at bowl/stem junction (Huey 1988). See also Hagerty (1985). Five pipes from the lees Wagner collection were examined by the author: (1) FDA 18-29 possesses an Hb in a beaded ring skewed at a 45° angle at the bowl/stem junction; (2) FDA 18-34 has an Hb at the bowl/stem junction; (3) FDA 18-98 possesses an Hb in a beaded ring at the bowl/stem junction; (4) FDA 18-211 has an identical mark to FDA 18-34 and possesses a bore diameter of 10/64&quot;; (5) FDA 18-216, is identical to FDA 18-34.</td>
</tr>
<tr>
<td>Yates, NY</td>
<td>Mohawk</td>
<td>1650 to 1660</td>
<td>Pipes first appear between 1650 and 1666 (McCashion 1979a).</td>
</tr>
<tr>
<td>CNJ 49 Tionontogen, NY</td>
<td>Mohawk</td>
<td>1650 to 1666</td>
<td>Hb at bowl/stem junction reversed, as in the Caughnawaga artifact (McCashion 1975).</td>
</tr>
<tr>
<td>Site Name and Location</td>
<td>Occupation</td>
<td>Date</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>------------</td>
<td>-------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Freeman, NY</td>
<td>Mohawk</td>
<td>1658 to 1666</td>
<td>Pipes first appear between 1650 and 1666. Fort Orange Types 14 (EH3 in a denticulate or sawtooth circle), 29 (EH3 in a beaded ring), and 30 (ringed EH3) marks at bowl/stem junction. See McCashion (1975) and Huey (1988).</td>
</tr>
<tr>
<td>Castle Caughnawaga, NY</td>
<td>Mohawk</td>
<td>1667 to 1693</td>
<td>One pipe possessed mark at the bowl/stem junction described as a &quot;poorly struck EH partially encircled by a dotted ring&quot; (McCashion 1979a:128). Bird, his widow, or Hendrick Gerdes is suggested as the maker. Marks at the bowl/stem junction include an HG, a crowned HG, a ringed EH3, and an EH in a dotted ring. At least 15 pipes have the HG surmounted by a five pointed crown at the bowl/stem junction (McCashion 1975 and 1979a).</td>
</tr>
<tr>
<td>Carley, NY</td>
<td>Onondaga</td>
<td>1640 to 1650</td>
<td>Fort Orange Type 29 (EH3 in a beaded ring) mark at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>Lot 18, NY</td>
<td>Onondaga</td>
<td>1650 to 1655</td>
<td>Fort Orange Types 29 (EH3 in a beaded ring) and 34 (EH3) marks at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>Indian Castle, NY</td>
<td>Onondaga</td>
<td>1655 to 1663</td>
<td>Fort Orange Types 29 (EH3 in a beaded ring) and 34 (EH3) marks at bowl/stem junction See McCashion (1975) and Huey (1988).</td>
</tr>
<tr>
<td>Indian Hill, NY</td>
<td>Onondaga</td>
<td>1663 to 1682</td>
<td>Fort Orange Types 34 (EH3) and 55 (goblet within a beaded ring) marks at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>Bloody Hill, (Doxstedter), NY</td>
<td>Onondaga</td>
<td>1675 to 1685</td>
<td>Fort Orange Type 29 (EH3 in a beaded ring) mark at bowl/stem junction (Huey 1988). McCashion (1975) noted ringed HG and crowned HG stamps at bowl/stem junctions.</td>
</tr>
<tr>
<td>Jamesville, NY</td>
<td>Onondaga</td>
<td>1682 to 1696</td>
<td></td>
</tr>
<tr>
<td>MSV4-2 Stone Quarry, NY</td>
<td>Oneida</td>
<td>1645 to 1655</td>
<td>First appearance of funnel elbow-angled pipes in New York State, originally dated between 1640 and 1650; later revised to 1645 to 1655 (McCashion 1975). EH3 is apparent at bowl/stem junction.</td>
</tr>
<tr>
<td>MSV6-2 Dungey/Lemery, NY</td>
<td>Oneida</td>
<td>1650 to 1660</td>
<td>EH3 at bowl/stem junction (McCashion 1975).</td>
</tr>
<tr>
<td>Site Name and Location</td>
<td>Occupation</td>
<td>Date</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------</td>
<td>------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>OND 3-4 Sullivan-Moot, NY</td>
<td>Oneida</td>
<td>1660 to 1677</td>
<td>Most pipes were of hard, &quot;dead white clay&quot; (McCashion 1975:12-13 and 1979a:96). Huey (1988) noted Fort Orange Types 14 (EB in a dentilicate or sawtooth circle), 29 (EB in a beaded ring), and 30 (EB) marks, as well as a crowned HG. McCashion (1975) reported a ringed HG mark.</td>
</tr>
<tr>
<td>OND 5-4 Upper Hogan, NY</td>
<td>Oneida</td>
<td>1677 to 1685</td>
<td>HG at bowl/stem junction (McCashion 1975 and 1979a).</td>
</tr>
<tr>
<td>Marsh, NY</td>
<td>Seneca</td>
<td>1640 to 1650</td>
<td>Pipes first appear between 1650 and 1670 (McCashion 1975).</td>
</tr>
<tr>
<td>Dann, NY</td>
<td>Seneca</td>
<td>1650 to 1675</td>
<td>Pipes first appear between 1650 and 1675. McCashion (1975) notes a ringed EB mark at bowl/stem junction.</td>
</tr>
<tr>
<td>Gannagar, NY</td>
<td>Seneca</td>
<td>1670 to 1687</td>
<td>Huey (1988) notes Fort Orange Types 12 (EB in a beaded ring) and 29 (EB in a beaded ring) marks at bowl/stem junction.</td>
</tr>
<tr>
<td>Salmon Valley, NY</td>
<td>Cayuga</td>
<td></td>
<td>See McCashion (1979a).</td>
</tr>
<tr>
<td>Burr's Hill, R.I.</td>
<td>Wampanoag</td>
<td></td>
<td>Fort Orange Type 34 (EB) mark at bowl/stem junction (Huey 1988). See also Gibson (1980).</td>
</tr>
<tr>
<td>Oscar Liebhart, Pa.</td>
<td>Susquehannock</td>
<td></td>
<td>Fort Orange Type 55 (goblet within a beaded ring) mark at bowl/stem junction (Huey 1988).</td>
</tr>
<tr>
<td>Ft. Shantok, Ct.</td>
<td>Pequot-Mohegan</td>
<td>1635 to 1675</td>
<td>Bradley and De Angelo (1988) express uncertainty if this is, in fact, the Native American group that is represented. See also Salwen (1966).</td>
</tr>
<tr>
<td>Fort Massapeag, NY</td>
<td>Massapequa</td>
<td>1656 to 1664</td>
<td>See Solec (n.d.).</td>
</tr>
<tr>
<td>Winnie’s Island</td>
<td>Unknown</td>
<td>--</td>
<td>EB in a dotted ring at bowl/stem junction (McCashion 1979a).</td>
</tr>
</tbody>
</table>
APPENDIX T
HYPOTHESES CONCERNING THE IDENTIFICATION OF THE COPPER-ALLOY COLUMN, THOUGHT TO BE A PORTION OF A CHANDELIER

Gloria C. Clifton, Curator of Navigational Instruments at the National Maritime Museum in Greenwich, England, replied:

"Your sketch suggests that you may indeed have found such an instrument [cosmolabe] but I am afraid that I too have only come across it before in Randier's *Marine Navigation Instruments* (Randier 1980). My only suggestion is that if it was not used for observation, might the notches have been used for recording, along the lines of a traverse board"? (Clifton, personal communication, 1992).

Rod and Madge Webster, Curators Emeritus at the Adler Planetarium in Chicago, Illinois, remarked:

"It is a fascinating object that we cannot explain. Because of the numbered teeth, it may be part of a timing or calculating machine. Except for the numbering on both sets of teeth, the lower set might have been a form of chain drive, but this is all speculation" (Webster and Webster, personal communication, 1992).

Raymond Ashley, a doctoral student at Duke University, explained:

"...Obviously, it is part of something bigger, and its asymmetry and shape suggest (1) a pedestal, and (2) rotation. I agree that it looks like a portion of the cosmolabe shown (I hadn't heard of one before), but after thinking about it I don't think that is what it is. or at least that such a device could have been used on the ship" (Ashley, personal communication, 1992).

Willem F.J. Mörzer Bruyns, Senior Curator at the *Schepvaartmuseum* in Amsterdam, specializing in navigation, wrote:

"At first sight I would suggest that the object is (part of) a leg a globe chair. The smaller object could be the central foot in such a chair. However, the fact that both objects are made of metal is in conflict with my theory. To my knowledge globe chairs of the type used on Dutch ships were made of wood. Also, the numbering of the notches would be unnecessary if it were part of a globe. The theory of the cosmolabe seems to me very unlikely. Randier gives no evidence that such an instrument was actually used at sea. Moreover it was invented in France in 1567, many years before the Dutch went to the West Indies" (Mörzer Bruyns, personal communication, 1993).
APPENDIX U

SILVER COINS FROM THE SEVENTEENTH-CENTURY NORTHERN EUROPEAN MERCHANT SHIPWRECK IN MONTE CRISTI BAY, DOMINICAN REPUBLIC. ILLUSTRATIONS BY ALEX ROBERTS.

PW 60

PW 350

PW 372a

PW 414a

PW 414b

PW 442
APPENDIX V

CALBETO TYPE COUNTERSTAMPS ON OCHO REALES MINTED AT POTOSI, 1649-1651
APPENDIX W

SELECTED LEAD (Pb) ARTIFACTS FROM THE SEVENTEENTH-CENTURY NORTHERN EUROPEAN MERCHANT SHIPWRECK IN MONTE CRISTI BAY, DOMINICAN REPUBLIC

PWA 55
PWA 380
PWA 1311
PWA 1379
PWA 1557
PWA 310
PWA 556
PWA 1312
PWA 1380
PWA 2106
PWA 374
PWA 561
PWA 1381
PWA 2108
PWA 956
PWA 1334
PWA 1382
# APPENDIX X

## COMPARISON OF LEAD (Pb) SHOT FROM SELECTED SEVENTEENTH- AND EIGHTEENTH-CENTURY SHIPWRECKS

<table>
<thead>
<tr>
<th>Shipwreck</th>
<th>Date and Nationality</th>
<th>Minimum Number</th>
<th>Dimensions in cm</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Curacao</em></td>
<td>Eighteenth-c. Dutch</td>
<td>Approximately 200</td>
<td>1.1-1.3, 1.5, 1.7-1.8</td>
<td>One artifact linked (single ball with a short fragment of copper wire.</td>
</tr>
<tr>
<td><em>Amsterdam</em></td>
<td>Eighteenth-c. Dutch</td>
<td>48</td>
<td>1.65</td>
<td>--</td>
</tr>
<tr>
<td><em>Anne</em></td>
<td>Seventeenth-c. English</td>
<td>1</td>
<td>1.8</td>
<td>--</td>
</tr>
<tr>
<td><em>Campen</em></td>
<td>Seventeenth-c. Dutch</td>
<td>10</td>
<td>1.38, 1.42, 1.43, 1.53: 1.54: 1.55: 1.66: 1.70: 1.70: 38.1</td>
<td>Respective weights are: 14.7 g; 16.1 g; 16.6 g; 21.2 g; 21.8 g; 22.0 g; 24.1; 27.7 g; 27.5 g; and 38.1 g.</td>
</tr>
<tr>
<td><em>Dartmouth</em></td>
<td>Seventeenth-c. English</td>
<td>not indicated</td>
<td>1.3 and 1.8</td>
<td>Smooth bore musket and pistol shot, respectively</td>
</tr>
<tr>
<td><em>Kennemerland</em></td>
<td>Seventeenth-c. Dutch</td>
<td>+3,000</td>
<td>not indicated</td>
<td>--</td>
</tr>
<tr>
<td><em>Lastdrager</em></td>
<td>Seventeenth-c. Dutch</td>
<td>not indicated</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><em>Meresteyn</em></td>
<td>Eighteenth-c. Dutch</td>
<td>60</td>
<td>1.2 and 1.65</td>
<td>--</td>
</tr>
<tr>
<td><em>N.S. Atocha</em></td>
<td>Seventeenth-c. Spanish</td>
<td>1,200 lbs. of shot packed in six barrels</td>
<td>500 lbs of musket shot: 700 lbs. of arquebuss shot.</td>
<td>Additionally, 200 lbs of spare balls were recovered.</td>
</tr>
<tr>
<td><em>Port Royal</em></td>
<td>Seventeenth-c. English (?)</td>
<td>295</td>
<td>Range from 8.9-20.3, with clusters at 13.2-13.7 (N=104); 14.7-15.7 (N=61); 16.0-16.8 (N=25); 17.3-18.8 (N=78)</td>
<td>--</td>
</tr>
<tr>
<td><em>Santo Christo de Castello</em></td>
<td>Eighteenth-c. Portuguese</td>
<td>not indicated</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><em>Sea Venture</em></td>
<td>Seventeenth-c. English</td>
<td>4,720</td>
<td>1.5 (N=2,036), 1.7 (N=1,527), 1.9 (N=1,157)</td>
<td>Eight double-headed lead shot comprising two 12 mm balls joined by a lead bar.</td>
</tr>
<tr>
<td><em>Sapphire</em></td>
<td>Eighteenth-c. English</td>
<td>1</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><em>Stonewall wreck</em></td>
<td>Seventeenth-c. Dutch (?)</td>
<td>not indicated</td>
<td>1.9 and 1.6</td>
<td>Weight = 38.0 g and 21.9 g, respectively.</td>
</tr>
</tbody>
</table>
# Appendix Y

**Bones Recovered from the Seventeenth-Century Northern European Merchant Shipwreck in Monte Cristi Bay, Dominican Republic (1991 and 1992 Field Seasons)**

<table>
<thead>
<tr>
<th></th>
<th>Cattle</th>
<th>Sheep/goat</th>
<th>Pig</th>
<th>Pig/sheep/goat</th>
<th>Rat</th>
<th>Fish</th>
<th>Unidentified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tooth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scapula</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humerus</td>
<td>2</td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radius</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ulna</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Tibia</td>
<td>3</td>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcaneum</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talus</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremity bone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long bone fragments (unident.)</td>
<td></td>
<td>1</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertebra</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rib</td>
<td>2</td>
<td>7</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atlas</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>8</td>
<td>19</td>
<td>18</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>20</td>
</tr>
</tbody>
</table>
APPENDIX Z

HAWKINS' COMMENTARY ON THE PERILS OF VERMIN INFESTATION ABOARD A SAILING VESSEL

Sir Richard Hawkins noted in great detail the nuisance presented by shipboard rodents:

"Here we made also a survey of our victuals. and opening certaine Barrels of Oaten meale, wee found a great part of some of them. as also of our Pipes and Fatts of bread: eaten and consumed by the Ratts; doub'tlesse, a fifth part of my company. did not eate so much. as these devoured. as wee found dayly in coming to spend any or our provisions" (Hawkins 1593:89).

The propensity for gnawing. which keeps rodent's teeth short enough to be functional. posed a serious threat to shipboard cargo and especially equipment. such as sails and lines. States Hawkins:

"When I came to the Sea. it was not suspected. that I had a Ratt in my shippe: but with the bread in Caske. which we transported out of the Hawke. and the going to and againe of our boats unto our prise. (though wee had divers Catts and used other preven{tions}) in small time they multiplied in such a manner. as is incredible. It is one of the general calamities of all long voyages; and would bee carefully prevented. as much as may bee. For besides that which they consume of the best victuals. they eate the sayles: and neither packe. nor chest. is free from their surpris{es}. I have known them to make a hole in a pipe of water. and saying the pumpe. have put all in feare. doub'ting least some leake had been sprung upon the ship. Moreover. I have heard credible persons report. that shippes have been put in danger by them to be sunke. by a hole made in the bulge. All which is easily remedied at the first. but if once they be somewhat increased. with difficulty they are to be destroyed. and although I propounded a reward for every Ratt which was taken. and sought meances by poysen. and other inventions to consume them. yet their increase being so ordinary and many. we were not able to clear our selves from them" (Hawkins 1593:89-90).
**APPENDIX AA**

**SUMMARY OF BONE ELEMENTS RECOVERED FROM THE SEVENTEENTH-CENTURY NORTHERN EUROPEAN MERCHANT SHIPWRECK IN MONTE CRISTI BAY, DOMINICAN REPUBLIC (1993 FIELD SEASON)**

<table>
<thead>
<tr>
<th></th>
<th>Unident Mammalian Bones</th>
<th>Cattle</th>
<th>Sheep</th>
<th>Goat</th>
<th>Sheep/goat</th>
<th>Pig</th>
<th>Pig/sheep</th>
<th><em>Actobatus normani</em></th>
<th>Serranidae</th>
<th>Unident Fish Bones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull</td>
<td></td>
<td></td>
<td></td>
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APPENDIX BB
GLOSSARY

An asterisk (*) denotes a word that is defined within the glossary.

acetabulum — the cup-shaped socket of the hipbone which holds the femur*.
aftermast — the mast* positioned closest to the stern* of a vessel.
aftersail — a sail positioned on the aftermast*. Closest to the stern* of a vessel.
Álvarez Chacón, Diego — the fleet surgeon on Cristóbal Colón’s second voyage to the New World (1493-1494).
Amazonia — the Amazon River and its surrounding regions.
Amsterdam — an outbound Dutch East Indiaman* that sank off Sussex, England, in 1749.
angeo — a heavy fabric used to make mattresses.
anorexiant — any substance taken to suppress appetite.
apothecary — a person who prepares and sells drugs or compounds for medicinal purposes.
aqua vitae — a strong liquor, such as brandy.
Arawak — a linguistic stock of Native Americans who occupied the Bahamas, the Greater Antilles*.
Trinidad, and areas of Amazonia* at the time of the Spanish Conquest.
armada — a fleet of warships.
Aruba — a leeward island in the Lesser Antilles*.
assayer — one who analyzes an ore or alloy to determine the quantity of a specific metal that it contains.
halze — a thick, coarse, woollen material used for household coverings such as curtains and table cloths.
balanced weave — the use of single elements for the warp* and weft* of textiles.
ballast — the weight distributed in the hull* of a ship with which the vessel is steadied or balanced, thereby improving its stability and controlling its draft*. A variety of materials served as ballast for seventeenth-century ships, including stone, shingle, iron, broken ammunition, guns, granite blocks, and gravel.
ballast monger — one who sells ballast*.
Banda — a Dutch vessel that wrecked off the coast of Mauritius in 1615.
Baardman — a Dutch name of recent origin used in reference to the bearded mask on Rhenish stoneware bottles. Among those working in the field of historical ceramics, the German name is preferred over the popular English name of Bellarmine*.
Barentsz, Willem — an Englishman (William Baerentalts) who migrated to Holland and adopted the Tudor rose as a symbol of his allegiance to Queen Elizabeth. Barentsz supposedly initiated the tradition of placing common symbols on the heel stamps* of his pipes, including “flowers, goblcts, scales, etc.” (Hagerty 1985:214).
Batavia — a Dutch East Indiaman* that wrecked in Western Australia in 1629.
Battle, Edward — a pipe maker from Bristol, England, who manufactured his wares between 1660 and 1685, and was one of several artisans who used an EB heel stamp*. Whether his pipes were exported to the Americas is debated.
beak (beakhead) — a ship’s decorative structure located forward of the forecastle*.
Beesten, Edward (Edward Beaste) — a pipe maker from Marlborough, England, who manufactured his wares ca. 1700. Beesten was known to use the EB heel stamp*.
bellow — a tool for enhancing oxygen supply to a fire, by alternate expansion and contraction, this instrument or machine draws in air through a valve or orifice and expels it through a tube.
bendlet — a diagonal, heraldic emblem that usually proceeds from the top of the escutcheon to a point beneath and on the opposite side. It is the diminutive form of the bend, and is usually half of its width or narrower.
**Betty lamp** -- a shallow, open oil lamp commonly used in the seventeenth century. According to Perry (1969:169), the name "Betty" is derived from the German besser, meaning "better." Thwing (1959:34) interprets this to mean that English expatriates living in Holland may have found the continental lamps to be superior to those from England. Many of these families later emigrated to North America, where the lamps are also found.

**Biggs, Edward** -- an English pipe maker from Henley who used the identifying heel stamp EB. Biggs was known to manufacture his wares ca. 1653.

**bilander** -- a small merchant ship that carried a square sail on the aftermast* and was characterized by a unique fore-and-aft mainsail. The bilander rarely exceeded 100 tons burthen*.

**bilge** -- the underside of a vessel’s hull* out to the outer ends of the floors*. With respect to the interior portion of the ship’s structure, it is the lowest point of the hull where water tends to collect.

**Binford formula** -- a regression formula* used for calculating mean deposition date of artifacts on archaeological sites, based on the measurement and evaluation of pipe stem bore diameters. The equation is:

\[ Y = 1931.85 - 38.26X \]

where Y represents the date to be determined. 1931.85 is the theoretical date at which the pipe stem bore diameter would reach zero. 38.26 is the slope of the line (the number of years between each 1/64 inch decrease), and X is the mean bore diameter of the sample being dated. See also Omwake’s Formula.

**biogenic** -- produced by living organisms.

**bivalve** -- having a shell composed of two valves.

**blackthorn** -- a hardwood tree, the European spiny plum (*Prunus spinosa*).

**blower** (propwash blower, “mailbox,” deflector) -- a large metal tube placed over the propeller of a boat to create and focus a stream or current of water.

**bodice** -- a cross-laced, vest-like garment that covers a woman’s body from the neck down to the waist.

**boom** -- a spar to which is attached the foot of a fore-and-aft sail.

**bottom first hull construction** -- a method of ship construction in which bottom planks* are assembled out to the turn of the bilge* before any internal frames* are installed. Planks are temporarily held in place with a variety of fasteners (wooden planking tongs, support chains, and small cleats*) until the bottom is shaped, after which the fasteners are replaced by floor timbers. The sides are then constructed.

**bote** -- a round-bottomed, small-transomed, fishing vessel of the North Coast of the Dominican Republic.

**bow** -- the forward end of a vessel’s hull* that begins with curvature toward the stem*.

**bowsprit** -- a spar projecting forward of the stem*, inclined slightly upward.

**boxwood** -- the close-grained hardwood of the genus *Buxus*.

**Brabant** -- a province in central Belgium.

**braze** -- a process whereby metal objects are fused together with solder. In addition to copper or zinc, these solders usually contain a variety of materials that have high melting points.

**breeches** -- short pants which cover the hips and thighs and fitting snugly at or just below the knee.

**breed** -- a group of plants or animals presumably related by descent from common ancestors and visibly similar in most characteristics.

**Brill** -- a Dutch West India Company schip (ship) that is repeatedly referred to within the *Letters and Resolutions of Curacao*, named after the first town in Zeeland that the Sea Beggars took from the Spaniards.

**buckwheat** -- *Fagopyrum esculentum*.

**burthen (burden)** -- the capacity of a vessel for carrying cargo.

**butt joint** (carvel joint) -- adjoining timbers or planks* whose connecting end surfaces were cut perpendicularly to their lengths.
cabotage — coastal navigation.
cacao — the chocolate tree, *Theobroma cacao*, which grows in tropical America and is used in the production of chocolate and cocaos.
cacique — a chieftain. *Cacique* is, literally, "to be thirsty for peace." To be "in peace," or "peaceful," is *cacicaya*. *Cacique* is derived from the Arawak* word *kassikoaan*, which literally means to inhabit or "to have a house."
calcium carbonate (CaCO₃) — a natural chemical compound found in (among other things) bones and shells.
caliver (qualivre, callior, kalliivre, quallivre, kalyvre, caleavre, acalyvre, callive, caleevre, calever, caliever, calivre, calliver) — a light musket* or harquebus* originally appearing during the sixteenth century. It seems to have been the lightest portable firearm except the pistol and was fired without a rest.
calumet — a highly ornamented ceremonial pipe used by Siouan and Algonquian peoples of the Great Plains and southeastern United States. The name is thought to be derived from the Medieval French word *"chalemael"* meaning reed, cane, stem, tube or pipe. The pipes were characterized by long, feather-decorated stems that were often inserted into stone or ceramic bowls. Considered sacred, calumets were often used at the conclusion of peace treaties, in adoption ceremonies, and to communicate with the animate spirits of nature.
Campen — an inbound Dutch vessel that sank off the Isle of Wight in 1627.
canafistula — *Cassia fistula*, a member of the Leguminosae. It is known by a variety of common names including canafistula, pudding-pipe tree, golden shower, and drumstick tree.
capitana — an armed galloon* that escorted the armada* by sailing in the lead. The capitana was the command vessel of the armada.
caravel (carabela, caravela) — a three-masted sailing vessel, generally square-rigged* with the aftermast* lateen-rigged*. The transition from large, bulky ships to this small, round-hulled vessel with shallow displacement enabled the Iberians to dominate the Era of Exploration and Discovery. When lateen-rigged*, caravels made excellent vessels for coastal exploration.
caravelo — see caravel.
Caraquas — Caracas. Venezuela.
carbine — a short-barreled, light-weight firearm.
carbuncle — an acute inflammatory nodule or boil of the skin, caused by bacterial invasion of the hair follicles or sebaceous gland ducts.
careen — a process in which a vessel is heeled to one side to be cleaned, caulked, or repaired.
Carlos I (Charles I) — the King of Castile and Aragon from 1516 to 1556. He was also Charles V, Holy Roman Emperor (1519-1558). Carlos was the son of Philip I and Joanna of Castile, grandson of Ferdinand II of Aragon and Isabella of Castile, and grandson of the Holy Roman Emperor Maximilian I and Mary of Burgundy. When his father died in 1506, Carlos inherited the Netherlands, Luxembourg, Artois, and Franche-Comté (Free County of Burgundy). With the death of Ferdinand II in 1516, Carlos came to rule Aragon, Navarre, Granada, Naples, Sicily, Sardinia, and the Spanish possessions in the New World. Along with his mother, he became regent of Castile. When Maximilian I died, Carlos inherited the Hapsburg lands in Austria.
Cartagena mint — a Spanish New World mint in Columbia. Coins from this mint were similar to those from Santa Fe de Bogotá, with the exception that the Arms of Granada were absent. Additionally, Cartagena coins possessed the mint marks "C" or "<" to the right of the Shield. Visible on the obverse* were the words "PHILIPPVS • IIII • D • G"*. The reverse* of the coin possessed the date in the upper left corner and the legend "PLVS ULTRA"* ran horizontally across the pillars on two lines. Both coins possessed the legend "HISPANIAE REX"* on the reverse, but those from Cartagena possessed the date following the inscription.
Casa de Contratación — the House of Trade that controlled Spanish commerce with the Indies and the New World. Located in Seville, Spain, from 1503 to 1717, and in Cadiz from 1717 to 1790, it was the main government agency for supervising the operation of the treasure fleets.

cassava (casabe) — a coarse-textured bread made from the manioc root, *Manihot esculenta*, a member of the spurge family, Euphorbiaceae. It is still used widely today, especially in the Dominican Republic. Early European explorers had little regard for this popular Native American foodstuff. Later, however, it became a staple in the Spanish diet. Exquemelin (1678:50) noted that “the manioc, or cassava, serves as bread, and is prepared in this manner. They scrape the manioc roots with scrapers of copper or tin, as they do horse-radish in Holland. When they have grated as much as they need, they put the shavings in sacks of coarse cloth and press all the moisture out until it is perfectly dry, and then pass it through a large parchment sieve. After sifting, it looks just like sawdust. They bake it in a hot griddle into a sort of cake, and then put these in the rooftops to dry in the sun. Perhaps this is where the old story comes from, of the land where the houses were covered with pancakes.”

Cathey — China.

catarrh — an inflammation of a mucous membrane, chronically affecting nasal and air passages.

catline (pipestone) — a densely-grained metamorphic rock noted for the ease with which it can be carved. It is a type of argillite, a red stone that most likely originated in deposits in southwest Minnesota, southeast South Dakota, or north-central Wisconsin. The material derives its name from George Catlin, a nineteenth-century “artist and adventurer” (Brown 1989:313) who, in 1836, was the first “white man” known to visit the quarries in Pipestone, Minnesota, where this rock is abundant. Native American elbow pipes made from this material are commonly found in the north-central region of the United States (west of the Great Lakes) and across the southeast.

caulking — a fibrous material driven into the planking* seams, then covered with pitch to make the seams watertight.

Cavelier, René-Robert (*sieur de La Salle) — a French explorer who, in 1687, was murdered by his own men in an attempt to march overland to the Mississippi.

cay (key) — a small island.

Cayo Ahogado (Hidden Cay or Island) — a small coral reef that rises to within two feet (0.61 m) of the surface of Monte Cristi Bay. It is one of two navigational features within the bay, the other being Isla Cabrera, summer home to the Monte Cristi Shipwreck Project. Cayo Ahogado is reported by the local fishermen to be littered with several shipwrecks.

Cayuga - one of five Iroquois* tribes, inhabiting Cayuga, the area around Cayuga Lake in present day New York.

ceiling — the interior planking* of a vessel.

Chanduy Reef Wreck — a Spanish galleon* that sank in 1654 off Guayaquil, Ecuador.

Charles I — King of England from 1625 until 1647, when he was overthrown by Oliver Cromwell’s rump parliament. Charles was executed in 1649.

chert — a compact rock consisting essentially of microcrystalline quartz. Chert from the Monte Cristi shipwreck was classified by Wayne Ahr at the Department of Geology at Texas A&M University as a very fine-grained, spiculiferous* flint with individual quartz grains and plagioclase feldspars*.

chevron — a heraldic device often consisting of two diagonal stripes meeting at an angle, usually with the point up, as an inverted V.

Cibao — the Pedregosa region of the Cordillera Central (Central Mountain Range) in the northern part of the Dominican Republic. The term is derived from the Native American word “ciba,” meaning “stone.”
clay pipe varnish -- a concoction meant to "prevent the lips from sticking to the porous clay" (Walker 1977:87 citing Duhamel du Monceau's informant). It could be made from a "mixture of soap, wax, gum and water," or from "oil, soapy water, and some animal or vegetable gum" (ibid). These varnishes "did not give as shiny a surface as that obtained when wax was used in addition" (ibid).

clast -- a rock fragment produced by mechanical weathering.

cleat -- a small wooden block nailed across two timbers to fasten them together.

clove -- a small evergreen tree, Syzygium aromaticum or Eugenia caryophyllata, of the Myrtle family, Myrtaceae. Clove oil is obtained by distillation and is widely used in synthetic vanilla and other flavorings as well as in perfumes. It is also recognized for its medicinal and antiseptic qualities.

cob -- a slang term for a Spanish silver coin, from "cabo de barra," or the "end of the bar."

cochineal -- a red dye derived from the dried bodies of the female cochineal insect, Dactylopius coccus, from the family Dactylopiidae.

Colón, Bartolomé -- the brother of Cristóbal Colón (Christopher Columbus). Bartolomé is thought by some to have accompanied Bartolomé Díaz on his voyage to the Cape of Good Hope.

conch -- spiral-shelled marine gastropod of the genus Strombus.

Conde de Tolosa (Count of Tolosa) -- a quicksilver gallon that, along with Nuestra Señora de Guadalupe*, sank in Samana Bay, Dominican Republic on 24-5 August 1724.

consolidant -- a compound applied to artifacts, such as pot sherds or pieces of textile, to bind them together and strengthen them.

Council of the Indies -- a Spanish governmental agency, the Supreme Court for American affairs, established in Spain by King Ferdinand in 1511 and reorganized by King Charles V in 1524. The council promulgated all the laws relating to the government of the colonies and appointed colonial officers.

counterstamp -- an incuse* mark placed on the obverse* of silver coinage coinage, usually next to or atop an existing stamp. The presence of such a stamp declared that the coin had been legally devalued.

course -- the lowest and largest square sail mounted on the mast of a vessel.

crazing -- the crackled appearance of a glaze* resulting from the unequal expansion or shrinkage ratio of the glaze to the ceramic body to which it is applied.

creole -- a person of European descent born in the Spanish Americas or the Caribbean.

Cromwell, Oliver -- (1599-1658) a Puritan who ruled England as Lord Protector from 1653 to 1658. He was elected to Parliament in 1640 and became a leading general in the civil war which erupted in 1642. He was one of the persons responsible for the trial and execution of King Charles I* in 1649.

Cayuga -- one of five Iroquois tribes, inhabiting the Hudson River Valley.

Dajabón (Dahabón) -- a city and river in the northwest corner of the Dominican Republic.

Dartmouth -- an English frigate that wrecked in 1690 on Eilean Rubha on Ridre, an island in the Sound of Mull.

deadwood -- timbers assembled on top of the keel*. usually in the ends of the hull*. to fill out the narrow parts of a vessel's body.

deal -- a thin, softwood plank*, usually fir or pine, used to sheath a ship's hull*.

de Oviedo y Valdés, Gonzalo Fernández -- (1478-1557) a noted historiographer of the West Indies who made six voyages to the New World during his lifetime. He was awarded the position in 1523 upon his return to Spain from Santo Domingo, where he had spent nine years as supervisor to the Spanish gold smelting operation.

de Vrient, Jacobus -- a seventeenth-century Dutch pipe maker who used the EB heel stamp*.
Delftware (delft) -- an earthenware ceramic with a lead-based glaze*. The glaze appears white and opaque as a result of the addition of tin oxide used as a flux*. The use of upper case letters in the name indicates manufacture in Delft, Holland: imitation pieces, such as those from contemporary England, are described with the lower case letter. There are those who feel that the term should be reserved only for those pieces that are known to have been manufactured in the Dutch city, with all others being referred to simply as “tin-glazed earthenware.” The ceramic type was probably first manufactured in Haarlem and Amsterdam, with production continuing, most likely, into the second half of the seventeenth century.

dendrochronology -- the study of tree rings as a means of establishing dates and evaluating environmental conditions in the past.

denticulate -- finely serrated: having teeth or pointed. conical projections.

dexter -- of or on the right-hand side. On an escutcheon* a design element is dexter if it lies to the right of the bearer, hence to the left of the spectator.

die -- the larger of a pair of stamping tools that produces an impression in a coin.

DNA -- (deoxyribo)nucleic (acid).

dogger (dogboat) -- A short, broad-nosed, wide-beamed* fishing vessel.-seventeenth-century sailing vessel that closely resembled a ketch and fitted with two masts and carried a variety of sail arrangements. The English dogger was a short, beamy, fishing vessel that towed or lined on the Dogger Bank. The English type was square-rigged on the main, had a lug sail on the mizzen, and carried two jibs on a long bowsprit. The dogger has been described as used in the North Sea cod (T. macrourus), ling (M. vulgaris), and herring industries (McEwen and Lewis 1953:136; Kemp 1976:256). The name, which supposedly dates to the early seventeenth century, is derived from the Dogger Bank of the North Sea, where the vessel type was designed to trawl or line fish. DeGroot and Verstman (1980:280), however, note that the name was first mentioned in 1404 and is derived from an old word for “cod.”

doubleret -- a close-fitting jacket worn by men in Europe, especially during the Renaissance.

Dominica -- a small island in the Lesser Antilles*. named by Cristóbal Colón for the Sabbath. the day on which the island was discovered.

draft -- the depth to which a vessel's hull* is immersed.

Duart Point Wreck -- a Cromwellian shipwreck near the entrance to the Sound of Mull off the west coast of Scotland. The vessel sank sometime in the middle of the seventeenth century.

Dutchman -- a repair plank*, usually fitted between bottom strakes* that have been damaged or worn.

dyewood -- a wood, such as fusitc* or logwood, from which colors are extracted for use in dyeing.

Earthcorps® -- the collective membership of Earthwatch* volunteers.

earthware -- a wide variety of ceramics containing a fairly low proportion of silica*. They are not vitrified because of the comparatively low firing temperatures and must, therefore, be sealed with a glaze* as they easily absorb liquids.

Earthwatch® -- a Massachusetts-based. nonprofit organization that seeks to match paying volunteers with scientific projects in need of financial and logistical support.

echinoderm -- any member of the Echinodermata, a phylum of radially symmetrical coelomate marine animals including the starfishes, sea urchins, and related forms.

EDTA -- ethylenediamine(tetra acetic) acid). a sequestering agent that complexes with iron. EDTA is also used to remove stains from textiles.

electrolyte -- a solution that will conduct an electrical current.

electrolytic reduction -- a process whereby corrosion products are reduced to metal through the passage of an electric current.

elkhorn coral -- Acropora palmata. which grows in the northwestern Atlantic, often on the outer reef crest.

encomienda -- a reward given to the conquistadores by the Spanish crown, granting them the right to collect tributes and demand services from Native Americans.

engravement -- a series of curvilinear indentations in the edge of an object, such as a coin.
entrepôt -- an intermediary center of trade and transshipment.

escutcheon of pretense -- a small shield on which the family arms of a heraldic heiress is placed over the center of a larger shield bearing the family arms of her husband.

Evans, Llewelin -- a pipe maker from Bristol, England who manufactured his wares during the latter half of the seventeenth century.

faience -- earthenware ceramic decorated with opaque colored glazes.

farina -- a type of flour or meal made from grain, potatoes, beans, or nuts; it may also mean starch.

fathom -- a linear measurement equal to six feet (1.83 m).

feldspar -- any of a group of crystalline minerals that are composed of aluminum silicates with either potassium, sodium, calcium, or barium. Feldspars are the most widespread of any mineral group and constitute 60% of the Earth's crust.

femur -- the proximal bone of the hind or lower limb, also called the thigh bone.

fleur-de-lis (fleur-de-lis) -- a heraldic design or device representing a lily flower. It is suggested by some that the symbol originally represented an iris.

floor timber -- the central part of a compound ship's frame* that crosses the keel* and spans the bottom of a vessel.

fluted -- or ornamented with small channels or grooves (flutes).

flux -- a substance added to a ceramic glaze* to lower its melting point.

fore-and-aft sails -- triangular or rectangular sails carried in a for-and-aft direction and secured on their forward side to a stay* or mast*.

forecastle -- the superstructure at the bow* of a vessel which was, traditionally, the location of the crew's quarters.

foremast -- the mast* closest to the bow* of a sailing vessel.

foresail -- a rectangular- or triangular-shaped sail positioned on the foremast* of a sailing vessel.

Fort Orange -- a Dutch-American settlement in what is now Albany, New York. Occupied from 1624 to 1675. With its capture by the English in 1664, the name was changed to Fort Albany. The Dutch briefly reclaimed it as Fort Nassau in 1673, only to lose it once again in 1674, when the name reverted to New Albany.

Fort Shantok -- a Native American (Mohegan*) village located in New London County, Connecticut, on the eastern bank of the Thames River.

four humors -- the bodily fluids -- blood, phlegm, black bile, and yellow bile -- which were thought to determine human health and temperament. An imbalance of these humors was believed to cause disease.

Fraile Island (Monk's Island, Isla Zapato) -- a small, boot- or shoel-shaped island northwest of Gran Granja, at the northern part of Monte Cristi Bay.

frame -- a transverse timber or assembly of timbers that determines the hull* shape of a vessel and to which planking* and ceiling* are fastened.

French Commercial Wreck -- a late seventeenth- or early eighteenth-century shipwreck located in Samana Bay, Dominican Republic. A single French coin, dated 1697, suggests the wreck's country of origin. A pistol, blue and white delftware* ceramic, and numerous red clay sugar molds were recovered. Frank Moya Pons, venerated Dominican historian, verified that the wreck appears to have been French and was most likely involved in the burgeoning sugar industry that began in Martinique and reached northward to Hispaniola at about the time this vessel sank.

fungicide -- any substance that destroys fungi or retards the growth of the spores.

fustian -- a stout fabric of cotton and flax or of twilled cotton or of cotton and low-quality wool, with a short nap or pile. The term has its origin in the French word fustaine, from Fustat, a suburb of Cairo where the fabric was first made.

fustic -- narrowly defined, the wood of a large tropical American tree, Chlorophora tinctoria (family Moraceae), which produces a yellow dye. More broadly, the name is used to designate any type of dyewood.
futtock — one of several timbers which, along with floor* timbers and top timbers, make up the frame* of a vessel.

galleon (galleon) — a war and cargo ship used principally by the Spanish in the Carrera de las Indias between the sixteenth and eighteenth centuries. The galleon forecastle* generally ended at the stem* and was characterized by a slim beak* that projected forward. The stern transom* was square and the poop* narrow. Galleons were square-rigged*, with the foremast* and mainmast* carrying courses* and topsails*, although there were one and sometimes two lateen mizzens*.

galley — a sailing ship that is chiefly propelled by oars.

gantry — a bridge-like framework on which barrels containing salt could be loaded directly onto the vessel.

garboard — the first strake* of planking laid along a vessel’s bottom on either side of the keel*. the lowest planking strake.

glaze — a thin, glass-like coating applied to ceramic bodies that makes them impervious to liquid absorption. It is also used for decorative purposes. The two major components of glaze are silica* and a flux*.

globe chair — a wooden or metal cradle that holds a globe, or a spherical representation of the heavens.

ginger — a group of tropical herbs of the genus Zingiber. Z. officinale is grown commercially in the East Indies, Africa, and China for its aromatic root stalk which is used for medicines and for flavoring foods.

gimbal — a bracket that permits a suspended body to tip freely in any direction, or to remain level when the support is tipped.

gin press — a mechanism comprising large wooden plates that clamp together.

goiter — a disease resulting from low thyroid secretion, caused from insufficient iodine in the diet.

gout — a metabolic disease characterized by painful inflammation of the joints.

Greater Antilles — the Caribbean islands of Cuba, Jamaica, Hispaniola, and Puerto Rico.

Guacanagarix (Guacanacari, Guaccanarillo) — the cacique* of Marien who aided Cristóbal Colón when the Santa María* ran aground in modern day Haiti.

haberdasher — one who sells men’s clothing.

haberdash wares — assorted articles of men’s clothing, including hats, caps, socks, shirts, ties, and accessory items, such as buttons and needles.

Haiti (Hauti) — the Taino* name for the island of Hispaniola. The word translates as “high ground.”

Halve Maen (De Halbe Maen; Half Moon) — a small merchant ship in which Henry Hudson, an English navigator and explorer, discovered the Hudson River in 1609. Although backed by the English Muscovy Company on his first two voyages, in 1607 and 1608, his third voyage — in which he sailed the Halve Maen — was financed by the Dutch East India Company. Each of these voyages had as its objective the discovery of a northern route to the East.

hardpack — a layer of densely-packed sand.

Hart’s Cove vessel — a shalllop* discovered near the mouth of the Piscataqua River in New Castle, New Hampshire. Based on statistical measurements of more than 200 pipe stem bore diameters. it is thought that the vessel may date to the late seventeenth century.

Hatcher junk (Asian junk) — a shipwreck on a reef in the South China Sea containing a large shipment of Chinese porcelain. The remains, discovered by Captain Michael Hatcher, are thought to represent a junk that sank between 1643 and 1646.

hawksbill turtle — Eretmochelys imbricata.

Hazardous — a 725-ton vessel, measuring 41.77 m in length and 11.59 m at the beam, built in Port Louis, France, in 1698. Originally named Hazareux, the vessel was captured by the English in 1703 and modified to 875 tons. It wrecked on the Isle of Wight en route to Virginia.

heel stamp — a mark, either incuse* or relief, that is placed on the heel of a clay tobacco pipe.
Henrietta Marie — an English slave ship, built in the late seventeenth century, that sank in the Florida Keys sometime around 1700. The vessel was involved in tripartite trade between England, Africa, and Jamaica.

herpes — any of several inflammatory viral diseases of the skin, characterized by clusters of vesicles.

herring — fish of the genus *Clupea*, commonly exploited by the commercial fishing industry. Often smoked or salted, or canned as sardines.

herring works — a station where herring* is processed.

Hesschen (hessian) — from Hesse, in Germany.

hidalgos — the lowest class of Spanish nobility that could carry the title of Don, or gentleman. The name is a contraction of the expression "hijo d' algo," or "hijo de algo," which translates as "son of something."

Hispaniarvm REX — King of Spain.

hold — the interior of a ship. Below decks.

Hollandia — an outbound Dutch vessel that sank among the Isles of Scilly in 1743.

hookah — a surface-mounted. air compression system used for breathing underwater.

house — the outer or master cup in a nested weight set.

hull — the body of a ship or boat exclusive of masts, yards, sails, and rigging.

humerus — the long bone of the forelimb that extends from the shoulder to the elbow.

Ile a Vache (Cow Island) — a small island off Haiti.

incuse — formed by punching or stamping.

Indiaman — a merchant vessel that traded in the East or West Indies.

indigo — a blue dye obtained most commonly from plants of the genus *Indigofera*, in the family Leguminosae.

innominate — a large flaring bone that, in mammals, constitutes a lateral half of the pelvis. It comprises the ilium, ischium, and pubis. They are fused into one bone in the adult.

in situ — in the original place or position.

Iroquois — a Native American confederacy from the Iroquoian linguistic stock, located in the upper and central part of the Mohawk Valley and the lake region of central New York, and consisting of the Cayuga*, Mohawk*, Oneida*, Onondaga*, and Seneca*. Later, when joined by the Tuscaroras*, they were referred to as the Six Nations. The name is derived from the Algonquian word "Iri'akhoiwi" or "real adders," with the addition of the French suffix "-ois." The Iroquois were also called "Ongwehro'ono'ni," their own name designating that "We are of the extended lodge," and, thus, the popular designation, "People of the longhouse." Additional names include Canton Indians; Confederate Indians; Five Nations; Mat-che-naw-to-wag; an Ottawa name meaning "bad snakes"; Mingwe, a Delaware name; and Nadowa, a name given by the northwestern Algonquians and meaning "adders."

Isabela — the first (intentional) European settlement in the New World. Located on the northern coast of Hispaniola and named for the Queen of Spain. Established in 1494 by Cristóbal Colón. Isabela was abandoned in 1498 when disease and despair, combined with an inadequate colonization strategy, all but wiped out European morale.

Isla Cabra — "Goat Island," located at the northern end of Monte Cristi Bay, on the north coast of the Dominican Republic. Throughout history, the island has been known by several names, including Isla or Cayo Cabra, Cabras, Cabrita (all references to "goat"), El Cayo, Cayo Pabellón, Cayo Sal (Salt Cay or Key), and Cayo de Monte Cristi. The island was the summer base camp for the Monte Cristi Shipwreck Project from 1991-1994.

Jamestown — the first permanent English colony in America, founded by about 100 emigrants under the command of Christopher Newport, in May, 1607, in present day Virginia, 32 miles up the James River.
Jew's-harp (Jews'-harp, jaw's-harp, Jew's-trump, Jew's-trump) -- a slang term for a musical instrument of ancient lineage with no traceable relationship to the Jewish people. It comprises a small metal frame that supports a flexible metal tongue. The frame is placed between the teeth as the metal tongue is plucked with the fingers. Each harp produces a single tone, the quality of which can be varied by changing the shape of the mouth.

jib -- a common term for a triangular sail carried on a stay* forward of the foremast*.

Jupiter Inlet Wreck -- a seventeenth-century Spanish shipwreck site in which there existed no structural remains. The extant cargo was located 550 feet ESE of the south jetty of Jupiter Inlet, Florida.

Jutholmen Wreck -- the probable remains of a small but typical seventeenth-century fluitschip (flyboat). The vessel most likely sank sometime near 1700 or shortly thereafter. The Jutholmen vessel was apparently 40 to 50 years of age at the time that it sank, suggesting it was constructed sometime around 1650. Theories for its demise include a possible collision with another ship, as well as the prospect that the ship broke from its mooring. The fluitschip was most likely leaving Sweden and was headed for a foreign port, as indicated by its cargo.

kaolin -- a fine, white clay used in ceramics as a filler or extender.

Kassa's Beach Site (Site LC008) -- a careening* location, most likely of a small vessel, that may have been "beached, destroyed, and scrapped for iron fasteners" (Smith 1979:47). The assignment of a midseventeenth-century date is tentative as it is based on clay smoking pipe fragments which compose a sample too small to "suggest a specific decade" (Smith 1979:47).

keel -- the principal longitudinal timber of a ship, often referred to in popular literature as the "spine" or "backbone." The frames*, deadwoods*, stempost*, and sternpost* assemblies were mounted to the keel.

keelson (kelson) -- an internal, longitudinal, stiffening timber mounted atop the frames* and extending the length of the keel*. The keelson strengthened the bottom of a ship's hull*, functioning as an interior keel.

Kennemerland -- an outbound Dutch East Indiaman* that sank off the Out Skerries in the Shetland Islands in 1664.

kersey -- a coarse, twilled, woolen cloth with a cotton warp*: also an overcoat of this fabric.

knee -- an angular timber usually fashioned from the crook of a tree, used to support the junction of two surfaces of different planes. In ships, these were most often used to brace deck beams to the side of a vessel (ceiling*, or quickwork, and shelf clamps). Hanging knees were set vertically and lodging knees were set horizontally.

Koln -- Cologne, Germany.

Kraken -- a revenue cutter that sank in Kalmar Harbor, Sweden, in 1651.

La Belle -- a vessel of about 60 tons and approximately 70 feet (m) in length. La Belle was one of two ships belonging to Rene-Robert Cavelier ("sieur de La Salle) that were lost in Matagorda Bay, Texas. La Salle lost the first ship in 1685 when he established Fort Saint Louis at the headwaters of Lavaca Bay, near present day Port Lavaca, Texas. The second vessel La Belle, a gift to him from Louis XIV, was lost during a storm the following year.

larch -- Larix sp.

Lastdrager (Load Carrier, Porter, Beast of Burden) -- an outbound Dutch East Indiaman* of 640 tons burthen* that sank in the Shetland Isles in 1653.

lateen-rigged -- an arrangement in which a long triangular sail is attached by its foremost edge to a long yard hoisted at an angle to the mast.

lateen mizzen -- a lateen-rigged* mizzen mast*.

league -- a linear measurement equivalent to approximately 3.18 miles (5.12 km), or about 1/20 of a degree of latitude.

lens -- a layer of sediment.
Lesser Antilles — the Leeward and Windward Islands of the Caribbean Sea. Among the Leewards are the Virgin Islands, Guadeloupe, Saint Eustatius, Saba, St. Martin, St. Kitts and Nevis, Antigua, Anguilla, Montserrat, and the British Virgin Islands. The Windward Islands include Martinique, Dominica, Grenada, Saint Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, and Barbados.

lice — the common name for members of two distinct orders of wingless, parasitic, and disease-carrying insects. The sucking lice of the order Anoplura, are external parasites of mammals, including humans. The group includes the body louse and head louse, considered varieties of the species Pediculus humanus, and the crab or groin louse, which belongs to the species Phthirus pubis.

linen — cloth, thread, or yarn made from flax fiber.

longitudinal — placed or running lengthwise.

longhorn — any of the breeds of cattle with relatively small bodies, a variable color pattern, and horns with a spread of up to 40 inches (101.6 cm). Originating in Spain, the breeds are common in the southwestern United States.

lugsail — a quadrilateral sail bent upon a yard* that crosses the mast* obliquely.

lupus (systemic lupus erythematosus) — a noninfectious disease in which immune system antibodies attack the body’s own substances. Symptoms include weakness, fever, weight loss, anemia, enlargement of the spleen, and skin lesions.

Maidstone — a 50-gun ship of 1,000 tons that sank in 1747 on the rocks at Petit Sèché, off Île de Noirmoutier.

mainmast — the principal mast of a vessel. It is the chief mast in a two-masted vessel, the center mast in three-masted vessel, and the second mast from the forward in all others.

mainsail — the sail of the mainmast*.

majolica — an early form of tin-glazed earthenware ceramic manufactured by the Iberians and Italians. Later adopted by the Dutch and English. The Dutch use the term to refer to wares with tin glaze* on the reverse (inside or face). English wares may also have a lead glaze on the reverse (outside or back). Knowledge of majolica production most likely passed from Spain to Italy. Italian craftsmen emigrating from Antwerp northward are thought to have introduced trade secrets to the Dutch sometime around the middle of the sixteenth century. Majolica was later imported into England, where it was, once again, copied.

Manila Wreck — a Dutch slave ship or escort, possibly belonging to the Dutch West India Company. The vessel sank on the North East Pointer Breakers (reef series) off Bermuda, sometime around the middle of the eighteenth century.

manor — a unit of English rural territorial organization such as in the Middle Ages in which an estate under a lord enjoying a variety of rights over land and tenants including the right to hold court.

Mao — a river of Santiago in the Dominican Republic that empties into the Yaque. City in the Cibao.

mare clausum — a “closed sea.” The Latin reference to a body of navigable water under sovereign control and therefore closed to other nations.

mare liberum — an “open sea”: the Latin reference to a body of navigable water open to all nations.

Margarita (La Margarita) — an island off the north coast of Venezuela.

María Galante — a small island located northwest of Dominica in the Leeward Island chain of the Lesser Antilles*. It was most likely named after the Santa María*, the flagship of Cristóbal Colón’s second voyage to the New World, which was also known as the Mariagalante.

Marien (Mariel) — a chieftain of Hispaniola divided into 14 nitainos* including Bayyá, Bainoa, Caribita, Caobonico, Cuaba, Dajabón, Guayubin, Guajaba, Guaraguano, Haiti, Hatiel, Jaime, Manui, and Iguamuco. Geographical boundaries were the Atlantic Ocean to the north; the chieftains of Jaragua and Maguana to the south; the chieftain of Magua to the east; and to the west, the Wind Channel (Canal del Viento) or Jamaica. The principal ports of Marien (according to their modern names) include Isabela, Estero Hondo, Jacaquito, Montecristi, Bayyá, Bahía de Caracol, Cabo Hatian, Acul, Port Margot, Puerto de Paz, San Luis, San Nicolás, and Gonaives.
maroon — a fugitive black slave of the West Indies and Guiana in the seventeenth and eighteenth centuries. The practice of "marooning", or putting sailors ashore on desolate islands or barren coasts, was called such because it suggested that outcasts’ survival depended on their ability to locate and integrate into the fugitive slave communities.

mast — a long pole or spar that supports the yards*, sails, booms*, and rigging of sailing vessels. On larger vessels, masts may comprise several sections, including the lower mast, topmast, and topgallant mast.

mastecouple — an alternate designation of the widest, or midship, frame* of a vessel.

mastic (mastick) — a small evergreen tree. *Pistacea lentiscus.* Lfe (1992:35, footnote 22) differentiates between mastic and the gumbo-limbo (*Bursera simaruba*), which Cristóbal Colón most likely encountered on Cuba. The term is applied by Rosloff (1986:22) to a "yellow/brown...compound," probably a mixture of wood tar and sulfur, used to protect a ship’s hull* against biodegradation.

matte — a finished surface that lacks luster or gloss.

Mayflower — a ship that carried 102 pilgrims and 25 to 30 crew men from England to New England in 1620-1621. The vessel is estimated to have had an approximate keel* length of 58 feet (17.7 m), a hull* length of about 90 feet (27.4 m), a breadth of 25 feet (7.6 m), a depth of 12.5 feet (3.8 m), and was probably between 140 and 180 tons burthen*. It carried six sails on three masts* and a bowsprit*.

Mayreni (Mairen) — a Taino* chiefman who helped to destroy the Spanish fort at Navidad*.

merchantman — a vessel used in commerce.

metasedimentary — a sedimentary rock that shows evidence of having been subjected to metamorphism, perhaps through heat or pressure.

midden — a refuse heap.

mitochondrial DNA (mtDNA) — DNA* found in cellular mitochondria. The mitochondrial genome consists of a circular DNA duplex and there are generally five to 10 copies per organelle. The mammalian mtDNA has a molecular weight of about 11 x10^6 and therefore is less than 10^-7 times that of the nuclear genome. The genetic code of mitochondria differs slightly from the "universal" genetic code. Since, of the two gametes, only the egg cell contributes significant numbers of mitochondria to the zygote. mtDNA is maternally inherited.

mizzen mast — the aftermast* on a three-masted vessel; the mast* directly aft of the mainmast*.

Mohawk — one of five Iroquois* tribes that inhabited Mohawk in the upper valley of the Mohawk River.

Mohegan — a Native American tribe, belonging to the Algonquian linguistic stock, that originally occupied most of the upper valley of the Thames River and its branches. They later expanded into areas previously ruled by the Nipmuc and Connecticut River tribes, as well as the territory of the Pequot. The name "Mohegan" translates as "wolf;" although they were also known as the River Indians, Seaside People, Upland Indians, and Unkus (Uncas) Indians, from the name of their chief.

Molettes Reef Wreck — an early sixteenth-century Iberian wreck site on the Molettes Reef in the Turks & Caicos Islands.

mollusk (mollusc) — any of the Mollusca, a large phylum of invertebrate animals as snails, clams, or squids that possess a soft unsegmented body usually enclosed in a calcareous shell.

Monte Cristo (Monte Cristo) — a native of Monte Cristi, Dominican Republic.

musketoons (musketoons, musquetoon, muskatoon) — a short, large-bore musket.

mum — a strong ale that was popular during the seventeenth century, made from wheat malt, oat malt, and flavored with herbs.

muscovy sugar — an unrefined sugar, also known as azucar moscopido.

mutton — meat from sheep, distinguished from that of a lamb. On board English sailing vessels, mutton was generally consumed by the captain and officers. Although it may have been shared with the sailors when in port.
naboría — the lower level or class of Taino* society. Rouse (1992:9) notes, however, that this division was the designation of the Spanish chroniclers who equated Taino social structure with their own, namely, one of “nobility” and “commoners.” See also nitaino.

Navidad — the fort and settlement built from the remains of the Santa María*, which ran aground on 24 December 1492, in what is now Haiti. The number of crew left behind at La Navidad is not agreed on by everyone. Charlevoix (1730:81) suggests 38 remained, as does Wilson (1990:71); Irving (1930:73), Morison (1942:306), and Fuson (1987:161) all mention 39 men. Granzotto (1985:206) suggests 40 crew members were left behind. Furthermore, not everyone agrees with the accepted historical account of the events surrounding the demise of the small European contingency: In a paper delivered at the Decimo Congreso Internacional De Arqueologia Del Caribe in San Juan, Puerto Rico (25 to 31 July 1993), Tattersall (unpub. 1993) suggests there is evidence that the Spaniards themselves initiated the fighting and destroyed the fort. She posits that at least 20 survived the onslaught and sailed away in a caravel* constructed at La Navidad.

nau — a large ship.

nectarine — Prunus persica, of the rose family, Rosaceae. The fruit of this tree is a smooth-skinned variety of the peach.

New Old Spaniard wreck (Lumberyard wreck) — a seventeenth-century shipwreck discovered by treasure hunter Teddy Tucker in Bermuda. The site was salvaged during the 1960s by Tucker and Mendel Peterson, from the Smithsonian Institution. Bermuda Maritime Museum archaeologists Steve and Cathy Hoyt investigated the hull in 1987. Under the sponsorship of East Carolina University and the Bermuda Maritime Museum.

New Netherland — A Dutch-American settlement in present day New York. In March 1624, 30 Dutch families left Amsterdam and headed for the New World. They settled at Governor’s Island in New York Harbor. Fort Orange on the Hudson River in present day Albany, and Fort Nassau or present day Gloucester, New Jersey. In May 1626 another group of Dutch families, headed by Peter Minuit, settled on the lower tip of Manhattan Island. The Dutch Colony became known as New Netherland, and the City of Manhattan as New Amsterdam.

nit — the egg or juvenile stage of a louse or other parasitic insect.

nitaino — the upper level or class of Taino* society. See also naboría.

Nooms, Reiner — a prolific Dutch painter and etcher, born in Amsterdam around 1623. He died there in 1664. Nooms used the alias “Zeeman” which translates as “seaman.” This pseudonym, along with his realistic depictions of a variety of vessel types and foreign ports, has led to speculation that he may have spent much of his life at sea, although little about him is actually known. De Groot and Voorstman (1980:275) postulate that Nooms traveled to Paris, London and North Africa, as attested to by the diversity of his art work.

Nuestra Señora de Atocha (Our Lady of Atocha) — a Spanish galleon* that, along with the Santa Margarita*, sank off the lower Florida Keys in 1622.

Nuestra Señora de las Maravillas (Our Lady of the Wonders) — a Spanish vessel that sank in 1656 on the Little Bahamas Bank during its return voyage to Spain.

Nuestra Señora de la Pura y Limpia Concepción (Our Lady of the Pure and Clean Conception) — a Spanish galleon* that wrecked on the Silver Shoals of Hispaniola on 31 October 1641.

Nuestra Señora de Guadalupe — a quicksilver galleon that, along with the Conde de Tolosa*, sank in Samana Bay, Dominican Republic on 24-5 August 1724.

oak — Quercus sp.

obverse — the side of a coin bearing the principal design; opposite of reverse*.

Omwake’s formula — a regression formula* used for calculating mean deposition date of artifacts on archaeological sites. based on the measurement and evaluation of pipe stem bore diameters. The equation is:

\[ Y = 1929.189 - 36.818X \]
where Y represents the date to be determined. 1929.189 is the theoretical date at which the pipe stem bore diameter would reach zero. 38.818 is the slope of the line (the number of years between each 1/64 inch decrease), and X is the mean bore diameter of the sample being dated. See also Binford's formula.

Oneida — one of five Iroquois* tribes, inhabiting the area around Oneida Lake, in modern day New York.

Onondaga — one of five Iroquois* tribes, inhabiting Onondaga in Onondaga County and the neighboring regions in modern day New York.

opacifier — an agent that makes a body impervious to the rays of light.

orbital rim — the bony ring around the eye socket.

pale — a simple heraldic figure or charge consisting of a broad vertical stripe in the middle of an escutcheon*, usually occupying one third of its breadth.

Patache (patage, patax, pataxe) -- a two-masted vessel that served as an advice boat. It was used in coastal exploration and was often employed as a guard to port entrances.

PB-3 (archaeological site) — a large ballast* mound measuring approximately 30 m in length on the Pedro Banks in Jamaica. Six large anchors and 21 iron cannon were associated with the site. Based on the coins collected from the site, it has been hypothesized that this wreck may well represent one of the four ships lost by the Spanish en route to Havana in 1691.

Peace of Westminster — a peace treaty enacted on 5 April 1654, that ended the Anglo-Dutch War* of 1652. Under this provision, the Dutch agreed to enter a defensive league with England, indemnify English merchants who had suffered during the war, offer a salute in English waters, and exclude the House of Orange from the office of stadtholder. It was a Treaty of Westminster that brought a close to the Third Anglo-Dutch War on February 9, 1674. Once again, the Dutch were to pay an indemnity, as well as surrendering to England the colonial settlements of New York, Albany, Long Island, and New Jersey.

pebble — a general term for a small, round, water-worn stone having a diameter of four to 64 mm, or a size generally characterized as that between a small pea and a tennis ball. In Great Britain, the range of ten to 50 mm has been used.

Philip IV — (1605-1665) King of Spain. Naples, and Sicily from 1621 to 1665 and, as Philip III. he reigned as King of Portugal from 1621 to 1640. Philip was the son and successor of Philip II of Spain. Although an intelligent king, he lacked interest in the affairs of state. During his reign, Spain declined politically and economically.

pieces of eight (octo reales) -- a slang expression for Spanish silver pesos. The first silver pieces of eight were produced around 1543 in the Spanish mints at Old Segovia, Toledo, and Seville.

pink (pinque) — a small, square-rigged* ship with flat floors* that possessed a narrow overhanging stern*. In the fifteenth and sixteenth centuries, the name was loosely applied to all small ships with narrow sterns. Pinks regularly sailed between New England and the Caribbean.

pinnace — a small, two-masted, and oared vessel of about 20 tons that originated in the sixteenth century. The sails were normally square-rigged* but were later rigged like those of a schooner*. Because of the ambiguous nomenclature of sailing vessels, the pinnace could range from the aforementioned small boat to a large, open water vessel carrying ten to 14 guns. They were typically utilized in privateering and cabotage*.

Pinzón, Martín Alonzo — (?-1493) a Spanish navigator who commanded the Pinta on Cristóbal Colón's first voyage to the New World in 1492. Along with his brothers, Francisco Martín Pinzón, master of the Pinta, and Vicente Yáñez Pinzón, commander of the Niña, Martín Alonzo figures prominently in the European "discovery" of the New World. For reasons that are not clear, but which are likely to have been grounded in personal ambition and greed, Pinzón abandoned Colón in the Antilles for more than six weeks. On the return voyage to Spain his ship became separated from the Niña in a storm, but both reached Palos the same day. 15 March 1493. He died soon afterwards.
PIMA — P(an-American) I(nstitute) of M(aritime) A(rchaeology). PIMA was established on 31 December 1990 as a nonprofit, scientific and educational organization dedicated to the study of the history and archaeology of New World seafaring.

pirogue (piragie) -- a small dugout canoe. The pirogue is mentioned several times in the letters from Fort Amsterdam, almost always as a small craft stationed to observe the movements of other vessels in coastal areas.

plagioclase -- all feldspars* that have an oblique angle between the two main cleavages.

planking -- the outer lining of a wooden hull*

planking strake -- a continuous row of planks, running from bow* to stern*.

Plus Ultra -- a Latin phrase appearing on the reverse* of seventeenth-century Spanish silver coins which translates as "and even beyond."

pockwood -- Guaiacum officinale, commonly known as the lignum vitae tree. The name comes from its use as a medicinal herb to defend against smallpox.

polder -- an area of low-lying land reclaimed by a body of water.

port -- the left-hand side of a vessel when looking from aft forward.

Port Royal shipwreck -- the remains of a vessel, possibly the Swan, a 246-ton warship captured by the English from the Dutch in 1672. The wreck was excavated from the submerged remains of Building 4 at Port Royal, Jamaica. Swan was 74 to 75 feet (22.56 to 22.86 m) long and 25 feet (7.62 m) at the beam.

potash (wood ash, pearl ash, potassium carbonate) -- a white, crystalline, deliquescent substance with the chemical configuration K2CO3. It was originally obtained from wood ashes or from the residue left in pots after certain plants (e.g., kelp) were burned in them.

potash glass -- glass made from wood ash, which was included as a flux*.

Princesse Maria (Princess Mary) -- a Dutch East Indiaman* that sank in the Isles of Scilly in 1686. The vessel was 48.8 m in length, 11.9 m at the beam, and 5.6 m deep.

prow -- the forward portion of a pipe bowl. Among the Native American pipes that are thought to have been prototypes for the European-manufactured funnel elbow-angled forms, a variety of prow shapes existed, including square, rounded, angled cuts, pointed, and hatchet-shaped. Bowls, too, exhibited a variety of designs, including cylindrical and flared, and were often carved with effigy figures. Pipe shanks* were often decorated with crests or ridges that were perforated to accommodate feathers or ornaments.

prunt -- a small, raspberry-shaped, glass ornament often applied to the sides of Dutch drinking vessels.

public branch -- the lower, forward-reaching portion of the pelvic bone.

PVA -- poly(vinyl) acetate is a transparent synthetic resin used as an adhesive or a consolidant in artifact conservation.

quarterdeck -- the after part of the upper deck, from the mainmast* to poop.

quatrefoil -- a common representation of a flower bearing four petals or of a leaf with four leaflets; also a four-lobed foliation in architecture.

quinto -- the "royal fifth," or 20% of all profits paid as a tax to the Spanish Crown for all goods brought back from the New World.

rabbet -- a channel or groove made in a piece of timber in such a way as to receive the edge of a tightly fitting second timber.

radius -- the proximal bone in the lower leg of a quadruped.

rampant -- an expression of wildness in some heraldic animals, characterized by rearing up on the hind legs with the forelegs extended.

rapeseed oil -- a brownish-yellow oil obtained from the rapeseed, a small European plant, Brassica napus, in the mustard family, Cruciferae. The oil is utilized chiefly as a lubricant as well as in the manufacture of soap and rubber. The leaves are used as feed for farm animals, usually sheep and hogs.

rapier -- a straight double-edged sword with a narrow, pointed blade.
real (Royal) — the basic denomination for Spanish silver coinage. The largest silver coin was the ocho reales, or the piece of eight. Coins of one-half, one, two and four reales were also minted.

regicide — the killing of a king.

regression formula — a function that yields the mean value of a random variable under the condition that one or more independent variables have specified values.

Rensselaerswyk — a Dutch colony or manor, established in 1630 by Killian van Rensselaer of Amsterdam, near Fort Orange, the present site of Albany, New York.

reverse — the side of a coin that does not bear the principal design; opposite of obverse*.

Rhenish — from the Rhine River, in Germany.

rheumatism — a general term for a variety of disorders that cause pain and inflammation in muscles, joints, bones, or nerves.

rheume (réume) — inflammation.

rider — an interior, transverse or diagonal timber that is seated atop the ceiling* and bolted to a main frame*. Used to provide additional stiffening. They could be single or composite pieces.

Rill Cove wreck site — near Kynance, Cornwall. The tentative date for the site is 1616.

roemer — an elaborately decorated glass drinking vessel used by the Dutch.

Roldán, Francisco — the mayor domo of Cristóbal Colón and the alcade mayor of the settlement of Isabel* in Hispaniola. Roldán took up arms against Bartolomé Colón* in 1498.

room and space — the distance from a molded edge of one frame to the corresponding point on an adjoining frame, usually measured at or near the keelson. The part occupied by the frame is called the room; the unoccupied distance between it and the adjacent frame is called the space.

roundel — a round figure or emblem, especially in a decorative motif.

rowel — a revolving disk with sharp marginal points at the end of a spur.

roulette — small, decorative hash marks placed around the bowl rim or stem of a clay pipe.

Ruan — a French fabric made in the continental city of Rouen.

ruff — a large round collar of pleated muslin or linen worn in the late sixteenth and early seventeenth centuries by both men and women.

rump parliament — a group that carries on parliamentary proceedings, despite the departure or expulsion of a large number of its members.

Sainte Dorothea (Saint Dorothy) — a vessel built in Holstein in 1672 for the Danish Royal Navy. Originally named the Nelle Blad (Nettle Leaf), it was later sold and renamed the Sainte Dorothea.

San Martin — a 300-ton Visayan-built nau* that sailed as the almiranta* of the Honduras fleet. The small galleon* was returning to Spain with a cargo of hides, cochineal*, indigo*, gold, and silver when it sank in a storm off the Florida coast (between the Sebastian and Jupiter Inlets) in 1618. The Green Cabin Wreck, designated as Site 8IR22 in the Division of Archives, History, and Records Management for the State of Florida, may actually be the remains of the San Martin. The extant hull measures 35 feet (10.67 m) in length by 18 feet (5.49 m) at the beam.

San Martin — an island in the Lesser Antilles* named by Cristóbal Colón on his second voyage to the New World. According to Samuel Eliot Morison, this is not the island of St. Martin in the Netherland Antilles, but rather, the island of Nevis. The vigil of the feast of St. Martin of Tours commenced on the day that Colón encountered this island.

San Miguel de Archangel — a Spanish galleon* that wrecked along the Florida Coast at a place called “Gega” in the spring of 1660, and suspected by Addario (1991) as being the vessel represented by the Jupiter Wreck*.

Santa Margarita — a Spanish galleon* that, along with Nuestra Señora de Atocha*, sank off the lower Florida Keys in 1622.

Santa María — The flagship for Cristóbal Colón's first voyage to the New World. Santa María ran aground in Hispaniola (in what is modern day Haiti) on 24 December 1492. Between 38 and 40 crew members were left behind in a fort constructed from the vessel's timbers.
**Santissimo Sacramento** -- the flagship of a 50-vessel convoy that sank near the entrance of the port of Bahia de Todos los Santos in Bahia, Brazil, in 1668.

**H.M.S. Sapphire** -- a Fifth-Rate frigate that sank in action with the French in Bay Bills, Newfoundland, Canada. The vessel was built by Deane of Harwich in 1675 and measured 32.9 m in length, 7.9 m in breadth, 3.0 m in depth, and drew 3.85 m.

**sapwood** -- the soft, new, living wood between the bark and the hard, inner wood of most trees.

**sarsaparilla** -- a number of native American plants belonging to the genus *Smilax*, in the lily family, *Liliaceae*. The root is often used in the treatment of psoriasis, a dermatological disorder.

**scantlings** -- a general term referring to the principal hull* timbers.

**scapula** -- the shoulder blade.

**scarf (scarp)** -- the lapped joint connecting two timbers or planks* without increasing their dimensions.

**schooner** -- typically a two-masted fore-and-aft rigged vessel with a foremast* and a mainmast* stepped nearly amidships*.

**Scipion** -- a French 74-gun ship of 1500 tons that sank in 1782 near English Port. Punta Icaco, in Samana Bay, Dominican Republic.

**scuba** -- s(elf) c(ontained) u(nderwater) b(reathing) a(pparatus).

**scurvy** -- a disease caused by a lack of vitamin C in the diet. Scurvy was common among sailors who ate little more than bread and salted meat on their long voyages. Fruits and vegetables in the diet curtailed the disease, which was characterized by weakness, prostration, swollen and bleeding gums, and discoloration of the skin.

**Sea Venture (Sea Adventure)** -- the flagship for a nine-vessel convoy that sank off Bermuda in 1609. At the time of its demise, the ship was carrying settlers from Plymouth, England, to Jamestown, Virginia. It is commonly believed that its sinking provided the inspiration for William Shakespeare's renowned work, *The Tempest*.

**Seneca** -- one of five Iroquois* tribes, inhabiting Seneca, between Lake Seneca and Genesee River in modern day New York.

**serge** -- a twilled, worsted, or woolen fabric used for clothing.

**serranid** -- any member of the Serranidae, or sea bass family. These fishes are characterized by oblong, compressed bodies that are covered with ctenoid scales. They are considered important food and sport fishes, especially in tropical seas.

**Sevilla** -- Seville, Spain.

**sewnt (svampum)** -- small pieces of shell that were strung together and used as a currency by some Native Americans. The value of these highly prized shells depended upon their color.

**Seychelles Portuguese wreck** -- a sixteenth-century shipwreck off Boudoise Cay, Seychelles. Founder’s marks on some of the armament range between 1515 and 1560.

**shallop** -- a ship’s boat employed for any number of tasks involving the movement of passengers and cargoes between ship and shore, or from ship to ship. Shallops were also used throughout the Caribbean for turtleing.

**shank** -- a straight, narrow, usually essential part of an object. In Native American pipes, it refers to the stem portion.

**shipworm (teredo, broma)** -- a warm water, marine, bivalve mollusk of the family Teredinidae. Although commonly referred to as a worm, it is actually a greatly elongated clam whose two shells, characterized by ridged surfaces, are used for boring. *Teredo navalis*, the common North Atlantic shipworm, may reach lengths of up to two feet (60 cm). Because they actually feed on wood particles, they are considered a serious threat to navigation in tropical seas.

**silica** -- silicon dioxide (SiO₂), which occurs in crystalline, amorphous, and impure forms.

**sinews** -- tendons and ligaments.

**sinister** -- situated to the right of the one looking at the escutcheon*. from the belief that omens seen on the left side were unlucky, or evil. or "sinister."
silver nitrate method — analytical procedure for determining the amount of chloride present in a sample of water. In this procedure, a ten to 30 ml sample of rinse water is drawn in a clean test tube and acidified with several drops of dilute nitric acid (10%). After vigorous shaking of the test tube, two to five drops of 0.2 N silver nitrate (AgNO₃) are added to the solution, which is held up against a black background. If chlorides are present, a cloudy, white precipitate will form in solution.

slip — a mixture of water and fine clay, used by potters to decorate wares, or to cement separate parts.

sloop (sloop, schloop, sloep) — Traditionally, a vessel of between 25 and 75 tons burthen that carried a single fore-and-aft sail and was often equipped with oars. It could be decked or undecked (Clifford 1993:65), but those employed by the Dutch in the service of New Netherland were generally undecked (Wilcoxen 1991:65). The presence or absence of a deck, at least at New Netherland, appears to be the singular difference between a sloop and a small working yacht. Sloops were generally employed as coastal, canal, or river vessels and were often used as a ship’s longboat equipped with oars. Originally, the term “sloop” designated a ship’s long boat (Wilcoxen 1991:65). The English at Port Royal employed sloops in the transport of groceries, as well as for carrying salt, turtle, fishing, and even treasure hunting. The Dutch-Americans utilized these vessels for dispatch and for catching turtles (RBC 14 April 1643).

Slotter Hooge (Hooge Castle) — a Dutch East India Company vessel that sank in the Madeira Islands in 1724.

snow (snow) — a small sailing vessel that carried a main and foremast, as well as a mastsail mast behind the mainmast. The snow resembled a brig and was, early on, employed as a warship.

soda — sodium carbonate, a white, odorless, water soluble chemical compound with the formula Na₂CO₃. Because seaweed ashes were an early source of sodium carbonate, it is often referred to as soda ash or simply soda.

South Hole Sound Site (Site LCLA113) — the possible remains of a small, midseventeenth-century sailing vessel.

Spanijola — Hispaniola.

Sparrow Hawk — went ashore on Cape Cod in an area known as Old Ship Harbour in 1626.

spiculiferous — replete with fossil sponge spicules, or small, calcareous or siliceous spine-like structures.

spijkerpennen — small wooden dowels placed in holes left behind by wooden cleats.

spotted eagle ray — Aetobatus narinari.

spotted goat fish — a bottom feeder belonging to the species Pseudupeneus maculatus.

sprig molding (sprig decoration) — a decorative device formed by pressing clay into a plaster mold bearing incised or molded designs. The plaster absorbs moisture from the clay, causing it to shrink. Prior to glazing, the clay, which bears the plaster design, is trimmed and "slipped" with a small quantity of uncolored liquid clay; this fuses the applied design to the ceramic body.

spruce — Picea sp.

sprue — a hole in a mold through which molten metal is poured; also the excess metal left on the finished product from contact with the sprue.

square rigged — sails positioned perpendicular to the longitudinal axis of a vessel.

St. Croix (St. Cris, St. Crux) — one of the American Virgin Islands.

St. Eustatus (Statia) — an island in the Lesser Antilles* which was, for the Dutch, "the most important of the three S-islands" (Saba, St. Eustatius, and St. Martin*) (Roemer 1985:12). All three were confirmed to the Dutch by the Treaty of Munster in 1648. As centers of illicit trade, these latter two were of little importance. Eustatius, however, was vital to the Caribbean and North America because it provided tobacco, sugar, indigo* and cotton to New Netherland, as well as the English colonies. Approximately 1,000 Dutch, English, and French colonists on St. Eustatius were outnumbered nearly two to one by African slaves.

St. Martijn (St. Martin) — an island in the Lesser Antilles*.
staghorn coral — _Acropora cervicornis_, which grows in the northwestern Atlantic, often found on the back portion of an outer reef.

starboard — the right-hand side of a ship when looking from aft forward.

stay — a rope that supports the mast* of a sailing vessel.

staysail — any sail hoisted on a stay*, as a triangular sail between two masts*.

Steen, Jan — a Dutch painter who lived from 1626 to 1679.

steeve — upward inclination.

stem — see stempst.

stempst — a vertical or upward curving timber or assembly of timbers stepped into or scarfed* to the keel or central plank at its lower end, into which the two sides of the bow were joined.

stern — the after end of a vessel.

sternpost — a vertical or upward-curving timber or assembly of timbers stepped into or scarfed* to the after end of the keel* or heel.

stoneware — a ceramic body in which the proportion of silica* is high enough so that, when fired to a sufficiently high temperature, partial vitrification occurs. Stonewares are generally nonporous and impervious to liquids.

strake — see planking strake.

Stuyvesant, Peter — (ca. 1610-1672) the Dutch Director General of New Netherland who served as governor of Curaçao. In 1647 he set up a board of nine men to advise him in his directorship of New Amsterdam and, although it was dissolved in 1651, the colony was granted municipal government by Holland in 1653. A harsh ruler, Stuyvesant lost territory to Connecticut in 1650, but conquered New Sweden in 1655. When overpowered by a surprise attack from the English, Stuyvesant was forced to surrender New Netherland to England in 1664.

Susquehannock (Susquehanna) — a Native American tribe of Iroquoian linguistic stock. They inhabited the Susquehanna River in modern day New York, Pennsylvania, and Maryland. Although the meaning of the name is unknown, they were referred to by a variety of names, including _Akkrakanaehronon_, a town name referenced by the Jesuits. _Andastie or Comestoga_, from _Kanustige_, which translates “at the place of the immersed pole”; _Ita'kwae'ronmons_, from the name of a town, and most likely signifying “at the place of the sun,” or “at the south”. _Minqua_, from an Algonquian word meaning “stealthy,” or “treacherous.”

Taíno — the Indigenous peoples of Hispaniola, Puerto Rico, Jamaica, Cuba, and the Bahamas. The root of the word “Taíno” means “good,” “noble,” or “prudent.” It may have been a name that they gave to themselves; several group members used the term to inform Cristóbal Colón that they were distinct from the island Caribs. However, there was no overall name for the central group of Hispaniola. Generally they referred to themselves by the regional localities, for example the Boriqen from Puerto Rico (the native name for the island) and the Lucayo (“small islands”) of the Bahamas.

Teniers, David — two Seventeenth-century Flemish painters: David the Elder lived from 1582 to 1649.

David the Younger lived from 1610 to 1690.

terminus ante quem — Latin phrase meaning “date before which.”

terminus post quem — Latin phrase meaning “date after which.”

tetanus — an acutely infectious disease of the central nervous system that is often known as lockjaw. It is caused by the toxins of the widespread bacillus _Clostridium tetani_. Infection is characterized by stiffness of the jaw and facial muscles, often followed by severe convulsions. The overall mortality rate is high, especially among the very young and the aged.

tibia — one of the two bones, along with the fibula, of the vertebrate hind limb, located between the knee and ankle. The tibia is the inner and usually larger of the two bones.

tin glaze — a lead-based glaze* to which tin oxide (SnO₂) has been added to make it opaque and white.

tingle — a small metal patch used to repair wooden surfaces.

toe — to drive a fastener (e.g., a nail) at an angle.

topsail — the sail immediately above the lowermost sail in a square-rigged* vessel.
Tortuga (Turtle Island) -- a small island located immediately off the northwest coast of Hispaniola, described by Burg (1983:7) as a “turtle-like promontory” some 25 miles (40.23 km) in length. Haring (1966:58) characterizes it as “a small, rocky island about eight leagues in length and two in breadth, separated by a narrow channel from its larger neighbor. From the shore of Hispaniola the island appears in form like a monster sea-turtle floating upon the waves, and hence was named by the Spaniards. ‘Tortuga.’” Burg continues: “Its northern shore had no harbors or beaches except the few gaps that separated steeply rising crags, and only a small harbor on the south side made any settlement possible.” The southern coast -- protected by a barrier reef running nearly its entire length -- rises abruptly from sea level to an elevation of 1200 feet (365.76 m), with a more gradual slope from there to the northern coast.

train oil (traine oile; trayne oil) -- an oil obtained from the fat of marine mammals, most often whales or seals. It was commonly used as a lubricant in the seventeenth century. Hawkins (1593-46) describes the method of extraction of train oil from a whale: “They presently cut great pieces of him, and in great cauldrons seeth them. The uppermost in the Cauldron is the fatt, which they skim off, and put into Hogsheads and Pipes.”

transom -- an athwartship timber attached to the sternpost*, shaping and strengthening the stern*.

transversal -- a timber that is set crosswise with respect to other timbers.

treenail -- a round or multifaceted hardwood peg used to connect vessel frames* and planking*, as well as other wooden components. Treenail ends were often split with wedges or nails, in order to increase the tightness of their fit. They also swelled when immersed in water.

trefoil -- an ornamental design in the form of a trifoliolate leaf (i.e., one with three lobes).

turtle grass -- a hydrophytic plant. *Thalassia testudinum* is the most common species. Forming dense beds in salinities of 25 0/00 to 40 0/00. It occurs between mean low tide and 30 m in depth.

Turtle Wreck (Site LC 002) -- the remains of a small, shallow-drafted, seventeenth-century sailing ship on Little Cayman Island. The vessel was apparently destroyed by fire, perhaps in 1670, when Manuel Rivero Padral raided the island fishery.

United Provinces -- the union of provinces in the Low Countries that rebelled against Spanish rule in 1579; it later became the modern state of the Netherlands.

upper works -- all constructional features of a sailing ship above the weather deck.

van der Cruys, Adrian -- a seventeenth-century Dutch pipe maker, one of several who used the identifying heel stamp* EB.

Vandyke beard -- a beard which is close-trimmed and pointed.

van Rensselaer, Killiaen (Killian) -- a Dutch merchant, patron, and director in the Amsterdam chamber of the West India Company. On 19 November 1629, he registered to establish a colony on either side of the Hudson River. This settlement later came to be known as Rensselaerswyck (ca. 1580 to 1644). Van Rensselaer was a wealthy diamond and pearl merchant.

van Rijn, Rembrandt Harmenszoon -- a Dutch painter who lived from 1606 to 1699.

vein quartz (milky, or bull quartz) -- pegmatite-type quartz from an igneous vein with high concentrations of silica*. Quartz of this type is commonly found in mountain streams.

Vergulde Draeck (Gilted Dragon) -- a Dutch East India yacht that sank off Western Australia in 1656.

vertebra -- a bone of the spinal column.

VOC -- (1)ereenigde (O)ost Indische (C)ompagnie, or the Dutch East India Company. The institution was chartered in 1602 by the States General of the Netherlands, with a mandate to initiate and run Dutch overseas trade. The lower tier of the governing structure comprised the Grand Council of 60 representatives, elected annually from the geographical areas or “chambers.” The original six chambers, which provided operating capital, represented Amsterdam, Zeeland, Delft, Hoorn, Rotterdam and Enkhuizen. Each chamber could appoint representatives to the Executive Council, or “Seventeen Gentlemen” (Heeren XVII). The trading rights of the VOC extended east from the Cape of Good Hope to the Magellan Straits. See also WIC (West India Company).

wainscotting -- wood paneling.
waist — the low midship region of a sailing ship, between the quarterdeck* and the forecastle*.

Wampanoag — Native Americans of Algonquian linguistic stock that occupied Rhode Island east of Narragansett Bay; Bristol County, Massachusetts; the southern part of Plymouth County, below Marshfield and Brockton; and the extreme western part of Barnstable. They were known by various names, including the “Eastern People”: the Massasoits, from the name of their chief, and Philip’s Indians, after King Philip.

Wan Li — Ming Emperor who reigned from 1572 to 1620.

waterline — the point on the hull* of a boat or ship to which the water rises.

Water Street ship — a merchant vessel interred as pier cribbing on the East River of New York sometime near the middle of the eighteenth century.

wether sheep — a castrated ram.

Whydah — a pirate ship that sank off Cape Cod, Massachusetts, in 1717.

WIC — the Dutch West-Indische Compagnie, established under the Oecray or Charter of 1621. The WIC granted a 24-year monopoly on trade and navigation for the Atlantic coasts of both North and South America (including the islands on either side of the Americas), as well as the Atlantic coast of West Africa. Provisional under this document, the Company possessed the authority to declare war or establish peace, maintain military and naval forces, and exercise judicial and administrative functions. The Company was controlled by the Heeren XIX (“Nineteen Gentlemen”) and comprised five kamers or chambers: Amsterdam, Zeeland (Middleburg or Middelburg), The Maas (Rotterdam), North-Quarter (comprising Hoorn and West-Friesland), and the district of Groningen with Friesland, or “Town and Country” (Stadt en Landen, or Stadt en Omnielen). Each regional chamber held stock and had its own directors, distributed in the following proportions: Amsterdam possessed 4/9 of the stock shares and had eight directors; Zeeland owned 2/9 shares and had four directors; The Maas, North Quarter, and Friesland/Groningen each held 1/9 of the stock shares and each had two directors. The nineteenth director was appointed directly by the States General as their personal representative. See also VOC (East India Company).

Wilson Site (OND 9-4) — dates between 1595 and 1625.

Witte Leeuw (White Lion) — a Dutch East Indiaman* that sank during a battle with the Portuguese in the harbor at St. Helena in 1613.

witching bottle — a ceramic bottle in which were placed items used to cast a magic spell or to ward off evil. These were most always of Rhenish stoneware and bore the bearded man (Baardman*) appliqué on the neck, in itself a bewitching sight. Merrifield (1987:167) notes that, although some of the contents of these bottles may make it appear that magic was practiced for “malevolent purposes,” numerous contemporary accounts attest to the fact that they were often nothing more than “counter-measures to witchcraft, with the purpose of saving the victim by throwing back the evil spell on the witch who cast it.” Items found within these bottles include pieces of heart-shaped cloth that were cut from the intended victim’s clothing, as well as fingernails, urine, and iron nails.

worsted — thread or yarn made of firmly twisted, long-stapled wool.

Yaqui del Norte (Yaque) — a river that empties on the northern coast of the Dominican Republic, second only in historical significance to the Ozama.

yard — a large spar mounted across a mast* in order to carry a sail.

yola — a flat-bottomed, flat-transomed, hard-chined vessel made of wood and laminated with fiberglass, popular as a fishing boat on the north coast of the Dominican Republic. The yola is virtually identical to the popular bote* of the north coast, with the exception that the latter possesses a round bottom and a small transom. Both types commonly travel northward to fish the Turks and Caicos Islands. staying at sea for days at a time, a tribute to their seaworthiness.

Zeewijk — a Dutch East Indiaman* that struck a reef and sank off Western Australia in 1727.
VITA

Jerome Lynn Hall was born by the sea in La Jolla, California. He received his B. S. degree in 1978 from Abilene Christian College, with a major in Biology Education. He completed his M. S. degree in 1989, at Nova Southeastern University, in Ocean Sciences with a specialty in Marine Biology. Mr. Hall has spent many years excavating the Monte Cristi "Pipe Wreck," and hopes to continue this work for several more seasons until the project is completed. In 1990, along with a few friends, he formed the Pan-American Institute of Maritime Archaeology (PIAMA), a nonprofit organization devoted to the study of seafaring in the New World. Mr. Hall is currently working as the Director of the Office of Underwater Archaeology in San Juan, Puerto Rico. His permanent address is 1344 Oliver Avenue, San Diego, California, 92109.