The NAUTICAL ARCHEOLOGY *of* PADRE ISLAND

THE SPANISH SHIPWRECKS OF 1554

TEXAS ANTIQUITIES COMMITTEE PUBLICATION NUMBER 7

This is a volume in

STUDIES IN ARCHEOLOGY

Under the editorship of Stuart Streuver

A complete list of titles in this series is available from the publisher

The NAUTICAL ARCHEOLOGY *of* PADRE ISLAND

THE SPANISH SHIPWRECKS OF 1554

J. Barto Arnold III
Robert Weddle
TEXAS ANTIQUITIES COMMITTEE

ACADEMIC PRESS New York San Francisco London
A Subsidiary of Harcourt Brace Jovanovich, Publishers

COPYRIGHT © 1978, BY ACADEMIC PRESS, INC.
ALL RIGHTS RESERVED.
NO PART OF THIS PUBLICATION MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPY, RECORDING, OR ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE PUBLISHER.

ACADEMIC PRESS, INC.
111 Fifth Avenue, New York, New York 10003

United Kingdom Edition published by
ACADEMIC PRESS, INC. (LONDON) LTD.
24/28 Oval Road, London NW1 7DX

Library of Congress Cataloging in Publication Data

Arnold, J Barto
The nautical archeology of Padre Island

(Studies in archeology) (Publication – Texas Antiquities Committee ; no. 7)
Bibliography: p.
1. Padre Island, Tex.––Antiquities. 2. Texas––Antiquities. 3. Treasure–trove––Texas––Padre Island. 4. Underwater archaeology––Texas––Padre Island. 5. Shipwrecks––Texas––Padre Island. I. Weddle, Robert S., joint author. II. Title. III. Series: Texas Antiquities Committee. Publication – The Texas Antiquities Committee ; no. 7
F392.P14A74 976.4'47 78–3331
ISBN 0–12–063650–6

PRINTED IN THE UNITED STATES OF AMERICA

CONTENTS

LIST OF FIGURES

PREFACE

In 1554, three ships of a small Spanish fleet carrying a considerable amount of silver to Spain from the newly opened mint in Mexico City were wrecked off what is now known as Padre Island, off the Texas Gulf Coast. This volume describes the excavation of one of these wrecks in 1972–1975 by the Texas Antiquities Committee.

The story behind the excavations, however, began some 4 years earlier, in 1967, when a group of "treasure hunters" discovered the remains of two of the Spanish vessels (the third had been destroyed in the late 1940s by the dredging of the Mansfield Cut). As they began to remove objects from one of the wrecks, several stories about them and their activities appeared in Texas newspapers, often with highly exaggerated claims of the commercial value of the pieces being recovered.

There are few things in life which excite most of us as much as tales of buried or sunken treasure, and when the newspaper stories began to appear they aroused widespread public interest, which shortly turned to indignation not only over the removal of the objects from Texas, but also over the destruction of all the information that could have been obtained from this important, historical resource by proper excavation. In 1967, however, the State of Texas did not have a formal antiquities law which specifically protected archeological and historical remains on state lands. Nevertheless, the controversy that ensued forced the termination of all work by the

treasure hunters, thus saving the second ship from extensive damage, and eventually, even the collections taken from the first ship were returned to the state, where they were given proper cleaning and preservation and were made available for public display.

Another, and even more important development from this public outcry was the action by the legislature and governor to enact the Texas Antiquities Code (Article 6145-9, Vernon's Texas Civil Statutes; revised and reissued as Chapter 191 of the Natural Resources Code, September 1, 1977), an exceptionally far-sighted effort to protect, at long last, the cultural resources on all public lands in Texas. The Texas Antiquities Committee was created to administer the new law.

One of the first actions of the newly appointed Antiquities Committee was to initiate a survey of the "treasure ship" area along the Padre Island coast, at first using private donations, and later appropriated funds. The first survey, which relocated both the partially looted 1554 ships, was done in July 1970, and actual excavation of the better of the ships, now believed to be the *San Esteban*, began in the summer of 1972 and was completed in the summer of 1975.

This book describes the results of these excavations and the related studies. It also provides us with a vivid contrast between the kinds of information that usually result when an ancient ship (or any other cultural resource) is dug by untrained people whose only interest is the artistic, commercial, or antiquarian value of the objects recovered, and when the ship is excavated by skilled people with proper equipment, operating within the context of a carefully controlled, scholarly study.

Fred Wendorf
CHAIRMAN, TEXAS ANTIQUITIES COMMITTEE

ACKNOWLEDGMENTS

This project was funded by the state of Texas under the auspices of the Texas Antiquities Committee. Additional funding was apportioned from the Annual Program Grant of the Office of Archeology and Historic Preservation, National Park Service, to the Texas Historical Commission. Monetary assistance was also provided by the Texas Historical Foundation and the National Park Service (Contract number CX700030195).

The enthusiasm and dedication of the crew members contributed in no small part to the success of this project, and their assistance is gratefully acknowledged.

1972 CREW

Carl J. Clausen, PROJECT DIRECTOR
J. Barto Arnold III, ASSISTANT ARCHEOLOGIST
Steven T. Rogers, ARCHEOLOGICAL TECHNICIAN
Michael G. Mallouf, ARCHEOLOGICAL TECHNICIAN
Dean C. Wierth, ARCHEOLOGICAL TECHNICIAN
Gordon W. Lyons, DECK HAND
Bram Lasseter, DECK HAND

Marleen Vandermullen, FIELD SECRETARY
Martin Meylach, TEMPORARY MAGNETOMETER SERVICES
Robert D. Friedman, TEMPORARY DIVE INSTRUCTOR
Susan C. Friedman, TEMPORARY FIELD SECRETARY

1973 CREW

Carl J. Clausen, PROJECT DIRECTOR
J. Barto Arnold III, ASSISTANT ARCHEOLOGIST
Steven T. Rogers, ARCHEOLOGICAL TECHNICIAN
Peter J. Farmer, PHOTOGRAPHER
Aurora F. Arnold, FIELD SECRETARY
Carolyn E. Goode, COOK
Cathryn S. Tarsovic, STUDENT
Jay C. Disque, STUDENT
David J. Backer, STUDENT
Jack B. Irion, STUDENT
Thomas E. Doran, STUDENT
Deborah K. Bauxer, STUDENT
Howard D. Loeser, STUDENT
Charles A. Hulse, STUDENT
Nathaniel G. Smith, STUDENT
William B. Edwards, STUDENT
Randal E. Rhode, STUDENT
Kenneth R. Pott, STUDENT
Randal C. Davis, STUDENT
Lisa Shuey, VOLUNTEER
Rebecca E. Jones, VOLUNTEER
Phillip Winsborough, TEMPORARY WELDER
Martin Meylach, TEMPORARY MAGNETOMETER SERVICES

UTMB–GALVESTON, MBI, AND AQUAMEDICS SUPPORT PERSONNEL

Denny Bowman, DIVE OFFICER
Ken Yoakum, UNDERSEA TECHNICIAN
Drs. Christenson, Mader, McDonald, Bailey, Love, Dillard, Cryer, and Bryant

The analysis of the archival material and preparation of the historical section of this book were carried out by Robert Weddle. He was assisted by

our translator, David McDonald, whose services in archival research and translation were acquired under contract with the Old Spanish Missions Research Library at Mission San José in San Antonio, Texas. I carried out the archeological analysis, and prepared the archeological section of this book.

Conservation of artifacts recovered during the test excavations was carried out under contract with the Antiquities Conservation Facility of the Texas Archeological Research Laboratory, The University of Texas at Austin, Dr. Dee Ann Story, Director, Dr. D. L. Hamilton, Conservator.

The illustrations in this book are by Edwina Traverso and Ed Aiken of the Texas Antiquities Committee staff. Darrell Creel and Virginia Wulfkuhle Kesler of the Texas Antiquities Committee staff also assisted in its preparation. Curtis Tunnell undertook the preliminary editing.

The Texas Antiquities Committee is a state agency. The governing body consists of Fred Wendorf, Chairman; Truett Latimer, Executive Secretary; Bob Armstrong, Henry B. Burkett, W. C. Holden, W. W. Newcomb, and Curtis Tunnell.

J. Barto Arnold III

HISTORY

Robert S. Weddle

Part I

THE GREAT LOTTERY

. . . he suffered much by sea while trying to save his own life and bring his men safely home; but do what he might he could not save his men, for they perished through their own sheer folly in eating the cattle of the Sun-god Hyperion; so the god prevented them from ever reaching home.

—HOMER, THE ODYSSEY

A system of ocean currents forms below the Greater Antilles, where cold water from the north converges with tropical waters of the Caribbean. Directed by the contours of shore and bottom, this hydraulic mass flows through the Yucatán Channel and into the Gulf of Mexico. It kisses the Mexican shelf, and then curves eastward with the Texas coast, eventually reaching the Atlantic through the Straits of Florida, where it becomes known as the Gulf Stream.

In the age of sail, when Spain held mastery of the seas, this natural phenomenon played a vital role in the New World discovery, exploration, and commerce. The system of currents combined with prevailing winds to provide a conduit for Spanish galleons to their western destination. Reversing itself, as did the wind, it served also to aid the ships on their return voyage. So favorably was the Iberian Peninsula situated in relation to these natural forces that its navigators seem to have been almost preordained for their role in American discovery and conquest.

Yet, in that age of primitive navigation, nature often seemed to contradict itself. Instead of favorable trade winds, it occasionally sent tropical storms and hurricanes that took a frightful toll of ships and lives. When the treasure-laden galleons from the Indies reached home port safely, the payoff was grand; but there were no guarantees that they would ever reach home port. Contrary winds and roiling seas exacted an especially heavy tribute from ships burdened beyond designed capacity for the sake of increased profit. And often lying in wait were French and English corsairs which, in their unburdened state, could easily outmaneuver the cumbersome and poorly armed Spanish cargo vessels and seize the grand prize.

Commerce with the Indies, therefore, was fraught with hazards. It was, as C. H. Haring (1918:294) suggests, "a great lottery" in which long chances were taken with the hope of enormous winnings. The odds were especially poor when, on April 9, 1554, four ships laden with passengers, precious metals, and other produce of the colonies put to sea from San Juan de Ulúa near Vera Cruz, bound first for Havana and thence to Spain. Only one of the four was to make port. The others, beset by a gulf storm, were driven back upon the Texas coast with heavy loss of life. Passengers and crew who reached the shore were set upon by sanguinary natives who dogged their miserable march through coastal dunes and marshes toward the meager Spanish settlement at Pánuco. From their wilderness odyssey at deeply human drama unfolds. It seems that only those tapped by some unseen destiny survived the ordeal.

Chapter 1

FATEFUL VOYAGE

The four ships were part of Captain-General Bartolomé Carreño's flotilla of 54 that sailed from Spain for various ports in the Indies on November 4, 1552. Their names were *San Esteban, San Andrés, Espíritu Santo,* and *Santa María de Yciar.* The voyage seemed marked for disaster from the beginning.

Officials of the Casa de Contratación ("House of Trade"), handing Carreño his assignment the previous April 27, had acclaimed him as "a man of the sea in whom we have complete confidence [Casa 1551]." He was indeed a man of the sea, having first sailed as a shipmaster, to Santo Domingo, in 1516. In recounting his services to the king a few years later, he was to claim 33 Atlantic crossings during 50 years of Indies navigation. In 1538 he had "discovered" Bermuda, charting its ports and bays. He had explored "all the islands of the Caribs" and taken part in warfare against the Carib Indians on the islands of Domínica and Matalino (Museo Naval 1975). Yet the "complete confidence" the casa officials placed in him as they entrusted the fleet to his care was to be severely shaken. And, for Carreño, the voyage would involve a personal tragedy.

With France and Spain again at war, outfitting a fleet to sail to America was no matter to be taken lightly. Arrangements had begun in February, with orders to send a six-vessel armada, well armed and carrying 360 soldiers for protection of the merchant ships.

By April, however, preparations for the armada had scarcely begun. With 15 merchantmen loaded and ready to sail, shipmasters at the port of Sanlúcar de Barrameda waxed impatient; valuable time was being lost and cargoes were spoiling. They begged leave to proceed without escort. In answer to their pleas, on April 5 the regent Prince Philip ordered the Casa de Contratación to choose six of the best merchantmen bound for Nombre de Dios (Panama), remove part of their cargoes, and fit them out as men-of-war under an experienced captain-general (Prince Philip 1552a). Carreño was selected for the job at a salary of 120 maravedís per day—less than half a peso, or about $2 (Casa 1552).

The cost of outfitting the armed escort was charged back to the merchant ships in the form of a levy called the *avería,* based on the value of a vessel and her cargo. The larger the number of ships and the value of their cargo, the less the *avería* for each vessel. In this instance, months dragged by while officials of the Casa de Contratación protested the amount of the levy and the means for collecting it (Haring 1918:71–73).

Embarkation, at one point set for July, was postponed again to allow for taking on additional cargo, contributing to the fleet's vulnerability to both heavy seas and enemy attack. By August the original 15 merchantmen had doubled, and the *avería* was reduced from 2.5 to 2%. But still the fleet did not sail.

The atmosphere at Sanlúcar was charged with rancor and impatience. Complaints came from many sources. One of the most noteworthy emanated from no less a personage than Bishop Fray Bartolomé de las Casas, the acid-penned champion of the American Indian.

Then 78 years old, Las Casas had come to Sanlúcar in September to see a company of Dominican priests off for the New World. He wrote on October 25 to the Council of the Indies: "It is to be lamented that greed . . . would delay for ten months the fleet going to the Indies, loading and stuffing the ships beyond measure, and it has not been dispatched [yet]. The ships of the armada are similarly overloaded, especially the *capitana,* and it will be useless for fighting. . . ."

While the ships waited in the harbor, a squall had blown up, Las Casas reported, causing some of the ships to be broken against each other. Two, apparently snapping their moorings or dragging anchor, had crashed on the coast. "It has been more than a month since I came to dispatch these friars," the bishop complained. "Because of the delays, I have left only fourteen of forty or more, and I do not know how many [of them] will stay. The same has happened to the Franciscans [Las Casas 1552]."

The amount of the 2% *avería* charged each ship of the 1552 fleet yields a clue to the relative size of the four vessels of our concern. *San Esteban,* paying the largest *avería,* of 374,251 maravedís, must have been the biggest merchant ship of the fleet. Her master, Francisco del Huerto, was a seasoned

mariner, having taken vessels to Tierra Firme—the mainland of South and Central America—each year from 1547 to 1550. The last such voyage had been with the same ship (Carreño 1552, Casa 1579). There is nothing to indicate, however, that he had sailed to New Spain; he may have lacked knowledge of the Gulf of Mexico and its winds and currents.

Next in order of size was *Espíritu Santo,* possibly a new ship to the Indies trade, since no record appears of her having sailed previously. Her master, Damián Martín, paid an *avería* of 305,033 maravedís. Martín had been master of a ship called *San Pedro*, outbound for Tierra Firme in 1550, but, like Huerto, he appears not to have sailed previously to New Spain.

Evidently the third largest ship, with cargo only slightly less valuable than *Espíritu Santo*'s, was *San Andrés.* Her master, Antonio Corzo, had been sailing to the New World since 1543 as both master and shipowner and had made at least three voyages to New Spain. *San Andrés,* like *Espíritu Santo,* appears to have been on her first Indies voyage.

Smallest of the four ships, but still of respectable size, was *Santa María de Yciar.* The *avería* she paid, 178,661 maravedís, was considerably higher than the fleet average. Her master, Alonso Ojos, may have been the least experienced of the four, but *Santa María*'s owner, Miguel de Jáuregui, sailed with him as captain and pilot. As master and owner, Jáuregui had made no less than 10 round-trip crossings, to both Tierra Firme and New Spain. His *Santa María* had made at least one previous voyage to New Spain with Juan de Mondragón as master.

Thus it appears that the four vessels about to embark on a voyage of disaster were among the biggest, finest, and perhaps the newest of the merchant fleet, and that each was in the capable hands of a seasoned mariner. They certainly came off well in comparison with the other 12 ships bound for New Spain, for only these four and one other were adjudged capable of making the round-trip voyage. The other 11 were to be scrapped when they reached San Juan de Ulúa, the island port near the squalid seaside village of Vera Cruz. As a whole, the ships bound for Tierra Firme were no better. Only 7 of 24 were approved for the return (Fuente and Martínez 1553).

The best of any ship in the Indies trade, however, was apt to have been used up in other service. A new ship often was dispatched first to the Levant or elsewhere; only when old and tired was she brought to Seville and sold to some shipper who, if lucky, would get one Atlantic crossing out of her, then consign her to a scrap heap in an American port (Haring 1918:276). The philosophy was not to risk a good ship on such a hazardous voyage.

Despite the many delays, the fleet at last was ready to put to sea. Bishop Las Casas saw 25 of his Dominican friars, bound for the Mexican interior, safely aboard *Santa María de Yciar* with Master Alonso Ojos. Twenty Franciscans destined for Mexico sailed with Antonio Corzo on *San Andrés,* and 16 of that order traveling to Santo Domingo boarded Francisco del Huerto's

San Esteban. Arrangements had been made for those who were sick at the time the ship reached Vera Cruz to obtain horses to carry them to their destination; the rest were to walk (Molina 1554).

On November 4, the 54 vessels hoisted sail, crossed the bar at Sanlúcar de Barrameda at the mouth of the Guadalquivir River, and set a southeasterly course for the Canary Islands (Perpetuo 1553). The escorting armada consisted of four converted merchantmen, *naos* of 300–375 tons burden, and two caravels of 220 tons.

Leading the way as *capitana*—Captain-General Carreño's flagship—was the 300-ton *Nuestra Señora de la Concepción,* whose master was Valeriano de Manzera, destined for a death at sea. Carrying more than 300 persons, *Concepción* had paid an *avería* of 153,145 maravedís, a fact supporting the accuracy of Las Casa's allegations: She was too heavily burdened to function effectively as a fighting ship. Furthermore, she was one of the condemned vessels. Having run upon a shoal in the Guadalquivir River, she later sprang a leak when caught in a storm in the Canary Islands (Fuente and Martínez 1553). But *Concepción* was never to make it to the scrap heap—a far worse fate awaited her in a nightmarish disaster at sea.

Forming the fleet's rear guard was the *almiranta* (rear admiral's vessel), the 375-ton *Santa Catalina.* She, too, was on the condemned list, yet burdened beyond designed capacity (Fuente and Martínez 1553). There is no record that she ever reached her destination. The other four armed ships kept to windward, the better to come to the fleet's assistance in case of distress (Haring 1918:222).

The six ships of the armada in Carreño's charge and 18 merchantmen were bound for Tierra Firme, of which Cartagena and Nombre de Dios were the principal ports. Ten would stop off at Santo Domingo (Hispaniola). Sixteen would proceed through the Yucatán Channel and thence to New Spain's major port of San Juan de Ulúa, not far from Vera Cruz Antigua, the second site of the first town founded by Hernán Cortés. The other four ships were destined for various ports: Puerto de Plata, Puerto Rico, Yucatán (Campeche), and Honduras (Chaunu 1955:II,485, Carreño 1552).

Fourteen days after sailing from Sanlúcar, the fleet made port at the island of Gómera in the Canaries to take on fresh provisions, wood, and water. Four days later, on November 22, sails were hoisted for the long haul to the Lesser Antilles and passage into the Caribbean, following the standard course, favored by wind and current; and then the trouble began. Between 80 and 100 leagues out, the flotilla, encountering foul weather and contrary winds, was driven back. Details of the misadventure are chronicled by Fray Perpetuo (1553), en route to the Colombian shore to take his post as bishop of Santa Marta. Before the voyage was over, the perceptive priest would be prompted to observe, "Matters of the sea are not in the hands of men."

So fierce were the wind and sea, the padre relates, "that we thought all of us would be lost." Running bare-masted before the storm, the ships

pitched and rolled in the rough sea for 6 days and nights, and finally were driven back "sixty leagues behind the Canaries." After springing leaks, two ships went down with all aboard. Another 10 or 12 found anchorage on the Barbary coast and, when the storm abated, set a westward course to arrive ahead of the fleet at Nombre de Dios and San Juan de Ulúa.

For the rest of the ships, it was out of the arms of the storm and into those of the French corsairs. After one of Carreño's stragglers had fallen to the privateers, he pulled his fleet remnants together and set course for the Canaries once again. Arriving at Gran Canaria in late November, he was able to count no more than 33 of the original 54 vessels. Entering the port with the armada, the captain-general left the other ships anchored outside the bay without protection. Fray Perpetuo, viewing the matter as a sorry spectacle, gives a description:

> For thirty days [an obvious exaggeration] we remained about two leagues off the island of Gran Canaria with bare masts. We could neither go ashore nor continue our voyage because the *almiranta* and two or three other ships were in the port and dared not come out to us for fear of the French who were watching them. We could not go in because the wind was against us. During this time four French ships attacked the armada, and they came close enough to fire on us. Their ships sailed very lightly, while ours were so heavily laden that they could neither fight nor navigate [Perpetuo 1553].

Four Spanish vessels fell into French hands, leaving Carreño with only 29.

The priest was moved by this experience to write to the Council of the Indies, complaining of the "frauds and treacheries" that permitted unseaworthy ships—rotten-hulled vessels "leaking water like sieves and so laden with merchandise and people that they could [he reemphasized] neither navigate nor defend themselves"—to sail on transoceanic voyages. The shipowners, he averred, lost nothing if their vessels sank; these decaying craft were insured for twice their value. The losses fell to the passengers who, even if they escaped with their lives, were deprived of all their property. "This we have experienced in this armada," he wrote, "that even though they might be able to get to port and save ship and cargo, they wanted only to let them go to the bottom. . . ." If the ship made port, the insurance was valueless (Perpetuo 1553).

There is no room to doubt that some ships were insured beyond their value. An example is Master Antonio Corzo's *San Andrés,* in this same fleet. The Casa inspector, Ortega de Melgosa, had attached to her register before she sailed this notation: "For the hull of this ship he [Corzo] paid no *avería,* because it seems to be insured . . . in an amount larger than its value." A similar question may have arisen concerning Damián Martín's *Espíritu Santo,* for Melgosa noted that no *avería* was to be paid on her hull until the Crown had been consulted (Casa 1573).

The disaster that stalked Carreño's fleet had many ingredients: the international power struggle between the monarchs Charles V and François I of France, which had given rise to the corsair attacks; the callous greed of the shipowners, manifested by excessive burdening of vessels, use of unworthy craft, and the ill-conceived insurance system that rewarded such cupidity; inexperienced crews, resulting from a greater demand for able seamen than could be met; and the wind and the sea, the control of which, as Fray Perpetuo so aptly observed, was "not in the hands of men."

The governor of the Canaries, Don Rodrigo Manrique de Acuña, had his own analysis of the plight of Carreño's fleet. With Carreño at last off his hands, Acuña communicated it to Prince Philip on January 4, 1553. The fleet had arrived, he wrote, in a very damaged condition "due to storms, bad management, and dissentions." The captain-general did not act upon good advice and was incapable of maintaining discipline. "Some of his ships sank, when he might have prevented it." Four vessels had fallen to the French, and he had not even had the courage to pursue them, or even to help the governor do it. "The French are pursuing him, and they will take whatever ships they wish. Just consider, Your Highness, the kind of control under which you have placed your honor and the interests of Castile."

Carreño obviously recognized the fact that his ships, heavily laden and cumbersome as they were, would not come off well in a contest with the fleet French corsairs. He therefore sat on his hands.

About December 20, the ships stranded offshore managed to make port at Gran Canaria. Fray Perpetuo and the rest of the religious company, observing the Vigil of the Nativity, had just sounded Christmas Eve vespers when Carreño issued sailing orders. It made no sense to Fray Perpetuo, for the weather was foul. But the fleet hoisted sail, put to sea against the contrary wind, and spent a miserable night of seasickness. The ill wind stiffened into a full-blown tempest, and once again the ships were driven back to Gran Canaria.

The third attempt to leave the Canaries, on December 30, met with better luck, but misfortune still dogged the diminished fleet. After almost 2 weeks of good sailing, disaster struck anew, this time in the form of human carelessness. Toward eleven o'clock the night of January 12, 1553, when the fleet must have been near the midpoint between the Canaries and the Lesser Antilles, the flagship's lantern went out. In the effort to relight it, the ship caught fire and burned to the waterline, while the rest of the fleet looked on helplessly.

More than 300 persons perished in the flames, including one of Carreño's sons, two nephews, and his personal slave. Only the captain-general, 18 seamen, and one passenger escaped. Among the dead were García de Busto, being sent as governor to Popayán; his wife; their four daughters; and members of both their families. The one surviving passenger was the governor's brother (Carreño de Ribera 1608; Perpetuo 1553). *Concepción*'s master,

Valeriano Manzera, went down with his ship. Carreño, for the rest of the voyage, traveled on *San Pedro,* of which Pedro Díaz Machín was master, Vicente Bozino owner and captain (Chaunu 1555:II,504, 507). This was the ship on which Fray Perpetuo sailed.

At last, the remaining ships made port at the island of Domínica to take on fresh provisions and water, then negotiated the Martinique Passage into the Caribbean. There the fleet split, those vessels bound for New Spain to follow the standard course between Cuba and Jamaica and thence through the Yucatán Channel. Doubling Cabo Catoche, they sailed southwestward until Punta Delgada was sighted on the Mexican coast, then south to Vera Cruz, riding the Caribbean Current and the prevailing winds most of the way (Manuel 1583). The 12 ships bound for Puerto Rico, Santo Domingo, and Puerto de Plata (if not casualties of the crossing) had dropped off just inside the Caribbean. The rest sailed southwestward from the passage through the Lesser Antilles to sight the northern coast of South America just west of Trinidad, then westward to the ports of Tierra Firme.

Fray Perpetuo relates that *San Pedro* made Santa Marta on February 6, 1553. Here was the settlement founded in 1526 by Rodrigo de Bastidas, offering "one of the best harbors on the Spanish Main, cut into the slopes of a snow-covered sierra [Morison 1974:200]." The 10 or 12 vessels that had taken refuge on the Barbary coast during the first storm already had reached Cartagena. Most of the 8 ships lost on the way over appear to have been from the Tierra Firme contingent; 14 of the 16 New Spain ships arrived safely. The 29 ships remaining with Carreño on his final departure from the Canaries, however, had been scattered again by storm or corsairs, and they dribbled into their respective ports on seven different dates during February and March.

Three ships, evidently part of the group from the Barbary coast, reached San Juan de Ulúa on February 2. Five others, including Carreño's second flagship, *San Pedro*, made port at Nombre de Dios on February 26 and 27. Three others, including *Santa María de Yciar* and *San Andrés,* which probably had stayed with the main fleet, made San Juan de Ulúa on March 5. Two more came in on March 23, another five on March 25, including *Espíritu Santo* and *San Esteban.* The latter had stopped off at Ocoa, on Hispaniola's southern shore, to deliver the 16 Franciscan friars she carried. It appears likely that the other late arrivals also had called at other ports. The last ship straggled into New Spain's principal port on March 30, almost 5 months after the sailing from Sanlúcar de Barrameda (Molina 1554).

At San Juan de Ulúa, a scene of devastation greeted the arriving ships. The port and the town of Vera Cruz had been ravaged by a hurricane and the resultant storm surge the previous September. Little had been done to repair the damage. The slowness in rebuilding may have caused some delay in unloading the ships, especially those of larger burdens, such as *San Esteban, Espíritu Santo, San Andrés,* and *Santa María de Yciar.*

Two of the February 2 arrivals, however, were promptly unburdened, reloaded, and ready to sail again on May 14 in the company of three vessels that had come from Spain with a previous fleet. One was *San Pedro,* a galleon owned by Alvaro de Bazán, whose master was Miguel de Iturriaga. Besides the four of our principal concern, she was the only vessel of the 1552 sailing approved for the return voyage (Fuente and Martínez 1553). The other was, for some unexplained reason, Master Alonso de Vargas's *San Nicolás,* designated for the scrap heap at the end of her outbound voyage (Molina 1554).

In the final stages of loading the five departing ships (*San Pedro, San Nicolás, Santa María de Guadalupe, San Pablo*, and another *San Nicolás*), the *alcalde mayor* of Vera Cruz, Alonso Manrique, observed that *Santa María de Guadalupe* was being burdened beyond capacity. He ordered her master, San Juan de Etorra, to leave unloaded four consignments of wool, comprising 61 bags. The wool later was shipped on *Santa María de Yciar* (Etorra 1553, Ojos 1554).

The port treasures divided 100,000 *pesos de oro de minas*, comprising 80 chests of silver, for His Majesty Charles V among four of the vessels—*San Pedro, Santa María de Guadalupe, San Nicolás,* and the second *San Nicolás*, whose master was Juan de Palma. But all five ships also carried "a great quantity of gold and silver belonging to private individuals [Molina 1554, Zárate *et al.* 1553]." *San Pablo*, like *San Pedro*, was a galleon owned by Alvaro de Bazán.

On June 12 the five ships dropped anchor at Havana to await Captain-General Carreño and his Tierra Firme fleet. Carreño came 25 days later with six ships of the armada and three caravels. The nine vessels brought the treasure shipment from Peru and 275,000 pesos in gold and silver from Martín García's ship, lost the year before within sight of Cartagena. By the time they reached Havana, *San Pablo* of the New Spain fleet was being careened and would remain behind when the others sailed (Heredia 1553, Zárate *et al.* 1553).

Carreño, to comply with royal orders, had all the king's treasure removed from the New Spain ships and reloaded on vessels of the armada. This operation entailed shifting some of the bullion that belonged to private individuals. The third of the four ships carrying the king's treasure was being reloaded when a fierce storm blew up. Lest his ships drag anchor and drift aground or be hammered against the docks, Carreño ordered them to sea, leaving the one cargo of gold and silver and the passengers behind. For 2 days they stood off shore awaiting a weather change that would permit them to return for the passengers and treasure, but the wind persisted and the small fleet sailed out through the Bahama Channel on its homeward course.

Officials of the Casa de Contratación reported to the Council of the Indies the arrival in Seville of *San Pedro*'s captain, Juan Pablo de Carrión, on October 22, 1553. With fair weather attending the latter stage of the crossing, the fleet had come in 5 days from the Azores to Sanlúcar de

Barrameda, where Carreño remained with his ships while they were being inspected and unloaded (Zárate *et al.* 1553).

While Carreño's ships were ending their voyage, another fleet was preparing to sail. The treasurer Francisco Tello had been dispatched from the casa to inspect the ships and see that registers were in order (Zárate *et al.* 1553). Cosme Rodríguez Farfán, veteran mariner, shipowner, and captain in 1552 of the Armada de la Guardia de la Carrera de las Indies—the fleet that patrolled the shipping lanes against corsairs—was appointed captain-general for the new voyage.

At least one caravel that had made the round-trip crossing with Carreño—Miguel de Oquendo's *Vera Cruz*—was to sail again with Farfán and therefore comes back into our story farther along. Also in the new fleet was Juan de Mondragón, one-time master of *Santa María de Yciar,* now sailing as master of *Santa Cruz*, of which Cosme Buitrón was owner and pilot. They, too, will reenter the story.

Sailing appeared imminent in October, but it was January 31, 1554, before Farfán's fleet finally got underway. Hazards rivaling those that had beset Carreño on his outbound voyage plagued Farfán's 49 ships during the 60 days before they reached the Lesser Antilles. Soon after sailing, two ships were damaged in a collision, and had to return to port. Before reaching the Canaries the fleet encountered such severe storms that some cargo and artillery had to be jettisoned. About mid-February, with the Canaries in sight, Farfán learned from a Portuguese ship, already robbed, that the noted French corsair Pie de Palo ("Peg Leg"), with eight ships, lay in wait for him at Gran Canaria. Forewarned, Farfán decided to pass up the scheduled provisioning stop. As a result, passengers and crew were to suffer severely for want of water. On the two flagships 14 persons died, including seamen, soldiers, and gunners. Then the *capitana* broke both her bowsprit and her rudder in a storm, forcing her to maneuver in heavy seas with only her foresail (Farfán 1554).

When the prayers of the priests in the fleet failed to alleviate such difficulties, sailors and passengers began to murmur that the armada was cursed by some demon; great sins must have been committed to bring such misfortune upon them. As if in answer, on Palm Sunday, two instances of sodomy were brought to light on different ships, one of them followed by murder to seal the lips of a Negro slave who had been forced to participate. Trial was held and sentence passed, to be carried out on reaching port, and most of those in the fleet sought out priests to hear their confessions. Thus purged, the ships enjoyed fair sailing. After a joyous Easter celebrated with the flying of bunting, the firing of cannon, and the music of trumpets and other instruments, the 47 ships reached the island of Domínica on April 2 (Farfán 1554).

Their troubles, however, were not over. Three small boats, going into an inlet for water, encountered the cannibalistic Carib Indians. The natives,

their naked bodies glistening with red grease paint, rowed toward them in pirogues, brandishing spears and poisoned arrows, wounds from which would cause death within 24 hours. The waterhaul was postponed until the following day, when soldiers armed with harquebuses were sent as guards. The fleet spent 2½ days taking on water and wood.

In the interim, the *almiranta,* bearing Admiral Diego Felipe and four or five other ships bound for New Spain, had fallen off to leeward of the island and disappeared through the passage into the Caribbean without taking on water (Farfán 1554, Salinas 1554). Half a dozen ships destined for New Spain were left behind. On April 4 they separated from Farfán's fleet and crowded on sail to overtake the other New Spain ships at four o'clock that afternoon. Felipe's ships reached San Juan de Ulúa together about May 1. Farfán, meanwhile, sailed on to Cartagena and Nombre de Dios.

The four ships of Carreño's fleet left at San Juan de Ulúa in 1553 had awaited the incoming flotilla for more than a year, hoping to sail homeward under the protection of its armada. Such delays were not unusual in the annals of Spain's commerce with the Indies and, for the most part, the time was easily filled. At last, however, the ships found themselves loaded, registered, and ready to sail. The New Spain contingent of Farfán's flotilla still had not appeared.

On April 9 a fateful decision was made to take advantage of fair sailing conditions and proceed to Havana to await the rest of the fleet there. It was exceedingly bad timing.

Chapter 2

DOOMED CARGO

When the fleet was in port, mid-sixteenth-century Vera Cruz—born of the Conquest and the wealth of precious metals opened suddenly to European exploitation—resembled a boom town. The town burgeoned beyond belief, feeding itself on the fat of Spanish shipping that slaked the thirst of old-country transplants for European goods, then sailed homeward with holds stuffed with precious metals. Situated closest to the most productive mines, it was New Spain's principal port.

The town's temporary buildings were too few to accommodate the merchandise disgorged from the holds of incoming ships or awaiting loading on vessels homeward bound. The site was ill chosen and sanitation poor. The Vera Cruz inhabitants, in typical boom-town fashion, were characterized by opportunism, and sometimes by easy virtue. Some stood ready to reap a harvest of silver pesos by pandering to the bestial appetites of rowdy seamen who had survived the perils of yet another crossing. Vera Cruz, like New Spain itself, was a cauldron of conflicting values. It paid homage on the one hand to the royal concern for converting the natives to Catholicism; on the other, it entertained few scruples against robbing or enslaving them.

Yet, despite these characteristics, Vera Cruz was not a boom town. When the fleet sailed out, the more prosperous Veracruzanos slipped away to the pleasant heights of Jalapa. In contrast to coastal Vera Cruz, Jalapa boasted "a marvelous site with a delightful outlook, a springlike climate,

bright skies, and wholesome air . . . streams of sweet and crystal-clear water, very cool and delicious, so that it seems a bit of earthly paradise . . . [Vázquez de Espinosa 1942:nos. 130–131]." Safe there from the discomforts and disease of the seacoast, the migrant population held its trade fairs and reveled in its prosperity and social life.

Left at the seaport was the laboring class who loaded and unloaded ships, tended the docks and warehouses, and ran the sloops and lighters transporting ships' cargo between the island port of San Juan de Ulúa and the town itself, 5 leagues away (Parry 1964:212, Haring 1918:204n).

Vera Cruz, having undergone its first move a few years after Cortés founded it in 1519, stood on a flat, sandy beach only a few feet above sea level, at the present village of Antigua, some 25 km north of the modern city of Veracruz. The original site, called Villa Rica de la Vera Cruz, was 25 km farther up the coast. The port of San Juan de Ulúa was on the island in the present Veracruz harbor, where the prison–fortress remains today as a tourist attraction.

The town and the port were, in a word, vulnerable. Low lying and exposed to the sea, surrounded by marshes and dunes, Vera Cruz already was building the reputation that would cause it to be called "the City of the Dead." For mariners, often arriving from long voyages in emaciated condition, it often was more deadly than the sea itself. The plague, the rat- and flea-borne "black death" of the fourteenth century, was not totally unknown in the sixteenth. And seaports were most susceptible. The marshy seacoast often swarmed with mosquitoes and was prone to a variety of fevers and other ailments.

The port of San Juan de Ulúa had no bay worthy of the name. Its island location was as exposed to attack by a daring enemy hungering for gold and silver as to the sea. There was not even a breakwater—nothing to check the ravages of either hurricane or enemy onslaught. Ships, to withstand the winds, were made fast with chains by the bow to a wall on the landward side, with anchors put out from the stern toward the mainland.

In 1552, few men were more conscious of the port's vulnerability than García de Escalante Alvarado, *alcalde mayor* of the city and provisioner of the port. As the son of a licentiate who had served 20 years as a judge in the court of His Majesty Charles V, and a nephew of the renowned Pedro de Alvarado of the Conquest, he was privileged to write directly to the king. Beseeching a royal estate grant, he recounted that he had served in New Spain as factor and captain for 15 years, during the term of the Viceroy Antonio de Mendoza. He also reminded His Majesty of the voyage he had made from New Spain to the Spice Islands and thence to India and Portugal (Alvarado 1552a). He had sailed in 1542 with Mendoza's nephew, Ruy López de Villalobos, who surrendered to the Portuguese after reaching the Philippines and then died there after twice trying unsuccessfully to sail back

across the Pacific to Mexico. The Spanish survivors were transported around the Cape of Good Hope to Lisbon (Morison 1974:492–493).

In his letter of March 24, 1552, Alvarado urged the king to order Viceroy Velasco to pursue a study of possible navigation to the Spice Islands and China. From his own experience, he asserted, he knew that such a route was feasible with suitable ships. "Your Majesty could have a million in gold each year from the spice trade alone without counting the income from the fifths and other benefits," he wrote (Alvarado 1552a).

But Alvarado was ahead of his time. Not until 1559 was a new trans-Pacific voyage ordered. Miguel López de Legazpi sailed from La Navidad on Mexico's west coast on November 21, 1564, to return successful in October the following year (Morison 1974:493–494).

Alvarado, however, had other matters on his mind besides a concession for himself and an idea ahead of its time. On orders from Viceroy Velasco he was about to begin building a trade house where royal officials could take stock of merchandise arriving from Spain. The site was to be on the mainland across from San Juan de Ulúa. With such a convenience, he believed, ships could be dispatched within a month after arrival, instead of the full year often required previously, and, thus, the cost of merchandise should be reduced by one-third. The royal exchequer would be increased, thefts and damage reduced, and the lives of the many seamen who annually succumbed to illness while in port would be spared by reducing their time in the unhealthful climate. Even scurvy, pirates, and storms at sea, it seems, were less to be dreaded than time spent in Vera Cruz.

Urging a fund allocation to bring in Negro slaves for labor and to buy the materials, Alvarado laid before the king a port development plan that was prophetic in scope. He advocated a repair service for ships and, foreseeing the day that foreign privateers would lay siege to New Spain's ports, fortifications and heavy artillery to guard the facility.

Temporary houses roofed with palm thatch were being built to serve the port until the permanent customshouse was completed, in 8–10 months; in the meantime, materials for the "strong house" would be gathered and construction begun. But the record of Alvarado's perspicacity serves only to prove the adage about best-laid plans.

On September 2, 1552, a severe hurricane devastated Vera Cruz and San Juan de Ulúa. The Río Vera Cruz, swollen by torrential rains and storm surge, overflowed its banks and destroyed most of the houses in the town. Hurricane-force winds uprooted trees and twisted them to splinters. The entire town was buried in mud, its citizens left homeless.

At San Juan de Ulúa, the sea rose 9 feet above its customary high-tide mark. Six heavy ships were destroyed in the port, and seven other vessels anchored along the coast were lost. Only a few lucky ones escaped with broken masts. The surging sea filled the church on the island, and one of the

bells was carried to the mainland by the violent wind and water. Roads were washed out, and the rock walls that had been put up as part of the port improvement program were swept away. The temporary houses begun on the mainland for unloading ships were destroyed. A loaded ship, carried by the storm surge, crashed into one of the houses, some distance inland.

Alvarado now urged removal of the city to higher ground and construction of a stone-and-mortar rampart 22 feet thick and 12 feet high, with artillery mounted at intervals, for the port's protection. To pay for the work, he recommended either restoration of the imposition in force during Mendoza's time or the collection of additional duties at the port. Alvarado had been to Mexico City to report on the storm to Viceroy Velasco who, unable to come to Vera Cruz to inspect the damage in person, had sent the Bishop of Tlascala in his stead (Alvarado 1552b).

When the ships of Carreño's fleet arrived in February and March of 1553, they found the devastated port poorly equipped to unload their merchandise, and the town of Vera Cruz offering little respite from the sea. The bishop, Fray Martín de Hoja (1553), having made his inspection, informed the emperor on April 8 that ships' companies and townspeople alike were being victimized by official bickering. The Royal Audiencia and Viceroy Velasco were divided over proposals to move the port.

By early May, the viceroy and the *audiencia* at last had agreed to a citizen's petition to move the town "one league in the direction of Mexico" to the property of "Doña María." But there the matter had broken down in a disagreement over an access road. So, on May 12, Alvarado again wrote to Charles V: "The city should be moved to a more healthful site," he persisted, "because it is now in the sand dunes; the present site is very humid and is exposed to danger from the flow of the river." "Concerning repairs of the port of San Juan de Ulúa on the island," Alvarado wrote, "a loading wharf must be built and, on dry land, warehouses for the receipt of merchandise [Alvarado 1553]."

Not until 1600 was Vera Cruz moved by order of Viceroy Gaspar de Zúñiga y Acevedo, Count of Monterrey, to a site across the bay from San Juan de Ulúa, where it was called Nueva Veracruz (Kraus n.d.:14).

With dock facilities and warehouse lacking, the ships from Carreño's fleet arriving in 1553 faced an extended wait. The royal treasurer, Fernando de Portugal, or his assistant, had to examine each register of incoming cargo for assessing a 5% tax, called the *almojarifazgo.* Portugal's lieutenant, Lucas de Molina, completed his account for the 14 ships at the end of February, 1554, long after they had been unloaded. Assessments averaged 1686 pesos per ship, ranging from 419 pesos for Francisco de Leyva's *San Vicente* to 2891 for Francisco del Huerto's *San Esteban.* From the tax computation, it appears that the value of the incoming cargo totaled more than 472,000 pesos. The same cargo had been assessed and the 2% *avería* levied in Spain

on the basis of a value of 517,330 pesos (Chaunu 1955:II,489, Molina 1554).

Unfortunately, no listing of this cargo is available. There is, however, an accounting for certain items that had to be appraised—probably because the port officials had no standard value to attach to them—and this list indicates the variety of goods brought from Spain to the colonies. The items, valued at a total of 314 pesos, included serge fabric, thread, braiding ribbon, shirts, and bed covers; knives, latches, mallets, and nails; and 11 *arrobas* of soap.

Aside from the settlement of the tax on the merchandise, travel arrangements had to be made for the Dominican and Franciscan friars who had come on the ships. Ten of the 25 Dominicans arriving on *Santa María de Yciar* were ill and, in keeping with Prince Philip's decree, had to be provided horses costing 10 pesos each to take them to their inland destinations. Six additional animals were provided to carry the padres' books and vestments. The 10 ailing Franciscans, of 20 arriving on *San Andrés,* also had to have horses to ride, as well as four more to carry their vestments. Shipmaster Francisco del Huerto of *San Esteban,* who had unloaded 16 Franciscans at Ocoa (Hispaniola), was paid 98,000 maravedís for their passage, and an additional 500 for having had to sail the rest of the distance to New Spain with empty space on his ship (Molina 1554).

The treasurer also had to levy and collect fines from members of the ships' companies. Two of the shipmasters, Corzo and Ojos, paid small assessments for unspecified infractions, and eleven of Corzo's sailors paid fines totaling 20 pesos (Molina 1554).

The tax paid and holds emptied, each shipmaster may have ordered his vessel careened to remove barnacles. Seams probably had to be caulked and the ship "rummaged" to rid it of the accumulated filth among the ballast that sent a stench throughout.

This latter process involved taking out all the ballast stones and throwing them on the beach to be washed by the tide; scraping the slime from inside the hold, and rinsing it out with vinegar. Then the ballast had to be put back into the bilge (Morison 1971:135). The ships that were returning—only *San Esteban, Santa María de Yciar, Espíritu Santo,* and *San Andrés*—were then ready to begin taking on new cargo and making new registers, on the basis of which taxes would be collected in both Mexico and Spain.

The unloading and reloading of ships has been a marvel for land dwellers throughout the centuries, and the procedure at San Juan de Ulúa must have been a spectacle indeed. Contrary to some romanticized accounts, however, gold and silver bars were not stacked on the dock "like cords of wood" (Carter 1963:35). The silver came in *planchas*—disks of varying size—bearing marks indicating ownership, the mine it came from, and the payment of tax; in disks and pieces, also of varying size; and in coin minted in Mexico or elsewhere in the Indies. Gold bullion, in lesser quantities, came in

bars, usually about 5 inches (13 cm) long and bearing assay and tax marks; and occasionally in dust.

Silver was measured by the mark, a unit equivalent to about 8 ounces (227 gm), and fractions thereof. Terms used to designate the fractions were apt to represent both a weight value and a monetary value. A peso, for example, represented one ounce in weight or 272 maravedís in legal tender; a real, ⅛ ounce (27 gm), ⅛ peso, or 34 maravedís (Ojos 1554).

Much needless confusion concerning the Spanish system of coinage has arisen from the use of more than one term to designate the same value, and the same term to represent different values. Furthermore, the standard peso at various periods represented varying amounts in maravedís. The amount seems to have been fairly stable in the mid-sixteenth century, however, at 272 maravedís per peso, excepting the *peso de oro de minas,* which was worth 450 maravedís (Ojos 1554, Urrutia 1554).

For simplicity's sake, nevertheless, it is helpful to understand that in 1554 pesos of gold in *tepuzque,* pesos of gold that flows *(oro que corre),* and pesos of common gold *(oro común)* all were valued the same as the standard silver peso: 272 maravedís (Ojos 1554).

The more esoteric meaning of these terms, as related to their derivation, is explained by Alberto Francisco Pradeau (1938:21). To meet a scarcity of small coins in Mexico immediately following the Conquest, tradesmen had gold dust melted into disks marked only with their weight. Debasing of this crude coinage by the addition of copper began almost immediately, and the natives, perceiving the fraud, applied to it their word for copper: *tepuzque.* In 1526 the Mexico *cabildo* authorized individuals to have their *tepuzque* made into slugs at the royal smelter and assay office. The owner might elect to have them made up in weights of 1, 2, or 4 *tomines*—a *tomín* being a weight measure representing 12 grains (.77 gm)—or, if he preferred, into pieces weighing 1, 2, or 4 *pesos de oro.* A *peso de oro* represented a portion of gold weighing 96 grains (6.2 gm), or 8 *tomines.*

The value of the different types of gold disks was originally computed according to fineness and weight. A *peso de oro* of *tepuzque* was worth 272 maravedís. The same amount of *oro común,* or unrefined gold, brought 300 maravedís; the *peso de oro ensayado* (assayed gold), 450 maravedís (Pradeau 1938:21).

By 1554, the value of the *tepuzque* peso and the *peso de oro común* had been equalized at 272 maravedís. The *peso de oro de minas* or *peso de oro ensayado* no longer referred to a specific coin but merely reflected a value unit of 450 maravedís. The *ducado,* or ducat, also was an abstraction, reflecting a value of 375 maravedís. For some reason New Spain's treasury officials seem to have preferred to express value in terms of *pesos de oro,* as all their accounts for the years 1553 to 1560 are given in that term (Portugal 1560).

The maravedí was the smallest coin, worth about 1.7 U.S. cents at July 1976 silver prices ($4.625 per ounce). Thirty-four maravedís made a real,

the value of a *tomín de tepuzque*. A 4-real coin was called a *tostón*. Two *tostones* or eight reales made a peso, roughly equivalent to an ounce of silver. *Pesos en tostones,* a term that appears often in ship registers of the 1550s, designated the size of the coins making up the amount—like a dollar in dimes or quarters. *Pesos en reales* seems to have indicated only that the shipment consisted of coin.

The practice of assigning a weight value to each coin actually simplified the task of deriving the monetary worth of bullion. The conversion, however, could not be exact, because values varied according to quality. Such conversions on the register of *Santa María de Yciar* invariably indicate a mark of silver was worth approximately 8.12 pesos (Ojos 1554). The use of weight equivalents is still of great value today, as it makes computing the worth of a sixteenth-century bullion cargo, in both pesos of that day and dollars of this, a matter of relative ease. On July 19, 1976, silver in the United States was worth $4.625 per ounce, the approximate modern value of a sixteenth-century peso.

The amount of gold and gold alloys contained in the registered coin shipments of *Santa María de Yciar* cannot be determined with certainty. Most of the cargo obviously was silver. There was one consignment of 200 *pesos de oro de minas en reales*, a term that expressed a value of 450 maravedís per peso as opposed to the 272 maravedís per standard peso, and did not reflect the metallic content. Another shipment contained 4000 pesos of superior quality gold of the mines. But the only one for which a carat value is given—and hence the only one definitely identifiable as gold—was "1140 pesos of gold of 18 carats" carried by passenger Blas Pérez de Prado for the Seville merchant Gaspar de Espinosa. For this shipment, probably worth 513,000 maravedís or 1886 silver pesos, Espinosa eventually was to receive 12,700 maravedís.

In whatever form they came, gold and silver were shipped in boxes or trunks or wrapped in English cloth or burlap. Uniform boxes were specially made for the king's treasure, of which each of the four ships of concern here carried approximately 25,000 pesos (Urrutia 1554) of "gold of the mines"—the equivalent of 41,350 standard pesos. The amount was the maximum prescribed by law. Each ship carried a much larger value in bullion and coinage of the Mexico City mint being sent to Spain by merchants and individuals. *Santa María de Yciar*, evidently the smallest of the four ships, carried more than 15,000 pounds of precious metals with a standard-peso value approximating a quarter of a million (Ojos 1554).

Unfortunately, *Santa María*'s is the only complete ship's register for the homeward voyage available. If the other three ships carried gold and silver proportionate to the value of the cargo brought from Spain—as indicated by the *avería* and *almojarifazgo*—the total was more than 1.5 million pesos.

A register of treasure on Antonio Corzo's *San Andrés,* made after she reached Havana, indicates such a figure to be extremely conservative. This

ship alone carried 623,815 pesos of bullion and coin, amounting to about 19.5 tons. If *Espíritu Santo* and *San Esteban*—both probably larger than *San Andrés*—carried as much treasure, the combined cargoes were worth in excess of 2 million pesos, or more than $9.8 million in modern terms.

Almost 6 weeks were spent in drawing *Santa María*'s register. A large portion of the cargo already was on board when the master, Alonso Ojos, and the ship's owner, captain, and pilot, Miguel de Jáuregui, went, on February 27, 1554, to Vera Cruz to solicit a royal notary to make the register. The process lasted until April 7, 2 days before sailing. There were 243 individual shipments, consisting not only of precious metals but also a variety of produce from the Indies. The document affords a penetrating insight to the commerce between Spain and Mexico, as well as the life and customs of the times (Ojos 1554).

The royal order that decreed the division of the 100,000 gold pesos of Crown treasure among the four ships was to prove its worth. While assuring equitable treatment for each shipowner, it also served as a hedge against loss of one or more of the ships. When the great lottery was cast, only one of the four vessels was to come up a winner.

Alonso Ortiz de Urrutia, assistant to the royal treasurer, saw to details of the shipment. A part of his report reveals that he consigned to *Espíritu Santo*, Damián Martín's ship, 24,997 pesos 6 *tomines* 7 grains of "gold of the mines." The term, however, expresses a value unit of 450 maravedís per peso; it does not signify that the shipment actually was made up of gold. To the contrary, the report specifies that it consisted of 2698 marks 2 ounces of silver and 19,433 pesos of common gold in reales. The treasure, says the report, represented the king's share of "the duties of the *almojarifazgo*" and other royal levies in the city of Vera Cruz plus the precious metals consigned by officials in Mexico City as the royal share of certain governmental receipts. It included 1% duty taken from the smelter, assayer, and marker. Each shipmaster—Martín, Huerto, Ojos, and Corzo—received 50 pesos in common gold in advance for transporting the treasure to Spain, where it was to be delivered to the casa in Seville.

Payment of 105 pesos 4 *tomines* was made to Aparicio Martínez, carpenter, for constructing the six dozen boxes in which the treasure was to be sent: "This pays for the cord and the work of the Negroes who tied and nailed the boxes. It also pays for the days [Martínez] worked unnailing the boxes in which the silver was brought from Mexico to Vera Cruz, and for putting it in the new boxes to be nailed and tied [Urrutia 1554]."

The "25,000 pesos of gold of the mines" of king's treasure, contained in 21 large boxes, was registered on *Santa María de Yciar* on April 4, received from Don Fernando de Portugal, His Majesty's general treasurer. It was to be delivered to the royal judges and officials of the Casa de Contratación in Seville.

Each consignment of treasure and other goods was registered according to an established form. Listed on the register were the name of the agent making the consignment, that of the owner, and the person authorized to receive it in Spain. Also specified were the person assuming the risk and the names of any persons authorized to remove it from the vessel at any point during the voyage—a precaution against mishaps that might necessitate transshipment of the cargo.

Often indicated also was the ultimate disposition of the treasure or merchandise. Shipments of coin and bullion by individuals were in payment of merchandise already received, to pay in advance for goods to be sent from Spain with the next fleet, or for use according to the undisclosed instructions of the shipper. Thus, *Santa María*'s register reveals not only the goods being shipped to Spain but also much of what had been brought by the same vessels to Mexico.

Among other disclosures is an indication of the extent of the black slave trade between Spain and Mexico. Almost from the time of discovery, Spanish invaders had enslaved Amerindians. The North American Indian slave trade, however, never assumed the proportions of the African commerce because the natives could not endure captivity or forced labor (Morison 1971:216). *Encomenderos* in the Indies, therefore, soon were seeking a different labor source. They found it in slaves from Africa.

Introduction of black slaves to America was restricted at first, probably for religious reasons. In Ferdinand and Isabella's time it was not yet regarded with favor by the Catholic church. But economics at last held sway, and the right to export Negroes was permitted for favorites of the Crown, as well as for individuals and companies who paid a handsome royalty for the privilege. Moorish slaves were excluded for fear they would subvert Christian religious teaching to the Indians (Haring 1918:134). On *Santa María*'s register, however, was Jorge, the *morisco* slave of Blas Pérez de Prado, and Ana de Reynoso, *morisca*, who was being returned to Spain as a prisoner. Later, the term *morisco* had a different meaning: "quadroon" (O'Crouley 1972:19). At this time, however, it seems to have been applied only to Moors; Jorge and Ana probably had entered New Spain illegally or by special privilege granted to their masters.

Relaxation of restrictions on the black slave trade had resulted from a grave miscalculation by Fray Bartolomé de las Casas who, after realizing his error, was to grieve its consequences the remainder of his long life. He recommended about 1516 the substitution of black slaves for Indian because they appeared to suffer less in captivity. By 1528, Negroes were being introduced to America by the thousands. Charles V granted to the German merchants Ehinger of Constance a contract to supply 4000 black slaves to the Indies from 1528 to 1532 (Haring 1918:99). Las Casas, after witnessing the suffering of black slaves in the Indies, perceived his error and was

conscience stricken for having recommended the substitution of one evil for another.

Foreign traders also managed to unload slaves illegally among the islands of the Antilles and on the coast of South America. The bishop of Charcas, arriving at San Juan de Puerto Rico with Farfán's fleet in 1554, learned of such a transaction. Three ships of unidentified nationality had unloaded 230 Negroes "furtively" (Salinas 1554).

At least three of the four ships about to sail with the treasure had brought slaves, as well as priests, the previous year. The *avería* had been paid on 10 Negroes brought on *San Andrés*, including three females and four males registered by Master Antonio Corzo himself. The same record shows Damián Martín had brought 14 black slaves on *Espíritu Santo.* From the amount of the *avería* paid, it appears that the slaves were valued in Spain at from 92 to 139 pesos, the average being 111 (Casa 1573). By the time they reached New Spain, however, the value had appreciated considerably.

On *Santa María,* one Francisco Ruíz de Ramales was sending to Rui Gómez Adalid in Seville 312 pesos 5 *tomines* in common gold as payment for a Negro named Diego. The slave had come on Francisco del Huerto's ship *San Esteban* (Ojos 1554).

Santa María's owner, Miguel de Jáuregui, also was involved to some degree in transporting slaves. Record is found that in 1537 "Gabriel de Balmaseda, Tenuxtitán merchant, authorized Francisco de Rosales, Vera Cruz merchant, to receive from Miguel de Jáuregui . . . all the Negro slaves he brought from Castile on the ship of which he is master. He sent him Juan Díaz de Monterde and Gregorio de Castro [Millares Carlo 1945:II,101]."

It seems a safe assumption that virtually all the ships and masters of the Indies fleet transported black slaves at one time or another. At least 15 transactions recorded on *Santa María de Yciar*'s register involve payment for slaves, from 1 to 19, brought to New Spain. Cristóbal Alonso, on behalf of Andrés de Losa, sent 2000 pesos to Field Marshal Alonso López de Valenzuela as part payment for 19 Negroes that had come over on Master Pedro de Andonalgui's ship. (This vessel evidently had arrived in New Spain, despite the fact that shipping records [Carreño 1552] gave her destination as Santo Domingo, and the master now was embarking as a passenger on *Santa María*.) On behalf of Juan García Montero, Losa sent 200 marks of silver as proceeds from sale of wine, merchandise, and slaves brought on the same ship. Pedro del Algava, a passenger on *Santa María,* carried almost 300 marks of fine silver plus two barrels of cochineal for delivery to his four partners as proceeds from six Negro slaves he himself had conducted on Hernando de la Mata's vessel. Two of his partners, interestingly, were officers of the Inquisition in Seville: Domingo de Azpitia, treasurer of the Holy Office, and Bartolomé de Vizcarra, alcalde. It appears that the slaves had brought at least 400 pesos each, somewhat better than the average price. Gregorio del Río dispatched 195 pesos, "the value of a Negro named

Gaspar" sent him on another skip called *Santa María* (Nicolao Marín, master, and Cristóbal Romero, owner) in Carreño's fleet. Romero himself sent 424 pesos 4 *tomines* to the magistrate Alonso Vázquez in Seville as proceeds from the sale of a Negro woman "given Vázquez in the city of Santo Domingo." Gerónimo de Cisneros's *Santa Catalina*, arriving at San Juan de Ulúa 2 days ahead of Huerto's *San Esteban*, had brought a Negro woman sent to Diego Alonso Larios of Mexico City by Diego Cavallero of Seville. Larios dispatched 208 pesos as payment. Hernán Ruiz, master of *Trinidad,* had brought to San Juan de Ulúa on February 2, 1553, 11 Negroes consigned to Hernando Ribadeneira. Ribadeneira sent 151 marks, 6 ounces of silver (1232 pesos) to Gaspar de Espinosa in Seville as proceeds from sale of the slaves. This was an average of 112 pesos each, considerably less than the price Algava had received for the 6 slaves he had sold. Ribadeneira apparently carried on extensive operations in the slave trade, for he also sent payment in silver for unspecified numbers of blacks he had received on two other ships (Ojos 1554). A resident of Mexico City, he evidently had extensive mining interests. Bartolomé de Medina, who perfected the patio process for silver amalgamation using mercury, would soon set up shop in Ribadeneira's home, which served as the seat of his operations for almost a year (Probert 1969:100).

In view of Ribadeneira's interest in Medina's work, it seems likely that his role in the slave trade was that of procuring labor for the mines. Viceroy Velasco recently had released, under the New Laws of 1542, 150,000 Indians held in bondage illegally (Lowery 1911:353). The Africans became their replacements.

Specific destination of slaves brought to Mexico by Carreño's fleet is not revealed, but several documents refer to the use of Negroes on the wharfs of San Juan de Ulúa, both in packing and loading cargoes and in port construction, as well as in the salvage of sunken vessels (Urrutia 1554, Alvarado 1552a, 1554). By 1620, it seems that black slaves served throughout the Antilles and North and South America, in the mines, on haciendas, and in the seaports (Vázquez de Espinosa 1942).

Silver and gold consigned to *Santa María* also were being shipped to pay for wine, clothing, textiles, vinegar, fruit, soap, olives, oil of unspecified variety, lead, a clavichord, "ladies' things," wax for church candles, and many shipments of merchandise of undisclosed nature. Among the goods Huerto had brought on *San Esteban* were 30 barrels of wine and 26 small barrels of olives. The wine shipment was one of 10 being paid for by consignments of bullion and coin on *Santa María,* at the rate of about 40 pesos per barrel. Juan Ramírez de Alarcón sent, by passenger Juan de Segovia, 66 pesos of *tepuzque,* in reales, to Doña Juana de León, wife of Melchior Vázquez of Seville, to pay for the clavichord she had sent him. Ojos carried a *plancha* of silver from the Holy Sacrament Charity of Mexico City to buy "white wax for illumination of the Holy Sacrament." Proceeds from 100 barrels of soap,

brought by Pedro del Algava with his slaves on Hernando de Mata's ship, amounted to 47 marks 1 ounce—about 380 pesos.

Many of the consignments were to settle old debts, to provide for the sustenance of dependents still in Spain, as rent payment on houses in Vera Cruz, and to settle estates. Cristóbal Ruiz de Huelva, a merchant in Mexico, having offered his services to Gaspar Melchior's company in Spain as a bill collector, transmitted to Melchior 120 marks of fine silver that he had taken for Melchior's past-due accounts receivable.

With remarkable frequency the ship's register reflects shipments sent to settle the estates of persons who had died. The will of one Diego de Balmaseda, attests to his honesty. It provided for the dispatch of 45 marks to the Hospital de la Misericordia of Seville to pay his bill. Ojos took from the agent of Dr. Antonio Rodríguez de Quesada, *oidor* of the Audiencia de México, who had served as probate judge during the preceding year, 7026 pesos for settlement of estates of 32 deceased persons. But that was only about one-third the total amount. The rest was divided, wisely, between *San Esteban* and *Espíritu Santo*, as a hedge against the loss of one of the vessels. None of the estate money went on *San Andrés,* the only ship of the four that was to make port.

Listed among this consignment was 326 pesos 7 *tomines* as "possessions of certain men who died in the war and conquest of Xalisco." Another was a bequest for building a chapel in Alcalá de Guadayra by its late daughter, María de Guzmán. Her executor sent 1586 pesos 2 *tomines* for carrying out the bequest (Ojos 1554). Among possessions of deceased persons to be returned to Spain were, ironically, those of Doctor Trenado and the licentiate Rabanal who, with 80 other persons, had drowned in the loss of a ship on the coast of New Spain. They had been coming to take posts in the viceregal government (Mexía 1555), Trenado as *oidor* in the Audiencia de México, Rabanal as His Majesty's *fiscal*. Their belongings that were recovered from the shipwreck had netted 119 pesos 3 *tomines.*

While waiting to set sail on the homeward voyage, Miguel de Jáuregui, *Santa María*'s pilot and owner, evidently had engaged in the salvage of a galleon lost by Master Cristóbal Díaz near the Sierras de Paparo. Jáuregui now registered on his own vessel "one-third of a thousand pesos" to be delivered in Seville to the galleon's owner. The amount represented shipping charges collected for merchandise carried by the lost ship. Jáuregui, it is noted on the register, still had to be compensated for the expense of the salvage operation. Before he was, however, the fate of Díaz's vessel became that of his own.

Masters of two of the vessels that had come from Spain with Carreño's fleet consigned to Ojos's ship the proceeds from sale of gear and rigging from their scrapped vessels. Hernán Ruiz sent to the owners of *Trinidad* in Seville 100 marks of silver "for the rents, earnings, sails, rigging, apparatus, and other things that came from the said ship." For Gerónimo de Cisneros,

master of the erstwhile *Santa Catalina,* Ojos took silver valued at 595 pesos 3 *tomines* to be delivered to the owner in Seville "for the rigging and other items" from the ship.

Still another shipment of silver, 89 marks 6 ounces, was placed on board by the lieutenants of His Majesty's officials of New Spain, for delivery in Seville to Fray Bartolomé de las Casas. The register ordinarily makes no mention of shipping charges for gold and silver, but in this instance, 2 ounces were taken to pay Ojos for shipping and the registering notary for his affidavit.[1]

Besides the produce of the mines, *Santa María* carried a variety of other products of the New World. Most prominent among them was cochineal, a red dyestuff consisting of the dried bodies of the female cochineal insect, which feeds on cacti. No description is found of how this tiny creature was gathered during this period in the huge quantities that were shipped. One may envision a widespread trade with the natives by which it was acquired in small packages and collected into the 500-pound barrels loaded on the ships bound for Spain. Cochineal plantations were developed quite early, however, and some may have been in operation by the 1550s.[2] The crop was valuable but uncertain. An early rain might destroy it, or it could be lost for want of labor at the proper time.

New Spain's cochineal culture was centered in the area around Puebla de los Ángeles and Tlaxcala. The various ways it is referred to by Vázquez de Espinosa (1942:nos. 375–386), writing in the 1620s, indicate that the red insects were both gathered from cactus plants in the wild and produced on plantations. At Tlaxcala, it had been proposed that the Indians pay their tithes in cochineal. If such a plan came to pass, the chronicler believed, "the Diocese will have an annual income equal to that of the Archdiocese of Toledo." The cochineal, grown on tuna (or nopal) cactus, was of the finest quality. At Cholula he observed "the great amount of cochineal, corn, and other products raised in its district." Cochineal also was grown in the district of San Diego de Huetjotzingo, which likewise produced corn, wheat, fruit,

---

[1] After the ship was wrecked and salvaged, Las Casas was to recover, in June, 1556, the sum of 138,311 maravedís, about 65 marks (Ojos 1554). The amount sent him was his pension, payable each year from the viceroy's accounts (Portugal 1560).

[2] One such operation, in Guatemala, in 1840, is described by John L. Stephens (1969:I,277). In the Antigua area he came upon an open plain shut in by mountains. The entire plain to the base of the mountains was covered with nopal (prickly pear) cactus 4 feet high, "set out in rows like Indian corn." On each leaf, a joint of cane was pinned with a thorn, and in the hollow of the cane were 30 or 40 of the dye-producing insects. Breeding in their narrow prison, they produced swarms of young to crawl out and attach themselves to the cactus leaf, which gradually took on an encrustation resembling "white mildew."

At the end of the dry season some of the leaves were cut from each plant and hung in the storehouse to provide the next year's insect crop. The insects were brushed from the rest of the plants, dried, and "sent abroad to minister to the luxuries and elegances of civilized life, and enliven with their bright colours the *salons* of London, Paris, and St. Louis in Missouri."

and root crops, as well as sheep, goats, and swine, and boasted a woolen mill. The Indians living on the slopes of the Nevado volcano collected quantities of fine cochineal while grazing their cattle and sheep on the sierra. In the Oaxaca district, both "cultivated and wild" cochineal was produced.

Cochineal, widely used as a dye by the American natives, was in great demand in Europe. *Santa María de Yciar* carried almost 22,000 pounds (874 *arrobas*) of the dried insects in 25 different consignments. Most if it was contained in huge barrels with ten iron hoops, but it also came in boxes of various sizes.

Shipping charges for a 20-*arroba* barrel varied, rising from 11 ducats on a registry of March 22 to 12 on March 28 and falling back to 11½ on April 3. This rate, of $70 to $76 in modern terms, indicates the substantial value of the product. The charge was payable 15 days after delivery in Seville. Some of the shippers were affiliated with trading companies in Spain. Others acted independently, often exchanging cochineal for goods to be sold in Mexico or applying its proceeds to personal needs or debts.

Santa María also carried 1226 cowhides, registered in 7 different lots from 62 to 400. They usually were described as being "dried and well conditioned," some with the hair removed. Each hide was shipped at a cost of 3¾ reales—about $2.17 (Ojos 1554).

Resins accounted for some 7000 pounds of the cargo, consisting largely of liquidambar, some of which came from Peru. In New Spain, liquidambar was produced in Chiapas and Honduras. It came from a tall, straight tree with five-pointed leaves resembling, to Spanish eyes, the white poplar. Its seed, says Vázquez de Espinosa (1942:nos. 558, 705), was a round, rough rosette the size of a small filbert. Its resin accumulated in large swellings on the trunk, which were slashed to collect the substance, "ruddy as gold and very fragrant." Each swelling usually yielded a half-*arroba* jug full—about a gallon and a half. "Its efficacy and virtues in the cure of diseases are very well known." Another resin included among the shipments was *tacamahaca*, from the balsam poplar that, to Vázquez (no. 589), resembled a medium-sized olive tree and had similar leaves. Its gum was both white and gray; ". . . its virtues are well known for [treatment of] headaches and migraines and other affections [afflictions]." This tree also grew in Chiapas and the adjacent territory in Guatemala. A quantity of *amine,* or canime oil, registered on *Santa María de Yciar* probably came from the Oaxaca valley or Guatemala (Vázquez 1942:nos. 505, 652), where it was drawn from the *curbaril* tree. The sixteenth-century uses of this resinous substance do not appear, but in modern times it is used in varnishes.

There were 13 barrels of white sugar in *panes enteros* (i.e., molded into cones), a total of 485 *panes.* Each barrel, bound with 10 iron hoops, contained 50 *arrobas* (1250 pounds). Shipping charges for the lot were 4 ducats. Such charges evidently were based more on the value of the shipment than

on weight. Fifty *arrobas* of cochineal would have been subject to shipping charges of 27 to 30 ducats.

Two trunks full of silk thread weighing only 143 pounds were charged 8 ducats, whereas five shipments of wool, amounting to 2500 pounds, appear to have been loaded at 1 ducat per 125-pound bag (Ojos 1554).[3]

One barrel of dried sarsaparilla root—found in Veracruz state and the Oaxaca valley and used as a flavoring—and several personal items rounded out the cargo. Personal belongings, of registered passengers in most cases, included a trunk containing two cotton beds and five silver pots and jars, a silver spoon, a gold spoon, and a silver perfumer, cup, and *cubilete* (a small drinking vessel, perhaps a porringer). One passenger, Alonso de Morales, registered, besides 50 marks and 250 pesos of silver in *tostones,* "one bed of this land" and various feather ornaments, curiosities of the New World (Ojos 1554).

The aggregate was more than 15,000 pounds of silver, a small amount of gold, and some 34,000 pounds of other produce for a total burden of almost 25 tons. *Santa María de Yciar* is believed to have been a 200-ton vessel, but such a description tells nothing about tons of displacement or weight of cargo. The term came from the number of wine tuns, a most common item of cargo, the ship could carry.

If the cargo of each of the four ships was proportionate to the *almojarifazgo* it had paid on goods brought from Spain, then *Santa María*'s 25 tons indicates a total of about 153 tons burden for all four. Aggregate shipments of precious metals would have amounted to some 91,000 pounds. *San Andrés* would have carried a total of approximately 40 tons, *Espíritu Santo* 41, and *San Esteban* 47.

By the same formula, *Santa María*'s 67 passengers and crew members indicate a total for the four ships of 410 persons, of whom 304 were aboard the three vessels marked for tragedy.

Besides the regular cargo, the ship's register lists three packets of letters. One apparently pertained to settlement, by last will and testament, of the affairs of one Juan García de Cibad and an accounting to his partners in Seville. Another was from Alonso de Manríque, who had succeeded García de Escalante Alvarado as *alcalde mayor* of Vera Cruz, to the lords and judges of the House of Trade. The third, of greatest importance, was a bundle from officials of the viceregal government to the House of Trade, containing another packet from officials of the Audiencia of Nueva Galicia, addressed to the king.

With the cargo loaded and the register nearing completion, the royal factor's lieutenant, Alonso Rodríguez, came on board, and, in his presence,

[3] Vázquez de Espinosa (1942:nos. 505, 513) found silk being produced from silkworms grown on mulberry trees in the Oaxaca valley.

Alcalde Manrique inspected the vessel. The ship's gunner, Lorenzo Hernández, was summoned and, after being "sworn before God, Saint Mary, and the sign of the Cross, according to law," made a declaration of the artillery and munitions the ship carried. His inventory consisted of 10 heavy artillery pieces, 32 *versos,* or light artillery pieces, 9 barrels of powder, 500 cannonballs, 100 harquebuses, 24 shields, 16 crossbows, and 250 spears and lances.

Then Juan de Macaoga, evidently the steward, was given the oath and asked to detail the ship's provisions: 50 quintales (5000 pounds) of *biszcocho*, or hardtack; 2 barrels of meat, 50 barrels of water, beans, olive oil, and vinegar. These provisions were declared sufficient for the voyage.

Next came the boatswain, Pedro de Ycazi, to testify concerning the ship's gear: four anchors, five cables, sails, and rigging—all that was needed for the homeward crossing.

Then a list was drawn of the 20 crew members and 7 ship's boys. Listed as a crew member was Pedro de Andonalgui, who as a shipmaster had brought a considerable number of Negro slaves (19 for Andrés de Losa and an unspecified number in the custody of Juan García Montera), for which payment in silver marks and pesos had been registered on *Santa María*. A passenger named Rui López probably was the same as the shipmaster of that name who had sailed in Sancho Biedma's 1550 fleet as master of a 96-ton caravel, *La Concepción* (Casa 1577, Ojos 1554). Another former shipmaster and owner, Andrés López de Archuleta, with his Negro slave, Baltasar, was a passenger (Ojos 1554). Since no other similar name is found on shipping lists of the period, it seems likely that this mariner was the captain-general of the 1544 fleet (discussed in Chapter 6) in which Tomás de la Torre sailed. In that account no Christian name is given (Torre 1973). Archuleta had come to New Spain as master of a galleon named *La Trinidad* and was returning with a quantity of silver received for ship and cargo.

Before registering the passengers, the *alcalde mayor* took an oath from the master, pilot, ship's clerk, boatswain, and other crew members that no person was boarding the ship without license: "Spaniard, Negro, Indian—no person whatsoever." In due legal form, they were reminded of the law prohibiting such transport, and advised of the penalties it carried. Then began the registration of the forty passengers: 34 men—2 of them priests—and 6 women. Among the passengers were 5 male slaves and 1 female.

Three of the passengers, including one priest, traveled as prisoners (Ojos 1554). The story of one of these prisoners reveals the disaster about to befall the three Spanish ships as the final tragic episode in a real-life melodrama that began with the Mexican Conquest. The prisoner was Doña Catalina de Ribera, wife of Juan Ponce de León—not Florida's discoverer but the son of a conquistador of New Spain who, until his mysterious murder in 1552, had lived at Tecama (Veracruz state) and enjoyed the benefits of his father's *encomienda.*

Of Doña Catalina the register says: "She goes as a prisoner by order of the Royal Audiencia to the [Casa de] Contratación of Seville, and the officials there are to deliver her to the proper persons named in the sentence and testimony. . . ." Records of the case were carried by *Santa María*'s master, Alonso Ojos (1554), who was to deliver them to the Casa.

Accompanied by her slave, María, Doña Catalina had been placed in the custody of her uncle, Pedro de Velasco, for the voyage. Velasco, accompanied by his unmarried son, Diego, and a Negro slave named Pedro, had consigned to *Santa María* more than 1100 pesos of silver in the name of Hernando de Herrera, a reporter for the Royal Audiencia of New Spain. By agreement with Herrera, he was to pay from the amount all the expenses of his niece's passage.

Doña Catalina's father-in-law was Juan González de León, who had received from Cortés the rights of *encomienda* to the village of Tecama as a reward for his role in the Conquest. Following the old conquistador's death, in 1542, a dispute arose between two of his sons, Diego de Ordaz and Juan Ponce, over possession of the estate. The row came to a dramatic conclusion on Sunday, May 8, 1552, when ". . . during the night assassins came over the wall and killed Juan Ponce while he and his family were asleep [Ordaz 1556]." Diego de Ordaz, however, was not blamed for the murder. By widespread rumor the deed was attributed to Bernradino de Bocanegra, to that time a well-respected citizen of prominent family. Doña Catalina, it was said, had arranged the opportunity by instructing a Negro servant to open the door from the street when so ordered by a visitor during the night (Torquemada 1723:620).

The matter never came up for official investigation, however, and the connection between the murder and Doña Catalina's present circumstance remain unclear. She was being banished from the Indies and sent to Spain without the three children of her 9-year marriage.

For a year and a half after Juan Ponce's death, she and the children had retained possession of the estate and continued to live there, hiring Juan de Moscoso as overseer. Their rights, however, were short-lived. On April 5, 1552, at Madrid, the Crown had decreed that *encomienda* rights could not extend for more than two generations. On December 5, 1553, Viceroy Velasco ruled that, with the death of Juan Ponce, the estate had passed through two generations and therefore must revert to the Crown (Ordaz 1556). Doña Catalina appealed the decision. Since her husband had not died a natural death, she and her children should be allowed to keep the property. Furthermore, she had no other means of support, and the viceroy's ruling threatened her and the children with starvation. Diego de Ordaz also appealed, on grounds that his brother Juan Ponce had never had legal possession of the estate. He contended that he himself, being the eldest son, should have it for his lifetime.

The resulting legal hassle was quickly brought before the Royal Audiencia. One of the witnesses was Ángel de Villafañe, himself a soldier of the Conquest, who yet had a part to play in Texas and Florida history. Cortés, recalled Villafañe, had granted in *repartimiento* many Indian villages to those who had served in the Conquest. Those remaining in possession of original grants which he knew to have been awarded at the same time as the late Juan González de León's, or their heirs, were easy to find.

The *audiencia,* nevertheless, ruled on January 11, 1554, that the village of Tecama must revert to the Crown. Eight days later Hernando de Herrera was appointed guardian of Doña Catalina for purposes of litigation, both by her and against her. The action was necessary, apparently, because she was a female under 25 years of age (Ordaz 1554). Then came the sentence by which she was being sent to Spain, and Herrera arranged for the widow's uncle to take her. The disposition of the children remains unclear. Torquemada (1723:620) says 10,000 pesos was provided for their support, presumably from their father's estate. As she boarded *Santa María de Yciar* for her voyage in exile, Doña Catalina must have recognized that she never would see her two small sons and daughter again; yet, of all the visions she may have had of the future, none could have been more grim than her actual fate.

Nowhere in the 200-page record of the contest over the *encomienda* rights is there indication of the events leading to her exile. Although neither she nor Bocanegra ever came to trial for the murder of her husband, the case, in Torquemada's view, was judged and sentence passed by God. Bocanegra was caught up in riots that developed from the beheading of one Alonso de Ávila and, though guiltless in that affair, was imprisoned and exiled. Doña Catalina was cast upon the wilderness coast to die "at the hands of the murderers of Florida" (Torquemada 1723:620).

Three years after she sailed to her unknown fate on *Santa María,* in April, 1557, the appeal of the estate case by Diego de Ordaz and the heirs of Juan Ponce and Doña Catalina reached the Council of the Indies in Madrid. In January, 1558, the Council upheld the decision of the Audiencia de México: Tecama remained Crown property.

As Doña Catalina embarked, she was not alone in her status as prisoner. Fray Alonso de Encinas of the order of the Holy Trinity also was leaving New Spain by command of the *audiencia*. Ojos was bound to take the priest to Seville to give an "account and statement to the judges." The third prisoner was Ana de Reynoso, *morisca* ("Moor"), also to be delivered to the custody of royal officials in Seville to answer unspecified charges.

The passenger list completed the register except for one final, formal admonition: "Then the same *alcalde mayor* ordered the same master, pilot, clerk, boatswain, crew, and passengers to have Antonio Corzo for their captain-general by virtue of the commission of his Lordship; to obey his

orders and follow his flag and lantern, and keep the ships together to guard the silver of His Majesty under penalty of death and loss of all your possessions. . . ." All pledged their compliance. Manrique and Rodríguez affixed their signatures to the register, witnessed by public and royal notaries, and *Santa María de Yciar* was ready to put to sea (Ojos 1554).

It is a virtual certainty that, during the next 2 days, passengers and crew members alike entered the chapel on the island of San Juan de Ulúa or the church at Vera Cruz Antigua to make their confessions and voice prayers for "those in peril on the sea." Then, as the passengers boarded and the ships prepared to sail, one of the Dominican religious among the four ships' passengers is said to have issued a dire prophecy. Fray Juan Ferrer, a priest of the same noble lineage as St. Vincent Ferrer, is said to have declared in a farewell speech at dockside:

> Woe to those of us who are going to Spain, because neither we nor the fleet will arrive there. Most of us will perish, and those who are left will experience great torment, though all will die in the end except a very few. I will remain, hidden in certain remote places, and will live several years with sound health—but it is my voyage that is important now in order that the will of God be fulfilled in me [Dávila Padilla 1596:286].

It cannot be known with certainty, after four centuries, whether Ferrer actually made such a speech; but his reputation among his fellow priests as a mystic is unmistakable. He had written in 1552 to the emperor of a mysterious book in his possession, containing such secret matters that he dared not reveal its contents to anyone but His Majesty himself. They related, he said, "to all the Pontiffs and Sovereigns and nobility from many years back, and they are in Spain, Italy, Germany, and all the Indies . . . as well as in France, Africa, and many others. . . . [Ferrer ca. 1552]."

It would be useless to send the book, for it was coded in numbers and no one else could decipher it. He therefore begged leave to bring it personally to Spain. The authorization came with Carreño's fleet, reaching him in April, 1553, but a recurring stomach ailment prevented his leaving with the May sailing (Ferrer 1553). While he awaited the next fleet the Dominican provincial of Mexico, Fray Andrés de Moguer (1553), replied to instructions for permitting Ferrer's departure:

> Today I received a letter from your Lordship ordering me to send Fray Juan Ferrer to Spain to give an account of his dreams and fantasies. I shall do so on the very first ships. . . . I do not regret his departure.

He cautioned, however, that Ferrer's wild ideas would only cause trouble, that the priest himself was a shame and an affront to the order whose habit he wore.

If indeed Ferrer actually uttered the dockside prophecy attributed to

him, it must have generated only mocking snickers. Heedless of his warning, the four heavily laden ships stood out to sea on the morning of April 9, 1554. The brisk southeasterly filled their sails, and they rode the gulf current northward on the course designed to take them to Havana.

The first word that came back from the homeward-bound vessels was news of disaster.

Chapter 3

THE HOSTILE SHORE

On July 15, 1554, Dr. Antonio Rodríguez de Quesada, a treasury official in New Spain, penned this report to the Crown: "The Lord permitted three ships to be wrecked on the 29th of [April] off the coast of Florida near the Río de las Palmas at 26½ degrees, where more than 250 persons died and more than a million ducats were lost due to the lack of caution by pilots and sailors. Efforts are being made to recover something of what was lost . . . [Quesada 1554]."

Appended to the copy of the register of *Santa María de Yciar* in the Archivo General de Indias is this statement: "It is said that this ship, while sailing for these kingdoms [Spain], ran into bad weather that took it to the coast of la Florida, where it is said the ship was lost [Ojos 1554]."

There is no room for doubt that foul weather was the primary factor in the wreck of *Santa María de Yciar, San Esteban*, and *Espíritu Santo* 20 days after they sailed from San Juan de Ulúa. Poor seamanship may have contributed to the disaster; there are few tests of a mariner's mettle to rival that of an overpowering storm at sea, especially if the ship is powered only by sail.

That the wrecks were reported as having occurred "on the Florida coast" is understandable: The term was used during this period to designate all the *tierra incógnita* north of Mexico's Río Pánuco. The writers who have been led astray by ignorance of that fact are too numerous to mention.

Actually the three ships, having lost steerage or run out of sailing room before the storm blew itself out, were driven aground on Padre Island, the narrow strip of barrier reef extending from Corpus Christi to Port Isabel, Texas. The latitude reported was remarkably precise; the ships lay within 5 miles (8 km) of 26°30′. *Santa María de Yciar*, by one report, went down 2 leagues from the other two (Velasco 1554), yet the three sites recently identified are almost equidistant from each other, about 2.5 miles (4 km) apart. The site was about 2°45′ (165 nautical miles) above the Río de las Palmas, the river known today as the Soto la Marina.

The nature of the storm that overtook the four ships as they sailed toward Havana is not definitely known. The hurricane season, as it has been defined over the last 104 years, is limited to June through October. These tropical cyclones, with winds of from 73 to almost 200 miles per hour, may form over tropical waters anywhere from the Cape Verde Islands off the African coast to 150 miles (240 km) off the Texas shore in the Gulf of Mexico. But none has ever been known to approach Texas in the month of April (Henry, Driscoll, McCormack 1975:4, 8).

Of much less importance to coastal areas but still to be reckoned with by mariners are equinoctial storms, the result of unsettled weather conditions attending the vernal and autumnal equinoxes, about March 21 and September 23. Spring's unsettled weather in the gulf region often extends well into May. It was such a spring storm, accompanied by 15-foot seas, that overturned an oil drilling platform under tow about 40 miles (64 km) southeast of Corpus Christi on April 15, 1976, resulting in the loss of 13 lives.

When disaster overtook the three ships, they had been at sea for 20 days, sufficient time under ordinary circumstances to have reached Havana. The voyage in colonial times was made in as few as 12 days (Weddle 1973:33) and as many as 40, the usual being 18–20 (Haring 1918:295, 227). Juan Pablos de Carrión, his treasure galleon heavily laden, had taken 29 days the previous year. Corzo's small fleet must have been well past the midpoint of the voyage when overtaken by the storm, then driven before it for several days more.

Contrary to sailing instructions, the four ships failed to stay together, and Antonio Corzo, as captain-general, was to be blamed for deserting the others in their peril. He managed to sail his own storm-battered *San Andrés* into Havana harbor, so badly damaged that she was unable to continue the voyage. Her cargo was transferred to Juan Bautista Preve's ship, in the fleet of Cosme Rodríguez Farfán, which arrived in August from Nombre de Dios (Corzo 1555).

The other three ships ran before the storm until there was no more room to run. Anchor fragments recovered from the site indicate that, on approaching the beach, at least one of the vessels may have put out anchors

in an effort to avoid grounding, only to have them snap under the force of wind and waves. The size of ships in this period had surpassed the efficiency of ground tackle, and broken anchors under such circumstances were common (Parry 1964:91).

As the ships gouged the bank, their hulls split open or they were swamped by waves. Months later, after a salvage expedition had recovered as much of the treasure as possible, the royal treasury officials reported to the Crown that "almost all the people perished. Some drowned in the sea, the majority killed on land by the Indian warriors of that coast [Salazar *et al.* 1554]."

Aside from the salvage report, most of the documentary references to the wrecks are brief. None gives an accounting of the survivors' experiences, or even their number. We have only a statement of Ensign Francisco Muñoz, an officer in Farfán's armada, based on a report he picked up in Havana 6 or 7 months after the disaster. He says that most of the people were killed by Indians and that "only about 30 persons escaped [Casa 1555a]."

For further details we must rely on the somewhat homiletic version of Fray Agustín Dávila Padilla, who was born 8 years after the wrecks occurred and published his account more than 40 years after the episode. He credits but two survivors, one of whom was Fray Marcos de Mena. It was Fray Marcos who told him the story. Dávila's account is confused on many points, and often at variance with facts pieced together from various documents.

Dávila, who claimed to have been influenced by Fray Marcos to enter the Dominican order, sought to exemplify, in the extreme suffering of the castaways, God's punishment for blindness to his will. Dávila's principal concern is with five of the six Dominicans, who, after preparing themselves to work among the Indians, where the need was greatest, had abandoned this calling to seek a more comfortable life in Spain (Dávila 1596:290).

Yet, if allowances are made for understandable ignorance of geography, the failure of memory after many years, and the religious point of view, the account appears to offer a fairly accurate picture of what happened. At least it coincides with a summary of the episode written only 5 years after the occurrence to argue the "propriety and justice" of making war on the Indians. The author, Father Vicente Paletino de Corzula, also a Dominican priest, wrote:

> In the year 1554, some ships were coming from New Spain which wrecked on the coast of Florida at the Río de las Palmas. There all the Spaniards were killed with arrows. Among those who died were five friars of the order of St. Dominic: Fr. Diego de la Cruz, Fr. Hernando Méndez, Fr. Juan Ferrer, Fr. Bartolomé Cisneros [not mentioned by Dávila], and Fr. Juan Mena.
>
> The Indians left, thinking everyone was dead; but one friar [Marcos de Mena], covered with wounds, arose. He traveled at night; during the day he stayed in the earth, by digging holes to hide in. . . . In this manner he traveled to Pánuco, and he recovered his health.

Filled with emotion at this example of native savagery, Corzula blamed Las Casas, the Indians' champion, alleging "this bishop has deceived the emperor with his evil advice [Corzula 1559]." Corzula painted a gruesome picture of "the Indians of Florida." The natives' record of cruelty clearly indicated, he says, that castaways on this hostile shore would never be safe until the natives were conquered. "Each day there are shipwrecks there; ships run aground; they are becalmed; and the people are killed by the Indians and eaten." He cites examples, including the Dominican Fray Luis Cancer who, with Fray Diego de Tolosa, Fray N. de Fuentes, a sailor, and an Indian woman interpreter, had been slain by Indians on the Florida peninsula in 1549.

But Fray Agustín Dávila Padilla read from the disaster a different message:

> These five men of religion were taken out of this province [New Spain] by their desire to go to Spain; and it seems that God, by means of their painful death at the hands of the Florida Indians, wanted to humble those who remained. And He wanted to warn all Spaniards to watch how they treat the Indians, and to curb their greed, for He permitted those who escaped the water to be captured and killed by the Indians, and their wealth to be lost in the sea. . . .

Mistakenly giving the year as 1553, Dávila records that the fleet of many vessels reached Havana safely but on sailing again encountered foul weather that swept the ships back upon the Florida coast. All the ships, he says, were broken up except two small vessels, one of which carried the news to San Juan de Ulúa, the other sailing to Spain. "Of almost one thousand persons who embarked less than three hundred escaped to the Florida coast, some swimming and others clinging to boxes and planks as best they could [Dávila 1596:273]."

Actually, while the ships may possibly have approached Cuba, no indication is found that any of them except Corzo's *San Andrés* made port there. And none of the ships of the small fleet returned to San Juan de Ulúa.

Now comprising Padre Island National Seashore, the area where the ships went aground is described by the National Park Service as follows: "The extremely salty air, combined with the fine blowing sand, soft footing, lack of fresh water, many insects, and high humidity creates a very hostile environment. Sore eyes, overexposure, and general discomfort usually bring the [hiking] adventure to an end long before expected [U.S. Department of Interior n.d.]."

The three ships, about 2.5 miles apart, lay on the bottom, the surf pounding around them. Near each, a group of wet and chilled survivors huddled on the shore, gloomily contemplating their circumstances. Among them were the five Dominican friars and, according to Barcia (1723:29), Doña Catalina de Ribera. The surging waves carried ashore boxes of the

lighter cargo, literally tossing food at their feet: biscuit, meat, and *cajetas* of fruit jelly. According to Dávila (1576:273), the castaways were so dazed that they remained where the sea had put them for 5 or 6 days. During that time they saw no sign of natives, although the island was the fishing ground of primitive Indians, largely Coahuiltecan, who lived most of the year on the mainland. At last overcoming the shock, they set out along the coast toward Pánuco, believing it to be no more than 2 or 3 days' travel. In that assumption they were sadly mistaken.

The survivors from all three ships presumably united, they began the trek along the coast, unaware that they were constantly under Indian surveillance. Although there must have been men among the survivors who knew how to provision a ship, no one considered food needs for the march, says Dávila; they left behind enormous food supplies that had washed ashore.

On the seventh day of the march, about a hundred Indians armed with bows and arrows suddenly appeared. Making signs of peace, they offered fresh fish and fire with which to cook it. The Spaniards accepted gladly. A good fire going, the women began roasting the fish on the coals, while a ship's officer described as "the general of the fleet" eyed the natives suspiciously. In the situation he perceived a paradox: Enemies would not have brought food; friends would not come so heavily armed. While the women cooked, the cautious mariner—perhaps Andrés López de Archuleta, believed to have been captain-general of the 1544 fleet—passed the word among the men to prepare to defend themselves. Several carried sabers salvaged from the wrecks, and there were two good crossbows and a number of bolts. The Indians, however, kept making signs of peace, urging the Spaniards to partake of the food. The men had to eat and let down their defenses or make an open breach of courtesy. So they ate. And the Indians, having them thus occupied, suddenly let out a whoop and began loosing arrows. The crossbowmen went quickly into action, killing three Indians and wounding many more. The Indians fled without a single Spaniard having been killed.

The Indians had been heartened, Dávila claims, because they saw the Spaniards carried no harquebuses, the weapon they feared most. While this was true at a later time, it seems unlikely that the Texas coastal Indians had yet even seen a harquebus; they scarcely had seen a Spaniard. Alonso Alvarez de Pineda had run the coast from Florida to Vera Cruz 35 years previously, Pánfilo de Narvaez a few years after that. But there is no conclusive evidence that either of them had ever set foot on Padre Island.

As the unfortunates resumed their march for Pánuco, they found themselves facing another enemy—the hostile environment. They had left San Juan de Ulúa prepared for a sea voyage—quite unlike the miserable trek they now were forced to make, over coastal dunes and marshes. Many were poorly shod or barefoot. Some, their clothing ripped to shreds, were almost

naked. None was conditioned for the rigors of such a journey, least of all the women and children. Yet the apparent peril forced them to quicken their pace.

The Indians soon returned. Darting among the dunes, they killed the stragglers. On orders from "the general," the two crossbowmen took a rear guard position, and the enemy retreated. For 5 more days the Spaniards traveled unmolested (Dávila 1596:274–275).

During this time, the castaways must have crossed at low tide from the island to the mainland to reach "a very large river flowing into the sea." They called it the Río Bravo "because of its turbulence and plentiful waters." It still carries that name in Mexico; in the United States it is called the Río Grande. In 12 days of walking they had traversed hardly more than 50 miles, excluding detours occasioned by the terrain.

During their march, they had eaten mostly herbs and shellfish. Lacking fresh water, they had licked the morning dew from the vegetation. (Ironically, had they thought to dig in the sand a few feet inland, they would have found potable water near the surface.) Consumed by thirst by the time they reached the Río Bravo, they fell on their faces to drink their fill. Some died from drinking too much. Then those who were able began preparations to cross the river.

With cord brought from the wrecks, they lashed together pieces of driftwood to make rafts. The crossing posed various difficulties, but the greatest misfortune was the loss of the crossbows. One of the priests, carrying a bundle that had become burdensome, decided in midriver to divest himself of it. He had picked up the wrong bundle. Thus the only effective means of defense were cast into the river's depths. The loss occasioned deep despair, but no one was willing to risk the raging current to retrieve the weapons.

After resting a while on the south bank, the remaining survivors resumed the march through thorny brush. A short time later they realized that the Indians were still with them. The natives rained arrows on the Spaniards from a distance, wary of the crossbowmen's skill. But they soon became aware that the crossbows were gone.

The few Spanish swords were no match for the Indians' arrows. Several Spaniards were slain, and the Indians "took a cruel vengeance on them." Thereafter, as the castaways hastened on, the natives stayed close behind.

One morning the Indians captured two Spaniards and stripped them of their clothing but did not harm them otherwise. The other Spaniards assumed this to mean that the natives wanted only their clothing. "[Almost] everyone," says Dávila, "disrobed completely: the general, the friars, men, women, and children. Leaving their clothing for the Indians, they made a shameful spectacle."

Four Spaniards who refused to disrobe became the special targets of the Indians' arrows. One had refused to give up a colored jacket. The natives

felled him, ripped the garment from his body, and tore it apart, so that each of them might have a piece, which they waved at the Spaniards "like plunder from [the defeat of] that man's pride."

With the nakedness added to their wounds and hunger, the remaining survivors struggled onward, still pursued by the relentless enemy. Some of the women fell dead, from shame, Dávila allows, because they "were helpless to protect the decency that normally would be bought at the cost of one's life." The sympathetic friars ordered that the women and children be made to walk ahead of the others to reduce their embarrassment. Under such circumstances, the chronicler points out, even "little problems became very troublesome [Dávila 159:276–277]."

The coastal plain south of the Río Grande's mouth was quite different from that on the opposite side of the stream, the white-sand beaches giving way to marshes and mangrove swamps. Below latitude 25°30′, the Laguna Madre extends inland almost 20 miles (32 km) from the barrier islands. The lake posed extra miles of travel and increased difficulties for the castaways. Farther south, the marshland turned into a jungle of thorny tropical brush—inhospitable and almost impenetrable. This region remained wild and unsettled for almost two centuries after their passage until, in the mid-eighteenth century, under José de Escandón's leadership, it became the last segment of northeastern Mexico to be conquered and settled (Weddle and Thonhoff 1976:161). Through this harsh land the weary survivors made their way until at last they arrived at the Río de las Palmas, another "river of plentiful waters."

This "River of Palms," so often confused by regional historians with the Río Grande, winds a tortuous course through lofty mountains before it reaches the jungled flatlands. Though the main stem now is known as the Soto la Marina, a southern tributary entering some 20 miles (32 km) from the Gulf is still called Las Palmas. Documents as early as 1583 indicate the mouth in the vicinity of latitude 23° to 24° (actually about 23°45′) (Weddle 1973:109, Manuel 1583). At its mouth, just above the Tropic of Cancer, the river spreads out in a wide bay, surrounded by a maze of lagoons and marshy tidelands, difficult of passage under the most favorable conditions. But this was the rainy season. Although affording a measure of relief from their thirst, the rain multiplied the Spaniards' other difficulties. The wide river that blocked their way offered new opportunity to their tenacious pursuers.

Despite the slow rain, water still was not easily found. The travelers were forced to detour from their course to seek some trickle of natural drainage from which to drink. "When a thin stream of water was discovered . . . , they threw themselves into it and, by drinking the dirty water, took into their hands the death they sought to escape."

At the sight of the Río de las Palmas the women, still traveling ahead, hurried to drink. The sudden exertion exhausted them. As they lay gasping for breath between gulps of water, the Indians attacked again. It was a pitiful

spectacle: naked women and children trying to pull arrows from their bodies; screaming children running to helpless mothers for protection; mothers slain while pausing to help a child; or, seeing their children wounded, unable to help without being killed themselves (Dávila 1596:278). It was during this attack, says Barcia (1723:29), that Doña Catalina de Ribera met her death. By the time the men reached the river, not a single woman or child remained alive. From the *montes* they could hear the Indians' savage cry of victory over helpless victims (Dávila 1596:279).

There is no record of the total number of women and children on the three wrecked vessels. Although four sons, presumably young men, boarded *Santa María de Yciar* with their fathers, only two children were accompanied by both parents. They were Lorenzo Méndez and his sister Isabelita, children of Francisco Méndez—who will appear later—and his wife, Elonor de Miranda (Ojos 1554).

Throughout his account, Dávila implies that the Indians responsible for the massacre were the same ones who had pursued the castaways since before their Río Grande crossing. This is highly unlikely. A century later, at least, numerous bands occupied various parts of the region. It therefore seems improbable that any one band would have pursued the travelers outside its own territory; not all the different tribal groups were friendly with each other. The Spaniards must have passed from the land of the various Coahuiltecan bands living north of the Río Grande into that of other diverse groups south of the river and eventually, between Las Palmas and the Pánuco, into the country of the Huastecas (Newcomb 1961:60; Wauchope 1969:VII, 298; Weddle 1973:59, 60).

Following the massacre of the women, Dávila continues, almost 200 men remained. Overcome by shock and sorrow "but finding no relief in grief," they began to look for means of crossing the stream. Searching up and down the river, they at last found a small canoe, "a mercy provided by God because of their hardships," if indeed there was mercy in the postponement of their death. After crossing the river, they again believed themselves safe, only to discover they were still pursued. The Indian attack came swiftly. When it was over, 50 Spaniards lay dead (Dávila 1596:279).

All five Dominican friars, Dávila notes, were still alive, although they had become separated from the main group at the river crossing. Suffering severely from their wounds, Fray Diego de la Cruz and Fray Hernando Méndez decided to leave the others. They planned to allow the 100 "Chichimecas"—a term applied to any hostile Indian, not a tribal name—who were pursuing the Spaniards to pass by, and then to seek refuge among a more peacefully inclined Indian nation. As they prepared to recross the Río de las Palmas, however, Fray Diego, weak from his wounds and lack of nourishment, fell into the sand and announced, "I can go no farther. Trust to God, Brother Hernando, and commend me to his Divine Majesty." They already had confessed to each other. Fray Hernando spoke words of com-

fort: "And it is to be believed," comments Dávila, "that God took Fray Diego to eternal life after the Purgatory of this experience (which was God's will)." Left alone, Fray Hernando dug a grave in the sandy river bank, and buried his companion.

Walking along the river, Fray Hernando encountered another Spaniard who had become separated from the others, a soldier named Francisco Vázquez. They traveled together, sustaining themselves with roots and leaves. During this period, they came upon a nude black woman who, having somehow escaped the slaughter of the other women at the river, had remained apart from the men because of her nakedness. Though "retching with death" herself, the woman gathered herbs and roots for them to eat, reserving the tenderest for the sick friar. Making camp on a small hill, they were thus sustained for 40 days, a "painful purgatory," in Dávila's words, for the friar. With Vázquez's help, the woman kept Fray Hernando's wounds cleansed until, while seeking food one day, she, too, was killed by Indians (Dávila 1596:280–283).

Maggots began to work in the priest's wounds and, viewing the Negro woman's death as punishment for his willfulness, he prayed fervently and feverishly before dying.

With imagination, a moving story might be woven around the kindly black woman. Perhaps she was Doña Catalina de Ribera's slave María, who was traveling with her. And it may have been she who, on the orders of her mistress, had admitted the murderer to the household, an act partly responsible for their miseries. If so, her penance was done.

After burying the priest, Vázquez set out to retrace his steps to the place the ships had wrecked. By Dávila's account, he was found there by a salvage ship several days after his arrival and it was he who told of the death in the wilderness of Fray Diego and Fray Hernando (Dávila 1596:283–284).

The other three friars, meanwhile, followed the path of the remaining Spaniards, ignorant of the deaths of their two brothers. At the Río de las Palmas they, with two ship's crewmen, became separated from the others while looking along the river for a craft in which to cross. Finding a canoe on the bay shore, they paddled upstream, hoping to cross at a narrower point. Out in the bay, they saw two protruding shapes that appeared to be rocks. As they went toward them, however, the shapes took life, and two young whales went swimming out to sea. Their sudden motion evidently capsized the canoe, for Dávila relates that the five men were forced to make camp for the night on a small island in the middle of the river, then to construct a raft from driftwood to complete the crossing. Today, a small island is found in the bay, near the left bank, not far from the mouth.

On the south shore, the three priests beheld a new scene of death and desolation. Several Spaniards lay dead a short distance from the landing; others, their bodies bristling with arrows, cried out for water or moaned in anguish. Still others, too far spent to speak, lay silently awaiting their death.

The one ordained priest among the religious, Fray Juan Ferrer, the mystic, offered spiritual consolation. He and the two lay brothers stayed among the dead and dying the rest of the day and well into the night. After midnight, having done all they could, they began the march to overtake those who had been able to escape the Indian archers. After a long day of swift walking they caught up with them after nightfall.

The Spaniards now walked along a smooth but soft sandy beach, sustained by the raw shellfish they were able to gather from the water's edge. For almost 20 days the main group traveled without seeing an Indian, but the ominous signs were there. When some of the stronger ones, in their haste to reach "Christian lands," went ahead, the main body usually found them dead or dying of arrow wounds inflicted by the lurking enemy.

Reaching "the last big river before the Pánuco"—identified by Barcia (1723:30) as the "Tanipa"—the remaining Spaniards began building rafts for the crossing, believing they had outdistanced their pursuers. Their suffering appeared to be nearing an end. But their hopes were dashed as they saw a large number of canoes filled with Indians gliding down the river on the swift current. The Spaniards hastily concealed themselves in tall grass at the water's edge, but it, too, contained a lurking enemy: a swarm of ants. Their naked bodies unprotected from the stings, the Spaniards fled from the hiding place to throw themselves into the river. Thus they were delivered to their enemy (Dávila 1596:284–285). Most of the remaining Spaniards were killed.

The two lay brothers, Fray Juan de Mena and Fray Marcos de Mena (also blood brothers), were badly wounded. Fray Marcos, with seven dangerous arrow wounds, was left for dead in the river's shallows. Fray Juan took an arrow in the back. Struggling to keep up with the few other survivors, he collapsed and died before he had gone a mile.

The fate of Fray Juan Ferrer, who had prophesied the disaster before the ships sailed from San Juan de Ulúa, says Dávila, remained uncertain. He may have died in the river with the others. But Dávila considers the possibility that, in further fulfillment of his prophecy, he stole away to survive the onslaught and live out his days "hidden in certain remote places." In either case, his mysterious book of numbers was lost forever.

The Indians withdrew to a flat, open field a quarter league beyond the river, where they had a commanding view of the death scene, to await the appearance of any Spaniards still alive.

Unaware that the enemy still lurked, a miserable handful of castaways renewed their attempt to cross the river. Fray Marcos, in spiritual and bodily torment, arose from the shallow water to remove the seven arrows that had penetrated his emaciated body. Most painful was a wound that had pierced the tear duct of his right eye, obscuring his vision, but he managed to rejoin the others and was carried across the river. As they reached the opposite

bank, however, it seemed evident that the Dominican brother had but a short time to live. He was unable to walk; if the others carried him their pace would be slowed and everyone might be lost. The ultimate decision was difficult and seemingly heartless, but it saved Fray Marcos's life. They left him buried in the sand with only his face exposed, that he might breathe naturally until death took his last breath.

As the others walked on, the Indians fell upon them again, attaining what appeared to be complete victory over the naked intruders. But Fray Marcos remained, alive and undetected, in his premature grave.

The warm sand was a comfort to Fray Marcos's tortured body, helping to overcome the shock he had suffered as a result of his wounds and the chill from lying so long in the cool water. He fell into a deep and restful sleep, and strength seeped back into his body (Davila 1596:286–287).

On waking past midnight, he heard the murmur of Indian voices, but he was not seen. Throwing off the covering of sand, he raised himself and began walking through the darkness, still in dread of a fatal arrow. And then he came upon his companions who, after leaving him for dead, had been slain themselves. He fainted at the sight. Regaining consciousness, Fray Marcos walked aimlessly along the seashore, constantly moving his parched lips in prayers for his salvation, expecting at any moment to be called upon for an accounting of his life. He traveled without food or drink for 4 days. His wounds filled with maggots, and he became nauseous. One night, sleeping in the lee of a dry log for protection against the brisk sea breeze, he awoke to find his wounds being painfully attacked by sand crabs. He resumed his agonizing march in the darkness.

After hours of walking he came to a big river—the Pánuco at last—and lay prostrate at its edge to quench his devastating thirst. The water was brackish. He humbled himself in prayer, from which he raised his eyes to see on the other side of the river two Indians in a canoe. Not knowing whether they were friendly or hostile, he saw in either circumstance the promise of an end to his suffering; he would die at their hands or be carried by them to safety.

But then he realized that they were not armed. His voice too weak to shout, he beckoned feebly, then fell exhausted into the sand. The Indians rowed quickly to him. Placing a cotton cloth on the ground, they lifted him onto it, carried him to the canoe, and laid him down gently, his head pillowed on a sheaf of straw placed beneath the sheet. They poured fresh water through his lips and gave him *pan de la tierra* (a native bread made from the roots of the manioc plant). Three hours later, at eight o'clock in the evening, they put him ashore at the village of Tampico (Dávila 1596:288–289), where 2 years previously Fray Andrés de Olmos had founded the Mission of Tamaholipa (Martínez 1969:8). Wrapped in the cotton cloth the Indians had given him, he walked toward the village and knocked at the first

Spanish house. Fray Marcos's host gave him some clothing, then took him next day to Pánuco, where he recuperated before beginning the trip to Mexico City.

If time periods assigned by Dávila Padilla to various segments of the trek are credited, it must have been July by the time Fray Marcos reached the semblance of civilization on the Pánuco. The chronicler accounts for 42 days, without giving the time consumed in the march from the Río Grande to the Río de las Palmas, the longest stretch of the journey. Thus it appears that word of the disaster was received and preparation for the salvage expedition begun long before Fray Marcos was able to tell his story.

On June 4, the viceroy in Mexico City provided funds for Ángel de Villafañe to outfit a coastal reconnaissance to search for the wrecks. Ten days later—probably when Villafañe reached Vera Cruz—García de Escalante Alvarado received at the port town an allocation for making ready six vessels for the salvage effort (Alvarado 1555). At this time, from all indications provided by Dávila Padilla, Fray Marcos and his companions were still in the throes of the death march's final stage, between the Río de las Palmas and the Pánuco.

How, then, had officials in Vera Cruz and the capital learned of the disaster? The records so far discovered are singularly silent on the subject.

Conceivably, Antonio Corzo, in *San Andrés*, could have remained with the three doomed ships long enough at least to forecast their fate and to estimate from wind direction the point at which they would strike the coast. Since the time of his arrival in Havana does not appear, however, there is no indicator. Had the news been received first in Havana, it seems certain the salvage expedition would have been dispatched from there.

Furthermore, Corzo later was taken to task for failure to keep his ships together—an indication that his vessel was separated from the others some time before they went down off Padre Island.

The answer, therefore, must lie elsewhere; perhaps in a reinterpretation of statements made by Dávila Padilla and the assignment of meaning to other bits of evidence. The first statement to be reconsidered is that two small ships survived the disaster, one of them returning to Vera Cruz; the second, that the people who reached shore remained there "in a daze" for 5 or 6 days before setting out for Pánuco, encountering Indians for the first time 7 days after taking up the march.

These statements, coupled with two additional facts from documentary sources, allow certain inferences to be drawn. The first report of the disaster gave the latitude with remarkable precision (Quesada 1554), an indication that the position had been computed on shore by a mariner skilled with the astrolabe. Additionally, it is known that Francisco del Huerto, master of *San Esteban,* survived the disaster to continue sailing to the Indies as late as 1561 (Casa 1579, Huerto 1559). The time factor alone seems to rule out any possibility that he was among those following Fray Marcos's corpse-strewn

path to Pánuco. To have put the news in the viceroy's hands by June 4 he could have come by only one route: the sea.

By the time Dávila Padilla took down Fray Marcos de Mena's account of the death march, almost 30 years after the disaster, the old friar was drawing near the end of his life. His memory may well have been obscured by the years, as well as by the physical pain and mental anguish that attended the episode. Some details, therefore, quite probably became confused.

Where the chronicler relates that a small ship returned to Vera Cruz, it must have been a boat saved from one of the ships, rigged with a sail, and navigated by Francisco del Huerto. It probably reached Vera Cruz by mid-May.

The survivors, instead of remaining at the wreck site 5 or 6 days because of their dazed condition, must have been awaiting a rescue vessel sent by Huerto. In that case, nothing short of an immediate threat by Indians would have driven them away. Therefore, it appears likely that the first 7 days of their march—before the Indians came—were spent in effecting a reunion with survivors from the other ships, one of them 5 miles away, and perhaps in crossing to the mainland to seek a more comfortable campsite at which to await rescue. This would explain why they left without food—while taking cordage that would have been useful in constructing a shelter—and with inadequate clothing: They expected to return to the wrecks to get what they needed after their camp was established. The Indian attack would have changed their plans; their retreat cut off, they settled on the march to Pánuco as the only alternative.

Aside from Fray Marcos and the soldier Francisco Vázquez, any survivors must have been in the boat that Huerto sailed to Vera Cruz. Their names, or even their number, are nowhere found. One conclusion seems warranted: Neither the masters of the other two vessels nor those shipmasters known to have been passengers were among the survivors, for none of their names appears on later sailing lists.

Dr. Quesada's statement of July 15, 1554, that more than 250 persons died must have been made on the basis of Huerto's report. When Huerto left the wrecks, the people who reached the shore were still alive; the 250 must represent the number who went down with the ships.

The report picked up in Havana by Francisco Muñoz several months later, of 30 survivors, had come with news that the salvage had been completed; it therefore may be considered fairly accurate. That number must represent the survivors who had made it to Vera Cruz in Huerto's boat. Again the record is silent. It seems likely that Huerto would have taken as many women and children as possible; and, with such an assumption, Dávila Padilla's description of the massacre at the Río de las Palmas comes up for question.

On the basis of fragmentary evidence, we have estimated the total number of persons on the three ships at 304. If this figure is anywhere near

correct, Dávila Padilla's account of the number of persons involved throughout is highly exaggerated. If 250 persons drowned without reaching shore and about 30 reached Vera Cruz in the boat, those undertaking the march to Pánuco would have been about 26. It is conceivable that *San Esteban* and *Espíritu Santo* carried more passengers than we have credited, but, even so, it hardly seems likely that more than 200 remained after the Las Palmas crossing.

Fray Marcos de Mena, after recuperating at Pánuco, went to Mexico City, where surgeons examined his multiple wounds. They found them healed over with stone chips from arrow points still beneath the skin, to pain him throughout the remaining 30 years of his life. After 25 years of service in Mexico, he went to Peru with Fray Bartolomé de Ledesma, afterward bishop of Oaxaca, and died in Ciudad de los Reyes—later Lima—in 1584 (Dávila 1596:290). Dávila Padilla knew him and was influenced by him to join the Dominican order. The chronicler, only 22 years old when the old friar died, claims to have talked to him on many occasions. He found Fray Marcos inclined to regard as miracles the events related to his ordeal. Not until 1596 was Dávila's book containing the story published, and it may be inferred that the narrative itself was not put into final form until after Fray Marcos's death. If, in the writing, questions came to Dávila's mind, he was unable to go back to the source. Through the intervening centuries, various writers on the 1554 disaster have tracked Dávila's account without additional facts to enable interpretation, and therefore have been unable to add to it significantly.

As for Francisco Vázquez, said to have provided details of the story of Fray Diego de la Cruz and Fray Hernando Méndez, Dávila says he returned to the wreck site to be found there by a salvage vessel a few days after his arrival. Barcia (1723:31) adds that Ángel de Villafañe found him in hiding on shore and that he was returned happily to Mexico, "giving many thanks to God for his liberation from such perils." Yet again, the extant documents are silent. The salvage report fails to mention him.

Part II

BROAD HORIZONS

They that go down to the sea in ships, that do business in great waters; these see the works of the Lord, and his wonders in the deep. For he commandeth, and raiseth the stormy wind, which lifteth up the waves thereof. . . . they cry unto the Lord in their trouble, and he bringeth them out of their distresses. He maketh the storm a calm, so that the waves thereof are still. Then are they glad because they be quiet; so he bringeth them unto their desired haven.

—PSALM 107:23–30

The sixteenth century, partly because of the discoveries of the fifteenth, was an age of ferment. Columbus had opened the door to an unknown half of the world. The decades that followed his discoveries were dedicated first to further exploration and discovery, and then to exploitation and development.

During his lifetime, Columbus glimpsed no more than the fringes of the vast new world he had found. He died on May 20, 1506, still holding Cuba to be a peninsula of the Chinese mainland (Morison 1942:669, 465). Not until 2 years later, with the island's circumnavigation by Sebastián de Ocampo, was definite proof offered to the contrary (Winsor 1884:201). Beyond this "cork in the bottle" lay an immense gulf whose shores encompassed wealth as yet undreamed of.

With the subsequent conquest of Cuba by Diego Velázquez in 1511, it was destined to become a springboard for Gulf of Mexico exploration and the Mexican conquest. Events and concerns in Europe, however, were vitally to affect the course of New World developments. Early settlement of Hispaniola (Santo Domingo), had whetted Spanish appetites for wealth from the Indies. They were to be sharpened further by discoveries on the Central and South American mainland, called Tierra Firme, as well as in Mexico. In the Spaniards' cupidity, and the promise of its fulfillment, lay the makings of economic and maritime revolution.

With the Spanish discovery of America and the opening of a new route to the Far East by the Portuguese, European commerce expanded from continental and Mediterranean in scope into an unprecedented system of world trade. The civilized world was grossly unprepared, as it usually is for momentous developments, to seize the opportunities the discoveries offered. Mercantile traffic, predominantly overland to this point, now extended across an unknown ocean for which there were no maps or charts. Galleys and clumsy sailing barges of 100-ton capacity or less, although generally adequate for European continental trade, were far from suitable for the transoceanic commerce so suddenly in prospect.

But, throughout history, mankind most often has risen promptly to great challenges. Western Europe, having emerged from the Dark Ages with renewed thirst for knowledge and adventure, was ready for a giant leap. Carracks and galleons soon challenged the secrets of the outer seas. "The shores of the Atlantic became the centre of international exchange, and the commercial hegemony of Europe passed from the cities of Renaissance Italy to the maritime states in the west. . . [Haring 1918:xi]."

Virtually all the commerce with the New World in the sixteenth century flowed through Spain. Only toward the end of that period did the northern maritime nations—France, Holland, and England—rouse to the possibilities afforded by possession of colonial empires in America.

In the two preceding centuries the lack of precious metals to meet the requirements of an expanding trade had been felt severely in Europe. When cargoes of gold and silver began in the early sixteenth century to pour in from America, in quantities out of all proportion to existing practical needs, the result was an economic revolution of considerable moment.

Spain applied herself to the task of colonization with profound seriousness, extending her faith, language, law, and administrative techniques to her overseas realm. She endeavored to make the colonies an integral part of the Spanish monarchy, building churches and monasteries, founding schools and universities. Trade and navigation were organized with the same meticulous detail as social and political institutions.

It is little short of amazing that she succeeded as well as she did. Well-rooted domestic problems and international squabbles, decades or centuries in the making, refused to take a back seat to Spain's efforts abroad, and rulers refused to let them. One priority often interfered with the other. In the short-term view, the colonies took the short end. But in the long spectrum the mother country, too, found that she had paid a heavy price for her efforts to defend an empire of global proportions.

The very broadness of its horizons confounded the age. Its complex characteristics bore most directly on the fate of Captain-General Bartolomé Carreño's outbound fleet of 1552 and the four ships that sailed from San Juan de Ulúa on April 9, 1554, into the teeth of a gulf storm.

Chapter 4

RULERS OF THE REALM

Behind the tragedy of the three Spanish vessels wrecked on the Texas coast and the torment endured by the survivors lay a number of contributing factors characteristic of the age: the greed of merchants; the rashness of mariners; the jealousies of kings. Perhaps even, as Fray Agustín Dávila Padilla would have us believe, the wavering dedication of priests.

Spain herself lay, like a bumbling adolescent, in the grips of change, as a result not only of the discovery, but of other complex factors as well. Through masterful intrigue, Juan II of Aragón in 1469 had arranged the marriage of his son Ferdinand with Isabella of Castile. With Ferdinand's ascension to Aragonese rule 10 years later, the two kingdoms were united and the fusing of many independent states into a political unity was begun. The plot by which Henry IV of Castile had been blackmailed into disclaiming paternity of his daughter Juana to make his sister Isabella his successor led to years of bitter civil war before Ferdinand and Isabella finally defeated Juana's Castilian supporters and her husband, Alfonso V of Portugal.

Also a legacy of the union was Aragón's long-standing enmity with France, which was to be carried on during a large part of the early and middle sixteenth century. The French corsair attacks on the Spanish fleets of Carreño and Farfán in the 1550s stemmed from this traditional rivalry.

Ferdinand and Isabella ruled jointly over their two kingdoms, but the fact represented only a start toward national unification. By various means

Ferdinand maneuvered both clergy and nobility into his orbit. Yet the stability of noble property was carefully safeguarded, and the Council of the Inquisition was established in 1483 by papal bull to deal with the supposedly evil influence of the sizable population of Jews and *conversos* (converted Jews). After more than 700 years of Moorish occupation, now nearing an end, Spaniards saw themselves as traditional defenders of Christianity against the infidel.

The year 1492 was important for more reasons than Columbus's discovery. At the urging of the Inquisition, some 170,000 Jews who refused to be baptized as Christians were expelled from the country. Also in that year, the last Moorish stronghold, at Granada, was conquered after a final 10 years of conflict. In recognition of these achievements on behalf of Christendom, the pope gave Ferdinand and Isabella the right to call themselves "the Catholic kings."

Ironically, by persecution of the Jews, Spain deprived herself of her economically most active citizens and opened her doors to exploitation by German and Italian financiers. And many thousands of *conversos* remained to exert a vital influence on Spanish history. Their blood was already fused with that of nobility, even royalty, thereby mocking the Spanish concern for *limpieza de sangre*—"blood purity"—so prominent during the sixteenth and seventeenth centuries. The *conversos* continued to play a significant role in every part of Spanish religious and intellectual life. From their number came some of the country's foremost literary figures and churchmen, not the least of whom was Bartolomé de las Casas, the champion of the American Indians and historian of the Indies.

Moorish influence, too, was outstanding, especially in the visual arts and architecture. Many of the buildings remaining from the Spanish colonial period in the Americas reflect a strong Moorish influence. The effect is most pronounced throughout southern Spain.

By the early sixteenth century the union of Aragón and Castile was showing remarkable strength. With the acquisition of the Kingdom of Naples through Ferdinand's diplomacy and show of military might, Spain at last rivaled France as the most powerful state in Europe. Ferdinand had reinforced his diplomatic position against France by marrying his daughters to the heirs to three other thrones. Catherine of Aragón became first the bride of England's Prince Arthur, then of Henry VIII. Juana of Castile (La Loca) was wed to Philip, the Hapsburg prince who ruled the Burgundian Netherlands. Another daughter, Isabella, went to Portugal as the bride of Alfonso, who died a few months later, and her sister María was wed to Manuel the Fortunate, who occupied the Portuguese throne from 1497 to 1521 (Merriman 1918:265).

These marital linkages had far-reaching implications. Descendants of Ferdinand and Isabella came to rule not only over the Holy Roman Empire but also in many European countries. Over the next century, Spain's interna-

tional relations were often complicated, or mitigated, by kinship ties of the royal family. On the death in 1504 of Isabella—who had pledged the resources of her own kingdom of Castile in support of Columbus when Ferdinand demurred—Juana and Philip ruled briefly in Castile. Their son Charles ascended to rule over all the Spanish kingdoms and the Holy Roman Empire, and it was his son Philip II who married England's "Bloody Mary," daughter of Henry VIII and Catherine of Aragón, the scourge of English Protestants. Another grandson of Ferdinand and Isabella succeeded to the Portuguese throne in 1521 as John III, and his sister Isabella, pledged to a marriage of expediency, nevertheless became the devoted wife of Emperor Charles V, her first cousin.

On the death of Queen Isabella in 1504, her son-in-law Philip I ascended to rule over Castile with the support of both Bergundian and Castilian nobility. Ferdinand was forced to accede but found himself again the uncontested ruler on Philip's death in 1506, his daughter Juana declared unfit for rule because of mental illness. In 1512 Charles was designated regent. But Charles had never been to Spain, having lived all his life in the Netherlands under the tutelage of a Hapsburg aunt; it was provided that his younger brother, Ferdinand, should take his place. Young Ferdinand, having been reared in Spain, was the favorite of the elder Ferdinand, who entertained hopes of making his namesake his successor. Only on his deathbed did Ferdinand the Catholic relinquish this wish, reluctantly acknowledging Charles as rightful heir to the Spanish throne.

Following the old ruler's death in January, 1516, Charles, still in the Netherlands, was proclaimed Catholic king at age 16 to serve jointly with his incompetent mother, Juana, who was confined because of her insanity in the Castle of Tordesillas (Merriman 1925:4–14). Spanish rule thus passed into alien hands. The young ruler of the Netherlands and heir to the Hapsburg dominions in Austria and South Germany, who neither spoke the language nor cared very much for things Spanish, delayed his coming until September, 1517, when he assumed the Spanish throne as Charles I.

The following month, an Augustinian priest and theology professor named Martin Luther nailed his 95 theses to the church door in Wittenberg, signaling a movement of vast implications: The Reformation (Lewis 1931:6). Thus was born the major social and religious concern of the century, as well as one of the many upsetting influences of Charles's reign. Charles had prospects for power that were unprecedented. His grandfather, Maximilian I, was the Holy Roman Emperor, and Charles seemed the most likely candidate to succeed him. The kings of Denmark and Hungary were his brothers-in-law, the rulers of England and Portugal his uncles (Merriman 1925:37). Yet the young monarch faced an ominous future.

Despite his high connections, Charles failed to win ready acceptance among Spaniards. His unprepossessing qualities, so disappointing to both his grandfathers, concealed whatever potentialities he might have had for great-

ness. Most unattractive in appearance, he was bug-eyed and jut-jawed. The peculiar shape of his lower jaw occasionally caused his mouth to hang open, giving him the air of an imbecile. This deformity also made it impossible for him to chew his food properly. In combination with his ravenous appetite, it afflicted him with digestive difficulties during most of his life, a concomitant of which was an unhealthy palor. Another result of this deformity was a stammering speech that exacerbated his linguistic limitations. His accomplishments otherwise were far from impressive, although he had a fair knowledge of history and a love of music and the chase (Merriman 1925:11) and was a jousting enthusiast.

Spaniards, eager at the prospect of having their king serve as emperor, were just as quickly disenchanted with the realization that it meant they would have an absentee ruler. Charles was to spend in Spain no more than 16 of the 40 years of his reign. He departed Spain for the Empire in 1520, more unpopular than on his coming. Civil discord and revolution followed in the wake of his departure. Indeed, the communes of Castile had begun their revolt before Charles was well out of the kingdom. Their grievances centered around the king's leaving the country; a tax *(servicio)* levied for the king's support; and the assignment of foreigners to fill key positions in government during his absence. Charles's Spanish subjects, quite simply, demanded a more nationalistic stance than his new post permitted of him.

His ascension as Emperor Charles V was accomplished by bribery, a common method of the times. Word of his election reached him on July 6, 1519 (Merriman 1925:43). It is significant that Hernán Cortés already had founded Villa Rica de la Vera Cruz and 10 days later dispatched a ship to Spain bearing letters to the emperor and a present of Mexican gold. The conquest of Central Mexico, which Cortés was getting ready to launch, came most opportunely, the unexpected present to the king even more so—just in time to save the monarch from bankruptcy. "It was the first real indication of the wealth of the Indies, a foretaste of the way in which the preponderance of the Hapsburgs in the Old World was to be supported by the resources which they could draw from the New [Merriman 1925:45]."

Charles V repeatedly found himself relying on shipments of gold and silver from Mexico and Peru to extricate him from financial difficulty. In gaining the emperorship, he had made an implacable enemy of the French king François I, his disappointed rival for the exalted post. Charles fought four wars with François and one with his successor, Henry II. The first erupted in 1521, and French corsairs lost little time in laying traps for Spanish ships returning from the New World along the approaches to their home port of Sanlúcar de Barrameda. The first serious loss of treasure from the Indies occurred the same year, when two caravels carrying another shipment of Aztec plunder from Cortés fell to the French privateers (Haring 1918:69).

There were four principal causes for Charles's wars with the French, some of which had little to do with Spain itself. First was the ancient rivalry over the Burgundian lands, which had been divided between the Valois and the Hapsburgs. Next was the resentment François I bore over losing the 1519 election to Charles. Third was the contest for hegemony in Italy, a continuation of the rivalry that had existed between France and Spain under Ferdinand the Catholic. And, finally, there was the quarrel over the possession of Navarre, which had been incorporated into Castile in 1512 over the strident protests of Louis XII and François I. These four causes were aggravated by France's awkward geography, which formed an irritating division of Charles's dominions (Merriman 1925:222).

France was but one of three enemies Charles had to deal with as king of Spain and Holy Roman Emperor. There also were the Turks, against whom Spain had to defend southern Italy and the Spanish south coast, and whom they fought in North Africa and on the eastern borders of the empire. The German Protestants comprised the third enemy. Luther's 95 theses were translated from the original Latin into German and various other languages for distribution throughout Europe. The scholarly priest, finding himself the center of a great church controversy, publicly burned in Wittenberg a copy of the papal bull threatening him with excommunication. Charles V in 1521 convened German princes, nobles, and clergy in the Diet of Worms to demand that Luther retract his heretical statements. Luther refused, unless his statements were shown to be "contrary to Holy Scripture or to plain reason." In March of 1522 he began the organization of his new church, and the Reformation moved forward, adopting as its "battle hymn" the one Luther had written to commemorate his followers who were burned for their beliefs:

A mighty fortress is our God,
A bulwark never failing. . . .

Charles V, his attention focused on myriad other foreign and domestic problems, was unable to devote enough energy to the fight against Protestantism, and was helpless to stop its spread. He had openly declared against heresy at Worms and later sanctified the burning of Lutherans in the Netherlands (Merriman 1925:129). But, probably because of the many other demands upon his resources, he failed to instigate timely action with sufficient forcefulness to stem the Protestant tide. When at last, toward the end of Luther's life and the termination of his own reign, Charles undertook serious efforts to suppress the movement, he found it too well entrenched. He nevertheless began the persecution of Protestants in the Netherlands and Spain, to be carried on by his son Philip.

In fighting his numerous enemies, Charles largely employed Spanish troops, paid for with Spanish treasure. His excessive demands on the

considerable wealth pouring in from the Indies caused the cargo of the three ships lying partially submerged off Padre Island to assume added significance.

Numerous events and circumstances of Charles's reign serve to reveal the nature of the times. Charles himself enjoyed jousting as a sport, and the art still had practical applications on the field of battle. When he proposed settling his differences with François I of France in personal mortal combat, he apparently was suggesting a jousting match.

The emperor himself led troops in battle: in the successful siege of the pirate Barbarossa's stronghold at Tunis, the disastrous assault on the Turks and Moors at Algiers, and in the rout of Lutheran forces under the Elector John Frederick of Saxony at Muhlberg.

Military leadership often was for sale to the highest bidder, as evidenced by Charles's wooing the famed Genoese Admiral Andrea Doria from his old rival François I and his attempt to do the same with Barbarossa, in the service of the Turkish sultan.

A sign of the times is seen, too, in the treatment accorded leaders of the Castilian and Andalusian rebellions that marked the early years of Charles's reign. The foremost offenders of the Andalusian Germanía were drawn and quartered—as were the mutinous captains of the Magellan expedition—whereas lesser offenders were hanged.

While the proper punishment of Antonio de Acuña, bishop of Zamora, for his role in the latter uprising was being debated by king and pope, the subject attempted to gain his freedom by murdering his guard. Charles forthwith ordered his execution, not waiting for papal approval. He then declined to take communion until the approval was granted (Merriman 1925:121).

Perhaps a most significant indicator of the period is the practice of employing well-planned marriages as an instrument of power. It was an age-old ploy, used by the Catholic kings as well as by Charles V. A corollary of this device was intermarriage of close relatives to the extent that it became genetically hazardous. Spain, in time, was to suffer the consequences.

An assumption that Juana la Loca was the victim of such may not be entirely accurate, but members of the royal families of Castile and Portugal had been marrying each other for generations. Charles himself, having already begotten at least two illegitimate children—after the fashion of kings and popes of the period—married his first cousin, the daughter of his mother's sister María and Manuel the Fortunate of Portugal. His sister Catherine married his wife's brother, Portugal's King John III. Charles then arranged the marriage of his son Philip II to Catherine and John's daughter—Charles's own niece as well as his wife's. The fruit of such inbreeding is difficult to assess, but one supposition is that it may be seen in Charles II, Philip's great grandson. All four of his paternal and three of his maternal great grandparents were direct descendants of Juana la Loca. His

reign, 1665–1700, was the nadir of Hapsburg rule, as he was called El Hechizado, "the Bewitched" (Gibson 1966:161).

Kinship between monarchs, either by consanguinity or by marriage, however, was no guarantee of harmonious relationships. Charles, after releasing François I of France as his prisoner of war, consented for his widowed sister Eleanor to marry the French monarch. She was welcomed in France as one of the authors of the peace, and with the pledge of its preservation, but Charles and François lost little time in renewing their hostilities (Merriman 1925:253).

In leading the assault on Tunis, Charles cast himself in the role of God's standard bearer, yet he permitted his troops the customary 3 days of plunder following the capitulation. The outrages that occurred, says Merriman (1925:317), "were rarely exceeded in the sixteenth century."

Otherwise, nothing in any of these episodes and circumstances suggests that Spain was more barbarous or less civilized than any other European nation of the day. These instances are cited only to emphasize that the period was somewhat different from our own.

Even in this seemingly barbarous age, there were stirrings of compassion within the Spanish breast. Indeed, some of the concerns of that era bear a marked similarity to this. About 1551, for example, steps were taken to outlaw the possession of swords and daggers because of the proclivity of persons so armed to do each other in. The Spanish Cortes, observing that heretics customarily were put to death by shooting them with arrows, pointed out that such a method often caused a painful, lingering death—"cruel and unusual punishment." To end this cruelty, it was suggested that the victims should be strangled before they were shot. Even the bullfight was petitioned against, because "it often results in men's deaths and other misfortunes." But even the king who had been reared outside Spain and had difficulty with its language knew better than to heed that plea (Merriman 1925:178–180).

It was, beyond question, an exciting, vibrant age. Despite Charles's failings, there is much about him to admire. The picture of the 18-year-old ruler acting decisively to send Magellan on the first circumnavigation of the globe, when Manuel of Portugal had lacked the vision, brings a tingle to the spine.

Two months after Magellan's departure, Charles was elected Holy Roman Emperor. His departure for the empire occasioned rebellions in Spain that rocked the kingdom. But shortly after Charles returned to Spain, in 1522, Juan Sebastián del Cano, having left Magellan—the victim of his own valor—dead in the Philippines, sailed the one remaining vessel back up the Guadalquivir to Seville. It was the greatest sea voyage of all time, having taken 1 month over 3 years. For Charles V, the most outstanding benefit was psychological. It strengthened his conviction that he was destined to rule the world.

During the same period, Hernán Cortés had conquered Mexico, far exceeding the authority granted him by the Cuban governor, Diego Velázquez. When the deeds of the conqueror were called to question, also in 1522, the emperor upheld him, naming him governor and captain-general of the conquered territory and forbidding further interference by Velázquez and the influential Bishop Fonseca. In so doing he attached a priority to the conquest of New World kingdoms, and on such decisions the future of the Americas, as well as Spain, depended. Had he denied Cortés, he would have found it impossible to follow the course he later pursued in Europe.

It was the same when, 5 years later, the emperor was petitioned personally by Francisco Pizarro at Toledo for authority to conquer the Inca civilization Pizarro had discovered in Peru. The sovereign unhesitatingly made him captain-general and adelantado, then set out for Italy to pursue more pressing matters. But Pizarro had the commission he needed for the conquest that would bring still further riches home for the emperor to squander on his ponderous royal apparatus and the never-ending wars of empire and kingdoms. The first ship bearing tidings of the conquest and a sizable sample of Peruvian gold reached Seville on December 5, 1534 (Winsor 1884:II, 512–520).

"Had Charles not had a series of fresh windfalls during this period, as a result of the conquest of the Empire of the Incas," says Merriman (1925:158), "his treasury could not possibly have stood the strain." From the peace of Cambray in 1529 to the death of François I in 1547—18 years—there were only 5 years of actual fighting with France, and most of that on the borders of France and the Netherlands, more European than Spanish in interest. But the use of Spanish gold and Spanish troops continually increased. The emperor took large numbers of Spanish soldiers to Italy in 1529; to the French Mediterranean province of Provence in 1536; to the Danube against the Turkish invasion of 1532; to the French channel province of Picardy in 1543–1544; and to Muhlberg in 1547, against the Lutherans. "Never before had so much money been sent out of the realm."

Before the end of Charles's reign, Castile had fallen into the position of having to shoulder most of the burden for maintaining Spain's Italian possessions, creating further drains on the influx of American gold and silver. At the same time, the emperor conducted large-scale naval warfare against the Turks in the Mediterranean and in North Africa. Spanish gold and Spanish soldiers were requisitioned for the purpose. Even so, the record is more one of failure than of success. Spain's mounting power and prestige under Charles V were counterbalanced by her enforced assumption of new duties and responsibilities. Her increased resources had to be applied almost exclusively to what her monarch regarded as his most serious responsibility—the wars against different enemies for the maintenance of Hapsburg supremacy in Western Europe (Merriman 1945:347, 349).

Charles V was undoubtedly responsible for shaping the course, to a

degree, of future Hapsburg rule in the peninsula. In 1543, when he found it necessary to depart for the empire and the Netherlands, he entrusted his son Philip with the regency of Spanish realms. It was Philip, therefore, who received reports on preparations for the 1552 sailing to the Indies and issued the necessary orders for seeing the 54 ships under Captain-General Bartolomé Carreño on their way to the New World (Philip 1552a,b,c). And it was to him that reports came back of the multiple disasters that befell them.

As the ships lay in the harbor at Sanlúcar de Barrameda, taking on cargo and provisions for New Spain and Tierra Firme, Charles V was enduring one of the bitterest periods of his life. Henry II, son of Charles's old nemesis François I, had formed a liaison with the Lutheran forces under Maurice of Saxony and had invaded Lorraine in the interest of German liberty, penetrating to the Rhine River. Charles's brother, Ferdinand, determined to succeed him as emperor, entered into negotiations with Maurice with a majority of German princes present. Much to Charles's displeasure, most of the Lutheran demands were granted. Charles turned in anger to drive Henry from Lorraine, only to reach a stalemate at heavily fortified Metz.

In Italy, meanwhile, the emperor's Sienese protégés had risen against the rule of his governor, driven him out, and allied themselves with the French. Naples was threatened by a Turkish fleet sent by Sultan Suleiman, who had renewed his alliance with the French crown, and Suleiman himself had advanced into Hungary. But the sultan, beset by troubles at home, was forced to withdraw (Lewis 1931:186–191).

Charles, feeling himself near the end of his effectiveness, at last conceded Ferdinand's desires to succeed him as emperor, and made arrangements to hand Spain and the Netherlands over to Prince Philip. But first he hoped to see his cousin Mary Tudor on the English throne, and Philip wed to her, thereby providing for a Hapsburg heirship to the English crown. While our four ships lay at anchor at San Juan de Ulúa, the marriage arrangements proceeded through Charles's ambassador Simón Renard. The marriage treaty was signed on January 12, 1554, and ratified on February 6. Charles continued to direct maneuvers from Brussels until Philip went to England for the wedding, leaving his sister Juana as regent of the Spanish realm. He met his cousin, who was eleven years older than he, and, on July 25, 1554, sacrificed himself to a marriage of policy (Merriman 1925:386–387, Lewis 1931:290–292).

In the interim, the three ships had wrecked on the Texas coast, the passengers and crew who reached shore had endured suffering and death on the march toward Pánuco, and expeditions had reached the wrecks to salvage the treasure so badly needed for the royal treasury.

Charles himself, aging and in declining health, was unable to find peace. The French war, begun in 1552, continued, and, in April 1554, three French armies simultaneously invaded Artois, Flanders, and Luxembourg. Charles was so short of money that he had to delay troop mobilization for 15 days to

avoid the expense, while Antwerp rioted over a defense tax imposed on beer. But at last Charles set out on his final campaign to drive French troops under Henry II from Flanders. His generals, meanwhile, routed a French force near Siena and penetrated French Picardy. A 5-year truce was negotiated the following year, only to be destroyed by Pope Paul IV, who, holding a grudge against Charles, fomented new hostilities in Naples in September 1556. Determined Spanish response, however, brought the Pope to terms and ended the French struggle for a foothold in Italy, though the war continued elsewhere until 1559 (Lewis 1931:301–303).

Charles's reign as Spanish and Netherlands ruler had come to an end in January 1556, as he abdicated in favor of Philip. He retained the title of emperor, however, until the electors could meet and name his brother Ferdinand in May 1558, 4 months before Charles's death.

As for Mary and Philip, her prince consort, the longed-for heir failed to materialize. The English were disenchanted with Philip from the start, and Philip with the whole arrangement. Mary saw her own devotion to her husband wasted. Half Spanish by heritage and thoroughly Spanish by upbringing, she pursued a policy that, in the eyes of her subjects, was more Spanish than English. But it was not the policy that Charles had urged upon her.

Philip left England and Mary early in 1556 to begin his reign. Mary, suffering physical illness and neurosis, dragged England into the Spanish quarrel with France and lost Calais, the last English foothold on the continent. The resulting loss of her subjects' loyalty perhaps caused her health to deteriorate further, and she died just two months after Charles (Lewis 1931:295).

On his accession, Philip II inherited an unfinished war with France and a debt of 20 million ducats. Spain's financial position seemed hopeless, and Philip's governments in both Madrid and Brussels had to declare a moratorium on their debts—and not for the last time during his reign. The remainder of Hapsburg rule in Spain was marked by a growing disparity between imperial policies and resources. Increasing treasure shipments from the New World inspired the hope of the king and his creditors for a reversal, but military undertakings continued to swallow up more than was being received.

With Philip away seeing after the wind-up of the war, his sister Juana continued to serve as Spanish regent, frequently seeking her father's advice, particularly on financial matters, for demands continued to exceed the treasury's resources. Charles, gout-ridden, asthmatic, and concerned for his soul, had retired to spend his final days in meditation at the mountain monastery of Yuste. There, in answer to one of Juana's appeals, he issued, in 1557, an order particularly reflective of the Spanish condition in relation to its New World colonies: All money from the Americas (apparently including pri-

vate treasure) must henceforth be applied to the treasury's needs (Lewis 1931:316).

But the old monarch's primary concern was for his own salvation. On his orders, four masses were said daily, in addition to the regular one—three of requiem, for his wife, his mother, and his father, and another, not of requiem, for himself. Then, after consultation with his barber and his confessor, he had his own mass of requiem made, as though he were already dead.

Almost immediately afterward, his health worsened, and he spent his final days rectifying all earthly matters—including providing for his bastard son—constantly attended by clergy. Then, in the early morning hours of September 21, 1558, clutching his wife's crucifix to his breast, he died (Lewis 1931:319–322).

Chapter 5

THE TRACERY OF TRADE

On November 4, 1552, the day our four ships sailed from Sanlúcar de Barrameda with Captain-General Barolomé Carreño's fleet, the regent Prince Philip issued orders for printing a new set of regulations governing Indies navigation. The orders came too late for the 1552 sailing, and thus could not have prevented the multiple disasters of 1554.

Since Columbus's discovery, numerous royal cédulas had sought to regulate navigation between Spain and her New World possessions. At first, these comprised only the Antilles islands. The commerce was governed by various commissions entrusted to the king's favorites, most notable of whom was Juan Rodríguez de Fonseca. This cleric, then archdeacon of the Holy Church of Seville, later became bishop of Burgos and head of Council of Castile.

American trade was first put on an organized basis on February 14, 1503, with creation of the Casa de Contratación ("House of Trade"). Its purpose was control and encouragement of Indies commerce. Since the new discoveries were considered the exclusive possession of Castile, that kingdom's wealthiest and most populous city was chosen as the seat of the casa. All the New World commerce had to pass through the casa. Hence, even though mariners by no means considered it the ideal port, Seville became the dominant center for trade with the Americas. It lay 20 leagues from the sea, and access was over the dangerous bar at Sanlúcar and thence up the narrow, tortuous channel of the Guadalquivir River.

As discoveries multiplied and trade burgeoned, the size of ships increased accordingly, thereby aggravating the problem. Instead of vessels of 100 tons burden or less, many of 200- and even 300-ton capacity were soon plying the ocean sea. The larger ships had difficulty negotiating the river channel, and many were forced to unload half their cargo 8 leagues below Seville. Delays of a month or more often resulted. In 1508, therefore, permission was granted for ships to load and register cargoes at Cádiz and Sanlúcar, under the watchful eye of a casa inspector. Still, ships bearing treasure from the Indies had to return to Seville (Haring 1918:8, 9). Not until 1717 was the casa finally moved to the deeper seaside port of Cádiz.

The increased commerce resulting from New World discovery presented challenges far exceeding those resulting from the lack of geographical knowledge and navigational technology, although these limitations were challenging enough in themselves. The problems also went beyond the sudden demand for more ships and crews. In short, the sudden rise of trade called for an extensive management apparatus to regulate and govern the system, while providing protection from abuses and avoiding unnecessary hazards. By 1552, enough mistakes had been made and frauds perpetrated that the needs—at least in terms of the concerns peculiar to Spain—were well understood. Previous regulations still in effect were brought together, their inadequacies recognized, and an effort made to correct and augment them with half a century of experience as a guide.

The 1552 *ordenanzas,* therefore, took on the semblance of permanence. Prince Philip's order granted to Andrés de Carbajal the exclusive right to print the document and, after 50 copies had been supplied for royal officials, to sell it for 4 years. Reprinted in 1585 and 1604, it became the basis of Book Nine of the Laws of the Indies (Haring 1918:32; *Ordenanzas Reales* 1604).

Conquering and settling two continents, provisioning the colonies, and returning their produce to Spain posed severe logistical problems for the Spanish government. Only private enterprise could meet such challenges; the inducements of free trade were an essential ingredient, even though the Crown saw fit to subject it to rather minute regulation. The Casa de Contratación, as the first administrative body created to attend to such concerns, expanded over the years into a sizable bureau. Its character was essentially commercial. Charged with carrying on the Crown's trade with the colonies, it gathered into its warehouses the merchandise and naval stores required for such commerce, as well as the raw materials brought from the Indies in exchange.

Casa officers kept close watch on the needs of the new settlements, maintaining close correspondence with royal agents in the colonies. They were concerned with the availability of suitable ships and crews, and had to be informed of current market conditions in order to buy and sell at greatest advantage. Theirs, too, was the responsibility for keeping accurate records of

all such transactions (Haring 1918:22). But they were explicitly forbidden from engaging in New World trade themselves.

With the wars of Charles V creating demands for Indies treasure faster than new conquests could provide it, the royal treasury was continually strained. The proper and efficient conduct of American commerce, therefore, was a matter of paramount concern. From the beginning, the casa officers were instructed to choose shipmasters and pilots carefully. Each master was given detailed written instructions for his voyage. The regulations, somewhat stringent from the start, became more so with each revision and expansion.

The first revamping came the year following the casa's founding. These rules, applying to all who were concerned in any way with the Indies, spelled out the office hours of casa officials, classes of prohibited merchandise, emigration laws, and the manner of disposing of property of persons dying on shipboard or in the colonies (Haring 1918:28). Each reissue contained new considerations and reinforced old ones.

In 1510, the functions and general administration of the casa were defined, giving it the form it was to retain until the eighteenth century. In 1524, the agency was made subordinate to the newly created Council of the Indies, but its basic responsibility and authority remained unchanged. It was a governmental department encompassing a ministry of commerce, a school of navigation, and a clearinghouse for colonial trade.

Further ordinances, issued in 1534, 1536, and 1543, had more to do with armament, provisioning, and manning of ships than with the administration of commerce. Then, in 1552, all the laws promulgated for the casa to that time were brought together. They included those dealing with the duties and qualifications of merchants, passengers, masters, sailors, and bankers, as well as the general rules of administration for the Casa de Contratación (*Ordenanzas Reales* 1604). It was perhaps symbolic that, on the day that Carreño's fleet set sail for the Indies, Prince Philip ordered the printing and dissemination of the new *Ordenanzas Reales.*

Had the new compilation been available to Carreño and the masters, pilots, and captains of his armada and merchant fleet, and had they been adhered to, some of the disasters might have been averted. Yet regulations on the books since 1510 were being evaded, and it is likely that the 1552 ordinances also would have been. For example, earlier cédulas stipulated against overloading of vessels to the point of interfering with the working of sails and artillery. But the ships of Carreño's armada were so heavily burdened that "they could neither fight nor navigate [Perpetuo 1553]." Hence, losses were occasioned to the French corsairs and perhaps to heavy seas as well. There is also a suggestion that decks cluttered with cargo, contrary to regulations, may have been responsible for the fire that destroyed Carreño's flagship with heavy loss of life.

Measures for preventing the use of unseaworthy vessels in the Indies

trade were prescribed in the ordinances of 1534 (*Colección de documentos* 1864–1884:XXXII, 493–494). Yet, according to Perpetuo, many of the ships in Carreño's fleet were not capable of withstanding the pounding of heavy seas, and insurance practices encouraged use of unseaworthy vessels in disregard for the safety of passengers and crews. Whether the blame belongs solely to the shipowners, who might have contrived to dupe the inspectors, or was shared by the officials is a matter for conjecture.

Heavy penalties were prescribed for violation of the ordinances. A master guilty of overloading his vessel could be fined and deprived of his license, and the excess cargo confiscated. Gold or silver brought from America unregistered or without the royal stamp could be confiscated, and the smuggler fined up to four times the shipment's value. To aid detection of such violations, a third of the confiscated goods and fines usually went to the informer. Yet even the promise of such rich rewards failed to check evasion of the ordinances.

By 1552, the casa had a chaplain and a chapel wherein masses were celebrated for the souls of those who died at sea. It also had a priest for receiving offenders sent home from the Indies or those brought before the casa officials for judgment. The casa had expanded into an elaborate and powerful institution. Nothing could legally be sent to or brought back from the Indies without the consent of its officers. Spanish merchants to whom bullion was consigned in payment for merchandise shipped to the Indies could receive it only after the casa released it.

The casa controlled and regulated the character of ships, crews, and passengers. It could impress carpenters, smiths, caulkers, and other workmen to repair and fit vessels for Indies voyages, paying them a just wage. The agency saw to the administration of all the laws and ordinances relating to trade and navigation with America. It had the right, and the obligation, to bring before the king anything it deemed necessary or beneficial to American commerce. The casa's importance is attested by the fact that it was one of the richest sources of revenue for the royal treasury. "Its functions," says Haring (1918:35), "were clearly determined, and its place in the political economy of the Spanish monarchy justified by fifty years of continuous and efficient service." With implementation of the 1552 ordinances, the Casa de Contratación was essentially complete; but its economic importance to the Crown continued to mount.

In 1508, a hydrographic bureau and school of navigation was established in the casa, under direction of the pilot major (a post first occupied by Américo Vespucci). The extent to which actual navigational instruction was offered, however, is unknown. The 1552 ordinances indicate that the pilot major's principal function was, with the help of experienced pilots and cosmographers, to examine pilots and masters to determine their fitness for sailing to the Indies. He was not permitted to give instruction in preparation

for the test. That function was assigned elsewhere (*Ordenanzas Reales* 1604:nos. 128–130).

When functioning as a court of law, casa officials sat in cases involving infractions of its regulations, in disputes between merchants and mariners of the Indies trade, and as a civil tribunal. It had complete civil and criminal authority in cases of barratry—a fraudulent breach of duty by shipmaster or mariner to the injury of shipowner or cargo. Sentences were carried out by the king's ordinary justices of Seville or elsewhere. All civil suits involving the royal exchequer or rules governing American trade and navigation were to be heard by the casa alone. The Council of the Indies, formed in 1524, held appellate jurisdiction. Suits between individuals and relating to the Indies could be tried either by the casa or by ordinary justices, at plaintiff's option (*Ordenanzas Reales* 1604:no. 7).

Although the casa's judicial authority had been disputed from time to time, Charles V strengthened it in 1539. He granted the agency original jurisdiction not only over infractions of its ordinances but also over local civil suits affecting Crown revenues and over all crimes committed on voyages to or from America. A prosecuting attorney was added to the casa's staff in 1546 (Haring 1918:40–43, 1947:299).

The Crown's dependence on the merchants to finance ships and their armament is attested by the fact that, in 1543, it permitted the formation of a guild known as the University of Merchants. This organization thenceforth saw after the settlement of virtually all civil suits between its members, considerably reducing litigation brought before the casa. The guild also arranged with the casa for the outfitting and dispatch of the fleets and advised casa officers on commercial and financial matters. Consisting of a few large commercial houses, it came to monopolize the Indies trade, giving the Seville merchants control of the character and size of outbound cargoes and therefore the ability to fix prices in America (Haring 1947:300).

Early in the history of the Casa de Contratación, a complex system of registering cargoes and passengers bound for the Indies was devised as a countermeasure to smuggling. Later, the registration facilitated collection of royal imposts. One such levy was the *avería,* begun in 1521 to pay the cost of escort vessels protecting the Indies navigation from corsairs. At first it supported squadrons to patrol the approaches to Spanish ports, principally between the peninsula and the Azores and Canaries. These were the Armadas de Guardia de la Carrera de las Indias. In 1537 a royal armada accompanied the merchant fleet to the Indies for the first time. Renewal of hostilities with France brought new decrees in 1543 requiring such protection, but the rules were not always observed. From 1550 onward, however, the system of convoys between Spain and America was well established, and the *avería* became a regular contribution. The amount varied, depending on the number of ships in the fleet, the value of their cargo, and the cost of the

escort. For Carreño's 1552 fleet it was 2% of cargo value, but in later times, as royal profligacy mounted, it was much higher. The tax was collected when the merchandise was registered. It was administered by a separate division of the casa in collaboration with the University of Merchants. Ships returning from the Indies also paid the *avería* on the basis of later expenses incurred by the armada.

The *almojarifazgo,* also collected at both ends, was a custom duty, rather than a levy to pay for specific costs. It was not extracted from the American trade at Seville until 1543, but thereafter only passengers' household goods and personal property were exempt.

To assure the collection of the imposts, as well as to control smuggling, the royal ordinances governing the Casa de Contratación and the Indies trade provided for a clerk, or *escribano,* to accompany each vessel to and from the Indies, to register and keep count of the cargo. In earlier times, shipmasters had been allowed to enlist their own clerks, and often sought inexperienced youths who could be easily intimidated and compelled to falsify the register. The 1552 ordinances (*Ordenanzas Reales* 1604:nos. 148–151) provided that officers of the casa not only should name the clerk but also see to it that he was "the most honorable and adequate person to be found." He was thus made an agent of the casa and bonded in the amount of 200,000 maravedís to assure his return with the ship he sailed on to report to the casa's *jueces oficiales.* He was not subject to removal by the shipmaster. As each item of cargo was received on board the vessel, the clerk entered it in the register with the name of the merchant consigning it, describing in detail the contents of all containers (*Ordenanzas Reales* 1604:nos. 148–151).

Before the ship could be loaded, however, the master had to obtain license from the casa and undergo the first inspection at Seville or Sanlúcar. The casa inspector had to determine the vessel's tonnage and age, and ascertain that it was in good repair, capable of making the voyage, and well ballasted in proportion to its burden. Satisfied on these points, he made affidavit to the casa officers. The master had to declare the tonnage of cargo and list the passengers he was taking, giving his oath that each one carried license for the voyage. If all was in order, the casa officers issued the permit; the cargo could be loaded and the register prepared.

On delivery of the register to the casa, a second inspection was made by the *contador.* It was his duty to see that the ship was properly loaded, with all cargo placed below decks, leaving the topside unencumbered for hauling the rigging, firing the guns, or launching the boat. He had to ensure that the ship carried artillery, ammunition, and provisions as stipulated by the royal ordinances, as well as the prescribed number of sailors, ship's boys, soldiers, and a qualified pilot.

The inspector also had to verify that the ship carried adequate rigging—sails, cables, and anchors, as well as pitch for caulking and wax for treating the bottom. If the ship was overloaded, he would order part of the

cargo removed at the master's expense. If it lacked arms or ammunition, or water and provisions in proportion to the people it carried, the ship could not be cleared for sailing until it was brought into compliance.

Prior to the 1552 ordinances, shipmasters sometimes borrowed rigging, artillery, and even crewmen from other vessels, to be put on display during the inspection and returned afterward. The ordinances expressly forbade the practice, providing for confiscation of any borrowed gear. Any sailor caught shuffling back and forth between vessels would receive 100 lashes. For either borrowing or lending, the master could be forbidden to sail to the Indies for 4 years.

A shortage of able seamen had given rise to another difficulty to which the ordinances addressed themselves. Sailors, having contracted to sail with one master and having received an advance, were known to disappear after the review, shipping on another vessel. Absences sometimes were not discovered until the ship had sailed. Ships that were short-handed were in greater jeopardy from weather and enemy attack. The new regulations provided that any sailor caught jumping ship would be fined twice the amount of his pay and be jailed for 20 days. The master who contracted a seaman knowing that he was already signed on another vessel incurred a fine of 10,000 maravedís.

On this second inspection, the master had to give bond of 10,000 ducats to guarantee that the registry submitted to the casa and signed by the casa officers would be delivered to the royal officers at his Indies destination. He was also bound to deliver the cargo to the persons to whom it was consigned. A similar bond was required for the return voyage. Colonial officers were duty bound to advise the casa in Seville of any discrepancy between the register and cargo, passengers, or gear.

After sailing clearance was given in Seville, no item of cargo or provisions could be loaded, under penalty of confiscation. After reaching Sanlúcar and perhaps being subjected to delays that diminished provisions, the master might obtain license to replenish or perhaps to take on additional cargo (*Ordenanzas Reales* 1604:nos. 152–160).

Ships loaded at Seville or Sanlúcar had to undergo a third inspection just before sailing, to ensure that no additional cargo had been loaded and that there were adequate provisions on board for the voyage. When an Indies fleet was being made up, one of the regular inspectors from Seville was assigned to Sanlúcar for this purpose. He could not begin an inspection however, without an order from the casa officers (*Ordenanzas Reales* 1604:nos. 186–196).

Water was carried in wooden or copper casks to ensure against breakage. A daily ration of 1½ *libras* of bread, 3 pints of water (including that used for cooking), and 2 pints of wine was to be provided for each person on board. Inspectors in the Indies would determine if the passengers and crew had received the specified rations. No more than 30 passengers could be

carried on a vessel of 100 tons burden or less (*Ordenanzas Reales* 1604:nos. 146–147, 190).

Shipmasters bound for the Indies were forbidden to take on cargo except in the approved ports of Seville, Sanlúcar, and, after 1535, Cádiz. It was the duty of the ship's clerk to advise the master, in the presence of witnesses, of this restriction. If the master still loaded goods in other ports, the clerk was obliged to enter the items loaded in the register, specifying the place of the loading and the reasons for it. If the reasons were just, and the master paid the required *avería* on reaching an approved port, the matter probably would not be pressed further.

To assist the inspectors in computing a vessel's cargo in *toneladas* (tons) for assessing duty, the 1552 ordinances provided a lengthy listing of items with the number of each required to make a *tonelada.* The list emphasizes that the vessel's burden was calculated not so much by weight as by the space it consumed. Twenty-two cured cowhides or six rolls of frieze cloth, for example, made 1 *tonelada (Ordenanzas Reales* 1604:nos. 163–171).

After completing inspection of a ship freighting for the Indies, casa officials delivered to the master a standardized set of instructions for his voyage. The first item expressly forbade loading cloth on the ship after the inspection without signed authorization, subject to confiscation of the goods, a fine of twice the value, and a 5-year suspension of the master's license. Other items in the list were as follows:

1. On sailing from Sanlúcar, the shipmaster should take his vessel directly to the Indies port it was freighted for.
2. Should provisioning be required during the voyage, he might stop at the Canaries, but he must have license from the casa for whatever he took on board there.
3. After dropping anchor at his designated port in the Indies, he must forthwith deliver to the royal officers the letters he carried and the ship's register before anyone else was permitted to go ashore.
4. He must obtain from the Indies officials certification that he carried no passengers, cloth, or other merchandise except that listed on the register.
5. The document would be delivered to the casa in Seville upon his return to Spain, where he also had to present his instructions to the royal official and attest that he had conformed thereto.
6. He could carry no passenger without license, and no special agreements could be made with passengers unless signed by the ship's clerk and witnesses.
7. He was not permitted to remove the clerk.
8. Should someone on the ship fall ill during the voyage, the master and captain must record the illness and inventory the victim's possessions in the presence of the clerk and witnesses.

9. Should the person die, his possessions were to be sold in the Indies at public auction, the proceeds delivered to the casa to be forwarded to his beneficiaries.
10. On departure from Spain the ship must carry provisions for the persons on board sufficient for 80 days.
11. In whatever port the ship might stop, the pilot should go ashore, take the latitude from the sun in the presence of the ship's clerk, and report it to the casa officers.
12. He must make a full report on all newly discovered and uncharted bays and islands visited, that they might be added to the master chart maintained in the casa.
13. After sailing on the return voyage from the last port of the Indies (Havana for ships from New Spain and Tierra Firme), the ship should make no port except in dire emergency until it returned to Seville and the casa's inspector went on board.
14. No boat should be lowered to visit another ship, nor should any person be permitted to leave the vessel.
15. If a provisioning stop become necessary, one reliable person should be chosen to go ashore and make the necessary arrangements. The delegate must be warned in the presence of the entire ship's company against bringing out gold or anything else.
16. On returning to the home port, no one was permitted to deliver a letter until official dispatches for the king had been handed to the casa officers and they in turn approved delivery of private communications. Violators might incur a fine of 10,000 maravedís or 100 lashes.

It was the clerk's duty to advise all persons on both the outbound and homeward voyage of the instructions, and they must agree to govern themselves accordingly (*Ordenanzas Reales* 1604:nos. 173–185).

Aside from these standardized instructions, the ordinances contain several other items pertaining to the master's conduct of the voyage: He should allow on board his vessel no blasphemy, and no gambling, except for insignificant stakes, as a pastime.

There were instances on record of masters having upped the fare for the passengers once they had put to sea. The ordinances forbade the practice: If a master pressed for more, he would forfeit the entire fare.

If rough weather made it necessary to jettison cargo, the master was subject to a rule doubtless contrived by a casa official who had never been at sea on a ship in distress: All the passengers and seamen should be gathered and should agree to the necessity. The ship's clerk then must testify to the accord and make a list of all items jettisoned, by quality and quantity, from topside and below. No artillery or rigging could be jettisoned.

Ship losses, it is noted in the ordinances, were of great concern to those

who had an interest in the cargo. The concern mounted when the register was lost with the ship, because claims could not be proved until a copy of the document was obtained by sending to the Indies—which involved a matter of months, or even years. It was ordered therefore that each ship sailing homeward from American should bring, in addition to its own register, the transcript of another (*Ordenanzas Reales* 1604:nos. 197–200).

Instructions for the return voyage reflect the same concerns for registering cargo and passengers as those for the outbound, but a change of emphasis is noted. Increased attention is paid to the safe return, under registry, of all gold, silver, and precious stones. On reaching Spain, a certified copy of the register had to be delivered to the casa. It listed the persons making the voyage and the quantity of "gold, silver, pearls, and other things" brought. When the inspectors came on board, the master was first given an opportunity to declare any treasure carried without registry. Then, within 24 hours after arrival, the ship was searched.

The inspectors were to ascertain whether the vessel brought back the seaman with whom it departed, if the artillery and ammunition tallied out, and whether the ship had stopped at any port during the return voyage.

Aside from being quizzed on their knowledge of any unregistered treasure and having their belongings searched, the seamen and passengers were asked "whether anyone has said blasphemy against our Lord . . . and whether the master, pilot, boatswain, dispenser, or other person has brought any woman for his mistress on said voyage, and whether they have gambled prohibited games or done any injury, violence, or other crimes, and whether he brings any concealed Indians [*Ordenanzas Reales* 1604:no. 213]."

The inspectors also inquired of the sailors whether they had been paid; if not, the master might be arrested and fined. The shipmaster had to report any deaths that occurred on the voyage and disposition of the deceased's possessions, and whether any slave was being brought without official license.

The bringing of Indians—men or women—to Spain had been forbidden by royal cédula of September 28, 1543, which was incorporated in the 1552 ordinances. This practice, the cédula observes, was causing depopulation of the Indies, and the Indians brought to the peninsula either failed to survive the voyage or died soon afterward because of "their fragile constitution" and the difference in environment. Some of the Indians brought to the kingdoms had escaped their masters and soon perished for want of livelihood. The penalty for violation of the order was extraordinarily severe: a fine of 100,000 maravedís and banishment from the Indies forever. If an offender was unable to pay the fine, he received 100 lashes, publicly (*Ordenanzas Reales* 1604:nos. 214–216).

This order was but one manifestation of a debate that raged throughout Spain and the colonies. "No other controversy," says Lewis Hanke

(1949:10–11), "so universally embroiled Spaniards during the sixteenth century or so well illustrates the climate of opinion." When the 1552 ordinances were issued, one of the century's greatest battles over the nature of the Indians was fresh in the minds of Spanish officials and subjects. It was the bitter contest, at Valladolid in 1550 and 1551, between Juan Ginés de Sepúlveda and Bartolomé de las Casas over the applicability to the Indians of the Aristotelian theory that some men are slaves by nature.

One other long-standing problem addressed in the 1552 ordinances was the matter of insurance, in which many frauds had been perpetrated to the great detriment of Indies navigation. Shippers had been prone to take out secret policies that enabled them to recover two or three times the value of a lost ship and cargo. Thus, as Fray Perpetuo (1553) alleges in his account of the 1552–1553 voyage, their principal concern had come to be the amount that could be recovered for a lost vessel, not whether the ship could deliver its cargo and passengers safely. To remedy this abuse, the ordinances decreed that no ship might be insured for more than two-thirds its value, and that no insurer, regardless of a policy's stated amount, would be legally bound to pay more. If in violation, the shipper would be deprived of the settlement, seeing it go instead to his accuser, the royal exchequer, and the magistrate (*Ordenanzas Reales* 1604:nos. 161–162).

The sixteenth-century Spanish legalistic mentality is manifested by the large number of articles in the ordinances devoted to the procedure for settling estates of persons who died intestate in the Indies or on shipboard. There are 32 such items (*Ordenanzas Reales* 1604:nos. 89–120) under *Difuntos y sus Bienes,* and a number of passing references to the subject in other parts of the regulations. The concern is borne out by the register made for *Santa María de Yciar* as she prepared to sail from San Juan de Ulúa on her final voyage. Thirty-two consignments listed in the register were property of persons who had died during the preceding year, and these comprised only a third of those being shipped by New Spain's probate judge, Doctor Quesada, at that time (Ojos 1554).

The proceeds from the intestates' property accumulated in the casa in great amounts, largely because of the tardiness of claimants in appearing. The Crown, in times of great financial stress, yielded to the temptation to borrow from such funds to the extent that confidence in the system was eroded, and individuals devised other means of estate settlement (Haring 1947:278).

A major concern of the Crown was to settle the Indies with people of good conduct, especially clerics who would set a good example. But it was by no means to be assumed that all clergy fit the category. The ordinances, therefore, stipulated that no friar or cleric of any order could go to the Indies without express royal license, "that we might know that such persons are in accord with God's service and our own, and capable of instructing the

natives." (Fray Alonso de Encinas, the Trinitarian priest who had the misfortune to be sent homeward on *Santa María de Yciar* as a prisoner, evidently had failed for one reason or another to measure up.)

Royal license also was required for new converts, both Moors and Jews, and their sons, to go to America. Forbidden to emigrate were "the reconciled" and sons and grandsons of anyone who had been burned or condemned as a heretic or for the crime of heretical depravity. Anyone else wishing to settle or trade in the Indies, including shipmasters, pilots, and sailors, had to obtain license from either the Crown or officers of the Casa de Contratación (*Ordenanzas Reales* 1604:nos. 121–123).

Unmarried women, excepting the daughters or servants of migrating families, were forbidden to go to the colonies. No emigrant, even a royal official, was permitted to sail without his wife except with special dispensation from the Crown. If a man left his wife at home, he had to have her written consent and give security of at least 1000 ducats that he would return within 3 years or bring her to America (Haring 1918:102). Even so, husbands often stretched their license and had to be corralled and sent home. *Santa María*'s register for the homeward voyage (Ojos 1554) affords examples. It is noted therein that passenger Alonso de Morales, with Francisco, his son, was going home to his wife, as was Gonzalo Garixo. Melchior de Villa Gómez was "going home to his wife by license of the viceroy." Cristóbal de Tritana and Juan de Baez were going as married men "by order of the Royal Audiencia." The shipmaster, Alonso Ojos, was under orders to give a statement about each of them to the officials of the Casa de Contratación under penalty of 100 pesos for the royal treasury.

Special royal license was required for taking to the Indies a male or female slave of any caste—white, black, mulatto, Moor, or Jew—under penalty of confiscation of the slave. The penalty was most severe for taking a Moor: a fine of 1000 gold pesos. Any slave reaching the Indies without license had to be returned at the owner's expense (*Ordenanzas Reales* 1604:no. 124). On *Santa María*'s register appears one *morisco* slave, evidently the property of Blas Pérez de Prado, a licensed passenger. Ana de Reynoso, *morisca,* was being taken as a prisoner to the royal officers of the casa to answer some unspecified charge (Ojos 1554).

A strict rule forbade the taking of books to the Indies, with specific prohibitions against "false and profane histories and books of dishonest content." It seems the only books allowed were those on "the Christian religion and virture, in the exercise of which the Indians and other settlers of the Indies should be occupied" (*Ordenanzas Reales* 1604:no. 125).

Haring (1918:122) characterizes the Spanish–American commerce of the sixteenth and seventeenth centuries as "A flood of restrictions, a jealous monopoly, on the one hand—on the other, a flourishing contraband trade of outsiders, aliens, either by way of Seville and Cádiz, or directly with ports in the colonies." The Crown sought to extend its power, monopolizing the

treasure of the Indies, by means of a rigid and complicated commercial system, only to see its New World trade ultimately pass into the hands of its rivals, its riches diverted at the source.

There was a rule to govern every conceivable circumstance. It was inevitable, therefore, that there was also one pertaining to salvage of lost vessels. Such operations in the past, it is noted in the 1552 ordinances, had been conducted in somewhat haphazard fashion. Thereafter, the justice nearest the shipwreck should act promptly in conjunction with a royal officer or *regidor* to arrange for undertaking the salvage and recovery of "all the gold and silver, pearls, and precious stones and other goods, artillery, and merchandise. . . ." The salvaged cargo and gear were then to be deposited with an honest and creditable person empowered by law, with payment for the service to be made from the goods recovered.

Care was to be taken in the salvage operation to observe and verify the ownership marks. The identification had to be recorded in a memorandum, copies of which were sent to the port where the ship was freighted, the port of its destination, and the prior and consuls of Seville, who would ultimately settle all claims. Goods that could not be salvaged in good condition were sold at public auction, and the proceeds joined with the other salvage for dispatch to the Casa de Contratación.

The foregoing procedure appears to have been followed when, in July, 1554, salvage expeditions were launched from Pánuco and San Juan de Ulúa to retrieve the riches from the gulf floor off the Padre Island sand bank.

Chapter 6

TO THE SEA IN SHIPS

The maritime revolution of the sixteenth century, as well as the age of discovery itself, grew out of an earlier period of radical change of perhaps even greater importance. The real revolution, says J. H. Parry (1964:78), was the vital marriage of square- and lateen-rigged vessels, of the Atlantic and Mediterranean, respectively, that occurred in the space of about 20 years around the middle of the fifteenth century. The ships of the discovery, from the little that is known of them, were the products of such changes. Therefore, they were not as unsuitable for the purpose as is generally supposed.

By the middle sixteenth century, the carvel structure of the Mediterranean had replaced the clinker-built (with overlapping planks) of the Atlantic, while the curved Mediterranean sternpost had yielded to the straight one more popular elsewhere. The towers once erected on vessels of northern design as temporary defensive bastions had become permanent features on many vessels; the high sterncastle and forecastle were incorporated into the initial design. The lateen (triangular) sails of the Mediterranean had come to be used in combination with square sails. They usually were rigged to the mizzenmast, aft of the square-rigged mainmast and foremast, with a spritsail on the bowsprit. Such rigging was somewhat more suitable for larger vessels and for ocean sailing.

While smaller lateen-rigged vessels possessed advantages in maneu-

verability, they lost efficiency with size and required inordinately larger crews. Such changes, therefore, were requisite to the extensive ocean commerce conducted by Portugal with the Far East and Spain with the Americas. A 250-ton lateen-rigged cargo ship of fourteenth-century Mediterranean design, for example, required a crew of 50. A square-rigged vessel of like capacity needed only 20, plus perhaps half a dozen apprentices (Parry 1964:76). Additionally, the square rig enabled a large area of canvas to be divided with relative ease into units convenient for handling. The hybrid three-masted ships, combining the advantages of the two styles of rigging, endured for more than 200 years after 1450. They spread throughout the Mediterranean and along the western European coasts, with only minor local variations.

Developments of hull and rigging, however, are much more easily traced than those of size. Even when the capacity of a Spanish ship is given in *toneladas,* the term is apt to be imprecisely used and must be considered as a variable, rather than a constant factor. The tonnage figures given by Chaunu (1955:II, 483–485) for the ships wrecked in 1554, based largely on guesswork, are questionable, especially in the light of the widely disparate value of their cargoes. The term generally referred to the ship's cubic capacity in terms of wine tuns—large casks equivalent in volume to two *pipas,* the long, tapering hogsheads still used in the twentieth century. Just what this means exactly in terms of a ship's size is subject to a variety of interpretations. Haring (1918:284) says the *tonelada* represented 56 cubic feet of cargo space, Morison (1942:115, 1971:124) says 40 cubic feet. Parry (1964:79) says two *pipas* of wine weighed about two thousand pounds and comprised from 40 to 45 cubic feet of liquid while occupying a considerably greater space in the ship's hold. The disparity seems to arise from the fact that the term had varying definitions in different countries.

Not a single dimension of any of Columbus's three ships of his first voyage is known (Parry 1964:79), though *Niña* has been determined to have had about 60-ton capacity or less (Morison 1942:114). She and *Pinta* were small trading caravels. *Niña* was lateen-rigged at the start of the voyage, but Columbus had her converted in the Canaries, giving her square sails on the main and foremasts, after she had yawed badly on the first leg of the voyage (Morison 1942:116). *Santa María* was a cumbersome *nao* of merchantman variety, which probably accounts for the fact that she grounded off Hispaniola and stayed there, the first of a long succession of Spanish wrecks left in American waters.

Not all captains were as quick as Columbus to perceive the disadvantage of lateen rigging for ocean sailing. Caravels enjoyed wide use in the early Atlantic crossings. They were light, sailed closer to the wind than the heavier *nao,* and had at most a single deck. Although the caravel originally was a specific type, any ship of around 100 tons later was termed a caravel.

Captain-General Sancho Biedma's armada, which sailed with the merchant fleet for Tierra Firme in 1550 and returned the following year, consisted of eight ships and two caravels. As the fleet prepared to sail, a large *nao* was substituted for two other caravels because the lighter vessels were unsuitable for heavy bronze artillery, and the *naos* were better for carrying passengers. The two caravels that made the voyage were of 96 and 110 tons. There were two ships of 170 and 190 tons, the others ranging from 300 to 450 (Casa 1577).

In 1552 we find two caravels of 220 tons listed in Captain-General Bartolomé Carreño's outbound armada, with four converted and armed merchantmen of 300–350 tons. The only tonnage figures available for the 48 merchant ships indicate a preponderance of 200–220-ton vessels among those bound for New Spain and Tierra Firme. Additionally, there was a sprinkling of 120-ton ships, Miguel de Oquendo's 80-ton caravel, and Alvaro de Bazán's 300-ton galleon *San Pedro.* A 30-ton vessel of Bazán's also is listed, but, considering his affinity for big ships, this is taken to be a misprint for 300. Except for one 300-ton vessel, all the ships destined for Santo Domingo were rated 120 tons (Chaunu 1955:II, 482–487).

While the revolution of hull and rigging belonged largely to the fifteenth century, that of ship size occurred principally in the sixteenth. Generally speaking, the richer the Indies trade became, the larger the ships employed. Business considerations, rather than military, dictated trends for the most part. During this period, the Crown possessed no navy in the accepted sense of the term. All ships were adaptable to a degree to both purposes. Addition of soldiers and artillery made the merchantman a man-of-war, and the emperor did not hesitate to embargo merchant ships to meet his military needs (Fernández Duro 1895:I, 331, Haring 1918:269).

The name of Alvaro de Bazán looms large in the annals of the sixteenth-century maritime revolution, as the first to employ as merchantmen in the Indies navigation large galleons of his own design and construction (Fernández Duro 1895:I, 327). He also had a hand in extending the application of many other innovations: copper bilge pumps; lead sheathing to protect hulls from teredoes, the voracious worms that bored into the wood and made sieves of ships' bottoms (a practice begun years earlier but apparently not widely used); mixing of wood preservatives in the wax with which the hull was treated.

In Bazán's role as innovator, his fame was to transcend even that of his father of the same name. The exploits of one are easily confused with the other. It was the elder Bazán who in 1533 commanded 12 new Spanish galleys in Andrea Doria's fleet during the emperor's war with the Ottoman Turks. In this instance, he played a key role in forestalling the Turks' recapture of Corón. Two years later, he led the successful storming of the fortress of La Galeota in the Bay of Tunis, stronghold of the noted pirate

Barbarossa, in a brilliant amphibious operation (Merriman 1925:299, 314). He was involved later in the same decade in the construction of galleys for use in the Mediterranean fleet (Fernández Duro 1895:I, 324).

The younger Alvaro de Bazán, born December 12, 1526, at Granada, commanded a victorious Spanish fleet against the French in the Bay of Biscay in 1544, before his eighteenth birthday, winning instant recognition from the Crown. At an early age, he foresaw that the ships of the future were destined to depend on sail rather than oars, and it was he who first correctly appraised the effects of New World discovery on the Spanish homeland (Merriman 1925:212). His name and that of his brother Alonso are joined with those of Pedro Menéndez de Avilés, the founder of St. Augustine, Florida, and Blasco de Garay as being most closely associated with Spanish maritime construction in the sixteenth century.

Alvaro de Bazán invented a new type of galleon for the building of which he obtained an exclusive concession in February, 1550. He was to supply within 2 months six galleons of a combined tonnage of 2000 for use in the royal armada, then begin construction of six more.

Bazán already had a number of his own vessels plying the Indies trade. Two of his ships, each rated by Chaunu (1955:II, 484–485) at 300 tons, were among Bartolomé Carreño fleet of 1552. Bishop Las Casas, in his letter complaining of the delay in sailing and excessive loading, comments: "These ships of don Alvaro and all the big ships are the ruin of the Indies . . . [Las Casas 1552]." This observation and others found in scattered documents indicate the controversy that attended Bazán's innovations, probably because of a fear that they would put owners of smaller ships out of business.

At this time, Bazán was on the threshold of a great naval career in which his fleets would win victories over English, French, and Portuguese, as well as Turks, Moors, and Berbers. It was his plan by which the Spanish armada engaged the English fleet in 1588, but he was not a participant. He died unexpectedly in February of that year before the battle (Espasa-Calpe 1968:II, 1323–1327). His name lives on in the Archivo-Museo Don Alvaro de Bazán, in the old palace that was his home at Viso del Marqués, near Ciudad Real, about 125 miles south of Madrid (Canedo 1961:I, 227).

During the 1550s, Bazán himself made several voyages to the Indies. In 1553, he was admiral of the fleet that sailed under Francisco de Mendoza (Sotomayor, Peñalosa, Vivero 1553). In 1554, the king named him captain-general of the armada protecting the Spanish coast and Indies navigation. The following year his armada was ordered to accompany the Indies fleet (Tello and Zárate 1555).

For the most part, Bazán's ships were larger, more capacious, and slower than their predecessors. They were also difficult to handle. Although their dimensions are not precisely known, it had become necessary by 1557 for the Crown to limit the size of vessels in the American trade to 400 tons. By

the same token, the 1552 ordinances fixed the minimum size for transatlantic voyages at 100 tons and specified that vessels of this capacity carry no more than 30 passengers. Vessels freighting for the Indies were placed in three groupings, and the ordinances specified the requirements of crew and armament for each group. The three ranges were 100–170, 170–220, and 220–320 tons.

Santa María de Yciar, rated by Chaunu (1955:II, 484–485) at 220 tons, carried on her final voyage a crew of 20 officers and men and 7 ship's boys, 21 short of the number specified for a ship of that size. She carried 10 pieces of heavy artillery instead of 8, 32 *versos* (light artillery) instead of 18, 16 crossbows instead of 20 specified, and 24 shields where only 18 were called for. Powder was somewhat less than the prescribed amount, and cannonballs were short for both the number of guns carried and the number indicated for the vessel's size (Ojos 1554).

The 1552 ordinances, sent to the printer the day these ships sailed from Spain, had not yet caught up with them. But, by the standards thereby established, *Santa María*—assuming the size ascribed to her is correct—was grossly undermanned when she sailed into the April gulf storm.

Accompanying the increase in the size of ships in the Indies trade were other changes relating to proportion. Pedro Menéndez de Avilés developed the idea of lengthening the keel in relation to the beam and received encouragement from Alonso and Alvaro Bazán in the face of opposition from more conservative shipbuilders. The short, deep, tublike ship of the sixteenth century gradually evolved into a longer vessel of lighter draft, less freeboard, and finer lines at bow and stern (Haring 1918:266).

In 1539, Blasco de Garay sent a memorial to the emperor outlining eight inventions for improvement of navigation. Most significant, and evidently the only one to be tried, was a means of propelling ships without oars—with paddle wheels turned by men. There were schemes also for armor plate, floating batteries, diving bells, and marine camouflage (Fernández Duro 1895:I, 328, Merriman 1925:212).

Bazán's ships were constructed in Biscay of native oak. Until 1593, however, ships of pine built in Andalusia continued to be used in American navigation. That year, the Crown banned the use of such vessels in the Indies fleet because nails and bolts tended to loosen, planks were easily sprung, and such craft were frequently lost to leakage. Given the best of shipbuilding knowhow, reasonable weather conditions, and the more experienced pilots and masters, ships of the period had a fair chance of making the crossing safely—if they did not fall to the French corsairs. But unfortunately, none of these factors was constant.

Another area in which evolutionary forces were at work during this period is that of arms and artillery. Gunpowder had been in use for military purposes for about 200 years, and the development of weaponry, though slow by modern standards, was at least constant. By the mid-sixteenth

century the importance of artillery was clearly recognized. It existed in an infinite variety of kinds and sizes, with standardization virtually unknown. In 1544, Charles V decreed that no more than seven models of cannon would be manufactured for and used by armies of the empire, but there still existed a wide range of sizes, even within the standardized types.

As Carreño's fleet prepared to sail in 1552, Prince Philip on May 1 ordered the Casa de Contratación to proceed with purchase of 26 pieces of "artillery"—4 *medio sacres* (medium-sized bronze cannon), 2 *falconetes* and 20 harquebuses—from a Seville merchant offering them for sale (Philip 1552b).

Two and a half weeks before sailing time, the master of Carreño's *capitana,* Valeriano de Manzera, receipted artillery consigned to his vessel by the casa: two medium culverins (*culebrinas*), six *sacres* and *medio sacres*, and one falconet. Manzera also reveals that the weapons were of bronze (in somewhat wider use than wrought iron on armada ships because it was more efficient), and that most of the pieces had been cast in the foundry at Málaga.

The largest piece was a medium cluverin, weighing some 3274 pounds, which was "hoisted on its stock, bound with iron plates and some linch pins and has wheels of eight spans [about 64 inches in circumference, indicating a field piece] with axletree pins, a copper shovel, a pole to carry it with, and a block on a pole to serve as a ramrod (Manzera 1552)." One culverin weighed slightly less than the other and had wheels of only three spans, but the bores may have been the same.

The *sacres* were similarly described, their weights ranging from 1100 to 1800 pounds. The falconet weighed only 708 pounds. It, as one of the *sacres,* was from the foundry in Flanders and was quite old.

Balls for the culverins were of cast iron; for the *sacres,* lead with iron cores; for the falconet, both lead and cast iron. In addition, a quantity of sheet lead was carried.

The importance of the weaponry is attested to by the degree of preparation required for carrying it, as well as by the number of items for its service listed among the ship's gear. These included large pulley blocks for hoisting the artillery, bolts to anchor the larger pieces to the deck, and hemp rope for lashing down the smaller pieces; calfskin sacks for the "service of the artillery," and nineteen sheepskins for cleaning it.

Scales carried on board apparently were used in measuring powder; copper pots and ladles were carried for molding lead; two barrels of saltpeter, probably for making cannon powder (five barrels of harquebus powder were listed separately); wooden wedges for directing the guns' trajectory; and skeins of fuses for firing both harquebuses and artillery. Spares included wheels for the artillery, quoins for the culverins, and cloaks for the artillerymen (Manzera 1552).

A number of halberds, or battle-axes, also was carried. Other ordnance included two goat's feet (crossbow cocking mechanisms) and bombs, gre-

nades, and combustible balls "for fireworks." Crossbows and harquebuses, not mentioned specifically, probably were in the care of the ship's complement of soldiers. It was their lot to board any enemy vessel that might be overhauled or stand off hostile Indians, as was required of those in Farfán's fleet at Domínica (Farfán 1554).

Among the soldiers in Biedma's fleet were fifers and drummers, enlisted at Seville, who doubtless provided a measure of entertainment for ship's company and passengers (Casa 1577).

The ordnance listed on *Santa María de Yciar*'s register included 10 pieces of large artillery of unspecified type and 22 *versos*. The *verso* was a light artillery piece of wrought iron, a number of which have been recovered at the wreck sites in recent salvage efforts. *Santa María* also carried harquebuses, crossbows, spears, and lances (Ojos 1554).

Some basis for comparison exists between the growth of transoceanic navigation in the sixteenth century, with all its pressure for innovation, and economic development in the United States following World War II. Each afforded seemingly limitless opportunities for large numbers of persons. Each called for skilled personnel to fill positions for which little or no training had been provided. As a result, countless jobs demanding experience, integrity, and responsibility were filled with incompetent opportunists. While effects of the recent economic growth already have begun to manifest themselves, a complete and objective appraisal must await a later generation of historians. In the case of the sixteenth century, results are seen in the countless shipping disasters extending from Nombre de Dios and Vera Cruz across the Atlantic to the shores of the Iberian Peninsula. That a lack of able seamen and qualified navigators was a factor in the diorama of shipwreck tragedy there can be no doubt.

As Biedma's fleet prepared to sail in 1550, pilots found themselves in command of a seller's market. Prices were rising as a result of the influx of gold and silver from the Indies, and they felt the 115 ducats ($734) they were being paid for a round-trip voyage to America was inadequate. The Casa de Contratación, in trying to enlist pilots at the authorized figure, received a variety of excuses. Some of the navigators had suddenly left Seville. Others feigned illness. Still others announced plans to go into the shipping business for themselves. At last the emperor authorized the casa to do what it thought best, "provided that said pilots are paid moderately" (Casa 1577).

Despite regulations to the contrary, crews were recruited from men of every type and condition. Many became sailors only as a means of reaching the Indies without running afoul of emigration laws. Their gross ignorance, in Haring's words (1918:197), "placed the ship in jeopardy with every passing squall." In the Indies port they deserted the ship even before the rigging was secured and moorings made fast.

While the lure of adventure in new lands was strong enough to entice large numbers of young men to the Castilian ports, it gave no assurance of

their adaptability to the sea. For want of experienced and willing native seamen, the working of Spanish ships often fell to the hands of foreigners, and that, too, posed a hazard. Early in 1553, for example, Francisco Mexía reported from the Casa de Contratación in Seville that "Many French Basques are coming here claiming to be from Biscay. They go in the armadas, pretending to be loyal vassals of Your Majesty, and they later abuse their knowledge by becoming corsairs" (Mexía 1553). In 1550, artillerymen for Sancho de Biedma's fleet had been brought from Lisbon (Casa 1577). As Carreño's fleet prepared to sail in 1552, it encountered a shortage of Spanish mariners. Prince Philip (1552c) granted permission to sign on foreign seamen for the armada as long as they were not English or French.

In January, 1555, Mexía advised the emperor that a ship loading at Cádiz for Santa Domingo was taking a French gunner named Guiller Hamel, "who cunningly put himself on board" as a merchant. "They say he is also a cosmographer and that he intends to learn all the ports of the Indies and the navigation [Mexía 1555]." Nothing could be more alarming to a sixteenth-century Spanish official concerned with Indies navigation.

Word was sent to Francisco Duarte, in Cádiz dispatching the armada of Juan Tello de Guzmán, to arrest both the shipmaster, Benito Sánchez, and Hamel, but the casa inspector, attempting to locate them, found that they had disappeared. The incident, however, sparked an investigation of Sánchez. It developed that he was not a shipmaster but a pilot, and a sorry one at that. It was he who had been responsible for the loss, on the coast of New Spain, of a ship in which 82 persons were drowned, including the royal officers, Doctor Trenado and the licentiate Rabanal (whose property had been dispatched for Spain on the ill-fated *Santa María de Yciar*). It was also learned that Sánchez's father-in-law, Diego Gutiérrez, had served as pilot major after Sebastian Cabot had returned to England in 1548 (Mexía 1555).

Seamen, like masters and shipowners, often were addicted to greed. This vice assumed the form of smuggling, taking advances in pay from one shipmaster then sailing with another, or jumping ship at any port offering likely inducements. Many were little inclined to accept personal responsibility for the safety of ship, cargo, or passengers, or to view their misrepresentations at the time of signing as being related to the disasters that potentially lay in wait for every ship.

Yet each vessel was dependent on its crew for more than the rotelike functions the instant sailors tended to view as their sole obligation. The business of hauling the rigging—weighing anchor, hoisting the main yard, or trimming sails of a wildly pitching ship at the advent of a storm—was beastly, grueling labor. On its efficient performance depended the safety of the ship and everyone on board. Living conditions aboard ship were far from commodious, and it is small wonder that many of those who thought they had a taste for the sea lost it before the first landfall. But with each defection the ship's chances in "the great lottery" diminished.

Before the forecastle was developed and became the traditional crew's

quarters, and before hammocks were adopted from the West Indian natives, the ordinary crewmen had to sleep on deck and, in foul weather, below deck, on the ballast. The latter was a frightfully unpleasant arrangement, for sanitary facilities were lacking. Garbage and filth of all kinds remained inboard, was washed down into the bilges, and collected among the ballast. Even after better accommodations were provided for crewmen, passengers seem to have fallen heir to the random quarters so unthinkable in the modern age.

Whatever the sleeping arrangement, there was an appalling lack of privacy. Naturally, says Morison (1974:171), there was joking about the seats hung over the rail forward and aft for those on board to ease themselves, referred to as "the gardens." There was jesting about the view they afforded of the moon and planets, and the unexpected baths provided when the deck was washed by waves. There also were complaints about the indignity of thus exposing to public view the Lord Bishop, and of the tarred rope end that had its counterpart in rural North America in the corncob.

On long voyages food often became rancid, its preparation subject as everything else to the vagaries of the weather. Cooking was done on an open wood fire in the fire box, an iron tray filled with sand, situated in the forecastle or waist. It was unusable in heavy seas. Just who did the cooking on the vessels of this period is uncertain, but the chore must have been passed among ordinary seamen or ship's boys (Horner 1971:39, Parry 1964:87).

From the register of *Santa María de Yciar* (Ojos 1554) we have seen that provisions for the return voyage consisted of ship's biscuit or hardtack (*bizcocho*), beans, olive oil, vinegar, and barrels of meat, which probably were pickled in brine. Purchases made for Biedma's fleet before it sailed from Spain in 1550 reflect a similarity but somewhat greater variety. They included salt pork and other meats, fish, sardines, anchovies, cheeses, almonds, garlic, beans and peas, hardtack, flour, and wine (Casa 1577).

The most complete supply list available, and the most descriptive, is that recorded by Manzera for Carreño's flagship, the ill-fated *Nuestra Señora de la Concepción*. Including all the foods listed for Biedma's armada, it also contains a number of additional items and reveals how some of them were carried: Sardines, anchovies, tuna fish, sugar, flour, raisins, and eggs (350 dozen) were packed in barrels. There also were 400 strings of garlic, wine in leather bags as well as in casks with four iron hoops, peas in hemp sacks, beans in canvas ones, Valencian rice in sacks, cheeses and hardtack in baskets of esparto grass, slabs of bacon and hams, lentils in palm baskets, olives in earthenware jugs and barrels, 20 dozen small dog fish and 6 dried hake, and 20 butchered hogs.

This list also represents one of the earliest recorded instances of live animals being taken along for slaughter during the voyage. Carreño's flagship carried eight hogs, five sheep, and eight steers on the hoof (Manzera 1552).

Fresh fish occasionally supplemented the provisions brought along.

When the ship was becalmed, fishing lines might be broken out and cast over the side. Tomás de la Torre (1973:482) tells of eating shark meat caught during a calm in 1544, his only complaint being that it was somewhat strong (Torre 1973:482). Manzera (1552) carried on *Concepción* a large box with padlock and bound with iron straps containing a small rowboat for fishing and angler's gear.

Drinking water, in its wooden casks, became fetid after days at sea, and the daily ration of two *cuartillos* of wine allowed for each passenger and crewman served in good stead. Wine and water casks functioned as ballast and when emptied often were filled with sea water that they might continue to serve.

Despite all attempts to provide adequate rations, sailors on the longer voyages were prone to deficiency diseases, principally scurvy. Not until later was the value of citrus fruits in this regard recognized.

Many of the billets on sixteenth-century ships called for skilled tradesmen. If the owner of the ship was on board, he may have been accorded the title of captain and have been in overall command. As in the case with Miguel de Jáuregui of *Santa María de Yciar*, he may also have served as pilot. But the master had to be a mariner. He commanded the crew and was responsible for handling the ship and storing the cargo. The pilot functioned as navigator and mate. The ship's crew usually was divided into two watches, each standing 4 hours on and 4 off, one under command of the mate, the other of the master. Of petty-officer status were the boatswain, who had charge of all gear and rigging; the steward, responsible for food, water, wine, and firewood; and the gunners, who had charge of small arms, artillery, and powder.

Additionally, each ship carried a carpenter, a caulker, and sometimes a cooper, the latter billet apparently not filled on *Santa María.* The carpenter's responsibility was repair of hull and spars, while the caulker was charged with maintaining water-tightness. Besides keeping the pumps in working order, he had to see after the caulking of seams, treating the bottom with wax to protect it from teredos, or tending to the sheathing, which served the same purpose more expensively. "Many of the tasks, in later years left to dockyard experts," says Parry (1964:87), "were at that time carried out as a matter of course by ships' companies. Nothing . . . is more impressive than the handiness and undaunted powers of improvisation displayed by tradesmen ratings and by seamen working under their direction. They often carried out major repairs to hulls and spars, using natural timber, in remote anchorages, or when necessary at sea in violent weather." A ship at sea, without recourse to outside help, was constantly thrown back upon its own resources.

It therefore was essential to carry the proper equipment and supplies to enable self-sufficiency, as exemplified by *Concepción.* There were, of course, the usual items of spare rigging: whipcord, tarred cordage, hoisting blocks (with two eyes), canvas, and two spare masts. For caulking there were barrels of pitch and for protecting the hull a *quintal* of grease (or wax).

Various other requirements of the ship were provided for with ten new forelock bolts, hinges, four padlocks and chains for the hatchways, scupper nails, clout nails, nails from Ascora, tacks, and "173 nails for battening to be used in the general's cabin." Tools included hammers, axes, pickaxes, and grappling hooks, and, for the cooper, chisels and picks. It was the cooper's job not only to see after the water and wine barrels and casks but also to keep wooden buckets and funnels in repair. The ship carried 12 wooden buckets, each with three iron hoops, and wooden funnels with two iron hoops. Willow hoops were carried for reinforcing the barrels, and 20 bundles of wicker for various uses.

A box eight spans long (about 5 feet) contained "sickbay" supplies: medicines, strainer ladles, mortar and pestle, and two spatulas. Four sheets were brought for "making bandages for the wounded."

Firebox supplies included a copper oven "with all equipment," 12 copper pans, a copper pot, a cauldron, and a spare sheet of copper. An *almud* was on hand for measuring beans and peas, and there were various other measures for the cook's use. Earthenware consisted of funnels, jars, three dozen pitchers, 10 dozen plates and a like number of soup plates, as well as 8 dozen white plates, 4 dozen large bowls, and 6 white jars, contained in willow baskets. There was a vat for salting meat, one *arroba* of salt, and a keg to put the meat in after it was salted. For stoking the firebox, 26 cartloads of wood were boarded.

Manzera (1552), doubtless honored to have his vessel chosen as the *capitana,* appears to have been especially proud of the flagship accouterments: a crimson flag in a small box from Sancho de Biedma's armada, two painted canvas pennants 20 and 30 varas long; three canvas flags 5 varas long with the royal coat of arms painted on them; and "a large earthenware lamp for my lantern." Unknowingly, the shipmaster recorded receipt of the instrument of his ship's destruction and of his own death.

Other items for illumination included seven *arrobas* of tallow candles in a wicker basket with a lid, 10 lanterns, one iron lantern with iron bar and two strands of chain 6 feet long (possibly for lowering the lantern into the dark hold), and two lanterns with straw shades from Milán. And one last item: a prison pillory with padlock and key.

The one category of supplies for his armada not detailed by Manzera is medicines. Such a list is supplied, however, by Diego López de las Roelas (1549), captain-general of the fleet immediately preceding Biedma's. (The partially translated list appears on pages 270–273.) Many of the terms are untranslatable and a large number of those that can be rendered are scarcely meaningful to the present-day reader. The list includes a variety of ointments, powders, syrups, and liquid potions, as well as a few home remedies still used in the twentieth century, such as turpentine. Some items bore the stamp of newly discovered products of the Indies, as cochineal pills, and others are remarkable for their novelty, as conserve of ox tongue. The medicine chest and its contents ran to 271 pesos—about $1253.

Few labor-saving devices were available on the ships of this period. They consisted principally of the blocks for hoisting the rigging, the pumps for removing the seawater that collected in the bilge from waves or leaks, and the capstan, or windlass, that worked the cables. The main capstan was an upright wooden spindle, anchored in the decking at top and bottom, which could be turned by means of leverage bars to bring in or pay out the cable for sails, yards, or anchors.

"The size and weight of ships," says Parry (1964:91), "tended to out-run the efficiency of the tackle with which they were handled." Anchors, for example, often were of brittle wrought iron that snapped under pressure, permitting the ship to run aground. Anchor fragments at the 1554 wreck site seem to indicate that this happened with at least one of the three vessels.

Each 4-hour watch aboard ship usually included pumping, routine cleaning and maintenance, keeping lookout from forecastle deck or maintop, trimming the sails as required by changes of course and wind, constant adjustment of the rigging, and steering. Putting the ship about, as when tacking, was extremely difficult under ordinary circumstances and vitually impossible in a stiff wind, entailing the possibility of the vessel's falling into a trough and losing steerage.

As with ground tackle, the size of ships also tended to out-run mechanical efficiency in steering. Ships still were steered by means of a long tiller or whipstaff. Wheels for steering were still in the future. The helmsman stood abaft on the main deck. Prevented by the sterncastle overhead from seeing either sails or sky, he steered by compass on orders from the watch officer topside. Great strength was required to steer the ship in a beam or following sea. The most difficult situation arose when it was necessary to run before a storm with reduced canvas or bare poles; considerable skill, as well as strength, was required to keep the vessel from broaching to.

From this discussion, one may imagine the ordeal of *Santa María, San Esteban,* and *Espíritu Santo* when, caught in a Gulf of Mexico storm, they ran before the wind and sea until there was no more room to run. Unable to come about, they may have put out anchors, only to have them snap or drag. Or, trying to come about, they may have broached to and lain helpless in the trough until the swells overran them.

Spanish officials fairly early realized that the new discoveries had brought a need for more qualified masters and pilots than were available. Columbus, who was no instrument navigator, had demonstrated that the ocean could be crossed in relative safety by means of dead reckoning—the determination of the ship's position from the record of time sailed on a given course and an estimate of the distance traveled, without celestial observations. But not every navigator possessed the Admiral's exceptional capabilities in this regard. Many who tried to follow in his wake quite literally hit shoal water. And it seems apparent that no pilot uncertain of his methods and capabilities could be of much assistance in charting the un-

known seas, islands, and continents that spread themselves before sixteenth-century Spain.

The Casa de Contratación, as a nerve center where geographical information on the New World was collected and analyzed in an effort to understand the discovery, concerned itself with developing the basis for safe navigation. To this end the offices of pilot major and royal cosmographer were established in the casa in 1508. Américo Vespucci was named as the first chief pilot by royal cédula of August 8. It became his duty thereby to instruct the pilots of the Indies fleet, imparting formal scientific knowledge to complement their practical experience.

The pilots, the cédula took note, lacked proficiency with astrolabe and quadrant and in computing latitude from readings obtained with these instruments. Ships, cargoes, and lives were being lost as a result. Thenceforth all who wanted to sail as pilots to the Indies were required to learn to use the instruments. Vespucci was to teach them in his home in Seville, for which service the pilots themselves would pay him, until they could satisfy him of their knowledge on an examination (Pulido Rubio 1950:66–67).

Besides examining and licensing pilots for overseas voyages, the pilot major sought to keep up to date a *padrón real,* an official map of the world, with the aid of information gleaned from returning pilots.

The extent to which Vespucci and his successors, Juan de Solís and Sebastian Cabot, were successful in instructing pilots is in doubt, but the idea, if not the accomplishment, was unique among the maritime nations and won the plaudits of Englishmen such as Richard Hakluyt (Morison 1974:475). Yet Spanish navigators, from all appearances, remained ignorant of the basic elements of celestial navigation. So charged Martín Cortés, who sought to remedy the situation by writing a book called *Brief Compendium of the Sphere and the Art of Navigation*, published in 1551. Not only were the pilots ignorant, Cortés asserted, but it was difficult to teach them because "they scarcely know how to read" (Haring 1918:303). Either the system had failed, the pilot major had been remiss in his job, or Cortés was laboring under an erroneous impression.

Whichever the case, a new system went into effect with the 1552 ordinances. Alonso de Chávez, named pilot major, was specifically forbidden to give instruction to pilots (*Ordenanzas Reales* 1604:no. 130). That function was provided for by establishing in the casa the following December a chair of cosmography and the appointment of Gerónimo de Chaves as senior cosmographer and maker of navigational instruments.

Don Gerónimo was to instruct his pupils from selected texts on navigation and teach the use of compass, astrolabe, quadrant, and cross-staff and the principle of each; the computation of latitude from the sun and polaris; the application of the day and night-time clocks; the use of the nautical chart in plotting the ship's position; and the determination of tides according to the phase of the moon.

Thenceforth no one was to be admitted to examination for a license as pilot or master unless he had attended the lectures for a year, or had covered the specified subjects. In view of the demands for pilots, however, the time requirement was unrealistic, and the strict intentions were once again relaxed (Haring 1918:303).

Before receiving his license to sail as a pilot to the Indies, the candidate had to be examined by the pilot major, the two cosmographers of the casa, and at least six experienced pilots. But first, he had to declare that he was a native or naturalized citizen of the Spanish kingdoms, more than 24 years old, and that he had sailed to the Indies for at least 6 years. He also had to affirm that he was of good deportment, not of quarrelsome nature or disposed to drunkenness or gambling, and that he was a diligent and cautious person. Four character witnesses not from his native province had to vouch for him, including at least two pilots with whom he had sailed. Then he was required to demonstrate his knowledge of the prescribed subjects, including the use of the various instruments. The panel voted in secret, by means of beans and black balls; if black balls prevailed, or in case of a tie, he was denied the license and required to make another voyage to the Indies before he could be examined again.

No one could sail for the Indies as a pilot or master until he was first examined by the pilot major for the specific voyage he was to make. A master was forbidden to take any pilot on his ship without the pilot's having been examined. If the master wished to serve as his own pilot, he could do so provided he took another mariner who was skilled in navigation. Each master had to be qualified as a mariner and examined by the pilot major. He also had to be a Spanish citizen, native born or naturalized, and a subject of the Crown of Castile (*Ordenanzas Reales* 1604:nos. 135–145).

To guard against the use of false instruments, the casa issued astrolabes, quadrants, and cross-staffs bearing its official mark. None of these could be sold until they had been examined and approved by the pilot major and the cosmographer (*Ordenanzas Reales* 1604:no. 141). Two of the three astrolabes recovered at the 1554 wreck site are marked with five dots, forming a cross with near equal arms. An astrolabe from the 1622 wreck identified as the *Atocha* bears the same mark (Lyon 1976:805).

The pilot major's instructions further provided for maintenance of the world map, deemed necessary and requisite to navigation by masters, cosmographers, and pilots. The map, kept in the casa, was to be brought up to date at the beginning of each year on the basis of pilots' logs of voyages to the Indies, and more often, should some important discovery so warrant (*Ordenanzas Reales* 1604:no. 126).

No copy of this *padrón real,* unfortunately, has come to light; outdated ones appear to have been destroyed as they were superseded (Morison 1974:475). In 1552, however, the map could have shown with any degree of accuracy no more than a rough outline of the American continents and many

of the Antilles islands. Latitudes often were inaccurately computed, and longitudes were purely a guess. Inlets, rivers, and bays were poorly defined, and confusion existed in names. Similar conditions prevailed 125 years later, when the landing of the Frenchman La Salle on the Texas shore forced the Spaniards to "rediscover" the Gulf Coast from the Florida keys to Tampico (Weddle 1973:24–25).

Pilots, therefore, were expected to go ashore and take latitude shots at each landing, recording the location and shape of all islands visited, as well as the ports and bays. An important tool in this continuing process of discovery and map-making was the leadline, with which the early mariners could obtain not only a warning that land was near but also samples from the bottom that yielded clues to their position. A deep-sea leadline, 200 fathoms long and weighted with 14 pounds, gave the first timely warning of the proximity of the coast. In shoal water, a shorter line with a 7-pound weight was used, cast continuously from the bow in the direction of the ship's movement. It was an essential precaution for any ship approaching land. Ships could be, and were, lost because of its neglect.

Off a well-known coast, the sequence of soundings would fall into an identifiable pattern. To provide supportive evidence, the hollow lower end of the lead weight was filled with tallow. Fragments of sand, mud, or shell clung to this substance, indicating not only the bottom's suitability for holding an anchor but also the location (Parry 1964:97–98). Sailing instructions of this period, defining the course to be followed among the Caribbean islands and on the approaches to the North and South American continents (Manuel 1583), clearly reflect the importance of the sounding lead.

Throughout the history of mankind, hardly any type of human endeavor has relied more completely on the sum of accumulated knowledge, particularly in the area of mathematics and astronomy, than navigation. This was never more true than in the present age of interplanetary navigation and exploration of the solar system. No lay mind today can be expected to understand all the bases of knowledge requisite for putting a man on the moon or sending space probes to Mars. Nor could the rank-and-file individual of the sixteenth century comprehend the foundations of learning that made it possible to determine latitude by sighting the sun or a star through some strange instrument.

That such an achievement depended on ancient knowledge is demonstrated by the fact that the accepted texts dealing with astronomy and navigation in this period were based on the work of Claudius Ptolemaeus (Ptolemy), the Alexandrian astronomer of the second century. In 1543, the Polish astronomer Nicolaus Copernicus received on his death bed an advance copy of his monumental work *On the Revolutions of the Heavenly Spheres* (Adler 1952:XVI, ix, 499–500). This contribution somewhat outdated Ptolemaic theory, but it came too late for Martín Cortés and Pedro de Medina, who brought out important works on navigation in 1551 and 1552.

Both of them clung to the astronomical system of Ptolemy (Haring 1918:311).

While geographers and cartographers had long understood that the world was round, they continued to make maps as though it were flat (Branch and Williams 1942:86). They were unable to apply spherical trigonometry to achieve the necessary correction on a flat map for the globe's curvature. One Gerhard Kremer, known to history as Mercator, had sharpened the navigator's geographical perceptions by constructing a globe in 1541. Not until 1569 did this Belgian surveyor, instrument maker, and cartographer—generally recognized as the era's most learned geographer—publish his world map containing the famous and highly important Mercator projection. While showing land surfaces as accurately as possible, this large map also was designed to serve the ocean navigator. It permitted the plotting of a rhumb-line course that intersected all meridians at the same angle, despite the convergence of such lines toward the pole (Parry 1964:127–128.

To determine the position of a ship at sea, the mass of data accumulated from the observations and computations of astronomers and mathematicians throughout the ages had to be brought together in understandable form. It seems that the age of discovery, exploration, and worldwide commercial development had produced a need for knowledge far surpassing all existing facilities for providing it. The ordinary sixteenth-century mariner, for the most part, simply lacked the background that enabled him to learn all the things he needed to know. The lack was not permitted to interfere with Spain's navigation to the Indies. Yet one cannot help but speculate on the cost, in terms of lost ships, cargoes, and lives, exacted by the explosion of commerce beyond the ability of education to keep pace. But the circumstance is not without its parallels in history, or even in the present age.

Nor can one refrain from conjecture upon the degree of competence attained by pilots and masters who received the prescribed year's instruction in the rudiments of celestial navigation. Instruments were crude and often inaccurate, especially on a ship at sea. In truth, all except the compass seem to have served the geographer's purposes far better than those of the navigator.

Of all the instruments, the compass was the most basic. By the mid-sixteenth century its manufacture had been taken over by the professional instrument-maker. It consisted of a magnetized iron wire, bent double and glued beneath a circular card that was mounted on gimbals for easy pivot, and enclosed in a binnacle that included a whale-oil lamp. From time to time it had to be lifted from the binnacle and recharged with lodestone to maintain its magnetism. The card was marked with the eight principal points and their subdivisions for a total of 32 points. The compass bearing was not expressed in degrees until much later (Parry 1964:96). The compass by the tiller was duplicated at the watch officer's post on the sterncastle deck. Communication between the two was through a hatch (Morison 1971:137).

The noctural and diurnal "clocks" referred to in the 1552 ordinances also merit some description. Time-keeping at sea, in the absence of clocks such as we know today, could be difficult and tedious. A half-hour sand glass, which had to be turned at each interval by a ship's boy, usually marked off the 4 hour watches. The occurrence of noon could be checked roughly by setting a pin in the center of the compass card and observing the moment at which it crossed the meridian. At night, since the guards of Polaris make a complete circle around the pole star each 24 hours of sidereal time, it was possible to tell the time from the relative position of Kochab, the brightest of the guards. The nocturnal, a simple instrument used for this purpose, consisted of a circular disk with a central hole for sighting Polaris and a swiveling pointer to be aligned to the guard star. A reading from the card gave the time (Parry 1964:93, Morison 1974:165).

Ironically, it was not a lack of knowledge of astronomy but the want of an accurate timepiece that posed the insurmountable barrier to accurate celestial fixes by ships at sea in the sixteenth century. The celestial determination of longitude—always a matter of guesswork in this period—had to await the invention of the chronometer in the eighteenth century (Morison 1971:137). This lack posed immeasurable obstacles to accurate cartography, as well as to precise navigation. It constitutes, for example, the most logical explanation for La Salle's navigational error that caused him to sail past the mouth of the Mississippi and land instead in Texas in 1685 (Weddle 1973:3 and n).

Other instruments in use by navigators were the mariner's astrolabe, used to observe the meridian altitude of the sun for computing latitude, and the quadrant and *ballestilla,* or cross-staff, for securing the latitude by sighting the sun or Polaris. All these instruments had been known since the thirteenth century, but the cross-staff was not in common use among mariners until the middle of the sixteenth. Since the instruments carried aboard *Santa María de Yciar* are not listed in her register, it cannot be known whether she carried either cross-staff or quadrant, though she probably did. Three astrolabes, however, have been brought up from the wreck sites, bearing dates of 1545 and 1550.

The quadrant was a simple device, comprising a quarter circle, marked off with a scale of 1 to 90 degrees and mounted at the foot of an inverted V. On one leg were two pinholes, forming a sight. A plumb line was suspended from the apex. The sight was aligned on the pole star and the reading taken from the plumb line's point on the scale. Polar altitude in degrees gave the observer's latitude, provided that all the necessary correction was applied to allow for Polaris's circular path around the pole. The correction could be ascertained from the position of the guards—if the navigator knew how to do it. It was a difficult instrument to use at sea because the slightest motion of the ship could set the plumb line swinging wildly, making it impossible to get an accurate reading from the scale (Parry 1964:107–108).

The mariner's astrolabe was slightly more convenient than the quadrant, in that it had no plumb bob. It did not have to be held in the hand but had a ring at the top from which it could be suspended at a suitable height for taking sights. It consisted of a wooden or metal disk or wheel with a propeller-like sighting arm made to rotate on a spindle at the hub until the sun at the meridian was sighted through pinholes in either end. The altitude was read from the scale at the instrument's outer rim and subtracted from 90° to get the zenith distance. The sun's declination was applied according to season and hemisphere to get the correct latitude. The declination came from daily tables contained in every rutter, or seamanship manual (Morison 1971:151–153).

The cross-staff consisted of a wooden rod three-quarters of an inch square and about 3 feet long, graduated along one side in degrees and minutes. A cross piece was fitted to the staff so as to slide easily along it. To sight the star, the end of the staff was held to the eye, the cross piece moved until it corresponded to the distance from the horizon to the star. The altitude was read from the scale. Although its use required considerable skill, its simplicity made the cross-staff the favorite instrument for its purpose (Parry 1964:109, Water 1958:53–55).

The inadequacies of all these instruments, however, imposed a continued reliance on dead reckoning—primarily the plotting of compass course, with speed, wind, and current effects largely estimated. Not even the chip log, which provided a more accurate method of determining speed, was in general use until after 1575. The gradual improvement of charts and the increasing experience of the navigators on particular voyages, however, helped to make sailing to the Indies progressively easier and less hazardous.

Chapter 7

THOSE IN PERIL

On his first voyage, Columbus utilized the northeast tradewinds and a westerly flowing current to propel him from the Canaries across the Atlantic. He undoubtedly had prior knowledge of these natural forces, but he also enjoyed a stroke of luck. He sailed at the northern limit of the trades and, but for extraordinary good fortune, might have been becalmed (Morison 1942:198–199). Understandably, the course to the Indies needed considerable refinement. Later, the most likely course for sustained favorable wind, as well as current, was much better understood. The natural ocean flows—resulting from vertical circulation of the ocean and the earth's rotation, contours of shore and bottom, and the wind—were an advantage on the entire round trip to America. This was especially true after the Mexican Conquest, as the Gulf Stream, one of the largest and most important of ocean currents, aided ships in their passage out of the Gulf of Mexico and northward along the Atlantic seaboard to a likely latitude for the homeward crossing.

On sailing from Sanlúcar de Barrameda, ships bound for the New World in the early eighteenth century rode the northeast trades and the Canary and Northern Equatorial currents west–southwest to latitude 18°, to negotiate the Anegada passage of the Antilles (Orbe 1712). In earlier times, they sailed even farther to the south to enter the Caribbean at Guadaloupe (as with the 1554 sailing) or Domínica (the case with Carreño's 1552 fleet);

the choice was apparently governed largely by chance. Once in the Caribbean, the New Spain fleet followed the southern shore of the Greater Antilles, sighting the prominent points. Soundings apparently were not considered necessary, even in the sixteenth-century, until Cape San Antonio, at Cuba's western tip, was passed and the Gulf of Mexico entered.

There survives in the British Museum an interesting document dated 1583, entitled "Pilot Major Francisco Manuel Concerning the Ship's Course of Father Urdaneta," which sheds considerable light not only on the course of Indies sailing but also on navigational procedures of the time. Appended thereto is a list of latitudes of prominent points and coastal settlements in the Antilles, Tierra Firme, New Spain, and the region then known as Florida (Manuel 1583). A comparison of Urdaneta's latitudes with a modern map shows considerable discrepancy, serving principally to reveal the inaccuracy, and inconsistency, of sixteenth-century navigational techniques. A part of the error may be attributable to use of "flat" charts—which is to say those not employing the Mercator projection. But Father Andrés de Urdaneta must be considered one of the most skillful navigators of his time. At age 17, he had sailed in 1525 with the Loaysa expedition from Spain to the Spice Islands, the first follow-up to Magellan's voyage. He returned, by way of the Cape of Good Hope and Portugal, a seasoned mariner at age 28.

Urdaneta went to New Spain in 1539 to help Pedro de Alvarado, then governor of Guatemala, put together a new trans-Pacific voyage, but it never came off. In 1552, at age 44, he became an Augustinian friar and joined in efforts to convert the Mexican natives. But his early experience was not overlooked. In 1559, Philip II ordered him to serve as chief pilot of a new voyage to the Philippines and allowed him to name the captain-general. It was on this voyage from the Mexican west-coast port of La Navidad, headed by Miguel López de Legazpi, that Urdaneta at last succeeded in finding an eastward route across the Pacific, which served the Manila galleons plying between the Philippines and Acapulco from 1567 to 1815 (Morison 1974:492–495).

When Manuel, pilot major in the Casa de Contratación, got around to compiling his notes and observations on navigation to the Indies, Urdaneta had been dead 15 years. The fact attests to the merit of the cleric's perception relative to that of other navigators of his time. The date that Urdaneta actually made the observations, unfortunately, cannot be known, but it probably was between 1539 and 1552, the year he took holy orders. The magnitude of Urdaneta's contribution is indicated by Manuel's subtitle: "Ship's course, landmarks, and lead soundings of the coast of New Spain, Tierra Firme, and the return voyage from the Indies to Spain with the measurements of sun, stars, and rays of the sun's declination with many questions and answers concerning the art of navigation and rules to gauge the moon, landmarks, and other pertinent information concerning navigation gleaned by Francisco Manuel. . . ."

Urdaneta's course struck the Antilles at Domínica. Entering the Caribbean, it advanced northwestward, then turned to the west to conform to the outline of the archipelago. Step by step, Urdaneta delineates the course and names the prominent landmarks, including these still found on present-day maps: Isla Saona, between Puerto Rico and Hispaniola; Santo Domingo, and Nizao to the southwest; La Beata (island and cape), at Hispaniola's southern tip; Cape Tiburón, at the western end of Haiti.

Doubling Cape Tiburón, the course turned northwestward until the Sierras de Cobre were sighted, then swung westward along the Cuban shore to pick up Cabo de Vera Cruz (Cabo Cruz). Sailing out of sight of land for a time, the mariners then looked for Grand Cayman, feeling the pull of the Caribbean Current as it flowed toward the Yucatán Channel.

The course from Grand Cayman was northwest, a quarter west until the Isla de Pinos came into view; then it bent west another quarter to sight Cabo Corrientes, then Cabo de San Antón (Antonio), marking the entrance to the Gulf of Mexico. Beyond, to the northwest, it was time to break out the leadline to sound the Campeche bank before turning west–southwest. Evidently, Urdaneta was wary of the Alacrán reefs which, being low-lying and difficult to sight, could easily snare passing ships. The sounding was recommended at 24°30′. If enough water was under the keel, the course was changed to west–southwest for a day's run before bending again to the southwest, taking care not to go south of latitude 20°.

The course was held until a thin sliver of rocky beach was seen protruding into the sea. This was Punta Delgada, which marks the shallowest part of the generally deep water along this portion of the Mexican coast. Near this point in 1519, Hernán Cortés—having passed up the present site of Veracruz as too marshy—dropped anchor to found Villa Rica de la Vera Cruz. In later times, a lighthouse and marine station were built on a rocky promontory called Punta del Morro, a few miles up the coast, with a commanding view of the rocky shoreline.[1]

With Punta Delgada safely behind, the sailing vessel eased along the coast in plenty of water, being mindful only to keep the shore in view, lest the current, flowing southeast, carry it too far out to sea before the Río de la Vera Cruz was sighted. The only reference to current in Manuel's compilation of Urdaneta, this mention evidently is of a shore current, rather than the main northerly flow that aided vessels on the Vera Cruz to Havana run. Passing the river (the present Río Antigua), which then marked the site of the town of Vera Cruz (Antigua), the ship found the channel at the southeast end of the island of San Juan de Ulúa. This was 18.5° by Urdaneta's reckoning—actually just above 19°. The pilot sighted the house of one

[1] The marine station, a beautiful ruin, had pigs sunning themselves on its ornate porticoes and ancient farm implements stored within its tiled halls on our visit there in the summer of 1975.

Buytrón on the mainland and sailed toward it, approaching his mooring off the island in 5 fathoms, careful to avoid the reefs along the channel.

If the ship were sailing from Cape San Antonio for Campeche, the course was west, a quarter to the southwest. Mariners were cautioned to heave the leadline until land was sighted. Then it was safe to proceed as long as soundings showed as much as 5–12 fathoms with rock bottom. A bower housing a sentry would be sighted, then three mesas of tall mangrove trees before Sisal, where the coast turns toward the southwest. Careful to keep 5 fathoms of water under the keel, the mariner held the coast in view until he spotted Campeche on an eminence above the bay (Manuel 1583).

Vessels bound from San Juan de Ulúa for Havana were advised to sail northeastward to about latitude 25°, then turn eastward until the wind was on the quarter. The course was designed to bring the ship within sight of the Tortugas, 65 miles (104 km) off Key West, and there the leadline was to be used again.

If the lead brought up sand, the ship would be west of the islands. The bottom on the southwest would yield shell, whereas black sand indicated the desired position south of the Tortugas, with open sailing between the ship and the Cuban coast. With a southwesterly course set, lookouts were posted for Havana.

However, if the ship departed San Juan de Ulúa with the wind from the northeast, the rules changed. The ship should then beat to windward until it reached latitude 27°30′—approximately on a line with Kingsville, Texas, and Palmetto, Florida. Soundings were then to be taken, probably revealing a position about even with the mouth of the Mississippi River—due north of the Alacrán reefs. Thence the course should bend eastward, with soundings again called for off the Florida peninsula, near the "Bay of Juan Ponce." And thence southwestward until bottom was lost, in search of Cuba, marked by Los Órganos, a mountain range with spirelike formations resembling organ pipes. Bending left along the coast, the course then would bring into view the breastlike formations flanking Havana, then the tower of Castillo del Morro, "which looks like a ship in sail." Entering the harbor, the ship was advised to stay close to El Morro's side, then proceed toward "the new fortress" a little farther in, where there was good depth (Manuel 1583).

From Havana, the homeward course lay northeast with a stern wind (aided by the Gulf Stream), in search of the head of the Mártires, the Florida Keys that possessed such great potential for making martyrs of Spanish seamen. On sighting the keys, the mariner was advised to proceed northeast, a point to the north, through the Bahama Channel, bending a point to the east at about 29°. That course was held to 37°–40°. Picking up the westerly winds (and the North Atlantic Drift), the ship headed for Cape San Vicente and home (Orbe 1712).

The Bahama Channel itself was fraught with hazards, especially when contrary winds were at work. On August 31, 1555, Pedro Menéndez de

Avilés wrote a letter, which was routed through the Council of the Indies, to remind the king of an urgent matter. Charles V had expressed the desire more than a year previously that Menéndez send a patache from Havana to seek the site for a fort on the Florida side of the channel, where storm-ravaged ships might take refuge. He had promised a cédula on the matter, but Menéndez (1555) had not received it. Not for 10 more years would Menéndez at last have the way cleared for founding St. Augustine, Florida, the oldest city in the United States.

In all the sailing instructions at hand, no specific mention is found of currents that could be taken to mean the complex system known today, of which the Gulf Stream is the best-known component. Yet the effect of these flows was perceived as early as Columbus's third voyage, and their study probably dates from an incident that occurred off the southern Hispaniola shore in 1498. Columbus, having sailed from the Boca del Dragón at Trinidad's western point, reached Santo Domingo at Isla Beata, 75 miles (120 km) west of where he had intended. "This current, which sets across the Caribbean Sea, and the continuation of which now bears the name of the Gulf Stream," says Irving (1849:II, 124), "was so rapid, that on the 15th, though the wind was but moderate, the ships had made seventy-five leagues in four-and-twenty hours." The flow referred to by Irving is that which is presently described as the Caribbean Current. In modern terminology, the Gulf Stream is the one flowing out of the Florida Straits, northward along the Atlantic seaboard.

In a letter to the Catholic kings, Columbus posed the hypothesis that this stream, setting out of the Boca del Dragón, had separated Trinidad from the Península de Paria. He further supposed that the current's continuous action had worn away the borders of the mainland, gradually producing the fringe of islands known as the Antilles, which he believed originally to have been part of the continent. In corroboration, he noted the form of those islands: a narrow strip from south to north, then curving westward in the direction of the flow (Irving 1849:II, 125).

A pilot on this voyage was Andrés de Morales (Sauer 1966:44), who was to win fame as a hydrographer. Morales sailed as a pilot with Rodrigo de Bastidas in 1500–1502 and with Juan de la Cosa, 1504–1506, on voyages to Tierra Firme's Pearl Coast. Resident several years at Santo Domingo, he was employed by Governor Nicolás de Ovando to explore and map the coasts of the Antilles. After Juan Díaz de Solís became pilot major in 1512, his maps were prized at Seville as the most accurate ones available. The exceptional powers of observation that made Morales a good cartographer also contributed to another accomplishment: He was the first to develop a theory concerning ocean currents in the Atlantic (Fernández Duro 1895:I, 119–120), thereby contributing greatly to Indies navigation. The beginning of his study, undoubtedly, was Columbus's third voyage, when the Caribbean Current swept the Admiral's ships off course.

The direction of currents that aided Spanish ships over the entire round-trip voyage to New Spain corresponded closely to the prevailing winds. Wind direction being the primary factor in determining the sailing route, the importance of the currents often has been overlooked. But they were early recognized by mariners sailing to the Americas as forces to be taken advantage of, or to be reckoned with.

They became most noticeable when they ran contrary to the desired course, as Juan Ponce de León, running Florida's east coast, discovered in May, 1513. When Ponce attempted to sail southward, he encountered a current so strong that it drove him back, even against the favorable wind. He had found the Gulf Stream, flowing northward out of the Bahama Channel. The ship farthest from shore was carried out to sea. Those closest in dropped anchors, but the flow was so powerful it strained the cables (Lowery 1911:140). This force, so contrary to Ponce de León's chosen course, was later turned into an advantage by Spanish navigators. Ships homeward bound from the Indies rode the Gulf Stream until they were in the North Atlantic Drift and westerly winds at latitude 37°–40°.

The Gulf Stream is part of a clockwise-flowing system that embraces the largest part of the North Atlantic. Fed by the North Equatorial Current, moving from North Africa to the Lesser Antilles, it splits at the islands—the northern branch, called the Antilles Current, flowing north of the Antilles, the southern arm passing through the Caribbean and, via the Yucatán Channel, into the Gulf of Mexico, where it makes a wide circle before reemerging into the Atlantic through the Straits of Florida as the Gulf Stream. Deflected by the Great Bahama Bank, the Stream flows north through the Bahama Channel, beyond which it is rejoined by the Antilles Current and continues, roughly parallel to the coast of the United States, to about Cape Hatteras. From there, it veers eastward, eventually to become the Atlantic Drift, one branch of which goes northeast to pass close to the British Isles before entering the North and Norwegian seas. The other bends southeastward to join the Canary Current, thus completing the circular path that helped carry Spanish fleets to the Indies and back again. Taken as a whole, the system is the largest and most significant of ocean currents. A major part of the complex whole, the Gulf Stream attains a velocity of about 3.5 knots [nautical miles per hour] in the Straits of Florida, with a volume of 920 million cubic feet per second—a thousand Mississippi Rivers. It was Ponce de León's luck to try to sail against it near its strongest point.

The first leg of the Indies voyage, from Sanlúcar de Barrameda to the Canaries, ordinarily took only 7 or 8 days. From the Canaries to the landfall in the Lesser Antilles—Deseada, Guadaloupe, or Domínica—required 25–30 days. From there, it was considered to be a 15-day voyage to Nombre de Dios—28 days to San Juan de Ulúa (Cespedes 1945:129, Haring 1918:223). On the course to New Spain, ships dropped off along the way at ports in the Greater Antilles—San Germán and San Juan de Puerto Rico,

Santo Domingo (now Ciudad Trujillo), and Santiago de Cuba—and at Trujillo and Puerto Caballo in Honduras (Haring 1918:225). Beyond Cape San Antonio, a ship or two might also leave the fleet to sail along the Yucatán coast for Campeche (Manuel 1583).

For the homeward voyage, all the ships would gather at Havana to sail together, except those at Puerto Rico and Hispaniola. The ships at Nombre de Dios, and later Portobelo, considering the maze of cays and reefs that blocked a direct course for the Yucatán Channel, sailed back to Cartegena on the eastward shore current. From Cartagena, the course was northwest past Jamaica and the Caymans to the Isla de Pinos and thence around the capes, through the channel, and along the Cuban shore to Havana (Haring 1918:226).

Cartagena, the first port of call for the Tierra Firme fleet, was the gateway to New Granada, a part of the viceroyalty of Peru until the eighteenth century. It was one of the richest and best-fortified cities in the Indies. When the fleet arrived there, the captain-general sent a dispatch boat to Nombre de Dios with the news, which was carried forthwith across the Isthmus of Darién to Panama, on "the South Sea." Another dispatch boat carried the word from Panama to Payta in Peru. From Cartagena, messengers also went overland to Santa Fé de Bogotá and Lima, whence runners carried the news to the outlying provinces. The ships were instructed to remain at Cartagena a week, but local merchants frequently offered inducements for them to stay longer (Haring 1918:188).

As the messengers spread the word, New Granada's riches began to flow toward Cartagena: pearls from Margarita and Rancherías, indigo, tobacco, and cocoa from the Venezuelan coast. The viceroy at Lima dispatched the South Sea armada, after the king's revenue was gathered from the various provinces, to carry the treasure to Panama for transshipment by muleback and river barge to Nombre de Dios (Haring 1918:188–189).

Despite the riches that passed through it, Panama was a ragged, squalid village of wooden huts housing about 500 Spaniards and 400 Negroes. Virtually all the citizens were merchants or transportation agents, with a smattering of farmers, ranchers, and pearl fishermen. Undoubtedly it had its wealthy merchants. But living costs were high, the mode extravagant, and comforts few (Haring 1918:185-186).

Nombre de Dios, on the opposite side of the isthmus, should have been in an enviable position. Passing through its port were all the cargoes from Spain that were destined for Peru. Peru's riches being sent to Spain were received from the mule trains and Chagres River flatboats that traversed the isthmus. Though it served as the major terminus till near the end of the sixteenth century, however, it was never more than a makeshift village. The bay was shallow, ringed with reefs, and unprotected from the sea. The unwalled settlement of 150 wooden houses had a narrow stretch of beach in front and jungle behind. Fever raged the year round, and the women were

sent inland to Venta Cruz to bear and rear their children. Although there was a flurry of activity when the fleet was in, it quickly fell away when the ships departed, and the population reduced to no more than 50 households. Nombre de Dios clung to its role until nearly the end of the century, when the port at last was moved 5 leagues to Portobelo—a better natural harbor, but just as unhealthy (Haring 1918:184–185).

In many respects Vera Cruz, whose more elegant citizens resided in Jalapa to escape its mosquito and ratborne diseases when the fleet was not in port was little better. That was certainly the case following the hurricane of 1552. Vera Cruz lay almost directly to leeward of Havana, a fact accounting in part for the indirect sailing route prescribed for reaching the Cuban port. The gulf current partially offset the disadvantage of the extra leagues of sailing, but not entirely. It took an average of 18–20 days to reach the Cuban port—as few as 12 and as many as 40.

Havana, as the port where the various segments of the fleet gathered for the homeward voyage, was of rising importance in Indies navigation. In 1553 the emperor, spurred by the exigencies of war, restored the semiannual *flotas.* He decreed sailings from Spain in January and September, and each fleet was to be accompanied by four armed vessels paid for by the *avería.* One of the armed ships was to sail with the merchantmen bound for Hispaniola and the other islands, another with the Tierra Firme fleet to Nombre de Dios. The remaining two would go with the Mexican flotilla through the Yucatán Channel and then turn off to Havana, from which it would patrol the island environs for corsairs until the fleet gathered again for the eastward crossing. So important was Havana that in February of 1553, the Audiencia de Santo Domingo ordered the Cuban governor to move his residence there from Santiago. Not only was Havana the rendezvous for ships from all the Indies; it also was the key to Spain's Indies possessions.

Time would prove that Havana depended on the fleets, drawing its life and prosperity from the crews awaiting the time for sailing home. It supplied the ships with fruits, salted meats, and various other provisions. It also provided accommodations for the ships' passengers, already weary of the sea from the first leg of their voyage from Cartagena or Vera Cruz (Haring 1918:203).

Attempting to reconstruct a sixteenth-century voyage to the Indies is subject to almost as many hazards as was the voyage itself. In previous efforts to do so, different writers have taken varying views. The voyage is depicted by some as a happy adventure; others view it as a medieval horror. The best view is afforded by someone who actually made the voyage, and recorded it soon after. Such a chronicler is Tomás de la Torre, one of 45 Dominican friars who sailed on July 9, 1544, from Sanlúcar for assignments in America. (Also among the group was Fray Vincent Ferrer, kinsman of Fray Juan Ferrer, the mystic said to have foretold the 1554 shipwrecks.)

This voyage is of particular interest because Bartolomé de las Casas,

bishop of Chiapas, was one of the number. It was he, remember, who came to Sanlúcar when the 1552 fleet was getting ready to sail to see his Dominican friars off to the Indies; he complained of the delays that caused them to scatter and denounced the overloading that increased the hazards for all who sailed. But he himself did not sail that time, because of his advanced years. The 1544 voyage, made when he was 70, was his last, and in some ways his most important.

On his final voyage, says La Torre, the old firebrand sailed "with great consolation and glory, as he was bringing the remedy for the Indies, consisting of many Royal laws and provisions, obtained and issued by the Council of the Indies. . . . He carried powers and provisions to liberate all the slaves, and to institute Royal Courts of Appeal, and too many other things to relate . . . ; but most of all, he was pleased to have assembled the largest group of Religious that ever had left our Order for the Indies [Torre 1973: 465–466]."

Las Casas, as all men with ideas beyond the common understanding, was a controversial figure. If he was looking to the voyage as a time of peaceful enjoyment of his life's accomplishment, it was not so. "The remedy for the Indies" that he was bringing was the "New Laws" signed by Charles V on November 20, 1542, forbidding the further granting of *encomiendas* (whereby Spaniards were accorded privileges to demand tribute or slave labor from Indians for their personal gain). Grants already in existence would lapse on the death of the holder. The laws also prohibited the enslavement or enforced personal service of the Indians. If Las Casas, armed with these decrees, felt that his life's work was accomplished, he was to be sadly disillusioned.

Las Casas's importance to this period and the far-reaching implications of his thought makes him worthy of a brief biographical summary. His name was known, and often despised, throughout the Indies. His ideas—principally, maintaining that the Indians were human beings and should be treated as such—were detested by the colonists, whose chief objective was to enrich themselves at the natives' expense.

Las Casas, whose father and uncle had sailed with Columbus on his second voyage, was born at Seville in 1474. While a student at the University of Salamanca, he had an Indian slave given to him by his father, who had received him from Columbus. One version is that his zeal for the Indians' welfare stemmed from Isabella's well-intentioned order that all such slaves be sent back to their country (Irving 1849:III, 416).

In 1502 Las Casas went to Hispaniola with Governor Nicolás de Ovando and became an eye-witness to the various forms of cruelty inflicted upon the natives. In 1510, he became the first priest to be ordained in the New World, but he still participated in the conquest of Cuba, 1512–1513. For his services, he was awarded a sizable *encomienda.* Indications are that he was, at this stage, still oblivious to the Indians' woes. Despite his priestly

status, he was little better than the rest of the gentlemen–adventurers who rushed to the New World in quest of quick fortunes. Various influences were at work on him, however, and eventually he experienced a change likened to that of Saul of Tarsus on the Damascus road (Hanke 1949:20–21).

In 1514, he renounced his *encomienda* and preached his first sermon against that system. Returning to Spain, he was granted an audience with Ferdinand to discuss the wrongs being done the natives, but a month later the old king died, and the Indians' "apostle" turned to Cardinal Francisco Jiménez de Cisneros. Charged to elaborate a plan for the Indians' relief, Las Casas returned to America to help put it into operation, only to have it thwarted by the *ecomenderos.* Back in Spain, he found favor with the new King Charles, and was again asked to devise a plan for ameliorating the plight of the New World natives.

At the time, Las Casas was ignorant of the evils of the trade in African slaves, the first of which had been taken to Hispaniola in 1501. He had heard only that the Negroes endured servitude much better than the Indians, and that one Negro could do the work of four American natives. He therefore proposed the substitution of one type of slavery for another. The suggestion was welcomed by his opposition—principally Bishop Fonseca and officers of the Casa de Contratación—and was implemented, much to Las Casas' sorrow. When he realized his error, Las Casas was conscience-striken and doubted that God would forgive him.

His next effort in the Indians' behalf, the establishment of a "model colony" on the northern coast of South America, ended in bitter failure. When he arrived there, he found the natives so hostile over slave raids by the pearl fishermen of Cubagua that nothing could be done. When the Indians raided his stores and murdered his followers, he took it as an indication of God's disfavor and his own unworthiness.

Returning again to Spain, he joined the Dominican order and spent the next 6 years in quiet study, composing his *Historia Apologética,* which has been acclaimed as one of the earliest and most valuable descriptions of the New World. In the interim, Charles V issued decrees favorable to his cause, forbidding among other acts the awarding of further *encomienda* grants. But the distance between Spain and the New World rendered enforcement impossible. The emperor's edicts were tacitly ignored.

The glaring contrast between the will of the king and the actual situation roused Las Casas to renewed activity in 1529. He began by pleading his cause again in Spain. Then, after sojourns in Peru and the islands, he scored the only real triumph of his entire effort. Guatemalan authorities, long perplexed by futile efforts to conquer the northern province of Tuzulutlán, challenged the crusading priest to subdue it by the peaceful means he advocated. They promised him 5 years without interference. Two years later, however, he was summoned by his Dominican superior at Guatemala

and sent back to Spain to collect more priests for the conversion of the Indians (Merriman 1925:656–660). He remained there until he sailed with the other 45 Dominicans from Sanlúcar on July 11, 1544, to take his post as bishop of Chiapas. In the interim, he wrote *The Very Brief Relation of the Destruction of the Indies,* which he finally had printed in a collection of his polemical writings in 1552 (Collard, 1971:xxvi).

The winning of the New Laws had not been easy; Las Casas encountered all manner of opposition from the emperor's advisers. It was worse at Seville, for he had been responsible for the freeing of all the Indian slaves there, arousing the hatred of the *Indianos*—the Spaniards who had been in the Indies and held property there. It was worse still on shipboard, and even worse than that in Mexico.

Shortly before the 1544 fleet was to sail, Las Casas joined the other priests at Sanlúcar, where they had gone hurriedly 6 months previously, upon receiving word that sailing was imminent. While they waited, a nameless duke contributed to their mission two cows, several casks of wine, and 37 bushels (24 *fanegas*) of wheat. The duchess sent money for masses, and delegations from neighboring monasteries came to offer prayers and good wishes.

At last, on July 8, the vicar general, Fray Tomás de las Casillas, advised the company to make confessions, say the High Mass of the Holy Ghost, and take Holy Communion in preparation for sailing next day. The following morning the priests arose before dawn to say mass before sailing, only to learn that departure had been delayed again.

Once on board the ship, they remained there, despite the oppressive midsummer heat, passing the time with religious chants. Mindful that they may never see their homeland again, they consoled themselves with anticipation of their reward, both earthly and eternal.

On July 10, sails at last were hoisted and the 26 ships—*naos,* caravels, and one armed galleon—began easing past Sanlúcar's treacherous bar with little wind. All but three of the religious sailed on *San Salvador,* whose master was Hurtuño de Vista. Pedro de Ybarra, the owner, sailed as pilot. At first, Father La Torre complained of the inconvenience of granting the request of "the Viceroy's widow"—María de Toledo, a cousin of Ferdinand the Catholic and widow of Diego Columbus—that two priests besides her brother, Fray Antonio de Toledo, sail on her ship. But when the large company of religious began to draw abuse from *San Salvador*'s sailors, he lamented that the company had not been divided among all the ships. He was even more sorrowful with the realization that a disaster at sea involving the one ship could wipe out the lot.

San Salvador's potential for disaster was demonstrated before she was out of the harbor. She grounded on the middle of the bar, to remain there until afternoon of the next day before she was hauled off and crowded on sail to overtake the rest of the fleet. La Torre blamed the accident on improper

loading and lack of ballast, which made the ship unmanageable. The ship rode badly at sea, and the cargo stowed topside had to be shifted below decks at the Canaries to provide ballast.

Difficulties between priests and sailors arose before the ship was off the bar at Sanlúcar. The heat was maddening. Undoubtedly, from the sailors' point of view, the ship seemed overrun with the friars, who had no place to go to get out of the way except into the stinking hold. Those sitting or lying on deck were apt to be stepped on. Complained La Torre, ". . . they treated us as Negroes, and made us descend to sleep below deck, like Negro slaves. . . . They gave us other hardships and annoyances which can not be described [Torre 1973:469]." The first day, a divine service was sung, but, because the sailors molested them, the religious sang only the *Salve* thereafter. Each one said his prayers individually, whenever he could find a peaceful moment.

Certain allowances must be made for the unusual circumstances on *San Salvador*—the large number of priests with their own concerns, many of them unfamiliar with the workings of a ship and therefore irritated and irritating—but La Torre's account stands in sharp contrast with Morison's chapter (1974:162–180) on "The Mariner's Day." Morison accentuates the thrilling adventure of sailing the high seas, emphasizes the religious devotion of mariners, and pictures the ship's boys leading the company in *la doctrina cristiana* at the close of the day. There was a vast difference between the best circumstances, which seem rarely to have occurred, and the worst, or even the commonplace.

La Torre (1973:471) saw the ship as "a narrow prison, very strong, from which nobody can escape even though there are neither bars nor chains, and it is so cruel that no distinction is made among the prisoners, who are all treated and punished alike. The crowded space, the suffocating air, and the heat are unbearable. The deck is usually the bed."

Mattresses filled with dog's hair were small and hard, whereas blankets were of coarse "goat's wool." Although few had a desire to eat, those who did found that sweets did not stay down well, and thirst was heightened by ship's biscuit and other salted foods. Water was rationed to one-half *azumbre* ($1\frac{3}{4}$ pints) daily, and those who had brought wine found good use for it.

"The place is full of lice that eat every living creature," La Torre continues, "and one can not wash one's clothes, as they shrink when cleaned in sea water." Below deck, the air was foul, as the frequent working of the pumps stirred up the stinking bilge—the receptacle of vomit, human excrement, and filth of all kinds. There was no room for walking, and the passengers spent most of the time sitting or lying down; little could be done while standing. Death was constantly before one's eyes. Although such sufferings were usual aboard ship, La Torre allowed, "we felt them more than most because we were not accustomed to this strange life."

San Salvador was hardly out of sight of land before she began to suffer

the effects of bad ballasting, accentuated by stormy seas and a wind that forced all the ships to trim back to only the foresail. She listed so badly that she occasionally lay in water to the middle of her deck, and barrels stowed topside began swimming around. A lifeline was strung from stern to prow, and no one traversed the deck without clinging to it. Cooking was impossible, and half the ship could not be used. Though cargo was shifted below decks to correct the list, it failed to help.

"Shortly," says La Torre (1973:469–470), "the sea made us understand that it was no place for human habitation." All the religious but three "collapsed as dead" with seasickness, and "all the world could not have moved us." The father vicar, one of the few still on his feet, brought buckets and basins to catch the vomit, but if the receptacles were not in easy reach of the victims they were useless. "Some were below deck being boiled alive, others were being roasted by the sun above deck; cast on the deck, stepped on and trampled, dirty beyond words. . . ."

Bishop Las Casas, a veteran of 16 crossings, had with foresight brought a coop of chickens for the sick. He now offered them, but the priestly stomachs, turned inside out with seasickness, were hardly receptive even to chicken broth. A momentary cure was discovered, however, when the religious retching below decks heard a cannon's roar and the sound of arms being brought out topside. With Charles V and François I of France warring in Picardy, the sight of a large vessel in full sail brought corsairs immediately to mind. The flagship pursued, firing a shot across the bow; the visitor struck sails, revealing herself as a Spaniard. The fright past, the seasickness promptly returned.

Again, on the afternoon before the fleet made port at Gómera in the Canaries, 16 sails were sighted, and the fleet was on its guard throughout the night. At last it was decided the ships were Spanish merchantmen returning from the Indies. If they were, they must have included *San Nicolás* and *La Madelena,* with Antonio Corzo and Miguel de Jáuregui as their masters (Casa 1579).

Worse than the fear of corsairs was that of sinking. On at least two occasions pilots of the other vessels gave *San Salvador* up for lost. Captain-General Archuleta, observing the ship's poor condition, brought his flagship alongside twice daily to see how she was faring. On one occasion he suggested securing *San Salvador* to his own vessel with hawsers, but the master and pilot disdained the idea.

No Christian name is given for this captain-general but, in the absence of any other mention of an Archuleta during this period, it is assumed that he was Andrés Lopéz de Archuleta, the shipmaster–passenger on *Santa María de Yciar* when she crashed on the Texas coast 10 years later (Ojos 1554).

Although La Torre (1973:472–473) claims the priests were in constant fear of death, he later admits that they failed to comprehend their plight. No thought was given to transferring the religious to other ships because they, too,

were overcrowded, "but truthfully we did not understand the danger. . . ." Only the pilots of the other ships, observing at a distance, really knew how close *San Salvador*, her 40-odd religious notwithstanding, had come to swamping.

The *Indianos* blamed the storm on the friars, especially Las Casas, who, having attacked their vested interests for two decades, finally had succeeded in obtaining royal decrees that severely curbed their license. The sailors, too, took up the vendetta, and La Torre suspected them of casting some of the padres' provisions overboard and breaking one of their water jars. Most objectionable to the religious was being ordered about "like Negro slaves" and sent into the malodorous hold to serve as ballast in an attempt to correct the list. "Then it was realized what a great mistake it had been to bring us all together on board one ship, for even those who ship merchandise divide it among different ships, so that if some of it is lost another part is saved [Torre 1973:474]."

It took 12 days to reach the Canaries, instead of the usual 7 or 8. *San Salvador* was not the only vessel in trouble during that part of the voyage. Another lost her rudder, forcing the fleet to check its pace to keep the vessel in view. *San Salvador,* meanwhile, plodded ahead and therefore was the first to sight the pine-tree-shaped mountain of Tenerife. Twenty-four hours later, the fleet approached the rather small harbor at Gómera, and several ships, each wanting to make certain of getting inside, crowded on sail and pushed forward. La Torre describes a ludicrous scene in which *San Salvador*'s topsail became entangled with that of another vessel. Lines and shrouds were lost in the effort to free the snarled rigging. Almost at the same time a third ship crowded in from the opposite side. A collision was avoided by pushing the ship off with long poles, but not without further loss to *San Salvador*'s rigging. Then a caravel approaching from another direction stuck its lateen yard into the ladder of *San Salvador*'s main topsail, much of which had to be cut down.

Amid all the shouting and cursing, the padres scurried about to get out of the way but could find no suitable place to hide themselves. Then boats began to arrive to take the passengers ashore, and two of the friars who had been "nearly dead" from seasickness suddenly came to life, springing into the boat as if they were in the best of health.

During the 10-day stay on the island, the priests feasted their eyes on the lofty mountains and bright red soil with vineyards ready for the vintage and trees of ripening figs. Housed in the local church, they drank the island's sweet water and dined on the two sheep provided daily by Bishop Las Casas and Doña María de Toledo.

The father vicar, meanwhile, argued with *San Salvador*'s master and pilot over arrangements for the rest of the voyage. The ship's officers, who held the priests' promissory notes to pay their passage at the end of the voyage, declared the vessel seaworthy and insisted they would have to pay whether

or not they sailed on her to Santo Domingo. The matter was not resolved until Doña María—evidently a lady devoted to her religion—threatened to return to Spain and report to the king on the treatment the religious were getting.

At last, six boatloads of stones were taken on *San Salvador* as ballast and 19 of the religious were distributed among other ships. The voyage went better after the first few days of seasickness subsided. *San Salvador,* with proper ballast, now led the fleet. But progress was hampered by the caravels, which sailed poorly with a stern wind. The padres, now fewer in number, could take their meals together, pray in secret, and hold devotionals unobtrusively. St. Dominic's Day was celebrated with a feast for all hands, followed by another next day for the Savior, for whom the ship was named. From time to time, when another ship came alongside, the religious found opportunity to talk with their brothers on the other vessels.

But all the fleet's troubles were not past. A man fell overboard from the flagship and could not be rescued. Vandalism, too, persisted, as someone drilled a hole in one of the priests' water casks. The Dominicans refused to allow the culprit to be punished, and the trouble ended. In the smooth waters of the Atlantic, the seculars happily strummed their guitars.

Meals were sparse because of the difficulty of cooking: "Mostly they gave us a little bacon in the morning; at noon a little boiled salted meat and a bit of cheese, and the same thing in the evening. Each meal did not amount to as much as a pair of eggs [Torre 1973:481–482]." Thirst was a continuing problem. Some of the seculars gulped down their whole daily water ration at once and had to go thirsty until the next day.

On St. Barnaby's Day, August 20, *San Salvador* hove to, waiting for the slow-sailing caravels to catch up, then lay becalmed in a milky sea for 2 more days. The friars went swimming, and the sailors fished for sharks. The Dominicans partook of the shark dinner "most willingly," La Torre (1973:482) noting only that the taste was "somewhat strong, as with all large fish."

At sunset on August 26, cannon shots from the lead ship signaled the sighting of Deseada, which was left to starboard during the night. Next morning María Galante lay close to larboard and, the ship becalmed, the passengers had plenty of time to drink in its beauty. Formerly, La Torre comments, perhaps echoing Las Casas, "these islands were among the most densely populated in the world, but most of them were ruined by the Spaniards because of their insatiable greed, and their unheard-of cruelty and tyranny [p. 483]." The Caribs, who still inhabited María Galante and neighboring islands, he adds, went naked and used deadly poisoned arrows. Many of the religious pitied them, hoping to be sent by God "to save those souls that were being lost without remedy."

With a faint wind in the afternoon, the island of Guadaloupe came into view. As the fleet cleared Domínica Passage into the Caribbean, the flagship

broke out her bunting, posted her crew along the rail, and fired off her cannon in salute. The Caribbean, surprisingly, offered a favorable wind in contrast to the calm around the islands—just the opposite of the usual situation.

Sailing northwestward, the ships came on Sunday afternoon, August 31, to an open stretch of water which the sailors called "the passage"—actually Anegada Passage between St. Martin and the Virgin Islands, the preferred point of entry into the Caribbean in later years—then passed between St. Croix and the Virgins. That night, within sight of the Puerto Rican shore, came the calm that lasted 2 days. Swimmers carried food and wine from *San Salvador* to an ailing priest on another ship that lay close by, but a sudden wind separated the vessels. The men in the water were nearly lost.

Next day several of the ships destined for San Juan left the fleet, joined by some others that were leaking and some with deaths on board. With 12 ships and a caravel remaining, Captain-General Archuleta sailed on to approach San Germán cautiously because it was a port often ravaged by French corsairs. Some of the priests who went ashore returned to the ship to dine after seeing the poor fare available in the town. Some brought back samples of the native produce: pineapples, bananas, guavas, potatoes, and casava, of which La Torre offers interesting descriptions (Torre 1973:486–487). But the most welcome treat was fresh water.

The night of September 7 the fleet struck sail off Santo Domingo, then entered the port on the morning tide, firing a salute before the harbor fort. *San Salvador,* bringing up the rear, crowded on sail to improve her position and came close to ripping out her bottom on a rock. When a lookout spotted the hazard, the rudder was laid over sharply, and she almost rammed the flagship. On Tuesday, September 9, 43 days after sailing from Gómera, the passengers went ashore in Santo Domingo, the end of the voyage on *San Salvador.*

There appears no explanation of why the Dominicans, bound for the Bishopric of Chiapas, of which Campeche was the closest port, sailed from Spain on a ship stopping at Santo Domingo, rather than one bound for New Spain. *San Salvador*, and perhaps the rest of Archuleta's fleet, eventually sailed on to Tierra Firme (Casa 1579). The friars were to remain in Santo Domingo more than 3 months before Bishop Las Casas was able to charter a vessel to take them to their destination.

In the interim, Las Casas observed first hand the reaction in the Indies to the decrees he had obtained from the Council of the Indies for liberation of the Indians. The first evidence was the reprisals being taken on the Dominicans in the island monastery. La Torre (1973:489) observes, ". . . the Spaniards could not stand the sight of the Bishop any better than that of the Devil . . . and as we were in his company they also showed us bad faces, and they would not give us food."

It seems that a continuing debate of some bitterness developed between Las Casas and the insular Spaniards. The colonials insisted that freeing the

Indians would ruin their estates and mines, and the bishop defended the Indians against the slaveholders' brutality. The argument evidently had its effect among Las Casas' followers, three of whom failed to arrive with their ship from Puerto Rico. Five more remained at Santo Domingo, and another returned to his native Mexico.

On Sunday, December 14, the chartered ship sailed from Santo Domingo with a good wind, and again the priests collapsed from seasickness. With French corsairs known to be prowling the Caribbean, the vessel sailed in the open sea only during the day, pressing in close to shore at night. Such ticklish navigation revealed the inexperience of the young crew. The ship's officers, La Torre notes disdainfully, were all Levantines—not a Spaniard among them. The ship was unarmed, ill provisioned, and otherwise badly prepared for the voyage.

Fear of the French, however, quickly gave way to a more immediate hazard: the weather. A stiff headwind arose on December 15 and forced the ship to pass below Jamaica instead of on the side of Cuba. The storm abated on December 18, allowing a day of sailing to correct the course, then struck again at midnight with increased fury. Most of the religious company, half kneeling, half lying on the rolling deck, said their litanies and commended themselves to God's care. The rain came in torrents, and each mountainous wave crashed upon them with such violence that it seemed the small ship would be smashed. With all sails furled, there was nothing to do but hang on and try to keep steerage before the storm. The blow lasted throughout the day and the second night was even worse than the first. The priests said their confessions and, clustered in the sterncastle cabin, prayed throughout the night.

There was danger of complete loss of steerage and, when it seemed that the ship would broach to, the pilot put on a patch of sail to take the wind on the stern and "steer by God and chance to where the wind would carry us." Even with the narrow strip of canvas, the vessel moved so fast that it was feared it soon would run out of sea room or ground on one of the banks or shoals that punctuate the Caribbean southeast of Jamaica. A sea anchor was put out to check the speed, but still the ship made more headway than was desired.

On Saturday, December 20, Bishop Las Casas, the pilot, and Fray Pedro Calvo, himself an experienced pilot, conferred and agreed that if the storm did not soon abate they would steer for one of the shoals, where the people might have some chance of survival. The ship could not endure such punishment much longer. That afternoon the entire ship's company confessed, and many promises were offered in exchange for rescue. But that night the storm worsened still, and "the waves seemed to reach the sky." The ship trembled as each mountain of water fell upon her stern, and the foremast, which carried the small patch of sail, snapped before the raging wind. The prayers of the religious were shouted above the storm.

But that night, the old bishop ordered them all to silence. He "exorcised the sea, ordering it in the name of our Lord Jesus Christ to abate and be silent." Then he told the people to banish their fears. ". . . God was with us and we would not now perish. . . . Then we sang hymns for a long time, and while we were singing one of the sailors said, 'Father, the tempest has ceased' [Torre 1973:498–499]." The company burst forth in a *Te deum laudamus* and gave thanks to God.

That Sunday, St. Thomas's Day, a good wind blew up that lasted until Christmas, which was ushered in with a midnight mass, following the Vigil of the Nativity before a makeshift altar. Then the crew slept, and it was providential that Fray Pedro Calvo, the priest–astronomer–pilot, sighted land. It was one of the Cayman Islands, indicating that they had returned to the course from which the storm had taken them 10 days previously.

A calm, then another brief storm, came upon the ship in the approach to the Yucatán Channel; but on New Year's Day, 1545, they found bottom with the leadline. Feeling their way along the Yucatán coast, the mariners lay off Campeche the morning of January 6, and a boat was launched to take Bishop Las Casas to the village of 500 houses but only 13 Spanish residents. When the boat returned, it was accompanied by a fleet of canoes filled with near-naked Indians, and the Dominicans still on board ship looked happily upon the "treasure" of souls to be saved for which they had endured the perilous voyage.

For two years thereafter Las Casas struggled in his new see against overwhelming odds, but the cause to which he had dedicated his life was essentially a lost one. Not only were the New Laws completely circumvented, but Las Casas himself, as their originator, was denounced to the Inquisition. He was the most unpopular person in the colonies. In 1547, at age 73, he returned to Spain, utterly disheartened. The evils he had labored so heroically to mitigate had steadily increased. The most permanent result of his work was not that which he had sought, but the perpetuation of "the black legend" of Spanish cruelty. In overstating his case—a common failing among ardent advocates—Las Casas provided ammunition for Spain's enemies that was happily seized upon (Merriman 1925:661–662). The injustice, so far removed from the goal he had in mind, lives on.

In 1550–1551, the old bishop engaged in his famous war of words with Juan Ginés de Sepúlveda over "natural" servitude and the right to conquer by war. He continued to write and maintained a voluminous correspondence on political issues (Collard 1971:xxvi). Though he is said to have resigned as bishop in 1550 or 1551, his dispatch of another contingent of religious to the Indies with Carreño's 1552 fleet appears to have been his last official act in this capacity. But he was sufficiently active thereafter to get himself again denounced to the Inquisition.

In 1559, when he was 85, he finished his *History of the Indies.* But Las Casas did not write for his contemporaries. The history was not published

until 1875 (Morison 1974:20). He evidently doubted the expediency of publishing it, for in 1560 he attached to the manuscript a note stipulating that he left the work in confidence to the college of the order of Predicators of San Gregorio in Valladolid. He begged the order's prelates to permit no secular person to read it for 40 years, after which time it might be printed if consistent with the good of the Indies and Spain (Irving 1849:III, 422).

The crusading priest, historian, and humanitarian, who felt himself annointed by God to sit in judgment of the events of those exciting times, was active almost to the end. He died in Madrid in 1566 at the age of 92.

Part III

THE GOLDEN FOUNTAIN

. . . the Lord sent out a great wind into the sea, and there was a mighty tempest in the sea, so that the ship was like to be broken. Then the mariners were afraid, and cried every man unto his God, and cast forth the wares that were in the ship into the sea, to lighten it of them.

—BOOK OF JONAH 1:4–5

During the reign of Charles V as Spanish king and Holy Roman Emperor, the extravagant royal apparatus was supported by gold and silver from the Indies. Not only did this source of wealth maintain the monarch in a manner he considered befitting one of such high importance; it also provided his armies, arms, and munitions for wars of both Spain and the empire.

In Charles's behalf it can be said only that he had the vision to recognize an obvious fact: The goose came before the golden egg. He therefore acted forthrightly to send Magellan on the round-the-world voyage that promised Spain a claim to the Spice Islands; to support Cortés in the Mexican Conquest, and Pizarro in Peru. Yet, even with the wealth that poured into Spain, he lacked the practical sense that would have enabled him to adjust expenditures to income. In this failure lay the making not only of a series of economic crises in his own time but also the ultimate ruin of Spain and the loss of her colonies.

In short, Charles V had visions of ruling the world, a grandiose dream that has appealed to the power hungry throughout history, none of whom has ever been able to find the resources to bring it to fruition.

Driven by this megalomania he, and his son Philip after him, often had the consignments of royal treasure from the Indies committed before they were received. In time, the Crown's share of New World wealth became grossly inadequate for the purposes to which he applied it. Charles thus was moved to commandeer the incoming treasure shipments consigned to private individuals.

All gold and silver bullion sent home to Spain, regardless of its final destination, went first to the Casa de Contratación in Seville, where the royal officers made certain that the shipment was legal and that all imposts due the Crown had been paid. Only after completion of this procedure was it finally delivered to its rightful owners—and perhaps not even then.

As early as 1523 the emperor fell into the habit of enforced borrowing from private treasure to finance his foreign wars and other exigencies. The loans were eventually to be repaid with interest, but the practice of deficit spending ballooned out of all proportion to reason and sound judgment. The result was stifling to Spain's economy. The history sounds a warning to twentieth-century America.

The indiscriminate borrowing claimed money destined for widows and children, forcing them into poverty. It drained the assets on which merchants were dependent for continued business operation. It undermined the economy and threatened banks with failure.

When the expected revenue failed to arrive, the result was financial havoc. From a monetary viewpoint, therefore, the loss of ships bearing treasure to Spain was a matter of no small importance. Economic conditions at home explain, at least in part, the promptness of official action to recover the gold and silver that lay at the bottom of the Gulf of Mexico off the coastal barrier known today as Padre Island.

Chapter 8

CATALYST TO DISASTER

Captain-General Bartolomé Carreño's fleet returning from Tierra Firme sailed into the mouth of the Guadalquivir at Sanlúcar de Barrameda on October 22, 1553. When word reached Seville, it was an occasion for rejoicing. The Crown, merchants, bankers, and private citizens were in desperate need of the gold and silver the ships brought.

For many, however, the jubilation quickly yielded to gloom. Four of the ships expected from New Spain had remained behind at San Juan de Ulúa, and with them a large quantity of goods and treasure needed by individuals and merchants to settle accounts. Two Seville banks promptly failed. Seville and, some said, the entire kingdom were in dire straits.

The situation was worsened by the slowness of the Casa de Contratación in releasing private property. Fifty-five days after Carreño made port, the casa at last cleared the individual consignments—those belonging to "passengers and foreigners"—while the merchants had to wait. Some excuse was given about casa officials having to render to the emperor an accounting of all the gold and silver remaining in casa vaults, then wait for His Majesty's approval before settlements could be made.

The University of Merchants was up in arms. The prior and consuls fired a letter to Prince Philip protesting the delay. Then, as if in answer, the emperor embargoed 600,000 ducats from private treasure brought by Carreño—some $3.8 million in modern terms. Again, the prior and consuls

tried to impress the gravity of the action on the Crown. They prophesied "total destruction" of the University of Merchants and of commerce throughout the kingdom—the Indies especially—if such practices continued. The fleet now preparing to sail would carry the word to the colonies and confidence would be destroyed: "Nobody will dare send anything back. . . . If they do . . . it will be hidden or unloaded before it arrives in Spain [Prior and Consuls 1553c]."

For months, the University of Merchants had stewed over precautions to thwart the usual hazards of Indies sailing. Their principal fear had been of French corsairs who, with growing boldness, eagerly awaited opportunity to pounce on a heavily laden treasure ship. The previous February the prior and consuls (1553a) had urged the sending of two or three armed vessels to meet Carreño at Havana and protect his fleet on the voyage across the Atlantic. The captain-general had shown himself inept at protecting his ships on the outbound voyage when three French ships and two *pataches* had snatched several Spanish merchantmen from under the very noses of the entire fleet and its armada.

Furthermore, it was feared that Carreño, abiding by his instructions, would wait 3 months in Havana for the New Spain fleet, and that would give rise to another hazard: He would be lying in that exposed port during the hurricane months of August and September, risking a repeat of the disaster that had befallen a Spanish fleet off Santo Domingo the previous August. Three loaded ships had gone down before the storm moved on across the Gulf of Mexico to ravage Vera Cruz. Then, should Carreño's vessels escape the hurricane season, they would reach the Spanish coast in midwinter, exposing themselves to still another grave risk.

The prior and consuls' paranoia stemmed from impending economic crisis. Their fears centered on the two basic and traditional causes of shipping losses in the Indies fleet: French corsairs—especially active since renewal of hostilities with Henry II the previous year—and foul sailing weather. To these two primary causes a third was irrevocably linked, and it served as a catalyst to both: inept seamanship. While often exacerbating the other two, this third factor was quite capable of functioning on its own. Many of the ships lost in Indies sailing might have been saved by capable masters and crews. With untrained men hauling the rigging and uncertain masters running the ships, any vessel became an easier mark for either storm or enemy action. This catalyst to disaster manifested itself in a variety of ways: use of unseaworthy vessels, excessive loading, improper ballasting, and inept management of arms and rigging. Yet there were times and circumstances when not even the best of mariners could triumph over the hostile sea; wind and waves refused to submit themselves to the control of men.

Instead of sending an armada to join Carreño's fleet at Havana, as the University of Merchants had requested, the Casa sent Captain-General Alonso Pejón to sweep the corsairs from the Azores and to wait there for the

homeward-bound fleet. In a letter dated May 1, 1553, Pejón reported to the casa that no corsairs had put in their appearance around the Azores for weeks. Sailing in the direction of the Indies for 10 days, he had encountered only one vessel, a Portuguese ship limping home from the Far East, most of her crew dead from scurvy, her rigging a shambles.

Pejón escorted the Portuguese to San Jorge Island, then put in at Fayal. Two small Spanish ships had just arrived, one from Santo Domingo, the other from Havana, with news of the hurricane that had struck San Juan de Ulúa and Vera Cruz the previous September. With 12 of the 15 ships in the harbor lost and the others in no condition to sail, Viceroy Velasco had sent word to Havana that he was delaying treasure shipments to the Crown until better vessels were available.

The two ships had other distressing news: the loss of Carreño's flagship on the outbound voyage and the death in Peru of Viceroy Antonio de Mendoza, who had been New Spain's first viceroy. One of Alvaro de Bázan's ships had grounded on the bar at Santo Domingo, begun sinking, and been unloaded there. And Carreño had lost another vessel to the French after his final departure from the Canaries. "It seems to me," commented Pejón (1553a), "that we are really having our troubles this year. May God remedy them."

He nurtured hope that the three storm-damaged ships at Vera Cruz might be made ready to sail after all and would bring the accumulated bullion. On that chance, he decided to remain in the Azores as long as his provisions lasted, to keep the French away.

By September, 1553, the prior and consuls were occupied with preparations for the sailing of a new fleet, with Cosme Rodríguez Farfán as captain-general. With Carreño not having returned, there was a shortage of funds with which to prepare the escorting armada, and the *avería* proved insufficient. The sailing, scheduled for October, at last was delayed until the end of January, 1554.

When Carreño's fleet at last arrived, it gave rise to hope, then despair. The news that the four New Spain ships had stayed behind was a disappointment to those who had counted on them to bring badly needed revenue. Another vessel, separated from the fleet, had made port at Terceira in the Azores, where her crew deserted and her cargo of bullion was unloaded. The approach of winter made it unwise to attempt to retrieve it (Prior and Consuls 1553b, Zárate *et al.*, 1553). There nevertheless was a ray of hope; four other ships had come from New Spain, though one of these had left part of her treasure cargo on the Havana dock when the fleet was forced by storm to put to sea ahead of schedule. But the hope faded as it became apparent that none of the bullion the fleet had brought would be applied to mitigating the monetary crisis.

The only remaining hope lay in a change of royal position concerning the private treasure consignments still held by the casa, or in the four ships

left at San Juan de Ulúa. When large chances are taken, the payoff often fails when it is most needed. Such was the case in the Indies trade generally and, specifically, with *San Esteban, Espíritu Santo,* and *Santa María de Yciar.* Economically and psychologically, the loss of those three ships could scarcely have come at a worse time.

It was, in a sense, a crowning blow to a long series of disasters, with a new one appearing at almost every turn. Losses were still being counted at Santo Domingo and Vera Cruz from the 1552 hurricane. The outbreak of war with France had increased corsair attacks to alarming proportions. Valuable ships and cargoes were being destroyed by stupid blunders. The repeated loss of treasure shipments meant further seizures by the Crown to finance the recurring wars of Spain and the empire. Merchants were deprived thereby of their only means of conducting business. It is small wonder the University of Merchants prophesied the ruin of the Indies trade.

The Spanish government, comprising a ponderous bureaucracy with confused goals and ill-chosen priorities, was failing utterly to cope. With the shortage of vessels becoming increasingly severe, the inadequacies of the ones available became more critical. Carreño's armada had arrived in bad condition. The ships would have to be repaired before they could sail again. The crews were sick, and many sailors had died at sea because of a shortage of provisions. Pressures mounted on those men and ships still available for duty.

Captain-General Pejón was sensitive to such pressures as he reported on October 30, 1553, to Prince Philip. He had not effected rendezvous with Carreño in the Azores, he said, because he had given chase to a French fleet that had sacked La Palma in the Canaries. Finding the corsairs at Isla de Flores in the Azores on October 5, he had pursued them 2 days, but it was a hollow effort. Merchant ships converted for war simply could not hope to outsail the corsairs. "On this voyage," said Pejón (1553b), "I have encountered many corsairs and they have all made fools of the armada."

To deal effectively with the Frenchmen, he suggested that the Crown order ships made especially for war. He recommended four galleons and two small frigates, which would enhance the armada's capabilities tremendously, quickly paying for themselves. With the present ships, half the time was being spent effecting repairs, a never-ending expense. Weak ships to begin with, they could endure no more than two voyages to the Antilles islands before they were put in the merchant fleet, and they could not carry the necessary artillery.

Despite his handicaps, Pejón (1553b) was getting ready to search out the French corsairs on the capes of Galicia. He had word that six vessels had sailed recently from St.-Jean-de-Luz, a French Basque fishing village on the Bay of Biscay. "I am certain," he said, "that these are bound for the Canaries. . . ." There they would wait for Farfán's fleet, now preparing to sail for the Indies.

The scarcity of ships was emphasized again with the sailing of Farfán's 49 ships on January 31, 1554. In 1553, a royal cédula had stipulated that, for the duration of the war with France, two fleets would sail for the Indies each year. Each would be protected by a four-vessel armada. After Farfán had sailed, however, the University of Merchants informed Prince Philip that it would not be possible to implement the cédula during that year. Farfán had taken all available ships and still had to leave behind much merchandise consigned to the Indies. Furthermore, there was not sufficient money at hand to provision another fleet that year "because Your Highness has taken what has come to the merchants."

Not only were ships lost to corsairs, storms, and careless seamanship, the prior and consuls (1554) pointed out, but also to the teredos that bored through the hulls, especially of vessels staying overlong at Vera Cruz. Action was urged to speed up the sailing from that port because 8 or 10 ships were being riddled by the shipworms each year. If the vessels survived the homeward voyage, they then had to be scrapped.

Ships laden with treasure were lost from almost every homeward-bound fleet. Even when such losses occurred in places convenient for salvage, the delay in getting the bullion to Spain crimped the royal coffers and caused cash flow problems for the merchants.

The fleet of Captain-General Sancho de Biedma returning to Sanlúcar on June 12, 1551, had sailed into a bad storm in the Bahama Channel that lasted 10 days. His flagship sprang a leak and went to the bottom. There was no loss of life, and all the king's treasure was saved, but no mention is made of that belonging to merchants and private individuals.

On June 9, 15 leagues from the bar of Sanlúcar, the powder magazine of a medium-sized ship in Biedma's fleet caught fire. The 10,500 ducats in Crown treasure she carried, as well as the unspecified consignments of private treasure and merchandise, were a total loss. Only a few of the passengers and crew managed to save themselves by jumping overboard (Biedma 1551). On Biedma's return to Spain, charges were brought against him for failure to keep his ships together.

Among the ships in Biedma's returning fleet, in which Bartolomé Carreño sailed as admiral, was *San Esteban* with Francisco del Huerto as master. Huerto had registered cargo for the return voyage in August, 1550, at Nombre de Dios, where he paid 6 pesos 2 *tomines* for a mass and burial of one of his sailors. Registered on *San Esteban* at Havana in March and April, 1551, was the cargo saved from San Juan Bernao's ship, lost as the fleet approached that port in December.

Arriving in Seville in June, Huerto (1551) showed the casa inspector proof that he had delivered royal dispatches to the officials in Nombre de Dios, and that he brought no Indians among his 12 passengers. The casa official collected maps and astrolabes for safekeeping in the casa vault until the next sailing.

Damián Martín, master of the ill-fated *Espíritu Santo* in 1554, also returned with Biedma's fleet. He had taken a ship called *San Pedro* on the 1550–1551 voyage to Tierra Firme (Casa 1579). The voyage provided these two masters a foretaste of the disaster to befall them later.

The Bahama Channel, rimmed by islands and shoal water and subject to rough weather at any time of year, was a particularly hazardous part of the homeward voyage. An even worse disaster than Biedma's was to occur there later that same year, when the galleon *San Juan* went down. The survival struggle of passengers and crew offers a parallel to that of the people from the three ships wrecked on the Texas coast in 1554. It was such disasters as *San Juan*'s that eventually caused Philip II to accede to the urgings of Pedro Menéndez de Avilés for the founding of St. Augustine in 1565.

San Juan, whose master was Juan de Lujarra of Vizcaya, sailed from Havana with four other ships on December 2, 1551. Juan Rodríguez was captain-general. On January 14, 1552, *San Juan*'s pilot, Francisco Martín, returned to Havana to relate details of the disaster to Dr. Gonzalo Pérez de Angulo (1552), governor of Cuba.

After a week of fair weather, the fleet had made 120 leagues (about 412 nautical miles) and sailed out of the Bahama Channel. Then a severe storm hit, blowing from the southwest. The ships managed to stay together during the first day and night of the tempest; but then they were blown apart, each to maneuver as best it could. On the third day outside the channel, all of *San Juan*'s masts broke under force of the wind and she lost steerage. Leaking badly below deck, the ship was taking on water rapidly. All the people were brought to the bridge and, as the ship began to sink, crew and passengers—more than 40 persons altogether, including 2 women—got into the lifeboat and abandoned the dying ship and virtually all her cargo of gold and silver bullion (Angulo 1552). Into the boat, however, went 249 marks of silver, which was to be retained even when 19 persons had to be put ashore in the Florida wilderness to lighten the boat (Bienes de difuntos 1552).

Then more than 80 leagues from the first island of the Lucayos, the castaways headed southeast, touching various islands of the Bahamas and sustaining themselves with a diet of snails and shellfish, until they at last reached an island they called Mymen, at the southern end of the Bahama Channel. Proceeding from there toward Matanzas, some 50 miles (80 km) east of Havana, they were overtaken by a strong wind that blew them on Christmas Eve to the Florida coast. Leaving the boat, they went a short distance inland and were attacked by Indians. Two sailors were killed. The others returned to spend the night in the boat.

On Christmas Day 23 painted Indians descended on the Spaniards with loud shouts and whistles and began shooting arrows. Ten sailors and passengers were wounded before the natives withdrew. When the Indians returned the following morning, the Spaniards greeted them with a crossbow attack. The natives then sent messengers who indicated by signs that they

wanted peace and would bring food. They brought 50 roasted eels, and the castaways gave them some shirts and linen in exchange. After 2 hours of visiting, the Indians suddenly took up bows and arrows and attacked. The Spaniards responded with their single crossbow, killing one of their attackers and ending the battle.

Rather than risk another such episode, the Spaniards put to sea again that night in the boat but the craft, damaged when it was tossed on the beach, was leaking badly. As the wind and sea arose, they returned to the beach and attempted repairs. When they tried again to sail, they found the boat still leaking. Menaced by both Indians and sea, the castaways seemed to have a narrow choice; they could elect only how they would die.

The sailors and passengers confronted the master and the pilot with their preference: Better to be slain by the Indians than to drown. At midnight they landed 3 leagues south of where they had been before. In shallow water, they brought the boat up on shore, using as an anchor some of the silver bars they had saved from *San Juan.*

They awoke next morning to find that the boat had broken its moorings on the flood tide and drifted off. When at last they found it, they spent 2 days free from Indian attack repairing it. Because of the boat's precarious condition, it was decided to divide the party in half, sending one group to Havana for help while the other waited on shore. Before the boat could be launched, however, 150 Indians came, pretending friendship and offering roasted whale meat. The Spaniards, remembering the previous treachery and mindful of the spears and bows the natives carried, would not be duped again. The crossbow was readied and fired, killing one Indian, and the natives withdrew.

That afternoon all the castaways again set sail in the boat, but it soon became apparent that the craft could not carry so many people. As it began sinking, 19 persons, including both sailors and passengers, leaped overboard and swam for shore while the others held the Indians off with the crossbow. Those still in the boat spent the night bailing water. The 249 marks of silver remained in the boat.

At daybreak there was no sign of the people on shore. The Spaniards in the boat resolved to go their way; but as they approached the keys, a contrary wind again set them back. Sailing along the coast the following day, they saw their companions on the shore, which they approached close enough to shout instructions for them to follow along the beach. The people on land thus waded the shallow water from one key to another, following the white flag hoisted on the boat to guide them.

But when the boat came to the island on which the shore party had been instructed to await rescue, the place was alive with canoeborne Indians. With the boat in near-sinking condition, there appeared no choice but to leave the 19 men on shore to fend for themselves. Eight days later the boat reached Cuba and the pilot Martín told his story to Governor Angulo (1522). With him in the boat was *San Juan*'s master, Lujarra, "the other sailors," one

passenger who was a prisoner, and the two women. Those left on the Florida keys—including nine passengers, among them an Augustinian religious, Fray Mateo—were presumed to have been slain by the natives.

The weather phenomena affecting Indies navigation were many and varied. Besides the hurricanes spawned in tropical waters from June to October, there were the northers of winter; the treacherous off-shore winds of the Bahama Channel, diverse of season as of direction; equinoctial disturbances of spring and autumn; and the violent, unpredictable Atlantic storms that could occur at any point on the homeward passage.

On June 15, 1552, the fleet commanded by Francisco de Mendoza—son of the late viceroy, Antonio de Mendoza—sailed from Nombre de Dios with 591,832 pesos in royal treasure. On the Barú Islands, Master Martín García's vessel, carrying 72,789 pesos in gold and silver, was wrecked. Everything was saved and transferred to Admiral Alvaro de Bazán's flagship. Fifty leagues out of Cartagena toward Cabo de San Antón, the fleet was overtaken by the storm, and Bazán's ship appeared in danger of sinking. Bazán managed to turn about and make return safely to Cartagena. The treasure was unloaded to await a later sailing. It was at last taken to Spain by Carreño, reaching Seville about a year later than had been anticipated (Heredia 1553).

Such losses were no less in succeeding years. On July 15, 1557, nine ships sailed from Santo Domingo for Seville and ran into a hurricane. Three of the ships went down, one with all hands, another with heavy loss of life, as well as its cargo of precious metals (Santo Domingo 1557). Haring (1918:294) begins a long list of sixteenth- and seventeenth-century Spanish shipping disasters with "four vessels wrecked on the shores of Florida in 1554." Others lost in the Gulf of Mexico include five ships of the Vera Cruz fleet cast away on the reefs of the Gulf of Campeche in 1563; four of the New Spain *flota* wrecked on the Tabasco coast in 1571, another five in 1572; 15 vessels of the fleet commanded by Antonio Navarro destroyed by a norther in the Vera Cruz harbor in 1590 with a loss of 200 lives; in 1601, 14 vessels wrecked at the entrance of Vera Cruz harbor in a sudden norther with loss of 1000 lives and "two millions" in merchandise; in 1614, a Tierra Firme galleon and seven vessels bound for Vera Cruz near Cabo Catoche.

Perhaps the worst disaster of all befell the 1622 fleet homeward bound from Tierra Firme. Sailing from Havana on September 4, the 28 vessels were caught in a hurricane while still in the Straits of Florida. By one account, eight ships, merchandise valued at 4 million pesos, and 1000 persons were lost (Haring 1918:296); by a second, 550 persons and cargoes worth a million and a half ducats (Lyon 1976:797). The flagships *Santa Margarita* and *Nuestra Señora de Atocha* went down within sight of each other, west of Florida's Marquesas Keys.

As with the three ships lost off Padre Island in 1554, Spanish expeditions sought to salvage the 1622 wrecks, and another vessel was lost in the

attempt. *Rosario* and *Santa Margarita* were salvaged successfully. Private searchers claim to have discovered *Atocha*'s scattered remains in 1971 (Lyon 1976, Daley 1976).

There seems little room for doubt that the greatest hazard of the sea was the weather, but corsairs of several nations also took a heavy toll of Spanish shipping. Corsairing—or, more accurately, piracy—was an ancient institution among western European seafaring peoples. Even before Columbus's initial discovery, French, English, and Irish pirates infested the waters about Great Britain, as well as Spain, Portugal, and the Azores. Sometimes they sailed under letters of marque from their governments, but often they pursued their calling without regard for international politics (Haring 1918:68).

The discovery of America and the advent of Indies commerce opened vast new opportunities for the freebooters, and they widened their sphere of operations. In the beginning, they lurked mostly about the Canaries and the Azores, one the last stop for outbound fleets, the other the first landfall for those returning. When Spanish armadas began patrolling these waters, the pirates perceived the advantages of moving their operations to the American islands. Mid-sixteenth-century records contain numerous references to the capture of Spanish vessels in the Caribbean and around the Bahamas, as well as attacks on Havana, Santiago de Cuba, Santo Domingo, and other Caribbean coastal towns.

After 1520, two factors contributed to a sharp increase in corsair activity: the beginning of Charles V's wars with François I of France and Cortés's conquest of the Aztec empire, with the resultant increase in gold and silver from the New World. In 1521, two caravels laden with Aztec treasure were captured by the French on the approach to Cape St. Vincent, and Spain began patrolling those waters against further incursions. Thus was born the *avería* as a levy on merchant ships to pay for this protection.

In 1522 Cortés sent to Spain in three caravels the king's share of the Mexican plunder. Two of the vessels fell into French hands in the Azores. The third escaped by making port at Santa María. In May, 1523, Captain Alonso de Amilivia's armada went out to escort her home. Near Cape St. Vincent six privateers under Jean Florin of La Rochelle captured two ships of the armada and all the Mexican booty (Haring 1918:70, Fernández Duro 1895:I, 203–204).

In 1527, Captain Martín Pérez de Irizar, sailing toward Cádiz from the north, encountered two ships under Florin's command and engaged them in fierce battle. After 37 of his own men were killed and 50 wounded, Pérez succeeded in capturing the enemy vessels and 150 Frenchmen, including Florin. Pérez, for his heroism, was granted patent of nobility by the emperor (Fernández Duro 1895:I, 206). Haring (1918:70n), incorrectly citing Fernández Duro, says Florin was hanged at Colmenar de Arenas, but makes no mention of

the fate of the other captives. In any event, the episode serves to show the bitterness that prevailed between the maritime forces of the two neighboring nations.

The Spaniards referred to the French pirates as *corsarios luteranos* ("Lutheran corsairs"), which appears at first blush to be a term of religious derision. Not so, according to Fernández Duro (1895:I, 212n): "It is a proven fact that the religious dissention and persecution of the Huguenots in France served to increase its marine, because many people sought refuge aboard ship." If the term bespeaks Spanish religious prejudice, it also reflects conditions in France that were responsible for driving many Frenchmen to the sea.

Although the freebooters increased when Spain and France were at war, piracy did not cease when peace was signed. Yet they were never able to muster the strength to take on an entire Spanish fleet. The tactic most commonly used was to lie in wait around capes and straits and watch the fleets, looking for the opportunity to capture a straggler.

They often sailed to the Indies under the guise of legitimate traders, encouraged by the hunger of colonists for European goods their own fleets could not provide. They became familiar with the various ports and bided their time until the propitious moment for returning to sack the settlements. Renegade settlers occasionally were known to join in such exploits.

The corsairs were the nightmare of Spanish seamen, but the greatest Spanish losses and the pirates' richest plunder came not so much from the capture of ships at sea as from raids on the settlements and the occasional bottling up of a number of ships inside a harbor. The ports usually were poorly armed, and the corsairs invariably held the advantage of surprise.

Hispaniola, with southern settlements easily accessible through the Mona Passage, probably suffered most often, with Puerto Rico and Cuba as close rivals. Fernández Duro (1895:I, 426–447) cites these many instances.

In 1540 an English ship with a French pilot, lying in wait off Santo Domingo, seized a Spanish merchantman laden with sugar, cowhides, and *cañafístula.* The pirates made for Cabo Tiburón, where their ship sank from leaking. After putting the merchantman's crew ashore, the raiders sailed away in the prize. In the shuffle, however, they left behind the French pilot.

In 1543, Santo Domingo officials got word that two French ships and a *patache* had taken four Spanish caravels at San Germán (Puerto Rico). Dispatching two large ships and two caravels with 250 men, they captured the French *capitana* and 40 prisoners, put the other ship to flight, and sank the *patache.*

In January, 1549, Santo Domingo officials wrote to Prince Philip that three French ships had come to Mona Island, San Germán, and Santo Domingo the previous November to trade but had not been permitted to dispose of their wines, silks, and other textiles. "Although there is peace, we

never lack for corsairs," the officials commented, asking that two armed caravels and a bark with oars, paid for from the *avería,* be provided to keep the intruders out of the Indies. By March, the corsairs were coming in numbers. They burned three Puerto Rican villages and ravaged San Germán, Cubagua Island, Santa Marta, Cartagena, La Yaguana (Port-au-Prince), and Havana without effective resistance. The request for an armada to protect the coastal settlements was repeated.

In August of 1549, corsairs operating near Santo Domingo, in a galley with 18 pairs of oars, plucked from the midst of six ships bound for Spain a vessel loaded with sugar, hides, and other produce, all valued at 20,000 ducats. The Frenchmen then intercepted a caravel approaching the islands with 150 Negroes and two others operating in the island trade. Each day brought new atrocities.

In July, 1552, French corsairs again sacked and burned La Yaguana, in a raid that was particularly costly for the Spaniards. On St. James's Day, July 25, three armed ships and a *patache* were dispatched in pursuit from Santo Domingo. Still at sea on August 29, they were overtaken by the hurricane that struck Santo Domingo and Vera Cruz. All the ships went down, though 130 crewmen were saved. Shipping losses in the islands otherwise were heavy. At Santo Domingo, not a vessel remained with masts standing.

In September, 1552, corsairs took a vessel near Santo Domingo, landed at La Saona, and robbed a ship anchored in the Río Zozo. Alonso de Maldonado arrived at Santo Domingo from Spain on February 1, 1553, to report that corsairs had captured one of his ships which, sailing badly, had fallen behind. Another had sunk from leaking, although the people were saved. The corsairs had put passengers and crew of the captured vessel ashore at Lanzarote in the Canaries, then sacked the island. Later the same month, a caravel carrying dispatches from Santo Domingo to Spain was seized at Isla Mona.

The following spring (1553), a French fleet of six large ships and four *pataches* equipped with oars as well as sail was moving boldly about Hispaniola. In March, the Frenchmen ravaged San Germán and seized several ships at La Mona and Saona. They robbed others in Puerto de Azúa and captured several more at La Yaguana. At Monte Cristo (Haiti) they took hides, arms, and sarsaparilla being loaded for shipment to Spain, then moved on Puerto Rico. With 800 men, half of them armed with harquebuses, they defied counterattack or pursuit. The aggregate losses were estimated at 100,000 pesos. The dreaded French corsair Pie de Palo ("Peg Leg") had visited the Indies (Fernández Duro 1895:I, 426–447).

It was about this time that Carreño began his homeward voyage from Cartagena, taking as prisoners 7 Frenchmen captured on the coast 7 leagues distant where they had landed from their *patache* for water. "It is a great shame," commented Governor Pedro de Heredia (1553), "that they have

the audacity to sail from France in one *patache* with 40 men to come here and return loaded with gold and silver, all for the want of two or three armed caravels to patrol these coasts."

On Palm Sunday, 1554, three French corsairs landed at San Germán to cart off a sugarcane press. The pirates continued to raid around Puerto Rico in the following weeks, capturing a number of vessels, and word spread that they intended to capture the island (Salinas 1554).

Another favorite target of the French pirates was Cuba, especially the ports of Havana and Santiago. In April, 1537, a lone corsair entered Santiago harbor and seized all the ships anchored there. The same year, French raiders, having first raided on Hispaniola, laid siege to Havana and captured three 200-ton merchantmen. In 1539, a corsair that had raided Puerto de Plata, on the north side of Hispaniola, put into Havana harbor. Two of her crewmen were captured on shore and sent to Spain. In 1549, a lone pirate ship that raided throughout the Antilles and on the northern coast of South America also inflicted considerable losses on Havana (Fernández Duro 1895:I, 426–435).

The situation was particularly bad in the 1550s. In 1552, when corsairs were terrorizing the ports of the Caribbean, a French ship sailed boldly into Santiago de Cuba. A merchant captain in port at the time summoned his gun crew and greeted the Frenchmen with a cannonade, killing three men and putting the rest to flight (Fernández Duro 1895:I, 211).

In a dispatch sent to the emperor by Farfán's fleet, leaving Havana November 2, 1554, the Cuban governor Dr. Angulo (1555) reported "the loss of Santiago de Cuba and the damage the French wrought in it on July 10, 1553." In October, 1554, 300 Frenchmen invaded Santiago and held the town for 30 days before carrying off goods valued at 80,000 pesos. And in July, 1555, the noted corsair Jacques de Sores again laid waste to Santiago, then proceeded to Havana to land 200 men half a league from the town for a predawn march on Castillo del Morro. The fortress quickly fell, and Sores's men proceeded to the rape of the town. Governor Angulo, gathering a force of Spaniards and Negroes from the countryside, returned that night to attack the Frenchmen, killing 15. Sores, himself wounded and enraged, ordered the massacre of all the prisoners and the burning of the cathedral and hospital. After removing the castle's artillery to his vessel, he burned the plantations in the surrounding area before finally sailing away in August. In October another French ship, having learned of the Spaniards' helpless state, disembarked to sack the plantations neglected by their predecessors and seized a caravel at Havana (Haring 1918:233).

Records of the period are filled with references to corsair attacks throughout the Caribbean: on Santa Marta, Cartagena, Cabo de Vela, Río de la Hacha, Puerto Caballo, Trujillo, and Isla Margarita, as well as Cuba, Hispaniola, and Puerto Rico.

Then, in 1558, they found the jugular vein of Spanish treasure ship-

ments from Peru: Nombre de Dios, at the end of the isthmian trail from Panama. Learning of the trade fairs held there each May, when merchandise arriving from Spain was exchanged for silver and gold that had crossed the isthmus from Peru, the French corsairs rose to the opportunity. On the way, they sacked Santo Domingo, "feebly defended by earthen dikes," and Puerto Rico, whose port was virtually unprotected.

At Nombre de Dios they carried off the gold brought for the exchange and 200 men crossed the isthmus to surprise the South Sea fleet in port at Panama. On their return, the French ships sailed northward along the coast to pass through the Yucatán Channel. In the Gulf of Mexico they intercepted the New Spain fleet bound from Vera Cruz for Havana. The result of the encounter is not told, but then the Frenchmen proceeded to Havana, where they "demolished the fortifications" (Roncière 1899:IV, 587).

The freebooters, either French or English, had not yet ventured across the gulf to attack the ports of New Spain—but the way was opened a few years later, in 1568. Ships of the Englishman, John Hawkins, sailing with a young captain named Francis Drake, were battered by a gulf storm and put into San Juan de Ulúa for repairs. They could not have chosen a more inhospitable port.

Having made slave raids up and down the West African coast and sold the Negroes on the northern coast of South America, they were heading home along the northwest Cuban shore when the storm drove them back across the gulf. While their battered ships rode at anchor at San Juan de Ulúa, 13 vessels arrived from Spain bearing the new viceroy, Martín Enríquez de Almanza. In an exchange of messages it was agreed that the Spanish ships should enter the harbor peacefully and the English would sail as soon as they were seaworthy. But, after getting settled in the harbor, the Spaniards launched a treacherous and deadly attack (Hakluyt 1970:74, 75, Villiers 1975:224). Drake and Hawkins got out with a fight, losing all but two of their ships, and Drake never forgot the deceit. He took revenge with his surprise raid on the treasure trains in Panama in 1572–1573, giving fresh impetus to privateering in the Caribbean (Hakluyt 1970:16). The Gulf of Mexico inner sanctum was no longer inviolate. Mexico's coastal towns suffered repeatedly during the next century, at the hands of French, Dutch, and English pirates.

On the outbreak of hostilities between France and Spain in 1551, both nations anticipated the maritime war with preparations, Spain to protect her Indies commerce, France to destroy it. While France armed a large fleet of corsairs, Prince Philip on November 24, 1551, issued a royal cédula granting license to all who wished to arm ships as privateers to operate against the French (Fernández Duro 1895:I, 417). Strangely, no record appears of Spanish privateering in this period. Not until February, 1674, says Haring (1918:256), did the Spanish government begin issuing letters of marque for privateers to retaliate on the English, French, and Dutch pillaging the West

Indies. Such a move was opposed by the Casa de Contratación and the Seville merchants, lest it weaken their control of Spanish trade. The French had no such compunction. Their king licensed large and effective squadrons of corsairs from the beginning, and they were putting to sea in droves by January, 1552.

They delivered the first severe blow not on Spain but on the Portuguese island of Porto Santo, near Madeira, because the inhabitants had dared to ask Spanish vessels for armed assistance. Before dawn on July 7, 1552, French harquebusiers debarked on Porto Santo and swarmed over the island aiming their weapons "at any inhabitant who stuck his nose out the door." The insular officials, hands bound and tied to their necks, were dragged through the public plaza while their homes were pillaged (Roncière 1899:IV, 575).

Cosme Rodríguez Farfán was assigned at this time to patrol the waters around the Azores and Canaries with two ships and two caravels in an effort to sweep the area of corsairs so that the Spanish Indies fleet might pass unmolested. He returned to Seville in July, 1552, to report the capture between the Azores and Cape St. Vincent of a French vessel and recovery of a ship the corsairs had seized from the Spaniards. While the 24 French prisoners were being transported from Sanlúcar to Seville, however, the corsair captain escaped, and charges were brought against Farfán (Council of the Indies 1552). The outcome cannot have been too severe, since he was still to serve as captain-general of the Indies fleet in 1554.

Under interrogation, the other captured Frenchmen said they had sailed, under license from the king of France, from the French village of Merena the previous January. Operating around the Azores, Canaries, and Cape St. Vincent, they had robbed three caravels and captured the ship *Matamoros,* outbound for the Indies, apparently the vessel Farfán had retaken. Sending the Spanish crew off in a *chalupa,* they had manned the prize with their boatswain and 16 French sailors, now the Spaniards' prisoners (Farfán 1553).

From this episode Farfán evidently came to be known to the French corsairs. But he was not alone; the Frenchmen seemed always to know who the captain-general of the fleet was, and, after trailing his ships for a time, could recognize him on sight. At the same time, the Spaniards came to know and fear a corsair leader named François Le Clerc, whom they called Pie de Palo because he had a wooden leg. A scurrilous villain to the Spaniards, he was no less a hero to all Frenchmen. He had been granted in 1551 a patent of nobility for the exploit in which he lost his leg (Roncière 1899:IV, 574).

In 1553 Le Clerc sailed his entire division to the Spanish Indies. Pie de Palo himself commanded *Le Claude*. He was ably supported by *l'Esperance*, commanded by Jacques de Sores, and *l'Aventureux* under Robert Blondel, with a total of six large vessels and four patrol boats. On the way, they blocked the path of Alonso de Maldonado, making for Santo Domingo, and cut off two of his ships. In the Antilles, the French fleet, with 800 men under

arms, raided unchallenged. After striking San Germán, they raided Mona and Saona islands and ransacked most of the Santo Domingo ports: Azúa, La Yaguana, and Monte Cristo. Returning to Europe via the Canaries in July, 1553, Le Clerc's men, seeking water and provisions at Isla Palma, encountered sharp gunfire. The warm reception provided an excuse to put 700 men ashore to sack and burn the town, indulging in "unbridled pillage for eleven days." At the end of that time the town was ransomed for 5000 ducats (Roncière 1889:576).

By Roncière's account (1889:578), French corsairs tailed Farfán's fleet on a homeward voyage from the Antilles in 1553, but Spanish records fail to indicate this captain's presence on such a trip. In any event, Vincent Bocquet and Fabius Cunctator, commanding *La Marguerite* and *La Barbe,* having put to sea from Dieppe in May, sighted the Spanish fleet outside the Mona Passage and clung to its skirts for 40 days, awaiting opportunity to pick off stragglers. Two ships heavily laden with gold, pearls, and cochineal were the first to fall behind, and the Frenchmen took them. Then the large ship of Diego Marín was blown away from the convoy by storm. Called on to surrender, she hoisted a white flag. A Spanish armada sent to meet the returning fleet was scattered by storm and, when the fleet reached Cádiz on December 7, the Spanish commander had only 8 of the 14 ships that sailed from Santo Domingo. The Frenchmen doubtless considered themselves well paid for the loss of one French ship and an empty Spanish prize to Farfán the previous year.

When Farfán sailed from Sanlúcar as captain-general of the Indies fleet on January 31, 1554, Pie de Palo and his corsairs lurked in the Canaries, destined to be his first stop. Farfán, warned by fishing boats, passed up the Canaries, at the cost of much suffering and death among his people. After sacking La Palma, the Frenchmen had been chased by Alonso Pejón's armada, which had raised them in the Azores, but they had no difficulty in outdistancing the pursuit. By February, 1554, Le Clerc's fleet again was on its way to the Indies. High point of the voyage was the rape of Santiago de Cuba.

While French corsairs preyed on Spanish shipping in the Atlantic and Caribbean, Turks and Spaniards warred in the Mediterranean. The Turks occasionally were in league with the French, and by such a circumstance Pie de Palo met his end.

The wreck of a treasure galleon on the Zahara coast and the resulting salvage operation early in 1555 brought eight Turkish vessels through the Strait of Gibraltar in May, 1555, to attack the Spanish operation. The Turks were driven off. French corsairs snooping around the area encountered contrary winds that forced them through the strait into the Mediterranean, where they encountered four Turkish *galeotas.* The Turks came alongside and, under the guise of friendship, boarded two of the French vessels and captured them. The Turks took one of the ships, setting the other adrift, her

deck littered with French corpses. When the Spaniards found the vessel and went on board, they found that one of the corpses had a wooden leg. They could only surmise that it was François Le Clerc, whom they knew as Pie de Palo.

With or without Pie de Palo, French corsairs were destined to plague Spanish shipping to and from the Indies for years to come. At least for the next century and a half, corsairs were as much a fact of Spanish maritime life as winter storms and hurricanes.

Because of losses to the hazards of Indies navigation—the weather, piracy, and inept seamanship in all its insidious forms—and because of the insatiable royal thirst, the 1554 treasure shipment was urgently needed in Spain. Concern for the safe return of treasure was expressed in more than a dozen articles of the 1552 ordinances. The rules were directed principally at proper registry of "all gold, silver, pearls, and precious stones," providing for confiscation of any shipments registered fraudulently or not registered at all. Masters and clerks were instructed, on reaching Seville, to deliver to the Casa de Contratación a certified copy of the ship's register. All treasure shipments had to be delivered to the casa before they were received by the persons to whom they were consigned. No gold, silver, or jewels could be shipped from one place to another in the Indies without being registered, and all precious metals must bear the proper marks indicating that the royal fifth and other fees charged against them had been paid. If a homeward-bound ship made port in the Azores or elsewhere, no gold, silver, or other items from its cargo could be sold beyond the amount required to pay for needed provisions and port charges. The limit was 100 ducats, and a precise accounting had to be given to the casa.

The casa inspectors personally inspected each ship returning from the Indies within 24 hours after its arrival, accompanied only by a guard and the ship's clerk. Each seaman and passenger was required to declare under oath whether or not he was bringing unregistered treasure, or that which was registered under a name other than the owner's. They were required also to testify as to their knowledge of anyone else who might thus be violating the ordinances. All chests on the ship then had to be opened and searched (*Ordenanzas Reales* 1604:nos. 201–213).

Such regulations, however, were difficult to enforce; they became almost impossible when a lost vessel was salvaged. And the margin for error in accounting for treasure recovered mounted with each pair of hands that touched it. Therefore, the laws stipulated the detailed procedure to be followed when a vessel was lost in a manner that invited salvage, and specified the persons to whom salvage might be entrusted. Responsible for carrying out the operation was the justice of the closest port, jointly with a royal official, if available, or a *regidor* of the local municipality.

When Admiral Diego Felipe's New Spain contingent of Captain-General Cosme Rodríguez Farfán's 1554 fleet reached San Juan de Ulúa on

May 1, it probably carried copies of the 1552 ordinances for colonial officials. Occasion soon would arise for effecting the salvage procedure the regulations prescribed; *San Esteban, Espíritu Santo,* and *Santa María de Yciar* had wrecked on the Texas coast 2 days previously, dumping cargo valued at a million ducats (Quesada 1554) on the sandy bottom.

When news of the disaster reached Vera Cruz, the port town's customary lethargy yielded overnight to bustling activity to prepare for the salvage expedition.

Chapter 9

FROM THE SEA'S DEPTHS

Seldom was a transatlantic voyage approached with more vigor than that for recovery of the lost treasure. A two-pronged expedition was planned, one arm to proceed along the coast from Vera Cruz, perhaps with the expectation of encountering survivors, the other to sail from San Juan de Ulúa with ships, equipment, and men for salvaging the wrecked vessels once they were found.

Chosen for the coastal reconnaissance was Ángel de Villafañe, soldier and *encomendero* from the city of Mexico whose name would come to prominence later in connection with an attempt to settle the present states of Florida and South Carolina. Because it took more time to outfit the armada, Villafañe was to reach the site of the shipwrecks ahead of the ships sailing under Captain García de Escalante Alvarado (1554).

The date and the manner in which the news of the disaster first came to Mexico has been hypothesized: Francisco del Huerto, master of *San Esteban* and a seasoned mariner, rigged a small boat with sail and reached Vera Cruz by mid-May, long before Fray Marcos de Mena got to Pánuco.

The immediate action then would have been to dispatch the news to Mexico City, where appropriate orders were issued by the viceroy. These included instructions for Admiral Diego Felipe, who had brought ten ships of Farfán's 1554 fleet into San Juan de Ulúa on May 1, to remain there until the treasure from the lost ships was salvaged, so that he could take it to Spain (Alvarado *et al.* 1555).

Villafañe, receiving 1500 pesos for expenses on June 4 and 6, proceeded from the capital to Vera Cruz and thence up the coast to the shipwrecks. He was accompanied by at least part of the 19 soldiers whose names appear in the account of expedition expenditures. The manner of travel is not precisely indicated, but he probably followed the shoreline closely in a small vessel, from which four sailors went out in a *chalupa* to reconnoiter each bay and inlet.

Although documents of the period indicate that Villafañe's role in the salvage expedition was subordinate to Alvarado's, the few published references to it credit Villafañe to Alvarado's exclusion (cf. Lowery 1911:353). Even so, little of Villafañe's background is revealed. The previous September, he had been sent by the viceroy to Meztitlán as *juez de comisión* to settle a dispute between the royal inspector, Diego Ramírez, and an *encomendero* pursuing one of his fugitive Indians. He was to arrest the principals if his investigation so indicated. There resulted a misunderstanding that impelled Villafañe (1554) to write an explanation to the king. The letter, dated March 20, 1554, was dispatched on Antonio Corzo's *San Andrés,* the one ship sailing from San Juan de Ulúa that April 9 that was to make port.

"It is imperative that I report [this incident]," he wrote, "because of the obligation I have . . . as your servant, which I have been here for more than thirty-five years. My parents and I, as noblemen, have served your Majesty and the Catholic Kings, to whom I am dedicated as your loyal subject. . . ."

From his claim of 35 years in Mexico, it may be inferred that he had served with Cortés in 1519. Juan Suárez de Peralta (1589), himself the son of a conquistador, attests that Villafañe was one of the conquerors, and his testimony in the matter of Doña Catalina de Ribera and Juan González de León's estate seems to indicate as much. Yet the only occurrence of the family name in readily available records of the conquest is of Antonio de Villafaña (as it is often misspelled), hanged by Cortés at Texcoco in 1521 as the leader of a conspiracy to assassinate him (Díaz del Castillo 1956:389–390, Cortés 1973:170).

Proceeding northward from Vera Cruz, Villafañe and his soldiers passed within view of high mountains, sandy beaches, and marshlands of mangrove trees and swamp grass. Their destination appears to have been fairly well determined: "the coast of Florida near the Río de las Palmas at 26½ degrees" (Quesada 1554). The accuracy of the latitude computation lends support to the thesis that the information came from a competent navigator, such as Francisco del Huerto. It was in error by less than 5 miles (8 km). "Near the Río de las Palmas," however, was a rather loose description, for the actual site lay 165 nautical miles (310 km) beyond the mouth of that stream, which is known today as the Soto la Marina.

After passing the Río Pánuco near present Tampico, Villafañe surveyed a wilderness area that had been visited by few Spaniards. It was at that time considered to be part of "La Florida." If he heard at Tampico or Pánuco of

the arrival of Fray Marcos de Mena or other survivors of the march through the wilderness he was about to enter, it does not appear. No diary of Villafañe's trek has come to light.

He learned at Tampico, however, that other salvagers had reached the shipwrecks before him. Just when Villafañe made initial contact with a ship's crew sent to the site by Juan Jiménez, Pánuco's *alcalde mayor,* is not clear, but what follows is the sequence of events (Alvarado *et al.* 1555):

On July 30 the treasurer Don Fernando de Portugal in Mexico City received from Juan Acedo, Bernaldo Peloso, Juan Carrasco, and Melchior Rodríguez 4305 marks of silver and 2302 pesos "which they said the *alcalde mayor* of Pánuco had taken from the three ships lost on the coast."

On August 4 Portugal paid to Acedo, Peloso, and Carrasco, on behalf of 40 Pánuco citizens, 385 pesos 7 *tomines* "because they had brought the silver that the Pánuco *alcalde mayor* had sent from the said ships to this city" (Alvarado *et al.* 1555).

Villafañe returned to Vera Cruz on Novermber 19, 8 weeks after Alvarado (Velasco 1554), and 5 days later he placed in Portugal's hands certain items of treasure from the sunken ships. These included three pieces of high-quality gold weighing 100 pesos (ounces) 6 *tomines* 12 crowns, found in the port of Tampico in possession of "the pilot and soldiers of the boat of that port," who claimed to have found it on Huerto's ship; four pieces of "excellent" gold weighing 74 pesos, a piece of a 15-carat gold bar weighing 104 pesos, and two small pieces of 10-carat gold weighing 84 pesos; and a gold chain weighing 6 pesos. Villafañe had taken these items from Juan Muñoz and Juan Acedo, "leaders of the Pánuco people," who said they were bringing them from "the Florida coast." In addition, there was a silver pitcher, a pot, three pieces of salt shakers, 12 spoons, and part of a perfumer, all weighing 9 marks 5 ounces 2 *reales* of silver, also taken from Acedo and Muñoz and brought by Villafañe "from the coast where the ships were lost" (Alvarado 1554).

On December 4 Portugal paid the Pánuco alcalde Juan Jiménez an additional 500 pesos "for the work he did in salvaging the silver he sent to this city from the three ships" (Alvarado *et al.* 1555). Thus it appears that Villafañe, arriving at Tampico on the way to the wrecks, learned that the Pánuco salvage boat had already retrieved the most accessible treasure from *San Esteban,* the only vessel of the three visible above water. It may have been at his urging that the treasure thus recovered was taken immediately to Mexico. Suspecting that the sailors had retained for themselves some items of treasure, Villafañe probably stopped at Pánuco on the return to shake them down for the small pieces of gold and wrought silver.

Ten days after Villafañe received an advance on expenses for his journey, García de Escalante Alvarado was sent 2000 Castillian ducats (2757 pesos) for expenses of the armada. Alvarado set about readying a fleet of at least six vessels, carrying 102 men (Alvarado *et al.* 1555).

Alvarado was a man of considerable achievement, with well-placed family connections. Born about 1516 in the small Spanish coastal village of Laredo, Santander, he was a son of Beatríz Osorio and the licenciate Alvarado who had served 20 years in the court of Charles V. His uncle was Pedro de Alvarado (Mendoza 1550), that valiant soldier of the Conquest who was Cortés's trusted lieutenant and who himself had conquered Guatemala and died in suppressing an Indian revolt in Nueva Galicia in 1541. The García de Alvarado who was a leader in the revolt that erupted in Peru following the assassination of Francisco Pizarro in 1541 apparently was not closely related (cf. Vega 1966:II, 911–912).

In 1538, García de Escalante Alvarado at age 22 went to join his uncle Pedro de Alvarado in Guatemala and served with him there and in Nueva Galicia until the latter's death. On the ill-fated Villalobos expedition to the Philippines and Moluccas that sailed from Puerto de Juan Gallego on Mexico's west coast on November 1, 1542, he served as "captain on land and sea" (Mendoza 1550). Only 144 of the 400 men who sailed on that voyage survived the ravages of hunger and disease at sea and attacks by the islands' hostile natives. Finding themselves unable, because of contrary winds, to sail back across the Pacific, the Spaniards surrendered to the Portuguese and were returned to Spain by way of Portugal almost 7 years after sailing. Alvarado (1548) wrote an account of the voyage dated Lisbon, August 1, 1548. Listed among the survivors besides Alvarado were Alonso Manrique, possibly the man who succeeded Alvarado as *alcalde mayor* of Vera Cruz and provisioner of the port of San Juan de Ulúa in 1554.

In 1554, Alvarado was 37 years old, knowledgeable of the sea, and a proven leader in his community as well as on the battlefield. His quest for a royal grant, however, had eluded him, although Viceroy Mendoza had written in his behalf to the emperor in 1550 and he himself had renewed the request periodically. It continued to elude him thereafter. He is virtually a forgotten man in history.

On receipt of the viceroy's orders for undertaking the salvage of the three lost vessels on the Texas coast, Alvarado applied himself to the task as a dutiful vassal of the king. The largest vessel, the brigantine *Mendoza,* was provided by the "Imposición," probably meaning the port authority that levied and collected the *almojarifazgo.* The rental was to be paid from the treasure recovered. Another vessel, *Santo Espíritus,* was hired with its master, Gaspar Díaz. The other four vessels, from all indications, were two-masted *chalupas* or small barks, which had a specific role to play in the diving and salvage operation.

Most of the vessels had to undergo repairs before sailing. Cedar planking was purchased for decking *Mendoza,* and a crew of carpenters and caulkers worked 9 days making the ships and boats watertight. Virtually every tradesman and shopkeeper in Vera Cruz took part in outfitting the expedition: cooper, candlemaker, and apothecary, who provided barrels for

wine and water, illumination for ship's lanterns, and medical supplies, as well as the tailor who made a taffeta flag. The public notary was paid to copy the register of each of the three ships twice, providing "one copy for Castile and one for Mexico." Juan Vergara was paid for "writings he drew up for Mexico," and messengers were recompensed from the treasure account for taking dispatches to the colonial capital. Provisions, arms, and rigging had to be brought on board, and cart drivers earned wages for hauling them.

Provisions purchased included 20 steers, 125 sheep, 26 *fanegas* of corn, 12 casks of wine, 6 *arrobas* of vinegar (about 20 gallons, probably for pickling meat), 24 *arrobas* of sugar, and 80 *quintales* (8000 pounds) of biscuit. Arms and munitions included "some crossbows and ammunition," six *quintales* of lead plus "some lead for balls" and purchases of munitions of unspecified character. No specific mention is made of harquebuses, or powder, but these items must have been included.

Items of ship's gear purchased included "rigging, tar, and burlap, tools, two spare anchors, 4000 scupper nails, grommets, some thin wire for the divers, and carpentry items, plus pots and pans, earthenware, and crockery for the cooks." Forty-one trunks were bought to serve as receptacles for salvaged goods, and a ream of paper—all of it probably needed, judging from the lengthy salvage report—was added.

The 102 men on the six vessels comprised 56 sailors, 5 cabin boys, 1 page, 3 carpenters, 3 caulkers, 2 dispensers, 3 gunners (2 of them called "iron worker and gunner," the other listed also as a sailor), and 1 man who served as surgeon and barber. Eleven Negro slaves were hired from their owners, 9 of them from the Imposición. There also were 11 divers, some of whom did double duty as sailors. While such work often was assigned to slaves, such apparently was not so in this case; names of the divers are given, whereas those of the slaves are not. The divers were paid for their services as individuals, while pay for the slaves went to their masters. The six shipmasters, Captain Alvarado and the notary (Hernando Ortego de Espinosa)—whose duty it was to list every item of treasure brought up and the specific circumstances of its retrieval—rounded out the personnel (Alvarado *et al.* 1555).

When the ships were repaired, loaded, and ready to sail, the port notary had to be paid to inspect them, and the town crier received 1 peso "for getting the people on board" (Alvarado 1554). The ships sailed for "the coast of Florida" at 26°30′ on July 15. On July 22 Alvarado anchored off Padre Island and established his camp on shore. This was Magdalen's Day and Alvarado, following the Spanish custom of naming geographical features for saints on holy days, called the site Costa de Madalena, "Magdalen's Coast," or Médanos ("Sand Bank") de Madalena. It is perhaps coincidental that the cosmographer Alonso de Santa Cruz, on his map of the De Soto expedition prepared about 1544, had labeled the Río Grande the Río de Madalena. The name has confused historians ever since. Bolton (1908:224n) erroneously

ascribes the application of the name Magdalena to various Texas rivers to the naming of a river in the present state of Florida by the Narvaez expedition in 1528. Such confusion arose over the river for which the name was intended that Pichardo (1931:I, 419), writing about 1808, was unable to identify it precisely. Neither was he able to determine the name's origin: ". . . despite all my investigations I have been unable to find who gave it this name, and when, or if anyone tells whether or not it is navigable. . . ."

The name was applied at various times to the Guadalupe and other streams emptying into the Gulf of Mexico farther up the coast. The confusion probably is due to Alonso de Santa Cruz himself. After calling the Río Grande by that name on his 1544 map, he changed it to Río Bravo on a later one, prepared after 1565. On the later map he correctly labeled Alvarado's Médanos de Madalena, then named a river emptying farther up the coast—about where the Guadalupe should be—the Río de Madalena. The name Río Bravo then was repeated on the stream drawn immediately to the east.

Villafañe, having reached the site before Alvarado, had begun salvage operations on Francisco del Huerto's ship *San Esteban* the day before Alvarado's ships arrived, using a diver who had come with him from Vera Cruz. For some unexplained reason, however, he delayed turning over to Alvarado the treasure recovered (13 sheets of silver) until August 8.

Espinosa, whose notarial record supplies details of the salvage, makes no mention of Villafañe at all until July 29. The two leaders met that day in Alvarado's tent and agreed that Villafañe should take a pilot, a boat, and part of the divers and search for the wreckage of Damián Martín's *Espíritu Santo.* To this point, all efforts had been concentrated on *San Esteban,* both by the people from Pánuco and by Villafañe and Alvarado. Only *San Esteban* remained visible above water. Dragging would be necessary to locate the other two (Alvarado 1554).[1]

On July 23, Alvarado began the salvage of *San Esteban.* Espinosa carefully recorded each parcel brought up, with its identifying marks and packaging. Alvarado, Espinosa, and the divers went each day in a *chalupa* to the wreck and anchored over it. The divers then descended to probe the wreckage. Details of the diving operation for this particular expedition are not disclosed, but the divers evidently were able to stay down for extended periods. While native divers or Negro slaves often were used for diving, the

[1] None of the salvage records at hand makes mention of the soldier, Francisco Vázquez, who Dávila Padilla says returned to the wreck site to await rescue. He may have been picked up by the people from Pánuco. But he may not have returned to the wreck until the Pánuco people had come and gone, in which case he would have been found there, as Woodbury Lowery (1911:353) and Barcia (1722:31) say he was, by Villafañe. The name is too common to warrant assumptions concerning it, but a soldier named Francisco Vázquez wrote a first-hand account in 1559 of the unfortunate expedition of Pedro de Ursúa to conquer the Amazon and Ursúa's death at the hands of Lope de Aguirre and Fernando de Guzmán (Vázquez 1559, cf. Vega, 1966:II, 1468).

11 divers used by Alvarado and Villafañe belonged to neither category. Alonso Beltrán, described as "pilot and diver," headed the group and was the only one who could sign his name.[2]

Divers at the wrecks on the Madalena Coast had to go down only 2–3 fathoms. *San Esteban* had not completely broken up and the divers had to go into her hold, a difficult and dangerous operation without some sort of breathing device. Yet there is no solid indication that they had one.

When possible, heavy parcels of silver were brought up with the packaging and labels intact: in sacks, wrappings of various kind, reed trunks, and the heavy boxes of serrated pine from the mountains of Perote, the kind used to ship the king's treasure. Occasionally such boxes were wedged in and could not be moved; boards had to be pried off to remove the bullion piecemeal.

Hooks evidently were used only when the divers could not free a parcel otherwise. On one such occasion, a box was buried in the sediment. The divers managed to attach the hooks, and it was brought up, with the help of a capstan on the deck of the small vessel. The box contained 650 pesos in coin, inside a sack that one of the black men from the Imposición recognized; he had sold it at San Juan de Ulúa to a passenger who died before *San Esteban* embarked.

---

[2] Antonio Vázquez de Espinosa (1942:nos. 127–129) tells how Negro divers in the early seventeenth century on "the Pearl Coast" recovered pearls in water as deep as 14 fathoms (84 feet). They apparently had no special gear except a rope attached to the boat, which they used to ascend to the surface, and a net bag in which they gathered oyster shell from the bottom.

By that time, diving methods for salvaging ships were somewhat more sophisticated. Eugene Lyon (1976:801) relates the invention by Francisco de Melián in 1626 of a 600-pound bronze bell with a seat and windows for use as both a search vehicle and a diver's station. He says the device was designed for and used in the salvage of *Santa Margarita,* lost on the Florida keys (Keys of Mateçumbe) in the 1622 hurricane. By Lyon's account, this ship was found in 1626 and the salvage effort continued until Melián's death in 1644.

Surviving in the Museo Naval in Madrid, however, is an account that seems at variance with this one. It is a treatise by Pedro de Ledesma on diving and salvage techniques—specifically, dragging the bottom with a chain to find the wreckage and use of a soft-leather diver's suit with breather tube and crystal window. Of Ledesma, it is known only that in 1608 he was secretary of the Consejo de Cámara de las Indias, the body that had jurisdiction over royal patronage in America (Carreño de Ribera 1608). Relative to his dragging method, Ledesma (1636) asserts this claim: "I made this invention in the year 1623 in the keys of Matazumbi to search for the two galleons with the silver—the *Margarita* and don Pedro Pasquies's galleon, which I found in the year 1636."

Ledesma's diving suit, however, defies credibility. It was bound with sponge-lined straps below the knees and above the elbows so the diver's arms and legs remained free. Another strap with sponge lining fastened over the head. Before the eyes, sewn into the leather mask, were crystal spectacles, providing clear vision, and a leather air tube was secured to the boat on the surface and was guarded at all times by a member of the boat crew. A light-weight cord extending from diver to boat was used to signal when the tube was to be lengthened or pulled up. With such equipment, Ledesma claimed, the diver could descend to depths of 16–25 fathoms and remain for 3–4 hours. Without some means of forcing air through the tube besides the diver's breathing, however, it seems likely he soon would be inhaling carbon dioxide and would suffocate.

Near the end of the salvage, Captain Alvarado (1554) ordered the divers to bring up the boxes they had emptied under water. When they were unable to do so, "the captain made them go down with some iron hooks so that, from the boat, they could exert force and pull the boxes loose." During this procedure the divers discovered two large boxes of the type used to transport the king's treasure, buried in the silt.

After the divers were convinced that they had brought up all the treasure it was possible to retrieve, Alvarado had them search for several more days, going over *San Esteban*'s hulk inside and out, from stern to prow. During one such search they found a box tied to the mainmast with part of the ship's rigging. The mast evidently was broken, for the box lay "beneath the beams of the ship's side" and could not be freed. The divers broke it open to retrieve a considerable amount of silver in disks and pieces, and a lead ink well. There was no identifying mark on the box, but the captain remembered having seen Fray Pedro de la Peña use it in Vera Cruz. Peña's name does not appear among the religious whose efforts to reach Pánuco are recounted by Dávila Padilla; perhaps he drowned before he reached the shore. Or, since Dávila Padilla concerned himself only with the Dominicans, Peña may have belonged to another order. No mention is made of finding remains of persons who might have drowned below decks in any of the ships, or any sign of those who reached shore.

On several occasions the divers went down and searched for three and four hours at a stretch without finding anything of significance. At last, on September 11, the captain took from them in the presence of the notary an oath that they had been unable after the many searches to find more bullion or coin than they had brought up and that further search was pointless—a legal formality that had to be repeated with each vessel.

Villafañe, meanwhile, had been supervising the salvage of *Espíritu Santo* since July 29. With knowledge of the ship's location provided by survivors, he took a *chalupa* and a *batel* to drag for it. The method used appears to have been at least similar in principle to that which Pedro de Ledesma (1636) claimed to have "invented" in 1623 (see Footnote 2, page 141). Ledesma's procedure was to drag along the bottom a length of heavy chain, the ends of which were suspended from two frigates by heavy ropes. A buoy was suspended from the middle of the chain to mark its position. The frigates then proceeded over the search area at full sail until the chain caught. Grappling hooks, which would snag on the sunken vessel's rigging, and a leadline, by which it could be determined if the impediment were a rock, were then employed. If the object was the ship, the location was marked with buoys. Ledesma's procedure involved a method for anchoring the submerged hulk securely. He also describes a suspended drag that would not reach bottom, for use in waters with uneven or rocky bottoms. Hooks attached to an iron bar, which was kept at the desired depth by a wooden beam floating on the surface, would snag the ship's rigging without engaging

rocks or other natural impediments. Such a device had little application, however, on the sandy bottom off Padre Island.

An even more complicated device is described by Ledesma for lifting a sunken vessel off the bottom and transporting it to shallower depths. It involved a specially made capstan, turned by means of two large wheels mounted on the deck of the frigate.

Villafañe, with no such problems, located the wreck of *Espíritu Santo* before the end of the day. This ship, frequently referred to by her nickname, *La Genovesa* ("The Banker"), lay in two fathoms. Villafañe anchored over the broken hulk and sent down divers to attach buoy moorings. They brought up a quantity of silver.

Operations at *San Esteban* were suspended for two days while Alvarado went with Villafañe to the *Espíritu Santo* site. After that, Villafañe took half the divers to his project, Alvarado half to his.

Espíritu Santo, being at least partially broken up, seems to have been somewhat easier to salvage than *San Esteban.* On one occasion, a large box was found outside the hulk, on the north side—possibly an indication that the ship had hit the bank head on, split open her bow, and gone down. When the box was brought up it was found to contain items of clothing that many of the boat crew recognized as having been worn by Pedro Milanes. Milanes had sailed from Spain in November, 1552, in company with the three ships now being salvaged, as master of the ship *Santa María de Begonia* (Molina 1554), one of the vessels that had to be scrapped after reaching San Juan de Ulúa. He had booked passage on Damián Martín's ship to return to Spain.

It was a sad moment for the mariners of the salvage crew as they inventoried his personal belongings: a black satin tunic with blue velvet sash, a blue challis, a cape fashioned from black sailcloth, some work clothes and a pair of plain shoes, three small silver disks, and a hundred pesos. The lieutenant Cristóbal López de Serna recognized some garments his wife had given Milanes in Vera Cruz when the ships were getting ready to sail. The clothing already was rotting. Evidently it was known with certainty that the shipmaster had lost his life, for Alvarado (1554) ordered the contents of the chest set apart "as belonging to a known deceased person" to be given his heirs.

With salvage of the two larger ships well under way, Alvarado decided on August 20 to go in search of the wreckage of *Santa María de Yciar.* Taking a *chalupa* and a *batel,* he sailed 2 leagues along the coast, then began dragging the bottom, the *chalupa* in 3 fathoms, the smaller craft in a fathom and a half, nearer the shore. At last the drag caught on the wreckage. Anchors were dropped and the divers went down to begin bringing up silver.

Santa María, like *Espíritu Santo,* had struck the sloping bottom, splitting open her hull. All the cargo was disarranged, both inside and outside the hulk. Nine boxes containing bullion were found scattered along the north side, buried in the silt. A strong shore current appears to have been a factor

in the shifting of the cargo, and heavy wave action had subjected the wreck to a severe pounding until she at last settled into her grave.

Although the water off the island was clear and calm on certain days, the salvage crew got a harsh reminder of the vagaries of the sea on August 25. While Master Hernando de Vergara's vessel was engaged in *Santa María*'s salvage, she was caught in a sudden squall and was either swamped or driven aground. Vergara later was compensated 1836 pesos from the salvaged treasure for her loss (Alvarado *et al.* 1555).

By that time the operation was nearing completion. Despite the loss of Vergara's vessel, Alvarado saw in the brief storm a possible advantage; perhaps it had uncovered more of *Santa María*'s buried cargo. The following day's diving proved his judgment correct. Seven boxes of the king's treasure were found, evidently still half buried. The notary Espinosa relates that "First they took off the tops, then removed the silver, and then brought up the boxes."

The divers continued to bring up bullion for several more days. At times they had to cast aside loose ship's planking to get at cargo boxes. Each day's take was less than the preceding one, however, until September 10, when only nine pesos was counted for the long hours of underwater search.

Salvage of all three vessels was concluded on September 12 with the weighing of the treasure, after the divers had given their oath that nothing had been found beyond what they had shown. At the encampment on shore, Alvarado (1554) had set up a scale, which he suspected of being faulty—possibly a hedge against being held responsible for later descrepancies. The bullion from *San Esteban* was calculated at 524 *arrobas,* with 9000 pesos in coin counted in addition. *Espíritu Santo's* salvage amounted to 391 *arrobas* and 11,000 pesos, while *Santa María*'s weighed 62 *quintales,* or 248 *arrobas,* and there were 2000 pesos in coin. By this calculation, the salvage totaled 29,078 pounds of silver bullion and 22,000 pesos—less than half the total amount carried by the three ships.

Alvarado (1554) ordered the treasure loaded on the brigantine *Mendoza* and set sail for San Juan de Ulúa, to arrive before the end of the month. The treasure was unloaded onto barges for removal to Vera Cruz. The barges moved into the mouth of the Río Vera Cruz on October 1 and were unloaded there. A roadway for carts had to be made from the river wharf to the wine cellar that was rented for storage of the treasure until it could be shipped to Spain. The merchant Juan de Sena, who had furnished much of the supplies and provisions for the small fleet for its voyage to the Madalena Coast, was engaged to take the silver to its repository and keep it under guard. Messengers were dispatched to Mexico City to inform the viceroy of the expedition's outcome.

With the ship *Mendoza* relieved of her burden, Alvarado (1554) took the precaution of ordering all the crew off the ship and having her searched. It

was no hollow gesture. Pieces of silver and coined pesos were found stashed between decks and bulkheads, in every nook and cranny. The total came to 624 marks of silver (312 pounds) and 600 pesos in coin—almost $26,000 by modern values.

This bit of thievery thwarted, all the recovered treasure was weighed and counted again in Vera Cruz by Miguel de Zuloaga, in the presence of Alvarado's notary, Espinosa. This tally included the gold as well as the silver recovered from *San Esteban* and *Espíritu Santo,* but the list for *Santa María* appears to be incomplete.

The final weighing—probably reflecting the stolen treasure recovered from *Mendoza*'s sailors and that retrieved by the people from Pánuco—gave somewhat larger figures for both *San Esteban* and *Espíritu Santo* than Alvarado had computed at the salvage camp. From the former vessel about 14,944 pounds of treasure had been recovered: 29,613 marks of silver, 9000 pesos of *tepuzque en tostones,* and 1213 pesos contained in two parcels of gold. The *Espíritu Santo* wreck had yielded some 14,635 pounds: 27,897 marks of silver and 11,000 pesos of common gold in *tostones.*

Of approximately 15,000 pounds of treasure registered on *Santa María,* about 6225 pounds were recovered, including 2000 pesos in coin, making a total for the three ships of approximately 35,804 pounds.

Without the registers of the other two ships, there appears to be no reliable method of determining how much gold and silver the three vessels carried to start with. In the absence of reliable tonnage figures it must be assumed that each ship's size was roughly proportionate to the value of the cargoes she had brought from Spain. On that basis *Santa María* must have been considerably smaller than the other two. From the reregister of *San Andrés*'s treasure cargo made at Havana, we know that she carried more than 2½ times as much treasure as that registered on *Santa María.* It appears from the amount salvaged that the others carried considerably more also.

Perhaps, then, it is not going too far afield to assume that the proportion of salvage from the other two ships in relation to the amount they carried was about the same as that of *Santa María*—41%. The total carried by the three, therefore, would be some 87,000 pounds. With 35,804 pounds recovered, some 51,330 pounds still lay at the bottom of the gulf.

The value of 87,000 pounds of silver in ducats would have been 1,008,695—within range of the million-ducat value. Dr. Quesada (1554) had placed on the three ships' cargoes when he reported their loss.

The various attempts at accounting for the treasure apparently were as confusing to viceregal officials as to modern researchers. On December 12 the Royal Audiencia and Chancery of New Spain ordered Luis de León Romano to Vera Cruz to reconcile the discrepancies and rectify the errors. León Romano, a former *alcalde mayor* of Vera Cruz, at that time was serving in the same capacity at Puebla de los Ángeles. No stranger to salvage

operations, he had managed the retrieval of 300,000 pesos from a caravel that had gone down on the coast near San Juan de Ulúa 7 years previously (León Romano 1555).

Having an initial inventory of the treasure drawn on January 9, 1555, León occupied himself several days in correcting various errors and providing an accurate accounting. After the fleet and the land force had been paid 35,687 pesos and various other expenses had been met, he reckoned the remaining balance at 70,150 marks of silver (35,075 pounds). Additionally, there were 15,396 pesos of common gold in reales and 2850 pesos 7 *tomines* of gold of diverse quality, all valued as the standard peso of 8 reales; 12 *escudos* of gold, probably worth 40 reales each; and 9 marks 5 ounces of engraved silver.

Admiral Diego Felipe, having been ordered to keep his five returning ships from sailing until the salvage was complete, was still in port awaiting clearance to sail (Alvarado *et al.* 1555). The salvaged treasure had already been placed on board. Felipe had been paid 1000 ducats for keeping his ships on stand-by to take the recovered treasure to Spain.

Initial jubilation over recovery of so much of the lost treasure, meanwhile, had given way to misgivings that it had not been more. On November 10, 1554, the treasury official Antonio Ribero Espinosa (1554) wrote to Prince Philip—who, Ribero apparently failed to understand, was in England as Queen Mary's new husband—concerning the Crown's portion of the salvage. Recounting that 100,000 pesos in Crown treasure had been dispatched on the four vessels that sailed the previous spring, and that three of the ships had been lost, he reported: "The greater part of the silver has been salvaged. . . . I understand that very little of what belongs to Your Majesty will be lost." In any event, 125,000 pesos from the mines was being sent to the Royal Treasury on the five ships preparing to sail.

On December 31, the three treasury officials, Salazar, Ribero Espinosa, and Portugal, reported that an official accounting of the salvaged treasure was underway, and noted that three private merchants had requested permission to go to the Madalena Coast to seek more of the treasure for a share of the find. The treasurers believed that this request should be granted since the Crown had nothing to lose by their efforts (Salazar *et al.* 1554). If the recommendation ever was acted upon, the record does not appear.

Meanwhile, another chapter was about to be enacted in the tragedy of the treasure, which had been loaded on the five ships, three of them with names remarkably similar to those that had sailed on the voyage of disaster the previous April. These were *San Esteban* with Marcos de Torres as master; *San Andrés,* Juan de Heredia, master; *Vera Cruz,* whose master was Miguel de Oquendo; *Santa María la Blanca,* Francisco de Santana, master; and Martínez Darieta's *La Madelena* (Alvarado *et al.* 1555). Oquendo's vessel was an 80-ton caravel. *La Madelena* was rated at 300 tons burden, the other three at 220 each.

Oquendo and *Vera Cruz* had made the 1552–1553 voyage in Carreño's

fleet, to Tierra Firme and back. Returning to Spain in October, 1553, he had sailed again with Farfán's fleet in January to arrive with Diego Felipe's group at San Juan de Ulúa on May 1, 1554. Juan de Gastuna, the master of *San Andrés* when she arrived in May, had died a short time before the scheduled sailing and was replaced by Heredia (Chaunu 1955:II, 530–534).

By January 21, 1555, the ships were loaded and ready to sail. On *Santa María la Blanca* was a cargo of hides, 850,000 pesos, and 28,000 marks of silver salvaged from the three ships lost on the Texas coast. Among the treasure was 27,000 pesos belonging to the Crown. The ship also was crowded with passengers. As she moved through the channel toward the open sea, she evidently struck a reef and went down with a loss of 85 lives (León Romano 1555). Among the victims was Gonzalo de Aranda, who had come to New Spain to investigate the royal accounts.

In reporting the incident to the Crown, Viceroy Velasco gave assurance that virtually all the treasure carried by *Santa María la Blanca* could be saved (Council 1555b). It evidently did not reach Spain until 1556, when 14,381 marks of silver "from Florida" showed up on the register of a shipmaster named Martín Sánchez (Relación 1556). The remaining four ships at last set sail for Havana.

Farfán's fleet, with which Diego Felipe had sailed to the Indies the previous year, had left Nombre de Dios in June, 1554, and reached Havana on August 12. Expecting to find Felipe's ships from New Spain waiting, as he had not been advised of delay, Farfán remained at Havana until November 3. Felipe having failed to appear, he at last sent word to the viceroy and set sail without him.

The failure of official communications notwithstanding, word had been brought to Havana by "some people from New Spain" that "most" of the gold and silver had been salvaged from the three lost ships. "Only about 30 persons," it was said, had escaped the disaster (Casa 1555a).

While Farfán waited, the treasure from Antonio Corzo's *San Andrés*, which had narrowly escaped the fate of the three, was transferred to two of his ships. *San Andrés*, storm-battered as she was, was in no condition to continue the voyage to Spain. Her 39,000 pounds of treasure, valued at almost 624,000 pesos, was transferred to Alonso Pérez Granillo's *San Miguel* and Juan Bautista Preve's *Nuestra Señora del Rosario* (Corzo 1555). Corzo sailed as a passenger on Preve's ship (Mexía 1555). The treasure left behind in 1553 by Bartolomé Carreño when he had to put to sea unexpectedly was taken aboard Farfán's *capitana*.

The 3-month delay in Havana was to prove most unfortunate for Farfán and all concerned. The captain-general, it would be alleged, had no authority to postpone his departure so long. When at last he sailed, it was against the advice of his masters and pilots. The season, they said, was wrong for sailing to Spain; to undertake the voyage in November was an invitation to disaster. Their wisdom was aptly proved.

Sailing from Havana with his 13 ships from Tierra Firme on November

3, Farfán ran into a storm in the mouth of the Bahama Channel. Driven back to Matanzas, about 50 miles (80 km) east of Havana, he remained there until November 28, repairing damage to his ships. During that time, Lope García de Ysasi arrived at Havana with his ship from Honduras and joined the homeward-bound fleet, increasing the number to 14 (Casa 1555a).

Putting to sea a second time, the fleet again ran into a norther at the mouth of the Bahama Channel. For about 10 days the ships remained in the channel with sails trimmed. During this time Diego García's 220-ton *nao Doña Juana* collided with the *capitana,* causing water to gush into the flagship's hold (Casa 1555a). The captain-general and 40 sailors were rescued by the ship *Bretondoña,* and 60 men were saved by other ships. While the treasure was being transferred, however, 30 persons drowned. Artillery, ammunition, and supplies were lost (Ávila 1555).

After clearing the Bahama Channel, the fleet was badly scattered by the storm. At the mouth of the channel, the Honduras ship was separated from the rest. She made the Azores but, taking on water, she had to be unloaded, and then she sank (Ávila 1555, Council 1555a). Juan García's *Nuestra Señora de Begonia,* carrying 25,000 pesos of Crown treasure, was lost at sea with all her cargo and presumably all hands.

Diego García, after causing the loss of the *capitana* and 30 lives, sailed ahead of the fleet with some of the other ships. In midocean, his vessel collided with Preve's *Rosario,* and this time it was García's ship that was damaged. *Doña Juana* leaking badly, García decided to head for Puerto Rico for repairs (Casa 1555a).

The fleet ensign, Francisco Muñoz, transferred from García's ship to Preve's, which made Sanlúcar on January 20, 1555, ahead of the rest of the fleet. Muñoz, reaching Seville on January 21, promptly made his report to officials of the Casa de Contratación. He was to be blamed for not keeping the ships together.

While Preve reached port safely with his treasure cargo, including at least half of that taken from *San Andrés,* the sea was not through visiting its wrath on the rest of the fleet. Granillo's *San Miguel,* carrying the remainder of Corzo's silver and gold, was storm-damaged beyond repair. After transferring her treasure and passengers in midocean to Martín García's 300-ton *Santiago*—the only one in sight—she made for Santo Domingo, where she had to be scrapped. García put in at Senibar, 6 leagues from the Lisbon cape. Four others, badly battered, also made port in Portugal (Ávila 1555). Three, including Diego García's *Doña Juana,* took their treasure to Puerto Rico and unloaded there (Prior and Consuls 1555). But that was not the worst of it.

Fifty leagues short of the Azores, the ships still sailing with Farfán encountered the worst storm yet. Farfán's second flagship, *Bretendoña*—carrying the treasure and 40 soldiers from the first—began making water badly. It was apparent she could not survive. Farfán, the soldiers, passengers, and crew were taken off by *Santa Cruz,* a ship owned and piloted by Cosme

Buitrón, whose master was Juan de Mondragón, late of *Santa María de Yciar.* There was not time to save the double cargo of treasure; it went to the bottom.

Farfán had been warned by his masters and pilots against approaching the Spanish coast in winter. It offered notoriously difficult winds in that season. It was a graveyard for ships with few parallels. As Buitrón's ship approached the Azores, she sailed alone, the rest of the fleet lost or scattered. As one of Spain's most experienced navigators, Farfán had been counted on for better judgment. But, with two ships and their valuable cargoes already having gone down under him since leaving Havana, he passed up his last chance to save the third. Reaching San Jorge in the Azores, he might have ordered the gold and silver unloaded from *Santa Cruz* and, while remaining within the bounds of his authority, done his king a valuable service. But he remained only a day and a half, then sailed on, into the final tragic episode of the winter crossing that had been a nightmare from start to finish (Mexía 1555).[3]

Approaching the Zahara coast, Buitrón's heavily burdened 220-ton *Santa Cruz*—carrying considerably more silver and gold than appeared on her register, as it developed—was unmanageable in the contrary winds. She could neither make port nor sail away from the hazardous coast. On January 23, Farfán reported that the ship had gone on the rocks "on the outskirts of Tarifa" near the Strait of Gibraltar, 3 leagues from Vejer (Farfán 1555a). One hundred fifty persons, including survivors of Farfán's two other flagships lost in unfathomable depths, had drowned in 1 fathom (Mexía 1555). Among them was Pedro de Heredia, governor and founder of Cartagena, who was going home for treatment of a chronic illness (Chaunu 1955:II, 517).

The wreck, occurring near a village, drew hoards of curious onlookers and sanguinary individuals who hoped to salvage for themselves a portion of the treasure. The result was further disaster. Some 80 persons attempting pillage were added to those who died in the initial tragedy, raising the total of drownings to 230 (Díaz 1555).

Farfán's voyage, in a number of references, is described with a single word: "disgraceful." Five ships and four treasure cargoes had gone to the bottom. A number of ships were too badly damaged ever to sail again, and the fate of those making port in Puerto Rico was still unknown. Five of the six ships to make a European landfall—of the original 14—remained with their treasure in Portugal. No more than 150,000 of the 375,000 pesos in Crown treasure with which the fleet had left Havana could be counted as

[3] The masters and pilots who sailed with him had been quick to perceive the lapse in Farfán's judgment. His reputation had not been won by such folly. There was gossip that he "kept a woman," implicit in which was the supposition that the affair was responsible for turning his head.

having landed safely on the continent. Private gold and silver shipments and other valuable cargo had suffered similar attrition, not to mention the heavy loss of lives.

While officials of the Casa de Contratación hastily arranged the salvage of Buitrón's ship, Diego Felipe at last had sailed from San Juan de Ulúa bringing the treasure retrieved from the three ships lost on the Texas coast. With three additional ships that joined him at Havana, he crossed the bar at Sanlúcar on June 16, 1555. Having passed up the Azores because of contrary winds, Felipe had failed to rendezvous there with Captain Juan Tello de Guzmán's armada and thus traversed the corsair-infested waters on the approach to Spain without an escort. He found officials of the casa, under constant pressure to meet royal demands for funds, more prone to find fault than to rejoice over his safe crossing (Tello 1555).

A portion of the treasure that had left San Juan de Ulúa on *San Esteban, Espíritu Santo,* and *Santa María de Yciar* 14 months previously at last had come to Spain. But the final settlements of accounts would consume months, stretched into years, before the final official word was written concerning the shipping disaster on the desolate stretch of barrier island called Madalena on the faraway Texas shore.

Chapter 10

THE ROYAL THIRST

All matters considered, it is small wonder that royal officials during the early months of 1555 were in a frenzy. The odds in "the great lottery" of Indies navigation had become inordinately heavy. Masters and pilots of the merchant fleet and officers of the armada, entrusted with the important task of bringing home the gold and silver needed to finance the Crown's endeavors, had failed when the need was greatest.

Aside from the wars of Charles V and the Crown's innate extravagance, there were a number of factors that created extraordinary demands. Prince Philip had wed Mary of England the previous July 25. In executing that stroke of grand political design, Spain's royal apparatus could scarcely afford to turn miserly. Treasure consignments arriving for Seville merchants had been embargoed by the Crown to send to the British Isles for Philip's pompous display (Casa 1555f). The extent to which Spanish imagination was captivated by the marriage is indicated by the way Philip was addressed in correspondence from the Council of the Indies: "The Most Distinguished King of England, Prince of Spain, Your Majesty" (Council 1555b). It had a pleasant ring to Spanish ears, though the very thought was enough to raise the hackles of Englishmen.

In less happy circumstances was Philip's sister Juana who, on January 11, 1552, had been wed to Prince Manuel João (Emanuel John) of Portugal to maintain the traditional political and matrimonial ties between the two

Iberian nations. The prince died on January 2, 1554, leaving Juana with child and no source of livelihood (Espasa-Calpe 1958:XXVIII, pt. 2, 3039).

Such affairs of the royal family resulted in demands for more revenue and hence the embargo of more private treasure shipments. The king was to lay temporary claim to all the treasure salvaged from the three vessels lost on the Texas coast to meet these and other expenses, and to repay what he had taken previously.

Officers of the casa, striving to cope with the Crown's needs, were confronted with the problem of finding sufficient funds for their own budget. They were constantly pressured by the University of Merchants, who complained that the royal seizure of private assets was wrecking the economy. The casa officials, faced with multiple disasters that had cut sharply into expected shipments from the Indies, moaned and cursed their luck. They also damned the masters and pilots and, more specifically, the captains-general, when they failed in their charge.

Farfán's "disgraceful" voyage was by no means the royal officials' only major irritant. The multiple reverses also included the loss, to corsairs and bad seamanship, of several vessels on Carreño's outbound voyage of 1552–1553; the wreck of the three ships in the Gulf of Mexico in 1554, followed by costly and only partially effective salvage; and the sinking of Francisco de Santana's vessel carrying part of the salvaged gold and silver, in San Juan de Ulúa harbor. There also were a number of lesser losses. But it was Farfán's fiasco and the vast effort required to unravel the snarl it had caused that rankled casa officers the most.

Besides the underwater salvage of Buitrón's ship *Santa Cruz,* treasure unloaded in the Azores, Portugal, and Puerto Rico had to be brought to Seville. An added aggravation was the fact that passengers put ashore in Lisbon were taking their treasure with them, thereby escaping the mandatory accounting in the casa and the Crown's embargo that would keep their assets frozen indefinitely. Word was passed from the casa that the identity of these evaders was known and that the public prosecutor would proceed against all who failed to bring their treasure to the casa for clearance (Casa 1555c).

At least the king's portion of the treasure unloaded in Portugal and the Azores arrived safely, but further difficulties attended the effort to bring the cargoes landed in Puerto Rico. Toward the end of 1555, Captain Gonzalo de Carbajal's armada was sent for it. In returning to Spain, says Haring (1918:294), two ships were lost on the Portuguese coast. Be that as it may, the documents at hand make mention of treasure from only one of the vessels having reached Spain. Cargo from Master Diego Bernal's *San Salvador,* one of those separated from Farfán's fleet by storm, was reloaded on Juan de Andeta's *Santa Catalina,* the *almiranta* of Carbajal's fleet. *Santa Catalina* made port at Lisbon, whence the gold and silver bullion was shipped overland to Seville (León 1556). No mention is made of treasure

from two other ships of Farfán's fleet, those of Pedro Ochoa de Trabudo and Diego García.

All sorts of difficulties, meanwhile, attended the salvage of *Santa Cruz* on the Zahara coast. Francisco Tello was dispatched almost immediately from the Casa de Contratación to recover as much of the gold and silver as possible (Farfán 1555c; Council 1555a), and it was ordered that none of the shipments to private individuals be released.

Tello reached the wreck in late January to find that, despite the additional loss of life among unauthorized treasure seekers, poachers had made off with part of the treasure. Others had robbed the bodies of the drowned victims. Juan Tello de Guzmán, taking his armada to Cádiz, confiscated from seamen and others 15 *partidas* of gold, silver, and pearls they had taken from the wreck (Mexía 1555). Word of the wrecked vessel and her rich cargo spread quickly along the coast and thence across the Strait of Gibraltar to Morocco. Tello, suspecting that some of the treasure itself might have crossed the strait, wrote to the Spanish military captains in Tangier and Ceuta asking them to investigate. Word came back from Captain Martín Correa de Silva at Ceuta that he had located four gold bars from *Santa Cruz*. Tello immediately dispatched a vessel to recover them. They were valued at 208 ducats. No reply came, however, from the captain at Tangier (Tello 1555).

The *alcalde mayor* of Tarifa delivered to Tello 15,000 ducats he had recovered from the wreck. Through intimidation, Tello was able to recover from the people of Tarifa and Vejer another 1000. The culprits were jailed, pending royal instructions for their disposition.

From such spreading of the treasure, word of the wreck and its bounty reached the ears of Turkish pirates in the Mediterranean. In May, eight Turkish vessels passed through the strait to launch an artillery and harquebus attack on the salvagers. Thirty to forty harquebusiers landed on the coast, but Pedro Suárez de Castilla, Tello's son, led a counterattack and repulsed the invaders.[1]

Foul weather hampered early salvage efforts but probably helped prevent more extensive pillage. Tello employed both divers and a device for dredging the bottom, the invention of an anonymous cleric. With the dredging device, operated from the shore, it was possible to plough into the sand to a depth of two *palmos* (almost 40 cm) and drag to the shore any object that lay in its path. After a parcel of gold valued at 800 ducats was recovered, the contraption broke under the strain and had to be sent for repairs and modification.

Tello then had capstans mounted on shore and with strong ropes attempted to shake the hulk loose from the sand. His plan was to attach

[1] It was these Turks who later worked treachery on five French vessels entering the strait, resulting in the death of the noted French corsair, Pie de Palo (Casa 1555d).

empty water casks to the vessel at ebb tide; then at next flood tide it would become suspended and be hauled ashore. Efforts to release the ship from her grave, however, only resulted in breaking the capstan lines. The water was so rough that the divers were unable to attach the casks. Operations were halted to await a calm sea and passage of Holy Week. At that point Tello (1555) expected the work to last the summer, perhaps even extending through the following winter. During the spring and summer, the coast usually swarmed with fishermen. He therefore left his son and four soldiers to guard the wreck and urged that an officer of greater authority be sent to stand off the curious anglers. Tello himself returned to Seville to perfect plans for raising the ship when conditions improved.

Before the salvage effort was well underway, casa officials had been advised by a royal official from Nombre de Dios that Farfán's fleet had loaded more silver and gold than was registered (Mexía 1555). As Tello's divers began bringing up chests, the accuracy of this assessment was proved. The ship's register listed only silver, but they were finding considerable amounts of gold. By the beginning of Holy Week, the amount recovered exceeded the registry, and there was a lot left (Pérez 1555a, Tello 1555). The effort continued until the amount recovered was more than twice that registered; in fact, 350,000 pesos were carried illegally in addition to the 150,000 appearing on the register (Fernández Duro 1895:I, 215).

Farfán, already in disfavor did not benefit by the discovery. Casa officers, highly displeased with the state of Indies navigation, were venting their righteous wrath wherever they found opportunity. They took reprisals not only on Farfán but also on Juan Bautista Preve, Ensign Francisco Muñoz, Diego Felipe, and Antonio Corzo (Tello and Zárate 1555).

The fleet ensign, Muñoz, having been aboard Diego García's ship when she sailed ahead, was accused of negligence for not compelling García to stay with the other ships. Preve, who also had sailed ahead, was held blameworthy for not staying with the others. Farfán himself was under general investigation for the inept manner in which he had conducted the voyage. All three were arrested and imprisoned.

Both the ensign and Preve had given testimony on events of the voyage, the latter bringing specific charges against the captain-general. Farfán, said Preve, had stayed 3 months in Havana without authority, then sailed, contrary to the advice of his masters and pilots, at the beginning of the winter season in bad weather. (Farfán himself [1555b] claimed he had sailed because of the demands of pilots and masters.) And he had contravened royal orders by not unloading the treasure from Buitrón's ship in the Azores (Mexía 1555). By Preve's analysis, the whole fiasco was Farfán's fault. But Preve, in attacking the captain-general, failed to win immunity for himself. The fact remained that he had not kept his ships with the fleet, according to standing orders to "follow the *capitana*'s flag and lantern."

As for Corzo, he had been designated by Don Luis de Velasco, viceroy

of New Spain, to serve as captain of the four ships sailing for Spain in April, 1554. "He gave a very poor account of himself in this responsibility . . . , avoiding his obligation as captain to go to the aid of the others. This was the cause of the loss of the armada. . . ." So said Francisco Mexía (1555), an officer of the Casa de Contratación, in a report to the emperor, promising, "I will do what I can to see that he is punished according to Your Majesty's interests."

Thus blame for the 1554 shipwrecks on the Texas coast fell on Corzo who, according to the charges against him, had deserted *San Esteban, Espíritu Santo,* and *Santa María de Yciar* when they needed help. Had Corzo attempted to go to their rescue, it probably would have meant the loss of four vessels instead of three and much greater loss of life. But he was responsible, nonetheless, for the safety of the ships sailing under his command.

Diego Felipe had to answer charges of a different sort. His offense was failure to stop at the Azores to join the armada sent to protect his fleet for the rest of the voyage, where the threat of corsairs was greatest. He claimed his decision had been due to bad weather, but the casa officials refused to credit his excuse. They would proceed against him just the same (Tello 1555).

No charges appear against the shipowner–pilot Cosme Buitrón or the master Juan de Mondragón. The major share of blame for the wholesale disaster that befell this ship and others of the fleet was assigned rightfully to Farfán. The affair apparently ended his career, for Farfán's name does not appear thereafter in connection with navigation to the Indies.

Unlike Farfán's case, the damage to the careers of Diego Felipe and Antonio Corzo was not permanent. In 1563 they and Cosme Buitrón were among a select group of pilots and masters called by the Casa de Contratación to give advice on the best times for sailing to and from the Indies. Corzo's view was ratified by the others present. In the light of the disaster that had befallen his fleet in 1554, his recommendations seem somewhat ironic (Masters and Pilots 1564). But more of that later (see pages 169–171).

Of greater urgency to the casa than retribution against incompetent shipmasters and captains, however, was satisfying all the various financial demands placed upon it. The Crown's fund requirements, having increased much more rapidly than silver, gold, and pearls from the Indies, were greater than ever. At the same time, the treasury officials of New Spain, in dispatching the 125,000 pesos on Diego Felipe's ships, put the Crown on notice that the royal patrimony had diminished during the previous 3 years. They believed it would not be possible to send another such amount for years to come.

Many factors militated against the accumulation of Crown revenue. One of the greatest, in the treasury officials' eyes, was the inspection conducted by Diego Ramírez—whom Ángel de Villafañe had placed under arrest the

previous year. Ramírez, taking an Indian census on which tribute was to be based under authority of the New Laws of 1542, was prone to sympathize with the natives or to allow himself to be deceived by their cunning. These unwilling subjects fled to the mountains when the inspector approached, leaving in each house only a man and his wife to be enumerated.

The religious, too, created an inordinate drain on revenue, spending wastefully to build monasteries and requesting funds "for bells, chalices, and other superfluities." Labor on the Augustinian monastery being built in Mexico City, the officials observed, had cost the Crown 9000 pesos thus far, and part of the structure already had caved in. Viceroy Velasco, they noted, unwisely had exempted the friars from paying taxes. The usefulness of many of those living in the monasteries had ended years ago; they were but drones (Ribero Espinosa 1554, Salazar 1554).

Such complaints reflected Mexico's general state of economic decline. The miners, faced with disappointing silver production, beseiged the Crown with requests for lower taxes and laments that the price of black slaves was so high. Velasco was insisting on strict enforcement of the New Laws of 1542, issued at the urging of Bishop Las Casas, and thousands of Indians had been released from bondage.

Charles V, while in sympathy with Las Casas's concern for the natives, offered no help to Velasco in his effort to satisfy conflicting demands. His revenue requirements continued to rise each year, and the pressures he placed on the viceroy were unrelenting. Gloomy reports from the viceregal government, therefore, were quite routine.

Nevertheless, the letter of December 31, 1554, shed a faint ray of hope. "A short time back," the officials wrote, "one Bartolomé de Medina arrived here." He had sought to bring with him a German who knew how to amalgamate silver ores with mercury, but the Casa de Contratación had forbidden the foreigner's passage, despite the fact that he seemed indispensable to increasing the output of Mexican mines. The officials asked royal intervention to send the German and a quantity of mercury to Mexico, "for without this the silver here will never be worth any more than it is now [Salazar 1554]." The German, whom the Spaniards called Master Lorenzo, never went to Mexico. But he had helped Medina work out fundamental steps of the amalgamation process in Seville. Medina found the Mexican ores lacked a necessary ingredient to make the process work, but through dogged persistence he at last hit upon the use of a catalyst.[2] Thus was born the "patio process," used effectively by miners from the Río Grande to Cape Horn for

[2] Medina probably never realized that it was vitriol, residual from nearby tanneries, that had energized the reactions in Seville. He did not know what a catalyst was. But he knew enough to try adding other chemicals to the mercury and salt. The magic ingredient he discovered was *magistral,* a medicinal substance that supplied the vitriol (Probert 1969:102–103). Thenceforth, a considerably greater quantity of silver could be extracted from ore, and mines previously adjudged too poor to work became prosperous.

350 years without significant changes. Not until the end of the nineteenth century, when modern chemistry provided the more efficient cyanide process for leaching gold and silver, did the method become obsolete.[3]

Bartolomé de Medina had changed the course of economic history in Hispanic America. The erstwhile Seville merchant "lived to see a cumulative increase in the king's tax revenue reach twenty million pesos over a twenty-five-year period [Probert 1969:92]." A silver boom was born that never died. The new method replaced one that involved the use of litharge (crude lead oxide) for smelting ores. It was so inefficient that ores assaying less than 10 ounces of silver per 100 pounds—200 ounces per ton—could not be produced economically (Probert 1969:91–92). Thus, ore that would yield $925 worth of silver per ton of ore at 1977 prices was discarded as useless.

Medina had the patio process more or less perfected within a year after the viceregal government reported his arrival in New Spain. Even though it was a great boon to silver output, it still could not fill the royal need. The Crown, throughout the reigns of Charles V and Philip II, continued to borrow against the future, draining off revenues faster than they accrued.

Gold and silver salvaged from the three wrecked vessels on the Texas coast and brought to Spain in June, 1555, by Diego Felipe's four ships amounted to almost 250,000 ducats after expenses of the recovery had been paid. After the Crown's 50,000 ducats was taken, almost 200,000 remained for distribution to various claimants, including beneficiaries of those drowned or killed by Indians.

The salvaged treasure represented but a fraction of all the gold and silver Felipe brought. Of the entire cargo, 167,500 ducats belonged to the Crown. The bullion consigned to private individuals, merchants excluded, totaled 721,000. The entire amount was sequestered to meet mounting royal obligations.

Exceptions to the embargo of private treasure were permitted only for

---

[3] A description of the process by which the mercury was used comes from Vázquez de Espinosa (1942:no. 1448). First the ore was ground in a mill. Then it was passed through a coarse wire sieve to reduce it to the fineness of flour. Then, after it was roasted in ovens to remove sulfur compounds, antimony, and other impurities, the silver ore was ready for amalgamation. From the ovens it was taken to troughs, where a little water and fine salt, then quicksilver, or mercury, were added. Water was stirred in little by little until the ore dust became a muddy mass, which was "kneaded like dough"—that is, trampled with the workers' bare feet. The process was repeated every 3 days, with salt and quicksilver added "as needed." At the proper time, the mass was put into a vat and washed with a beater run by a *labadero,* or water mill. The amalgamation process was then complete. The silver was put into coarse sacks, which were squeezed to get the quicksilver out. The remaining silver, of doughlike consistency, was placed in an earthen jar which, with a screen over its mouth, was inverted over a second jar. Fire was applied to the upper jar, causing the mercury to pass through the screen into the lower vessel. The silver was left free of mercury, pure, and "white as snow." It then was ready to be melted into bars, graded by the assayer, and the Crown's fifth deducted by royal officers.

persons in extreme need. These amounted to 60,000 ducats. Another 15,000 ducats was allowed for settlement of wills, giving of alms, "and other pious deeds." Thus, the total amount confiscated was reduced to 636,000, which "fell far short of what is needed [Charles V 1555]." Another 100,000 ducats, therefore, was taken from merchants, despite the fact that the emperor had ordered that they be paid in full.

The 736,000 ducats was quickly allocated: 250,000 went to the emperor; another 150,000 to Italy for current and back pay for soldiers stationed there; 50,000 to Burgos "on credit for their exchanges"; another 20,000 went for powder to be sent to Flanders, where Charles V's troops were engaged in a struggle with those of Henry II of France; and 25,000 to finance Admiral Alvaro de Bazán's armada, also destined for Flanders. Yet another 231,000 ducats was required for the Catillian War Council, and even that amount was considered insufficient. The final 10,000 ducats was provided to Her Serene Highness Princess Juana "on credit for what is due for her dowery . . . because she is in much need and has nowhere to turn to maintain herself [Charles V 1555]."

So much for 736,000 ducats dug from the mines of Mexico with slave labor, carried on muleback over narrow trails and high mountain passes to the port of San Juan de Ulúa, and sent to Spain on leaky wooden vessels at high risk to both ships and lives.

The Casa de Contratación, meanwhile, had drawn a list of its own expenses in the conduct of affairs of Indies navigation, totaling more than 146,000 ducats. Among them was 20,000 ducats previously "borrowed by His Majesty which has to be repaid" and another 16,000 for sending a new viceroy to Peru to succeed the late Mendoza. Other expense items included salaries for employees of the casa, ship stores and equipment for 54 Dominican and Franciscan religious and Crown officials going to the Indies under royal orders, and costs of maintaining the various armadas.

The royal exchequer had granted authority for the needed amount to be taken from the Crown's share of treasure landed by the five ships of Farfán's fleet in Portugal, from Juan Bautista Preve's *Rosario* at Sanlúcar, and from the salvage of Buitrón's *Santa Cruz* on the Zahara coast (Molina 1555). But such plans reflected the royal custom of counting chickens before they were hatched, of borrowing against the future. When the royal revenue was tallied, it again fell short, and the Crown ordered seizure of 200,000 ducats that belonged to passengers in Farfán's fleet (Pérez 1555b).

Complicating the financial plight of Charles V's reign was his involvement with foreign bankers. The sums he borrowed from his subjects were trifling in comparison to what he owed the great financial houses of Florence and Genoa and, especially, the Welsers and the Fuggers of Southern Germany (Merriman 1925:194–195). The Welsers of Augsburg were active in colonial affairs, with an agency in Santo Domingo and mines in New Spain, thereby cutting off Crown revenue at its very source. After 1528 they took over the province of Venezuela to settle and exploit (Haring 1947:296).

The Fuggers had advanced Charles large sums for influencing in his favor the imperial election of 1519. Thenceforth, the emperor's dependence on them increased steadily. "For every new loan, they managed to possess themselves of one after another of the sources of royal revenue [Merriman 1925:195]."

Both the Welsers and the Fuggers helped to finance the voyages of García de Loaysa to the Moluccas and Sebastian Cabot's attempt in that direction. The Welsers also were involved in the expedition of Pedro de Mendoza to colonize the Río de la Plata. But such colonial ventures had gone sour, and Charles, near the end of his reign, renewed the policy of excluding all foreigners from the New World (Haring 1947:296).

Still, old debts had to be settled, and royal credit at the time of Charles's abdication was at a far lower ebb than at any time since the rule of Henry the Impotent. The Crown probably owed the Fuggers well over 2 million ducats, and the amount due other banking houses approximated 5 million (Merriman 1925:196).

Early in 1555, while awaiting salvage of Cosme Buitrón's vessel and arrival of Diego Felipe's ships bringing the salvaged treasure from New Spain, casa officials had put the Council of the Indies on notice concerning such obligations. "The Fucares [Fuggers] must be paid 100,000 ducats plus interest. The merchants of Seville have to be paid for what was embargoed from them to be sent to England [for Philip's wedding]. . . . Something will have to be paid the Esquetes from the first gold and silver to arrive on the account of 400,000 ducats plus interest [Casa 1555f]."

In light of such burdensome debts, the heirs of the victims of the three shipwrecks in Texas and other claimants to the salvage would simply have to wait. True, the Crown had made an effort to resolve the plight of the most needy among those who had an interest in shipments of money or bullion on the three lost ships. But an undated list of amounts released to such persons comes to a total of only 1361 ducats—an average of less than 65 ducats per person (Council 1555b).

In exchange for the confiscated assets, the Crown offered perpetual annuities. The precise formula for such compensation remains evasive though, as curiously stated in a letter of Charles V to the *jueces oficiales* of the casa in Seville, the beneficiaries of the ships wrecked in the Gulf of Mexico would receive "fourteen thousand maravedís per thousand [pesos?] assigned to credit [Casa 1556]." Those who did not "insist" on the annuity should receive bills of exchange bearing 12% interest and be released from taxes and payment of the royal fifth on bullion shipments until they were fully compensated. They also were to be allowed an additional 8% for "damages, insurance, and risks incurred in bringing [their treasure] from New Spain [Philip II 1556–1557]."

Despite such royal good intentions, the results of confiscation often were disastrous. American trade was placed in serious jeopardy. Bankruptcy among merchants and failure of banks occurred frequently, as those depend-

ing upon the resources due them from the Indies found themselves unable to pay their debts and carry on business.

Needless to say, complaints were frequent. Dr. Hernando Pérez, writing to the Council of the Indies in June, 1555, declared, "My heart breaks when I see what is happening as a result of this practice." There were poor people to whom small portions were due who had to forego the betterment of their lives, the relief of their daughters, help to get out of prison; students, dependent on relatives in the Indies for their maintenance, who had to abandon their studies; and others who were sending their earnings to Spain to bring their wives to join them in America. Pérez suspected that shipmasters and passengers had managed to conceal their own gold and silver and bring it unregistered to avoid having it retained; the poor man who had to entrust his savings to a ship of the fleet for transport to Spain to support his family or pay his debts was the real loser (Pérez 1555b).

Protests came repeatedly from the prior and consuls (1555) of the University of Merchants, who warned that the practice of confiscation was ruinous not only to Indies trade but also to the kingdom as a whole (Prior and Consuls 1555). They pleaded that gold and silver shipments due the merchants be released to enable them to pay their debts and transact business (Prior and Consuls 1555, Casa 1555a).

But Charles, about to abdicate, was little inclined to heed such pleas. He had repeatedly blamed the war of the moment for his inability to adjust outgo to income. But he maintained an expensive royal apparatus and indulged in pompous display "to promote our reputation and service in a very important manner [Charles V 1553]." His promises of a brighter future were false.

Fifteen months after Prince Philip succeeded his father on the Spanish throne, he responded to pleas of the University of Merchants to release the merchants' embargoed treasure. The prior and consuls had represented that, as a result of the confiscation, many of the tradesmen were unable to satisfy their creditors; bankruptcies had increased and trade diminished. Creditors had foreclosed, and debtors had been imprisoned, some to die in jail. Still others had sought sanctuary in churches and monasteries. The total effect was a general loss to all the kingdoms.

In response to the plea for mercy, Philip II ordered in May, 1557, that merchants and others from whom gold and silver had been taken be provided the means to satisfy debts incurred before their property was taken (Philip II 1556–1557). There was no guarantee against the seizure of private shipments in the future, but Philip felt it necessary to move more circumspectly than had his father.

The silver and gold recovered from our three ships, after reaching Spain in June, 1555, were weighed by the assayer and sold at public auction in Seville between July 3 and October 23. The proceeds were received by the Casa de Contratación, and held there for royal disposition (Tello 1556).

Each sale was announced by the town crier and bullion merchants gathered for the bidding. The successful bidder, after reducing the gold and silver to legal fineness, presented it at the mint, where it was converted into coin of the realm. Six different gold and silver dealers purchased the treasure from the ships of Martínez Darieta, Miguel de Oquendo, Marcos de Torres, and Juan de Heredia in nine separate lots, paying from 2010 maravedís per mark to 2272 (Casa 1555h). They probably resold the metal for an average profit of 4 maravedís per mark (Haring 1918:174).

Settlements with merchants and individuals to whom consignments of treasure on the three sunken ships belonged were made over a period of years. The emperor immediately ordered various exceptions to the embargo for 32 persons of special rank and privilege. Among these appears the name of Bishop Bartolomé de las Casas, whose due from the four ships was 200,000 maravedís.

Other such notables included the Duke of Alba, to be paid 20,000 ducats of the 40,000 arriving in his name; and the Marqués del Valle (Philip II 1556–1557), Hernán Cortés's legitimate son Martín, whose annual income from his father's estate has been placed at 86,000 pesos (Johnson 1975:221). Cortés was to receive one-third of what came for him.

Two *partidas* sent from New Spain by Viceroy Velasco also were exempted, as were those of several other royal officials. Don Luis Colón, admiral of the Indies—Diego Columbus's son who disgraced the family name by flagrant polygamy—was to receive a meager 6 pesos "of what was sent him from the Island of Española from what came from his hacienda, notwithstanding what was commanded [Philip II 1556–1557]."

Aside from these exemptions, or partial payments, the copy of *Santa María de Yciar*'s register in the Archivo General de Indias at Seville has record of 24 settlements noted in the margin. They are of such widely varying proportions that no generalization can be drawn. The rate of recompense ranged from as little as 1.3% to as much as 100%, indicating that each consignee was paid according to the amount of his *partida* that was recovered and identified.

Bishop Las Casas, for his consignment of 145 marks—his pension paid by the viceregal government of New Spain—received 138,311 maravedís in June, 1556. The amount was about 43% of the original shipment's value. Doña Juana de León recovered only about 10% of the value of the clavichord she had sent to Juan Ramírez de Alarcón. Ana Hernández de Morón got 67% of the amount sent her from her dead son's estate, and the widowed mother of Pedro Velasco, a passenger on the ill-fated *Santa María* with his son, was granted a settlement of 67% on 10 marks of silver he had carried. On the other hand, the cousin and brother of Pedro de Salazar, a royal notary in Mexico, collected only about 10% of the 200 ducats their relative had sent them (Ojos 1554).

The widow of Alonso de Morales, traveling homeward on *Santa María*

with his son, recovered in March 1558, about 23% of the 50 marks of silver and 200 pesos he had shipped on the same vessel (Casa 1555g). Rui Gómez Adalíd was paid a little more than 10% of the value of a slave he had sent to New Spain (Ojos 1554).

All the marginal notes (of which the preceding are samples) represented little more than 2000 ducats. Other settlements were made in diverse manner over a period of years. Many probably were never made at all, for some of the persons who stood to benefit from the salvage may never have learned of it. There is found a detailed list of the *partidas* appropriated by the Crown, running to 267 pages (Casa 1558). But no such accounting is found of the final settlement.

One case brought up for litigation concerned the property of Francisco Méndez, who had embarked on *Santa María de Yciar* with Elonor de Miranda, his wife, and their children, Lorenzo and Isabelita (Ojos 1554). The action was brought by Beatriz and Mencia Núñez of Granada, Méndez's stepdaughters by a previous marriage. The sisters claimed that their mother, Leonor Díaz, had married Méndez after the death of their father, bringing to the union a dowry of 2000 ducats in cash and jewelry. Méndez then had taken the money, invested it in textiles, and sailed for New Spain. Returning on *Santa María,* he died in the shipwreck "on the coast of La Florida." They asked to be awarded the 2000 ducats plus half of any profits that had accrued therefrom. The matter dragged on for 5 years; the transcript runs to 224 pages.

Testimony in January 1557, in the *audiencia* of the Casa de Contratación revealed that Méndez had consigned to *Santa María* silver bullion and coin worth almost 3500 pesos. Of this amount, 579,681 maravedís—2131 pesos or 1545 ducats—had been recovered, returned to the casa, and confiscated by the Crown. The casa's attorney contended in May, 1559, that the sisters' claim was invalid because they had not instigated proceedings at the right time or in the right manner. Moreover, there was no testimony to indicate Francisco Méndez's place of birth, who his parents were, or that he and Leonor Díaz actually had been married, not to mention proof that there had been a dowry. His position was that Méndez had died without heirs, that his estate was vacant and therefore the property of the Crown.

The plaintiffs then produced witnesses to testify that their father, having died about 1530, left property consisting of several houses and household furnishings valued at more than 2000 ducats; that their mother had married Méndez about a year afterward; and Méndez some years later had sold the property and sailed to the Indies, leaving his wife in poverty. He had, the witnesses believed, acquired considerable wealth in New Spain before the death of his wife, about 1546.

Eventually, the casa tribunal ruled in favor of the sisters, but the Crown's attorney appealed to the Council of the Indies. The matter came up for review on April 22, 1561. The Council upheld the previous judgment,

awarding Beatriz and Mencia Núñez the full 579,681 maravedís of Méndez's property recovered from the wreck of *Santa María de Yciar* (Núñez 1561).

Méndez exemplifies the reasons behind the royal decree restricting the emigration of married men to the Indies without their wives. He apparently gave no thought to returning. By the time he at last embarked for Spain, his first wife was long in her grave, and he had acquired in the colonies a new family who accompanied him to a cruel death.

During 1556, largely in June and July, the Crown acceded to petitions for payments to merchants of Seville, Burgos, and Jérez de la Frontera for treasure confiscated from the salvage of *San Esteban, Santa María,* and *Espíritu Santo.* The total was more than 26,000 ducats. Largest beneficiary was Gaspar de Espinosa, Seville merchant with a variety of partnerships and exclusively owned business enterprises. Having been paid settlements of 31 and 67% on two of the previously mentioned individual settlements, of relative insignificance, Espinosa the merchant received 10,600 ducats for himself, plus another 1446 to share with various partners.

One other merchant, from Burgos, was ordered compensated 720 ducats for what was taken from him when the Crown sequestered 600,000 from Carreño's fleet in October, 1553 (Philip II 1556–1557).

Such payments resulted from petitions to the Council of the Indies. Interest was added at 12%, dating from August 1, 1555, to the date of payment, and 8% was granted for "duties, insurance, or risk necessitated in the delivery from New Spain to Seville."

By present-day standards, there was little that was fair or just about either the practice of enforced borrowing from New World treasure shipments or the manner of adjudicating claims. Despite the Crown's concern for justice and legality, favoritism crept in; the rich and powerful held sway, while the poor and the needy—despite token efforts at relief—continued to suffer.

There are many parallels between the Spain of Charles V and twentieth-century America. Each attained heights of prosperity previously unknown by any nation. Yet both are characterized by the chronic practice of spending beyond their incomes—of borrowing against the future. Visions of world leadership, if not world domination, were foreign to neither. Each became a ponderous bureaucracy, its people subjected to a plethora of regulations beyond their understanding or ability to comply, and government confiscation of their resources for purposes they had little voice in choosing.

In the case of Spain, her unprecedented resources were dissipated, largely for concerns outside her own borders. History lucidly reveals where the path of deficit spending and well-intentioned but misguided and excessive government regulation led for Spain.

Chapter 11

HOME FROM THE SEA

No development since the conquest of Peru had increased the yield of precious metals from Mexico and South America more than the perfection by Bartolomé de Medina of the patio process of silver amalgamation. From 1522, when silver and gold had started coming from New Spain, through 1557, the Crown's share of wealth from that region totaled slightly more than 2,750,000 pesos. From 1558 through 1601 the amount exceeded 34,385,000—a twelvefold increase.

Despite the reverses of the early 1550s, New Spain's bullion shipments for the emperor in 1555 (207,118 pesos) surpassed all previous years except 1550, when the total of 236,344 pesos represented 2 years' receipts. All records fell in 1556 with arrival of 433,914 pesos (Haring 1918:332)—slightly more than $2 million at 1976 silver prices. In 1557, Crown revenue from New Spain passed 1 million pesos for the first time, and after 1586 the royal take exceeded a million more often than not.

No precise parallel to the New Spain figures is found for all of South America, but annual Crown royalties from Potosí (Bolivia) alone, between 1556 and 1600, ranged from 133,885 pesos in 1572 to 982,979 in 1593 (Haring 1918:333–334). Total expected revenue from the Indies in 1608 was 2 million ducats (2,760,000 pesos).

Since the Crown's share during this period usually amounted to one-fifth—but sometimes only a tenth—taken after a 1% assayer's fee was

deducted, the total registered treasure brought to Spain was at least five times greater. Silver and gold brought legally from New Spain during the sixteenth century, therefore, must have exceeded 180 million pesos or, at 1976 silver prices ($4.625 per ounce on July 19, 1976), $832.5 million.

The precious metals mined in Mexico on which the Crown revenue of a tenth was levied, however, may be far greater than is generally supposed. From August 21, 1555, to January 15, 1560, for example, royal tithes on silver amounted to 36,923 marks, while fifths taken totaled 40,047 marks, a ratio of 92.2% (Portugal 1560). If this proportion held throughout the century, the yield of Mexican mines for that period totaled at least $1.6 billion dollars. While this is not a highly impressive amount by present-day standards, it was enough to have a vital effect on sixteenth-century Europe, especially when the treasure from South America was added.

In considering such figures, it must be kept in mind that they are computed only on the basis of the weight and modern value of the metal. They do not take into account purchasing power, which dropped sharply in the sixteenth and seventeenth centuries as the output of precious metals increased—an inflationary process not unheard of in the twentieth century.

Officials were constantly irritated by illicit traffic in gold and silver in the colonies. In compliance with a royal decree barring goldsmiths from practicing their trade in New Spain, most such craftsmen left Mexico in the early 1550s for Guatemala. Thereafter, gold was wrought secretly in Mexico or brought from Spain already wrought, both illegal, as royal imposts were thereby avoided.

"There also is fraud," Dr. Quesada (1554) reported, "in the manner the Indian silversmiths of this country work in molds." The native craftsmen dwelt in scattered areas and there were no means of collecting from them the royal tax. "They do as they please . . . , producing inferior silver work without paying the fifth." He estimated that the number of such smiths in the viceroyalty exceeded 2000.

The amount of precious metals brought illegally cannot be calculated, but of a certainty it was considerable. Estimates range from 10 to 50% of the total (Davies 1965:296). Possibly another 10% was lost in transit, to either corsairs or shipwreck.

The result of this influx of gold and silver was an extensive price revolution. Considering the results of inflation today, it is not difficult to imagine the effect on those segments of society whose income could not keep pace with rising costs.

Spain became a distributor of the precious metals to the rest of Europe. The pace of the distribution was accelerated by the fact that agricultural production on the peninsula was somewhat limited and manufacturing all but nonexistent. "Her manufacturers, even her grain, came to her from France, England and the Netherlands, and thither went her gold and silver in exchange [Haring 1918:178]."

Furthermore, Hapsburg imperialism served as a catalyst to the distribution process. Spain became but a conduit for the transfer of wealth from the Indies to other nations. Had she been an industrial nation, or even one of prosperous agriculture, revenues from the New World might have been applied to internal development in a way that would have put her centuries ahead of other Western European countries.

Under circumstances demanding extraordinary economic *savoir faire,* Charles V was notoriously naive in matters of economics. And the emperor, whose viewpoint remained dynastic rather than national (Merriman 1925:201), never was able to view realistically the effect of his policies on the nation's economy. Thus, Spain, possessing the opportunity of a millennium, passed it to her enemies. She permitted her rivals the greater benefit from the riches that might have brought her lasting glory, had her rulers possessed the good judgment ot apply them properly.

When, in January, 1556, Philip succeeded his father on the throne, he inherited a host of old problems, including the war with France and debts estimated at 20 million ducats. Revenues from the Indies were on the increase, but Philip was no more able to adjust outgo to income than Charles had been.

Mines in Mexico and Peru were increasing in production, owing to accelerated development was well as to the new silver amalgamation process. The earliest treasure from the New World had consisted almost exclusively of native art objects of gold. The metal itself soon proved to be relatively scarce, but silver mines were plentiful. The years 1531 and 1532 marked the discovery of the first such mines in New Spain, in the Michoacán area west of Mexico City. Within the next few years, the shipment of bullion to Spain began to assume importance (Haring 1918:244).

In 1543, the first local office of the treasury of Nueva Galicia was established at Compostela, primarily to collect silver taxes from the newly discovered Espíritu Santo mines. Other mine discoveries followed in the south and west of the province. In 1548, the great mines of Zacatecas, destined with those of Guanajuato to be New Spain's richest, were discovered. They precipitated a rush of considerable proportions. The royal treasury office was ordered moved to Zacatecas in 1552, and a smelting house was built. Rich mines had been discovered in the western part of Nueva Galicia, at Culiacán and Xocotlán, and at Guachinango, northeast of Mexico City. Guadalajara, which became the seat of the Audiencia of Nueva Galicia, was overshadowed as a mining center by Zacatecas (Bakewell 1971:15, 17). In 1552, the famous Real del Monte mines were begun at Pachuca, and it was there in 1554 that Bartolomé de Medina set himself to work to prove that silver ore could be amalgamated with mercury.

At the smelter, the bullion extracted from the ores was shaped into *planchas* (disks), the Crown tax was extracted, and each *partida* marked. Such markings indicated the payment of the tax, the assay, and the mine and

smelter from which the bullion came. The silver disks brought up from the wreck site of the 1554 treasure ships bear a variety of such markings.

Aside from increasing silver production, the patio process offered an additional source of royal revenue. Mercury, on which the process depended, became a Crown monopoly. In 1559 the Casa de Contratación in Seville sent to Mexico 253.5 quintals of the liquid metal, which was sold at public auction conducted by officials of the viceregal government on September 16. Proceeds of 33,208 *pesos de oro de minas* were remitted to the Crown (Portugal 1560).

The assayer took from each bar a bit of silver, weighed it, and placed it in a separate receptacle cast from ashes obtained by the burning and grinding of bone: "like the little molds used by the silversmiths in casting silver or gold [Vazquez de Espinosa 1942:no. 1657]." A hot flame then was applied to melt the metal in each crucible, evaporating any impurities of copper, tin, or lead. The silver, thus refined, was removed and reweighed on an accurate balance and the grade determined from the extent of shrinkage. Then the bar was stamped according to its grade.

The assaying process, like that of extracting silver from ores, also was the subject of some innovation in the 1550s. Intense heat being a crucial part of the process, it was discovered that pine charcoal was a much more effective fuel than the heath used previously. The improvement was found to yield two grains more of fineness (Casa 1577).

The royal treasurers' audit of income and expenses in New Spain from 1553 to 1560 reflect the continued vitality of the times. One entry recounts the spending of 118,435 pesos (in gold of the mines) for outfitting the armada "sent by the viceroy in Your Majesty's name for the pacification of Florida and Punta de Santa Elena [Portugal 1560]." Ángel de Villafañe would play a prominent part in that episode.

Another item shows 9797 *pesos de minas* spent on the ships being sent from Port Navidad to the Spice Islands. This was the expedition that had been urged by García de Escalante Alvarado, himself a captain of the tragic Villalobos expedition of 1542, to open trade between Mexico and the Far East. Headed by Miguel López de Legazpi, with Fray Andrés de Urdaneta as chief pilot, the new voyage was to succeed in establishing the long-sought eastward sailing route across the Pacific.

The 1554 shipwrecks off Padre Island have afforded a window to the past. Placed in context with the spectrum of navigation between Spain and America in that period, and with politics of Spain and her New World colonies, the study of this isolated incident pushes back the frontiers of knowledge.

Yet, while the episode may have been isolated and seemingly unrelated to a broad view of stirring events of the times, it triggered events of more far-reaching significance. The names of many of the story's characters appear

in the documents of later years: Fray Marcos de Mena, Francisco del Huerto, Antonio Corzo, and Ángel de Villafañe.

Huerto, who it has been assumed sailed to Vera Cruz in a small boat to carry news of the 1554 disaster, continued to sail as a shipmaster from 1557 to 1561 (Casa 1579), to Tierra Firme and Cabo de Vela. In 1558 he was tried before the judges of the Casa de Contratación for having permitted some persons to leave his ship before it was inspected. Claiming through his counsel that sailors had gone ashore without his knowledge or permission, he won reduction of the penalty from a fine of 50,000 maravedís to 20,000 and the 4-year suspension as a shipmaster to 1 year (Huerto 1559). Nothing of his background appears in any of the papers dealing with his case, except that he was a resident of Seville.

Actually, Huerto's place of residence was the sea. Not one scrap of paper is found that he wrote himself, but the evidence indicates that he was a hardy mariner who knew no other home. His intimate knowledge of and respect for the sea had enabled him to survive the 1554 disaster. But for the hostile Indians, his stalwart seamanship would have saved the others who escaped drowning.

In January, 1563, Huerto and two other shipmasters of the 1552 fleet, Hernán Ruiz and Bartolomé Sánchez, were among 32 pilots, masters, and shipowners sitting as a body to transact business of the University of Masters and Pilots. Cosme Buitrón, still a pilot, also is among the number (Masters and Pilots 1563).

Later that same year, the casa summoned to a session in Seville a select group of masters and pilots to make recommendations on procedure for sailing to the Indies. Among them was Antonio Corzo, who had been blamed for the loss of the three ships on the Texas coast; Diego Felipe, who had brought home the salvaged treasure; and Cosme Buitrón, owner and pilot of Captain-General Farfán's third flagship on the disastrous homeward voyage of 1554–1555.

Much had been learned during the bleak years of the 1550s concerning navigation to the Indies, and efforts to render the maritime system less hazardous and more efficient continued. Philip had ordered that all ships sailing to the Indies should go in fleets. The fleets, however, frequently were not ready to sail at the appointed time. Casa officials had found that coordinating two fleets, one bound for Tierra Firme, the other for New Spain, was especially difficult because they were governed by different considerations; it seemed more reasonable that they sail separately. On January 18, 1564, the assembled group was asked to give its opinion. Out of the meeting came recommendations that shaped the maritime system for years to come. Antonio Corzo, who had been accused of abandoning his ships 10 years earlier to a cruel fate on a hostile shore, articulated the plan.

The panel unanimously endorsed Corzo's views but, from the final draft

submitted for Crown approval, it appears the University of Masters and Pilots had second thoughts. Corzo, apparently mindless of the disaster that had befallen the ships of his charge in April, 1554, had proposed that the New Spain fleet sail homeward from San Juan de Ulúa each year on April 1. By his recommendation, it would have arrived at Sanlúcar in late July or August, a schedule that might have found the ships still in hurricane waters during the hazardous season. In final form, the departure time from New Spain was advanced to March 1, arrival in Spain to "by July" (Masters and Pilots 1564).

The recommendations—eventually adopted—otherwise called for separating the Tierra Firme and New Spain fleets. The former would sail from Sanlúcar in August, pass through the Caribbean after the height of the hurricane season, and arrive in Nombre de Dios in October, when the heaviest rains were past. Departing in December, it would return to Cartagena in January, sail for Havana the following month, arrive in Havana in March, and set sail for home in April. The voyage would end in late June or early July.

The New Spain fleet, including ships bound for Santo Domingo and Honduras, would sail for Spain during April, when good weather generally prevailed in the eastern Atlantic. It would make Hispaniola by June, take on supplies at Ocoa Bay, and resume the voyage within 8 days. At Cape Tiburón or Navassa Island the Honduras ships would split off, and the rest of the fleet would drop anchor at San Juan de Ulúa, "where they will arrive with God's help in July, safe from hurricanes and northers, which do not occur in that land during this season [Masters and Pilots 1564]." Wintering there, the fleet would sail again the following March, make Havana in April, and depart early in May.

The schedule was designed to eliminate the uncertainty that had attended previous sailings. Passengers and inland dwellers, who in the past often had arrived at Vera Cruz or Nombre de Dios to find that the fleet already had sailed or that they had a long wait on their hands, would be able to depend on the schedule and would come at the proper time. By sailing at the season calculated to offer the best weather, the fleet would be able to stay together; risks would be cut in half. Lives would be saved and bankruptcies resulting from ship losses avoided. No longer would it be necessary for a captain-general to order his ships to sea at the height of the hurricane season or, as Farfán had done, to approach the hazardous Spanish coast in winter.

But if the masters and pilots themselves were not oversold, a great deal of their rhetoric must have been aimed at convincing the Crown. They certainly knew that hurricanes could occur in the Gulf of Mexico before July; and there was no guarantee against equinoctial storms or spring blows such as the one that had sunk *San Esteban, Espíritu Santo*, and *Santa María de Yciar.*

One point of the recommendations may have reflected Corzo's memory of that incident. It dealt with what a captain-general should and should not be. Although this high officer should be an experienced mariner, he should not be the master of his own ship. If he were, he naturally would be more concerned with the welfare of his own vessel—as Corzo doubtless had been in 1554—than with that of the fleet. If a master found himself unexpectedly appointed captain, he should obtain the best pilot available to relieve him of a master's responsibility, for his duty then would be to guard the entire fleet. "There are many who can run a ship that sails behind the *capitana*'s lantern but are not capable of filling the captain's shoes [Masters and Pilots 1564]." Corzo, unfortunately, had been one.

At about the time the masters and pilots were making their recommendations on sailing times, another prominent figure of the 1552 sailing reappears: Captain-General Bartolomé Carreño. Serving now as inspector of fleets and armadas, he petitioned the Crown for an increase in his annual stipend of 100 ducats. The amount was insufficient, he claimed, because of the many trips he had to make to Sanlúcar in the course of inspecting the 40–50 ships that sailed each year. He asked 200 ducats annually as travel expenses and another 200 as salary, because he had a wife and children to support (Museo Naval 1975).

His wife, from all indications, was a daughter of Blasco Núñez Vela, captain-general of the 1535 Indies fleet and first viceroy of Peru. They had lost one son in the disastrous ship fire in 1553. Their son Francisco had accompanied Núñez Vela to Peru and "served there many years in the company of his grandfather [Carreño de Ribera 1608]." Francisco then followed his father's footsteps into a maritime career. He served as captain in the armada of Pedro Menéndez de Avilés, admiral of the Armada de la Guardia de la Carrera de las Indies commanded by Cristóbal de Braso, then as governor and captain-general of Cuba.

The shipwrecks on Padre Island, with those occurring frequently in the Bahama Channel—such as the wreck of the *San Juan* in December, 1551—bore results also in the New World. Viceroy Velasco in 1556 urged upon the Crown the necessity of reducing the Indians on "the coast of Florida" (Lowery 1911:353) which, in the terminology of the day, embraced all the territory north of the Río Pánuco.

Pedro Menéndez de Avilés (1555), whose name was of rising prominence in matters of Indies navigation, had proposed to Charles V the establishment of a fortress "where ships damaged by storms in the Bahama Channel might take refuge from the Indians." The suggestion probably came on the heels of the *San Juan* disaster, which left 21 persons on the coast of the present state of Florida to die at the hands of the Indians. The emperor had responded by promising a cédula authorizing Menéndez to explore the coast from Havana in search of a suitable location. The order, however, never came. Menéndez soon was occupied with other urgent matters. He

was elected to see to the transport of salvaged treasure from Buitrón's ship at Tarifa in 1555 (Díaz 1555). Later that year, he sailed as captain-general of one of the two fleets dispatched to the Indies. In 1556, he and the other fleet, captained by Alvar Sánchez de Avilés, returned home with more than 2.3 million ducats in gold and silver (Haring 1918:337).

A number of tragic episodes had contributed to the evolution of the idea for a "Florida" colony, beginning with the ill-fated 1528 expedition of Pánfilo de Narvaez, from which began the 8-year odyssey of Alvar Núñez Cabeza de Vaca across Texas and Mexico. The 1539 Florida landing of Hernando de Soto's men and their subsequent trek through 10 southern states also was a factor. Each of these *entradas* did its part toward assuring the permanent hostility of the Indians with whom it came in contact. When a company of Dominicans headed by Fray Luis Cancer attempted a missionary entry on Florida's west coast in 1549, all who went ashore were killed (Winsor 1884:II, 255).

While these misfortunes had a bearing on official thinking concerning the northern gulf shore, the 1554 shipwrecks solidified such thought. The relationship has not been entirely overlooked by historians, but misunderstanding of where the wrecks occurred—and often misconceptions of the extent of Spanish geographical knowledge—frequently has caused it to be discussed in erroneous context. Despite the Narvaez and De Soto expeditions, geography of the wilderness that lay behind the shoreline remained obscure. The Spaniards possessed few facts on the true nature of the Indians in any given part of it, and all the land bordering what they called "the coast of Florida" was consigned to the same category: unknown.

Although many shipping disasters had occurred along the Florida peninsula, none had quite the impact of the one on the Madalena Coast of Texas. Not only was the loss of property severe, but the vengeance wrought by the natives had been near total. While royal approval for a Florida colony proposed by Julián de Samano and Pedro de Ahumada had been denied (Winsor 1884:II, 254) and Charles V had demurred on Menéndez's plan, the idea now won approval.

The impetus may have come from a letter dated April 25, 1557, at Tampico, "port of the province of Pánuco." Written by the prebendary Pedro Fernández Camillas and the *alcalde mayor* Rodrigo Rengel (or Ranjel) to the king, it proposed settlements on three rivers "on the borders" of the province: the Río de las Palmas, the Río Bravo, and the Río Achuse (Fernández and Rengel 1557).

This earliest known proposal for settlements that might have included Texas recounted the missionary efforts of Fray Andrés de Olmos and his desire to spread the Catholic faith among the neighboring Indian tribes. That noble Franciscan had broken ground in 1552 by planting the Misión de Tamaholipa at Tampico's present site (Martínez 1969:8). He now desired

royal support and additional ministers for settling the three rivers, a project, in the writers' view, that seemed marked by divine favor.

If it were not possible immediately to settle all three rivers, they suggested, a settlement should be founded at least on the Río Achuse, "because it would help protect ships in distress and would provide the best entry to La Florida, should it ever be settled. That statement was somewhat more than conjecture on Rengel's part, as he went on to explain to the king: "I the *alcalde mayor* know it because I traveled over that land with Captain Don Hernando de Soto who by Your Majesty's order discovered the greater part of that province [Fernández and Rengel 1557]." Actually, he was De Soto's secretary, who kept a diary of the march that has been preserved (Winsor: 1884–1889:II, 291).

Having come to the Pánuco in 1542 as a member of the tattered remnant of the De Soto expedition, led from the wilderness by Luis de Moscoso, Rengel had remained there. While this letter was not the sole factor in determining the subsequent action, it links both De Soto's disaster and the shipwreck tragedy on Padre Island to a new effort to plant a settlement on the northern gulf shore. The Río Achuse (Achusi or Ichuse) recommended by Rengel was Pensacola Bay, where De Soto had planned to establish a settlement (Vega 1951:247, 386, 484).

The letter from Tampico, with the one from Viceroy Velasco that had preceded it, undoubtedly influenced the Crown. In 1558, Philip II decreed an expedition to plant two colonies, one at Santa Elena on the South Carolina coast, the other at a site to be chosen. On advice of the Council of the Indies, Philip entrusted the project to Velasco. This official, since succeeding Mendoza in 1550, had earned a reputation for prudence and ability, and also as an unwavering protector of the Indians. In response to the New Laws implemented at Las Casas's urging—completely evaded by his predecessor—he is said to have freed 150,000 of New Spain's Indian slaves (Lowery 1911:353, 355). The occupation was not to be one of conquest but would deal with the Indians "on the basis of natural equity [Winsor 1884:II, 256]." Velasco, therefore, was the logical choice to carry out the plan. The Dominican provincial of Mexico was asked to choose religious members of the undertaking. The purpose was not to conquer but to bring the Indians to a knowledge of "our Holy Faith and Catholic Truth."

Even though Velasco had sought such authorization, it apparently caught him unprepared. Recognizing the need for more information on the area to be settled, he hurriedly outfitted three vessels for a voyage to examine "the Florida coast [French 1875:236]." And therein lies the source of the wholesale misconception. "The Florida coast" meant not the Florida we know today, or even the region to which the name was applied at the end of the seventeenth century; the phrase embraced the gulf shore from the Río Pánuco to the Florida keys and much of the east coast of the present-day

United States. To examine as much of the coastline as possible, Velasco chose Guido de las Bazares, of whom little is known except that he was the recipient of 82 marks of silver that left San Juan de Ulúa with the ill-starred 1554 fleet (it came on Corzo's *San Andrés* to Havana, thence to Spain on Juan Bautista Preve's ship) (Corzo 1555). When Bazares put to sea from San Juan de Ulúa on September 3, 1558, his assignment was much broader than sailing across the gulf to Pensacola Bay, then looping around the peninsula and cruising northward to the mouth of the St. Marys River. He was to explore the ports and bays on "the Florida coast for the security of the people who in the name of His Majesty must settle the said Florida and Santa Elena Point [Lowery 1911:473]."

Bazares, with 60 soldiers and sailors, sailed northward with a large bark, as well as a *chalupa* and a galley with oars for negotiating shallow bars and bays. After touching at Pánuco, he paused on September 14 on the Texas coast at 27°30′, a degree north of the three wrecked ships. From this point between Corpus Christi and Baffin bays, he continued along the coast until he discovered a bay at 28°30′. This was Matagorda Bay, which he claimed for the king and named San Francisco. But the flat coastline and shallow entrance flanked by shoals evidently failed to impress him; ". . . and thence to the Alacranes, the coast of which extends from northwest to southeast . . . [French 1875:236]."

Bazares's report seems to indicate that he crossed the gulf from Matagorda Bay to the Alacrán reefs, off the Yucatán coast, then back to the northern gulf shore at 29°39′ latitude; but he mentions no reason for such a strange maneuver. It therefore must be inferred that "Alacranes" in this case refers to another location. In any event, he apparently sailed into Breton Sound, found the Chandeleur Islands east of the Mississippi Delta, and maneuvered inside them to determine the nature of the coastal lands. He found them marshy, subject to flooding, and unpromising for settlement. But he took possession and named the body of water Swampy Bay.

Ten leagues farther east, after sailing along a narrow island 10 leagues long (about 29 km), he passed between the island's point and the mainland in water of 4–5 fathoms (7.3–9.1 m) to enter a bay 3 or 4 leagues by twelve (about 16 × 50 km).

"Of all the discoveries made from east to west [Bazares reported], there is no bay accessible and commodious as this. The bottom is of mud, and the harbor is from four to five fathoms deep at low tide. The channel is three to four fathoms deep, and at high water near one fathom more. The climate is healthy, and similar to that of Spain. It abounds in all kinds of fish and oysters. The pine forests are extensive, and can be used for ship-building. There are, besides, live oak, cypress, ash, palmetto, laurel, cedar, and other trees, one which yields a fruit resembling the chestnut. All of these trees commence to grow near the shore, and extend for many leagues into the interior . . . [French 1875:237]."

Small rivers drained into the bay, and one large inlet seemed to be the

mouth of a great river. To the north lay a plain where the trees were not as dense: suitable for cavaliers to hold their tournaments and graze their horses. Hills of red clay rising to the east suggested pottery manufacture. A great variety of wild game was observed: eagles, turkeys, geese and ducks, partridges, and doves. Along the shore stood many Indian huts surrounded by crops of corn, beans, and pumpkins. Many canoes, used by the natives to hunt and fish, lay along the water's edge.

Woodbury Lowery (1911:473–474) identifies this bay with Mobile, then spends an appendix noting contrary points. He obviously expected latitude computations and distance estimates to be exact. They seldom were. We hold for Mobile Bay, on grounds that the dimensions are too accurate for it to have been otherwise; it was too large and not deep enough for Pensacola Bay, which in 1687 had 10 fathoms (18 m) at the entrance and a good anchorage of 7 fathoms (13 m) inside (Weddle 1973:49); and the description of the marshy coast immediately to the west seems precisely to fit the Mississippi Delta.

Bazares named his bay Filipina, took possession for his king, and sailed eastward until contrary winds turned him back. With the season advancing, his pilots advised against continuing the voyage. He apparently never saw Pensacola Bay. Leaving the coast on December 3, he returned to San Juan de Ulúa, intent upon resuming the exploration later. There is no evidence that he did.

On June 11, 1559, a fleet of 13 vessels bearing 1500 colonists—soldiers, Negro slaves, women and children, and six Dominican friars—set sail from San Juan de Ulúa for the colonization venture under Tristán de Luna y Arellano, son of the Yucatán governor. Their destination appears to have been Ichuse, Pensacola Bay, visited by De Soto's men in 1539–1540, and not the one Bazares had praised so highly. Sighting the coast east of Pensacola, they sailed westward looking for it but passed it by to land by mistake at Mobile Bay. Luna sent a vessel to look for Ichuse, and the expedition finally landed there on August 14.

Misfortune stalked the colony from the beginning. By the time Viceroy Velasco sent Angel de Villafañe as governor and captain-general of Florida in the spring of 1561, the settlement had been reduced to a miserable state by a storm, internal dissention, and starvation. As Luna withdrew and proceeded to Spain to alibi his failure, Villafañe attempted to transplant the colony to Point Santa Elena—but he, too, was destined for failure.

The standard version is that on May 27, 1561, he arrived with two frigates and a caravel at Santa Elena Sound and sailed up the river 4 or 5 leagues (about 22–28 km) without discovering a likely port or land suitable for a colony. Continuing up the Atlantic coast, he sounded around Cape Fear, then explored northward as far as Cape Hatteras until June 14, when a storm caused him to sail for Monte Cristo on Hispaniola, arriving July 9 (French 1875:239–240).

Of Luna's and Villafañe's efforts, Juan Suárez de Peralta (1589) has a

different story to tell. Suárez was born in Mexico City about 1537, the son of Juan Suárez Marcayda, a conquistador of Mexico and brother-in-law of Cortés. Ángel de Villafañe, says the writer, also had served in the Conquest.

Impetus for the colonization venture, Suárez (1589) notes, came from the wreck of the three ships in 1554, "one of the greatest losses that had occurred in that land." By his version, Villafañe had become rich from salvaging the vessels, while lawsuits to recover the property were "a sight to behold." He continues:

The settlers assembled in Mexico, and the viceroy accompanied them on their march to Vera Cruz as far as Tlaxcala. After landing on the Florida coast, the men and women filled their time with making love until provisions grew scarce and their appetites took a sudden turn. Luna, instructed by the viceroy to settle where he had landed, did nothing more for fear of exceeding his authority. When word of his plight reached Mexico, Villafañe was sent to replace him.

Moving the colony to Santa Elena, Villafañe's ships were struck by a storm as they entered the Bahama Channel and were carried through the passage. The pilots became confused and lost. When at last they learned their position from a passing ship, they were well past their destination; the wind and current made it impossible to turn back. They were forced to leave the coast and sail for Hispaniola.

Luna, by Súarez's appraisal, had accomplished nothing. Eventually the English settled the region around Point Santa Elena where Villafañe had failed to effect a landing (Suárez 1589).

Philip II, by royal cédula of September 23, expressed serious doubts that the effort to colonize the Atlantic coast should be pursued. Before making a final ruling, however, he wanted a detailed account of Villafañe's voyage and the opinion of those who had participated.

Joining with Villafañe (1562) in framing the response—dated March 12, 1562—were Field Marshal Jorge Cerón; Captains Baltasar de Sotelo, Juan de Porras, Mateo del Sauz, and Diego de Biedma; the expedition's treasurer, Alonso Velázquez; and shipmaster Hernán Pérez. They related that the principal rivers and bays along the gulf shore from New Spain to the Bahama Channel entrance were the Río Bravo at 25°30′ (actually about 25°58′); the Río del Espíritu Santo; and Filipina, Polanca, and Miruelo bays.

As for Punta de Santa Elena and vicinity, it offered neither convenient ports nor land suitable for settlement; there were no natives to be gathered in missions and no gold or silver to make settlement worthwhile. If the region should be settled at all, it should be done from Spain instead of Mexico; New Spain's high prices and the site's lack of advantages seemed to render the project unfeasible. In any event, the site was not worth a great deal of expense. There, for the time being, the matter rested.

A few years later Pedro Menéndez secured a portion of the east coast against the French, establishing St. Augustine and ousting the "Lutheran

heretics" with fire and blood. The hazardous Bahama Channel had its haven for castaways, its refuge from the ravages of treacherous storms. But the barrier islands at the Gulf of Mexico's far corner remained bleak and desolate, inviting only as a final resting place for ships cast up by the angry sea.

The Texas coast, with its shallow bays and narrow passes, its island barriers infested by cannibalistic Indians, and its difficult paths to the interior, often converted to quagmires in the wet season, would not be settled by men from the sea. It had to await the advance of the long, dusty trail from the Mexican interior, which in time would bring it settlers on the backs of horses and mules.

Yet the sea had played a part, and would play a part still. It had brought the first explorers to view the shoreline from a distance, as Pineda and Narvaez; and castaways to experience its harshness, as the Narvaez expedition's survivors in 1528 and the victims of the three shipwrecks in 1554.

It would yet bring would-be settlers, as La Salle and his unfortunate followers; and explorers, as the Spaniards who came in search of the Frenchmen. And men of the sea, such as Don José Evía who, in 1785, would chart the coast and sound its bays from the Mississippi's mouth to the Río Pánuco, laying the foundation for a vital ocean commerce in centuries to come. That commerce, as the Spanish Indies trade preceding it, would leave in its wake the bones of many a lost ship.

Discovery of sixteenth-century shipwrecks in the western hemisphere, however, has been extremely rare. The 1554 wrecks appear to be the oldest yet investigated. Coming as they did at the precise time that Medina was on the threshold of revolutionizing silver mining, these wrecks have yielded perhaps the only remnant of silver bullion in existence that was extracted by the old method of smelting with litharge. Because of impurities this early process left in the bullion, this silver may not be as badly oxidized as that recovered from later wrecks. A variety of other information comes from such shipwrecks, which have been likened to time capsules, revealing much about life on land and sea as it was lived at the time the ship went down. The mariners carried with them the tools, weapons, and utensils of their homeland and the colonies, as well as the goods of trade.

Until recent times, treasure hunters have led the way to shipwrecks, often destroying evidence of immense value to the historian and the archeologist. But with the realization that each wreck represents a priceless resource, a legacy for posterity, efforts have been made by a number of coastal states to preserve these "time-capsule" records in the most meaningful manner.

Between 1500 and 1820, it has been estimated, 17,000 Spanish ships, most of them bearing silver and gold, sailed homeward from the Indies. Rough calculations are that 5% of these (850) were lost at sea—not counting those spirited away by corsairs—and that 2% (340) were never salvaged by the Spaniards (Dedera 1975:30). Considering the entire fleets that were lost

in hurricanes, there is little reason to believe such figures exaggerated. Although many ships were lost in deep water as a result of leaking, midocean storms, or accidents, a larger number went down in shallow water, swept onto rocks and shoals by gales or sudden winds. Inside the Caribbean and the Gulf of Mexico, as well as through the Bahama Channel in the Atlantic, much of the sailing route lay within sight of land—and for good reason. With imprecise instruments for celestial navigation, navigators felt much safer with the coast in view than sailing out of sight of land at the risk of coming upon an uncharted reef or one misplaced by navigational error. This practice, however, substituted one hazard for another. A sudden wind could sweep a ship onto the shore before she could be brought about. Or, should a tropical storm or hurricane arise, as in the case of the three 1554 wrecks, the vessel might run out of sailing room before the tempest blew itself out.

Of all the ships that were lost during the colonial period, there is reason to believe that many besides *San Esteban, Espíritu Santo*, and *Santa María de Yciar* were wrecked on the Texas coast. Today, Padre Island—situated as it is in relation to the gulf currents and at the corner of the Gulf of Mexico—seems to form a natural trap for flotsam from all over the gulf and the Caribbean. Driftwood from the mouth of the Amazón and seabeans that grow on the coastal islands of South America and the Lesser Antilles come ashore there (Whistler 1976). Channel-marker and mooring buoys believed to have drifted over a thousand miles of water are found. In modern times, the barrier-island beaches have been the grave of many unfortunate shrimp boats, pleasure craft, and fishing vessels, and Padre Island has come to be called the "Graveyard of the Gulf."

The sailing route for ships homeward bound from New Spain ran northeastward from Vera Cruz, taking advantage of the same current that carries flotsam to the Padre Island shore. How close the ships sailed to the Texas coast depended largely on wind direction, but they almost always came close enough that hurricane winds, moving counterclockwise, or a severe blow of any kind from the south or east would serve to carry them onto the beach somewhere between the Río Grande and the Sabine.

When the French explorer La Salle landed at Matagorda Bay in 1685, he found the Karankawa Indians well accustomed to pillaging wrecked vessels. The continuing battle between his feeble colony and these natives, eventually responsible for the massacre of the colonists' last miserable remnant, had its origin in a row over the Indians' claim to salvage from the wreck *l'Aimable.* This 350-ton flyboat was lost on a shoal outside Pass Caballo, at the bay's natural entrance. Another of La Salle's ships, *La Belle,* later was swept across Matagorda Bay by a norther and grounded on Matagorda Peninsula (Weddle 1973:3, 220). Neither wreck site has ever been found.[1]

[1] A search for them was planned by the Texas Antiquities Committee for the summer of 1978.

While the 1554 shipwrecks perhaps have offered the most dramatic subject for study possible, there doubtless are many others worthy of investigation, the accumulated disasters of three centuries of navigation between Spain and America. As demonstrated by the La Salle episode, not all the wrecks worthy of study are Spanish. With the coming of the French and English to trade among the Texas coastal Indians, the number of shipwrecks mounted. Record of four such losses is readily found among documents of the 1770s.

In 1772, five English sailors from a vessel lost near Corpus Christi Bay were picked up by a cavalry patrol from Presidio de la Bahía. The following year the ship of one Chevalier Gremer, bound from Vera Cruz with supplies for Spanish New Orleans, wrecked on Matagorda Island. Sixty sailors died at the hands of the Karankawas. In May, 1776, a deep-draft English frigate ran aground on St. Joseph's Island, where its crew was massacred by Karankawas from a village near the mouth of the Guadalupe River. In December of the same year, the ship *El Renombrado,* bound from New Orleans to Havana with passengers and lumber, ran into a storm that drove her back on the Texas shore with a loss of five lives. Survivors were rescued by soldiers from La Bahía. Antonio Gil Ybarbo, from the village of Bucareli on the Trinity, found in the summer of 1777 a derelict English vessel laden with brick at the mouth of the Neches River (Weddle and Thonhoff 1976:67, 43, 37, 38–39).

While none of these vessels was a Spanish treasure galleon, the list serves to indicate the probability of a large number of shipwrecks on the Texas coast during the colonial period. Each one that can be found offers an opportunity for the enrichment of knowledge concerning the period of the ship's life.

Changes of water depth and shoreline, as well as the inclination of wreckage to bury itself in a sandy beach, bear directly on efforts to locate the graves of lost ships. The English frigate wrecked on St. Joseph's Island in 1776, for example, reposed on her side upon the beach when Captain Luis Cazorla's men found her. Her remains now may lie beneath the island's sand or under water some distance offshore.

Records of the 1554 Spanish salvage expedition on the "Madalena Coast" reveal that the broken ships lay in approximately 2 fathoms (3.65 m) of water (Alvarado 1554). Their remains discovered in the twentieth century were brought up from depths of 5.5–6.5 m. Oceanographers generally believe that the sea level has risen slowly during the last 6000 years, to the total extent of about 6 m (Dedera 1975:30). Such a slow change, however, would account for a rise of only .4 m in 400 years. The difference, then, must be due to other factors.

There is some indication that Padre Island's outer shore has withdrawn a considerable distance during the twentieth century. *Nicaragua,* a Mexican gunboat, was wrecked in 1912 on the island's Big Shell Beach, a few miles up the coast from the 1554 wrecks, and lay for years at the water's edge (Warren

1976). Her engine heads, the only visible remains, now are visible above the water some 150 m offshore.

All the ships that have come to rest in "the Graveyard of the Gulf" potentially offer windows to the past for latter-day "adelantados"—those who come seeking knowledge rather than silver and gold.

ARCHEOLOGY

J. Barto Arnold III

Part IV

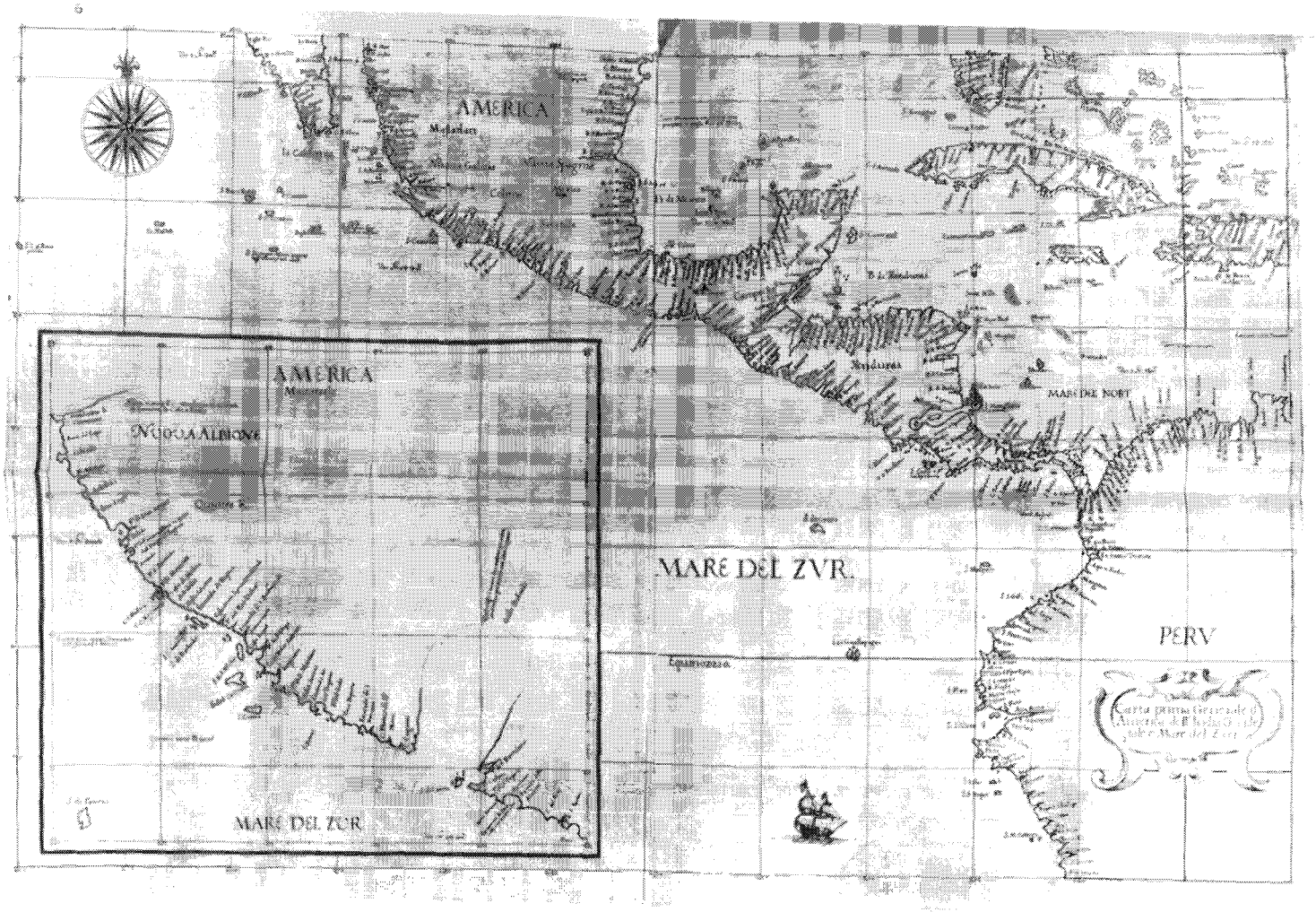
ARCHEOLOGICAL RESEARCH

Chapter 12

INTRODUCTION

In April of 1554, three of four ships homeward bound from New Spain to Spain via Havana were wrecked on Padre Island by a storm. The survivors suffered from exposure to the elements and from a running battle with Indians and were nearly wiped out on their trek down the coast toward Mexico (see Chapter 3). A Spanish salvage expedition visited the site of the wrecks during the summer of the same year, and a large part of the valuable cargoes, mainly silver coin and bullion along with some gold bullion, was recovered. The incident must have gained considerable notoriety some years later after the publication of Dávila Padilla's (1596) somewhat distorted account of the disaster. In 1646, a reference to the incident was published in a nautical reference book by Sir Robert Dudley (Dudley 1646), the son of the famous Earl of Leicester of Queen Elizabeth I of England's reign. This was the only shipwreck indicated on the map which indicates the contemporary notoriety of the incident. The relevant section is reproduced in Figure 1. The map bears a notation at about 26½° on the Texas coast, "*Qui perirno tre naue Spagnole.*"

A late sixteenth-century map in the collection of the Humanities Research Center of the University of Texas at Austin by Gastaldi (no date) indicates the name for this section of the coast, Costa Bara della Maddalena. *Barra* means sandbar or reef in sixteenth-century Spanish (Pontillo 1975:53). The name on Dudley's map is Medaos di Madal. *Medaos* is very


AMERICA
AMERICA
NUOVA ALBIONE
MARE DEL ZUR
MARE DEL ZVR.
MARE DE NORT
PERV

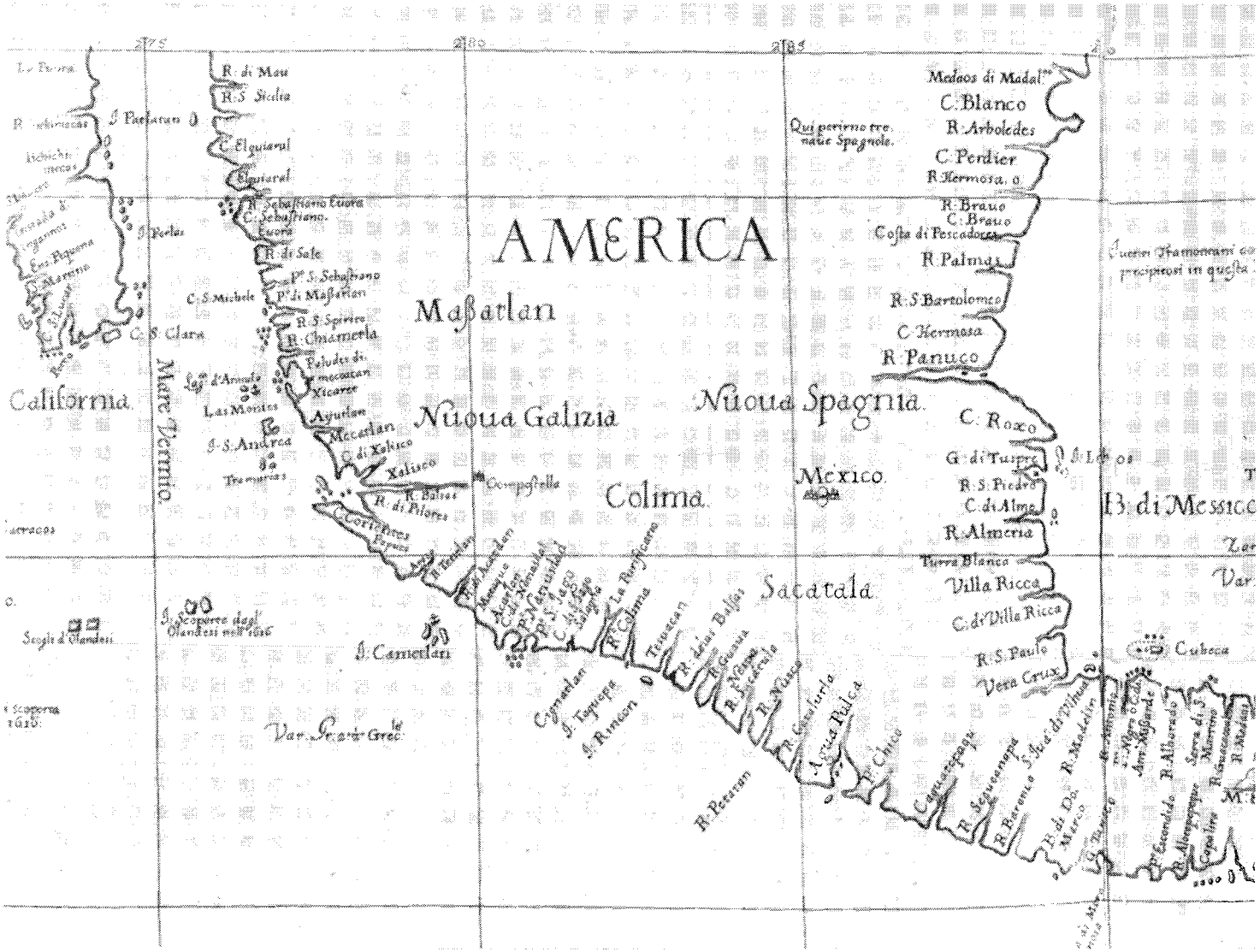


FIGURE 1. (Top) Dudley's 1646 map of the New World. The reference to the 1554 wrecks is the only such reference on the map, indicating a degree of notoriety. (Bottom) An enlargement of the relevant section of Dudley's map. Note the wreck reference opposite the appropriate section of the coast in the upper right. [Reproduced by the kind permission of the Humanities Research Center Library, The University of Texas at Austin, Austin, Texas.]

close to the modern Spanish word "*médanos*," meaning dune, sand hill, or sand bank, a good characterization of Padre Island.

This book covers the investigations conducted by the Underwater Archeological Research Section of the Texas Antiquities Committee including historical documentary research relating to the 1554 fleet and the archeological excavations at the site of one of the three shipwrecks.

The first of the wreck sites lay at the Mansfield Cut approximately 68 km (42.5 miles) north of the mouth of the Rio Grande, the border between Mexico and the United States. The Mansfield Cut is a manmade opening between the Gulf of Mexico and the Laguna Madre, which, when constructed in the late 1950s, obliterated this wreck site. The only artifacts available from this site are a 2-real coin found on the beach and an anchor left on the jetties. The next site (41 WY 3) lies 4.5 km (2.8 miles) north of the Cut, and the third (41 KN 10) lies 4.1 km (2.6 miles) to the north of the second (Figure 2). Site 41 WY 3 was exploited by treasure hunters in the fall of 1967 before the Antiquities Code of Texas, precipitated by this incident, put a stop to such actions. Site 41 KN 10 was excavated by the State of Texas under the auspices of the Texas Antiquities Committee in the summers of 1972, 1973, and briefly in 1975. The site lies about 500 m (1650 feet) offshore in 5–7 m of water. It is this, the northernmost of the three sites, that is the focus of this report.

The 1554 wrecks have been well known in recent times, beginning with the coins found on the beaches opposite the sites by beachcombers and treasure hunters. It is interesting to speculate upon the probability of a construction project such as the Mansfield Cut squarely hitting and totally obliterating a shipwreck site, the main body of which was probably no more than 30 × 50 m. The odds are so infinitesimally small that one might almost think the site had been aimed at. At any rate local lore makes it plain that once the site had been hit, everyone realized what it was. An anchor, very similar to the ones to be discussed in what follows and almost surely from this wreck, was left on the north jetty and later recovered and preserved by the National Park Service after the establishment of the Padre Island National Seashore.

In the fall of 1967 a treasure hunting firm began working on the middle wreck site (41 WY 3). Litigation between the State of Texas and the treasure hunters has been in progress ever since. As a result of the controversy caused by this incident, a new State Antiquities Code (1969) was passed, and the Texas Antiquities Committee was established to oversee cultural resources on state lands and beneath state waters. Under contract to the Texas Antiquities Committee the collection of artifacts from 41 WY 3 has been put through the conservation processes and analyzed by the Antiquities Conservation Facility of the Texas Archeological Research Laboratory of the University of Texas at Austin (Hamilton 1976, Olds 1976).

In July, 1970, the Institute for Underwater Research of Dallas under-

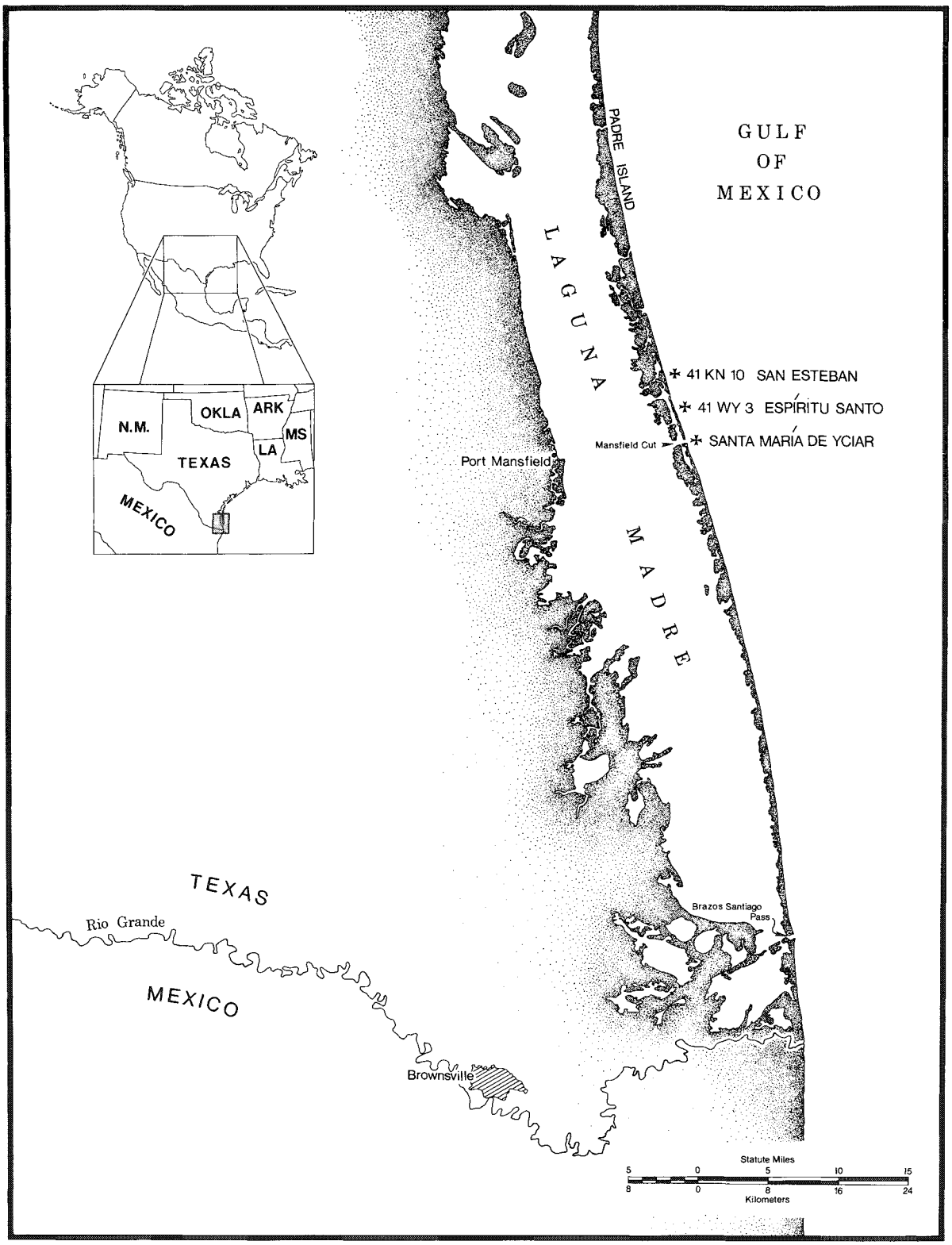


FIGURE 2. Research area map.

took a 1-month initial magnetometer survey and site testing project. About 20 miles of coastline were covered in various areas off Padre Island. Twenty-four anomalies were recorded, and 13 of these were investigated by divers. In only one case was there any wreckage above the sandy bottom. The northernmost of the three 1554 wrecks (41 KN 10) was the one, and a few artifacts were recovered in order to confirm the identification of the site (Hays and Herrin 1970) (Figure 3).

Based on this information, the Texas Antiquities Committee began its underwater archeological research project on this site under the direction of Carl J. Clausen who was then the State Marine Archeologist. During July, August, and September of 1972, the first season's excavations were carried out. The first step was to conduct an in-site delineation magnetometer

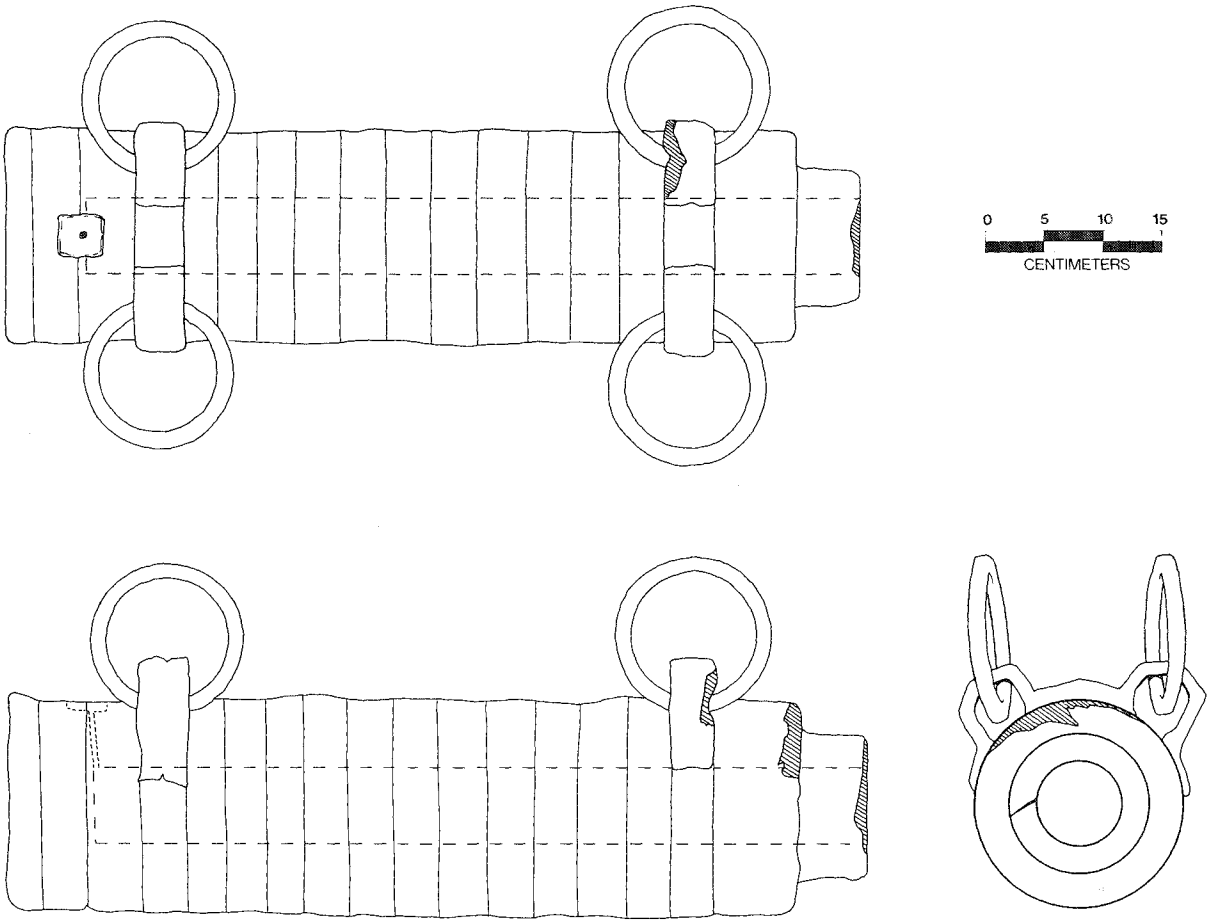


FIGURE 3. Wrought iron breech chamber recovered during test excavations in 1970.

survey to create a detailed magnetic map of the site as an aid to planning the excavations. Upon completion of the magnetometer survey the excavations commenced. In 1973, work continued at the same site. The crew was composed of archeology students who received six semester hours course credit for a field school in archeology through an arrangement with the Anthropology Department of the University of Texas at Austin for the first 9 weeks of the project, beginning in early June. The excavations lasted to the end of August with most of the students remaining and on the payroll for the period after the field school. We returned to the site for a few days in 1975 to check on a small anomaly remaining at the site which turned up during a magnetometer survey carried out in 1974 (Arnold and Clausen 1975). A small section of the site which had been missed during the 1972–1973 seasons was investigated.

Artifacts recovered during all phases were cleaned and preserved under contract by the Antiquities Conservation Facility of the Texas Archeological Research Laboratory, University of Texas at Austin. Other ancillary research was carried out under contract by the Old Spanish Missions Research Library of San Antonio. Researchers were sent to various archives in Spain and Mexico, and over 1000 pages of original documents dealing with the 1554 fleet were microfilmed and later translated into English.

The present authors assumed the responsibility for producing this book after Clausen left the Texas Antiquities Committee. Unfortunately the site plans with the locations of all artifacts recovered in 1972 and 1973 have disappeared from our agency files as have the original field notes containing the measurements and provenience data necessary for reconstructing the site plan.

The purpose of these investigations was to answer a number of questions related to the 1554 fleet and the nature of shipwreck sites on the Texas coast in general. What was left of the ships and their contents and what could they tell us after more than 400 years and the depredations of at least one treasure hunting expedition? The historical research was intended to determine exactly what happened to the fleet and to put to rest the various folk tales and poorly understood historical reports which identified these ships with those of the preceding year which ran into trouble on the east coast of Florida. The local conditions of extremely poor visibility, averaging about 1 m, necessitated the development of appropriate techniques of magnetometer survey, excavation, and recording as a precondition to answering these questions.

Chapter 13

RESEARCH SUMMARY

THE 1972 FIELD SEASON

The preliminary phases of the 1972 field season got underway on July 15. Between that date and August 2, the numerous logistical arrangements necessary to field an underwater archeological expedition were accomplished. Included in these tasks were moving a large amount of equipment and setting up a headquarters in Port Mansfield, the small town located on the mainland side of the Laguna Madre opposite the Mansfield Cut, the permanent population of which was around 60 at the time. Basic or refresher scuba training was going on at the same time. We conducted a systematic magnetometer survey of the middle (41 WY 3) and the northern (41 KN 10) 1554 wreck sites and installed the digging device and a canopy of the 15 × 6-m (50 × 20-foot) barge which had been leased for the occasion. After the magnetometer survey, Clausen picked up our 10.2-m (34-foot) aluminum crew boat from the manufacturer in Louisiana and brought it to Port Mansfield.

The magnetometer is the most useful of a number of electronic instruments employed to locate shipwreck sites. It measures the strength of the earth's magnetic field and localized distortion or anomalies in the earth's field caused by ferrous components of shipwreck sites such as anchors and cannons. There are basically two kinds of magnetometer surveys. A search

mode survey, with widely spaced survey tracts, is designed to locate shipwreck sites. An in-site survey, with closely spaced tracts covering a much smaller area over an already known shipwreck site, is to delineate the individual components of the wreck and thereby provide a guide for excavation. The data are reduced in the form of a magnetic contour map. The in-site survey is especially useful in areas where the remains of the wreck are covered by sediment, as is the case on the Texas coast.

The key to the success of a magnetometer survey is the accurate and systematic acquisition of data. Electronic positioning systems are available which admirably fulfill the control requirements of both types of surveys (Arnold and Clausen 1975). These electronic systems are relatively expensive, however, when compared with a survey set up with optical survey instruments and controlled visually with range markers and radio assistance from shore. The latter system was used in 1972 on the wreck sites of two ships of the Spanish *flota* of 1554.

The in-site survey was conducted as follows. A baseline was established parallel to the shore, along which two sets of evenly spaced paired range markers were erected (Figure 4). The first set was established with the paired

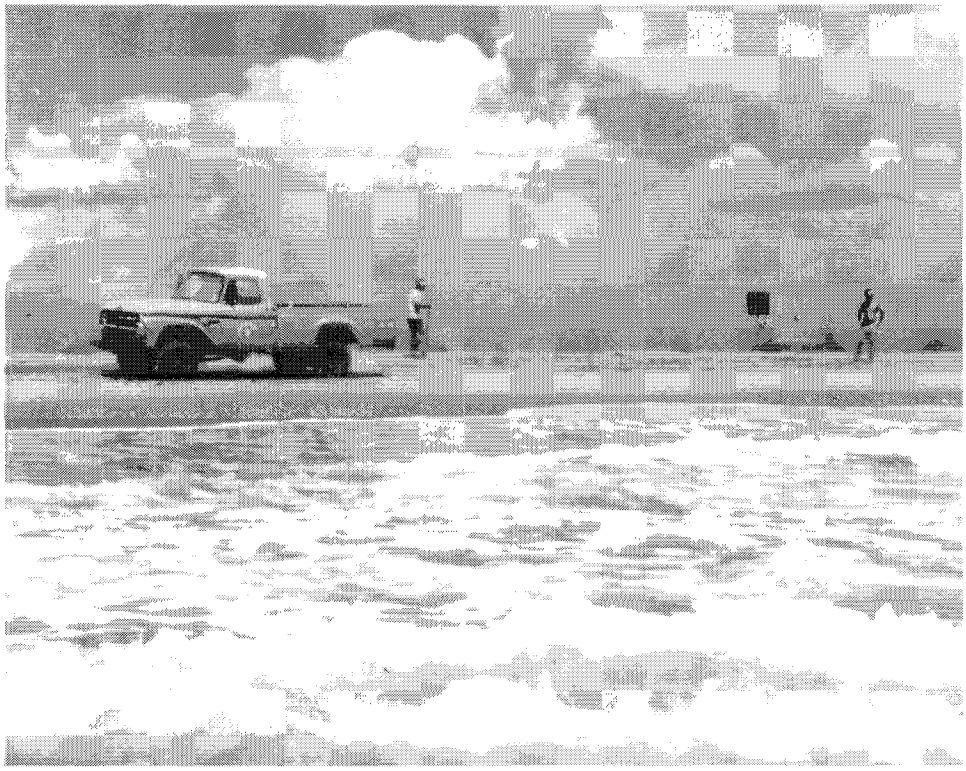


FIGURE 4. Range markers on beach during magnetometer survey.

markers at right angles to the baseline, directly opposite the wreck site and extending slightly beyond the width of the site on both ends. Further up the baseline a second set of ranges was established at an appropriate angle to guide the survey vessel obliquely across the site. As always with range markers for maritime use, the front member of the pair was shorter than the rear one so that both were visible to the pilot of the vessel to enable him to maintain a straight course. To a landsman this may seem somewhat haphazard, but McKee (1974) in his work with the *Mary Rose* near Portsmouth in England amply demonstrated how incredibly accurate this system of location and navigation can be in the hands of an experienced seaman.

As the research vessel towing the sensor of the magnetometer crosses the site, along each survey tract, an observer equipped with binoculars observes the first set of ranges mentioned above, and as each pair came into alignment the observer would notify the magnetometer operator who would place an event mark on the magnetometer strip chart record (Figure 5). Vessel guidance can be assisted from shore by setting up a transit between the two range markers from which supplementary guidance instructions can be radioed to the vessel pilot. We found it easier to record data only on runs toward shore. The interval required to reposition the survey vessel for the next tract was utilized to move the single pair of tract ranges and the transit to the next station on shore. In the reduction of the magnetometer data from the strip chart record in preparation for drawing the contour plot, the coordinates of each reading are defined by two axes. One grid axis is provided by the vessel tract and the other by the event marks on the strip chart recorder. It is, of course, possible to interpolate between the event marks in order to increase the data sample to be plotted (Figures 6 and 7).

An additional dimension was added to the survey by utilizing a recording fathometer and applying event marks to its strip chart in the same manner as they were applied to the magnetometer strip chart. The bathymetric data were then contoured in the same manner as the magnetic data.

A total of nearly 12,000 kg of encrusted metal and other artifacts was recovered during the excavations of 1972 and 1973. These artifacts, together with the rock ballast, had migrated downward through the sediment and lay scattered on top of a dense level substratum of Pleistocene clay. The unconsolidated overlying sediments approximately 1.5 m in depth consisted mainly of fine sand and contained scattered lenses of soft silts and shell. Since the greatest elevation above the clay layer of any of the remains of the wreck was somewhat less than this, no artifacts extended above the sandy bottom to indicate the presence of the site. Consequently, the magnetic contour map was used as the primary guide for excavation of the site. It is clear that the depth of the unconsolidated overburden has varied from time to time, however. The various marine organisms present on the surface of

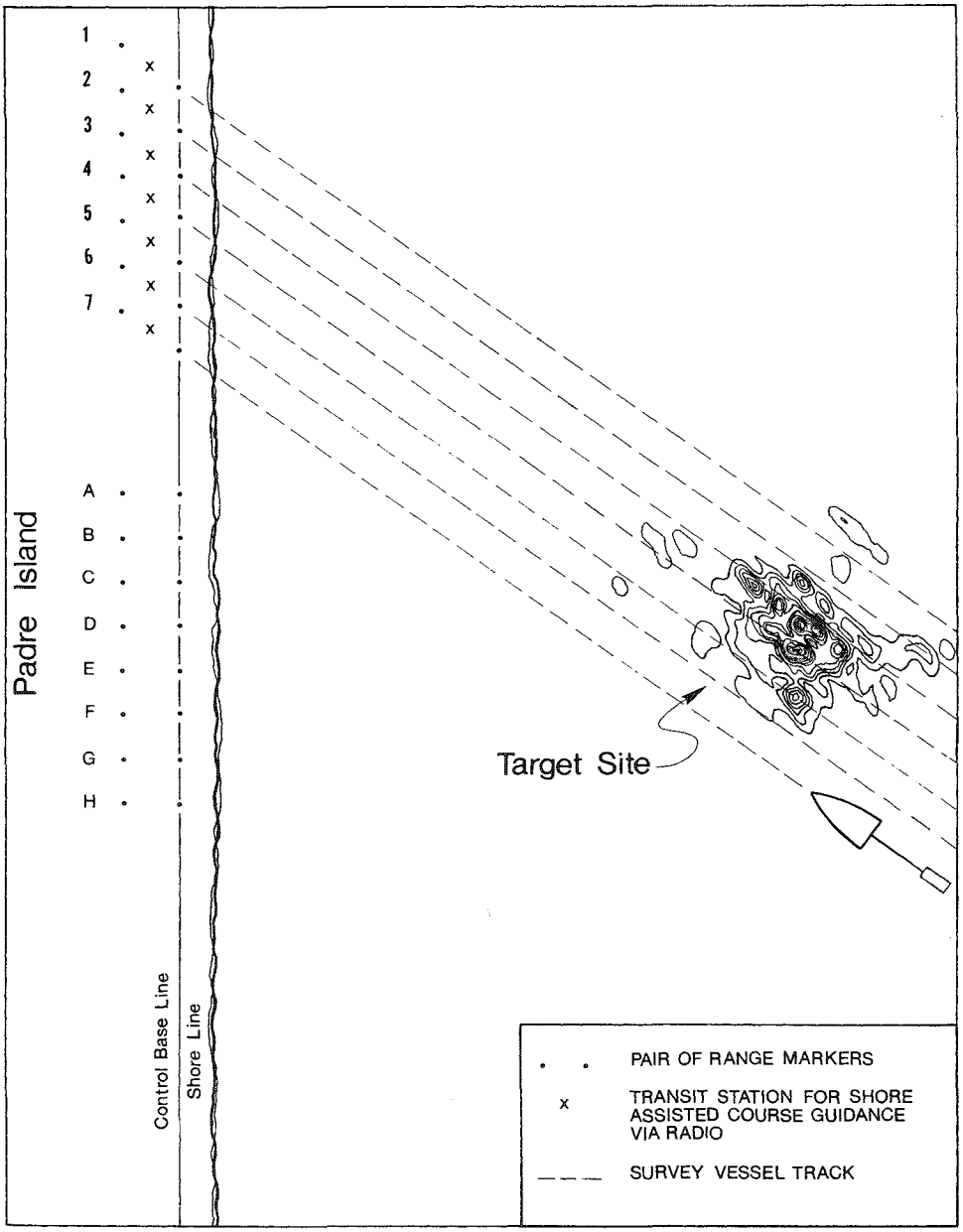


FIGURE 5. Map of ranges and site coverage for magnetometer survey.

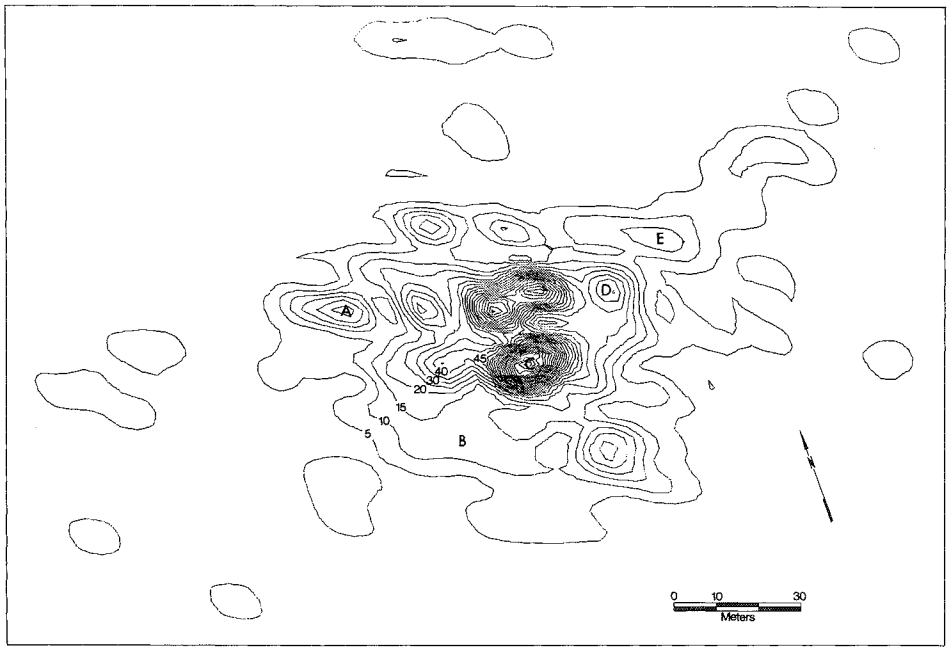


FIGURE 6. Magnetic contour plot of 41 KN 10. Contours plotted by computer on a 5γ interval. The background strength of the earth's magnetic field on July 24, 1972, the date the survey was run, was about 48,860γ. The sensor-to-target distance was about 6.5 m. The 30γ anomaly labeled "A" was caused by a wrought iron anchor (No.80) weighing about 345 kg. The more defuse area "B" of about 10–15γ reflected a scatter of small iron artifacts. Anomaly "C," about 125γ, was the distortion of the earth's field resulting from the mass of anchors and other iron artifacts at the center of the site. Conglomerate No. 79 was responsible for anomaly "D" and a group of two wrought iron cannon with their breech chambers for "E" (see Figure 11).

the conglomerates (see Appendix B) indicate that for considerable periods of time they must have been above the water–bottom interface (J. S. Holland and N. J. Macivlek, personal communication). Also there were slight depressions 4–8 cm deep around the largest conglomerates. These depressions were probably produced by scouring. The variability of sand depth is not too surprising considering the strong, north–south along-shore current. In fact, in our 1975 work along about 80 km (about 50 miles) of the coast in this area, we found sand depths from 2 cm to 2 m at different sites. As expected, the depth of the overburden above the clay layer was deeper in shallow water near the surf line and shallower in the deeper portions of the survey area farther off shore. Great precision in guiding the excavations could be achieved by using two surveying stations on shore and through simple trigonometric calculations. The same two shore stations could also be used as base points to establish the provenience of artifacts and other features of the wreck encountered during the excavation.

From the survey and excavation of this relatively small vessel, it would appear that the typical magnetic signature of the wreck of a sailing vessel of

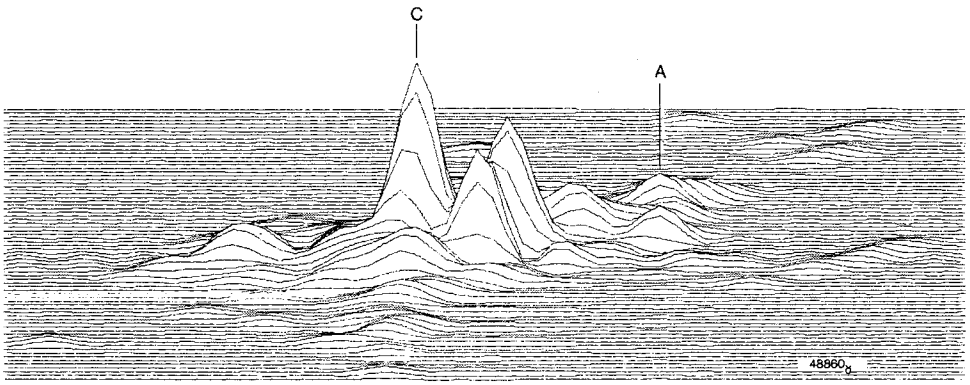


FIGURE 7. Three-dimensional magnetic map of 41 KN 10.

wooden or composite construction will consist of a central area of magnetic distortion characterized by a number of intense and localized anomalies surrounded, depending on the depth and dispersion of the wreck, by smaller magnetic disturbances.

A comparison of the site plan prepared during the excavation with the magnetic contour plot provided by the in-site magnetometer survey suggests that fewer than 10 of the more than 1500 individual artifacts recovered were found outside the 5γ magnetic contour line around the main body of the wreck. Furthermore, with the exception of one large olive jar sherd found about 12 m north of the main part of the wreck, the remainder of the few artifacts found outside the 5γ contour line were all located within a few meters of this zone.

Our experience at this site suggests that in areas where shipwreck sites are buried in sediment or camouflaged by coral or other marine growth, the guidance afforded by an in-site delineation magnetometer survey can be of inestimable value in maximizing the cultural data collected and in raising the efficiency of the underwater operations in general. In fact so successful has this approach proven that we believe it to be an essential preliminary step to a thorough and efficient excavation of an underwater shipwreck site.

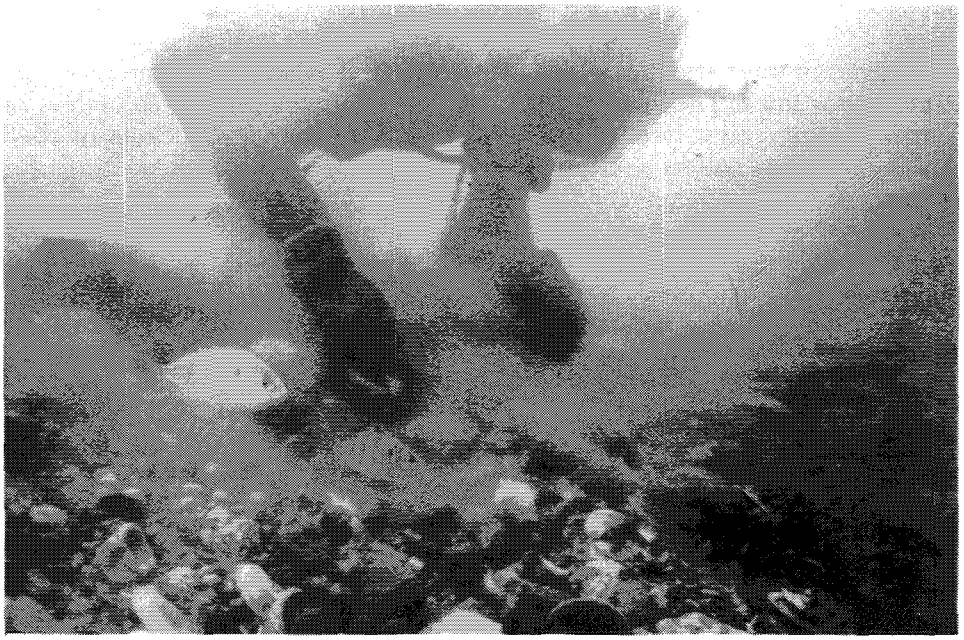
The barge was towed out to the northern of the three sites on August 22. Bad weather prevented work for the next few days, but excavations commenced on August 28. The excavating device, specially constructed for us by Parker Brothers Company of Houston, consisted of a diesel engine connected through a right angle drive to a ship's propeller in a .6-m (2-foot) diameter pipe. This ocean-bottom-sediment displacement unit sent a column of water straight down to the seabed and eroded away the .6–1.3-m (2–4-foot) deep sand and shell overlying a layer of dense clay upon which the artifacts rested but for the most part did not penetrate. The strength of the water column could be adjusted for delicate work or rapid digging by changing the setting of the throttle of the GM 671 diesel engine. The locus

of excavation was varied by moving the barge across the site by means of the four anchor lines. The crew, working in pairs, moved around the edges of the expanding crater-like hole being excavated removing pockets of shell which tended to collect and impede the erosional process and watching for artifacts to be uncovered (Figure 8). Through a system of trilateration from subbase points, sections of aluminum pipe stamped with a number and driven into the bottom, the location of each artifact was plotted before it was removed. Through use of a theodolite the exact position of the subbase points was fixed by measurements taken on the bottom, and from angles turned to key subbase points from two previously surveyed and established base points on shore. After plotting, the smaller artifacts were brought to the surface by the divers, and the larger conglomerates and individual artifacts such as anchors were buoyed for later retrieval when heavy lifting capabilities would be available.

This basically two-dimensional recording system was found to be appropriate since the only meaningful vertical relationships at this heavily disturbed and dispersed site were those which were permanently preserved within the conglomerates of artifacts cemented together by the corrosion products of the metals.

By the time excavations began, the crew consisted of Clausen (the project director), Arnold (as assistant archeologist), and a crew of three other diver–archeological technicians—two archeology graduate students and one undergraduate. We very quickly determined that more help would be necessary to haul the barge anchor chains and lines and generally help out with records, filling tanks, and other topside chores, thus, three local people were added to the crew.

Within the first 10–15 minutes of the first dive, Clausen and Arnold found the fluke of an anchor (No. 80) being uncovered (Figure 9). By the time the anchor was completely uncovered, we had also found a lead sounding weight and a silver disk. The edge of the ballast pile was also beginning to be defined. For the next few days, we worked in the area that would eventually prove to be the southwest and south portion of the wreck, locating several artifacts including a few small silver disks and several small conglomerates containing lead straps and oxidized spike heads which had formed against wood. Similar conglomerates were later found in place on the section of the keel, amply demonstrating their origin as being on the exterior of the ship's hull. After recovering scattered artifacts located off the south edge of the main ballast concentration, we then moved into the center of the wreck, uncovering a very large conglomerate (No. 81). Feeling our way around the main body of the wreck, we next moved north and located another large conglomerate (No. 79) and then south and east a few meters coming upon the large section of the keel, virtually the only portion of the vessel's perishable fabric remaining. The keel (No. 224) and another large conglomerate (No. 157), which was partly uncovered at this time, were not



a.

b.

FIGURE 8. Divers during excavations. a. Erosion of fine sand overburden. Pleistocene clay is exposed to the right of the small fish. b. Diver recovers lead weight found sitting in small hole in the Pleistocene clay. A ballast stone lies to the right.

raised until the 1973 season. Upon completing exposure of the keel, we located a breech chamber (No. 72) near its northeast end. During these excavations considerable digging was done in areas away from the main body of the wreck to help define its edges. Another breech chamber (No. 74) was found in this manner. The concentration of artifacts dropped off dramatically when the scattered ballast at the periphery of the main body was left behind, with only a very few scattered objects recovered.

Bad weather was a frequent occurrence the first season. This did not necessarily mean storms, although we did have a few squalls. The prevailing direction of the summer winds on this coast is from the southeast. This created wave conditions which built up to the point that, for considerations of safety, our operations were shut down by midafternoon on most days. There were quite a few days when we could not work at all. On one such day we arrived at the barge to discover that one of the two 3.1-cm ($1\frac{1}{4}$-in.) steel bolts securing the blower's tube in the down position at the right angle drive had been sheared through during the night due to the rocking of the barge by the waves.

On the last day of excavation, chain bridles were fastened to the anchor (No. 80) and another large conglomerate (No. 81), which proved to be a broken anchor with many smaller artifacts encrusted within its covering of corrosion products and marine organisms. It was noted that this object partly overlay another large conglomerate yet was not encrusted together with it. This indicates recent disturbance of the site. Assistance in the actual lifting was provided a few days later by the *Longhorn,* a research vessel belonging to the University of Texas Marine Science Institute at Port Aransas. This accomplished, the gearing down and packing up of the equipment was completed and field operations ended on September 28.

During the 1972 season, we had gained an appreciation of the site's potential and an awareness that at least several large conglomerates remained. We returned to Austin to spend the winter studying the artifacts being processed at the conservation lab and the historical documents that were beginning to become available through the efforts of our researchers and translators. Needless to say, a great deal of time and thought also went into planning and making arrangements for the next summer.

THE 1973 SEASON

PLANNING AND PREPARATIONS

Two major changes in the mode of operation were made for the second season of excavation at 41 KN 10. A larger barge (18 × 7 m; 60 × 24 feet) was acquired and was modified with a longitudinal slot along the center line

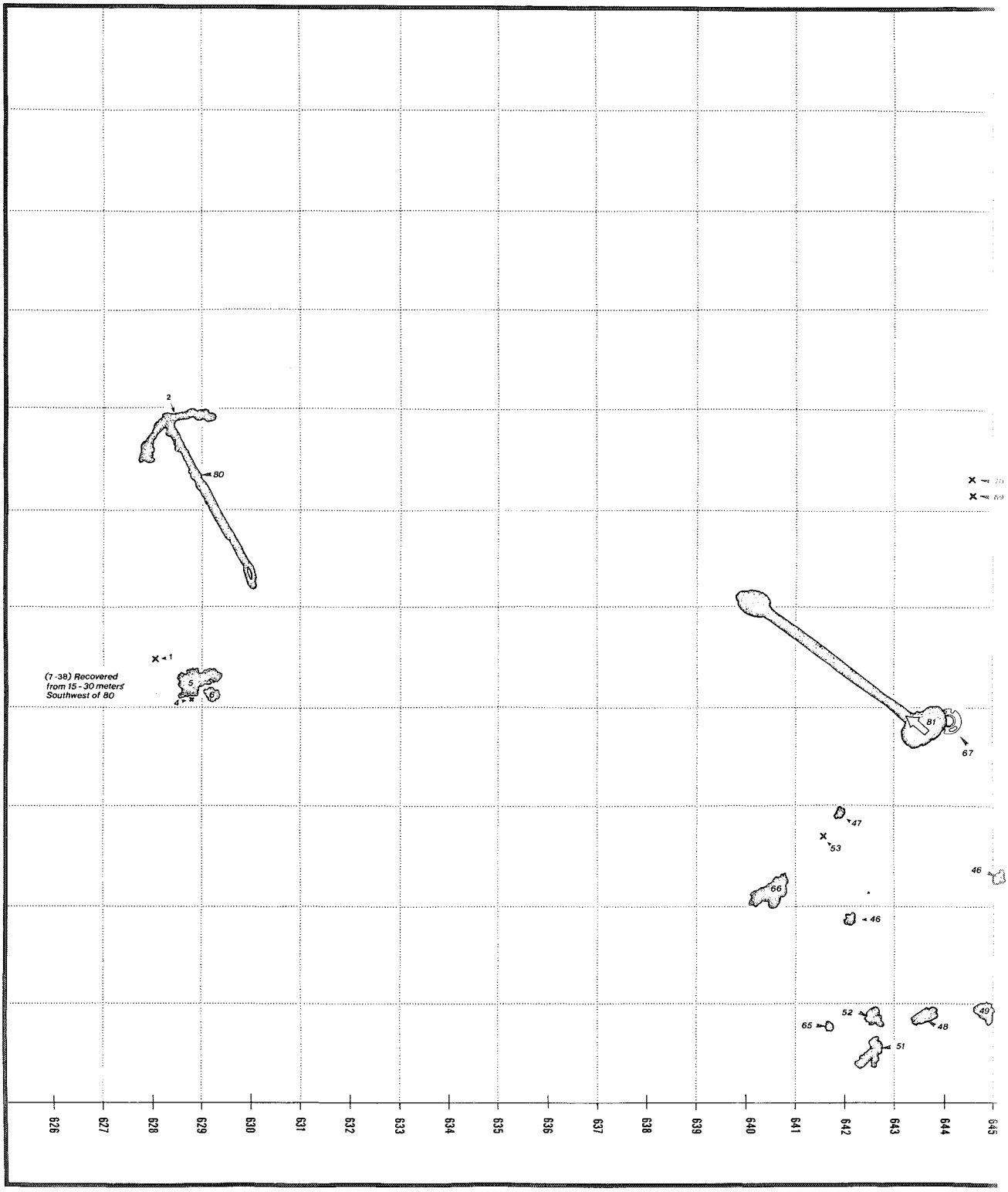
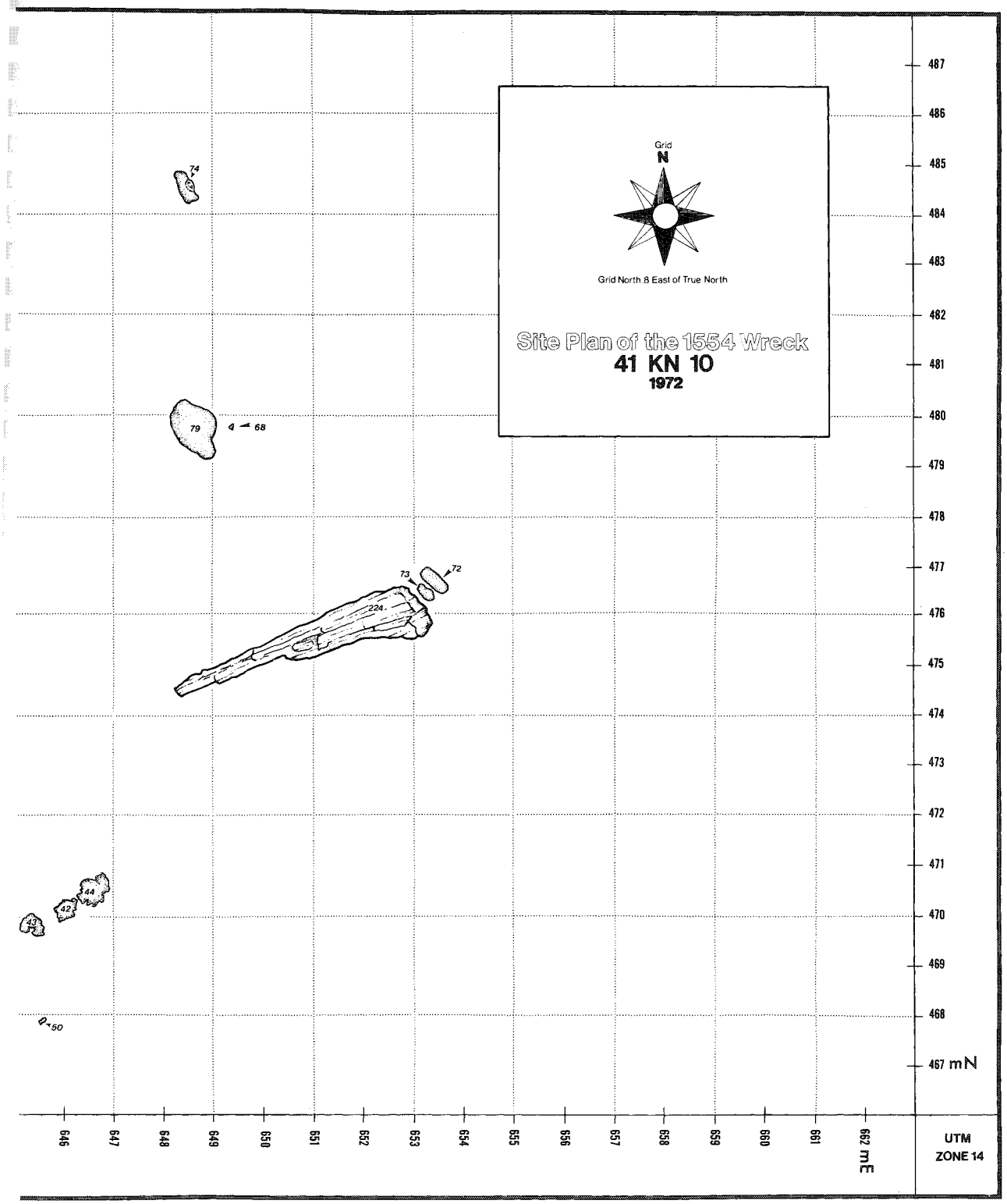


FIGURE 9. 1972 site plan—41 KN 10. Dotted grid drawn at two-meter intervals.


Grid
N
Grid North 8 East of True North
Site Plan of the 1554 Wreck
41 KN 10
1972
74
79
4
68
73
72
224
44
42
43
0
50
487
486
485
484
483
482
481
480
479
478
477
476
475
474
473
472
471
470
469
468
467 mN
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662 mE
UTM
ZONE 14

of the deck for lowering the tube of the blower. This was necessary to correct the pronounced list that mounting of the tube over one side had caused on the barge we used in 1972. The larger barge would also provide greater stability and allow us to work under more adverse sea conditions than before. Hence, only 2 or 3 days were lost to weather after the barge was on site. And, since the barge was better able to withstand the seas we were able to work late into the afternoon.

The other alteration involved the size of the crew. We needed a larger crew but budget for an increased crew was a problem. An arrangement was made with the Department of Anthropology at the University of Texas at Austin to offer an underwater section of their upper division 6-semester-hour field course in archeology. Aside from supervisory personnel, the crew was provided in return for on-the-job training and a number of evening lectures for the first 9 weeks of the project. After that, we would keep the most promising students on as salaried crew members. To assure high safety standards, we contracted with the Marine Bio-Medical Institute (MBI), part of the University of Texas Medical Branch at Galveston, for support in the form of a dive master and an aquamedic, an M.D. trained in the medical hazards of diving, who would be aboard the barge during each day diving operations were carried out. It was necessary to have an extensively qualified professional diver on the staff as dive master, preferably one who was instructor-qualified, to oversee the diving operations and attend to the safety and diving equipment maintenance aspects under the direction of the archeologist in charge.

The response was such that we were able to select undergraduate archeology majors from all over the country. One graduate student was also selected. Many students had field experience in archeology on land, and most were certified scuba divers. However, it was decided to carry out our own short but intensive dive course during the first week of the project (which began June 1) in order to let Denny Bowman, the dive master and instructor from MBI, assess the competence of each student. This was an important aspect, since it provided a refresher for the more experienced divers, and allowed us to take a few students with field experience who had no previous diving experience.

The emphasis on archeologists stemmed in part from our belief that it is preferable to make a diver out of an archeologist than to try to make an archeologist out of a diver. We found this to be true. The archeologists had been trained in the excavating and recording techniques of land archeology, many of which are the same underwater. In addition, they had been inculcated with a respect for cultural resources, many of which are finite and nonrenewable.

The crew consisted of 14 students and a supervisory staff of eight: Clausen as director with Arnold as assistant, the dive master, the aquamedic,

one diver–archeological technician from the 1972 crew, an underwater photographer, a field secretary, and a cook.

The large crew enabled us to leave two crew members in port each day on a rotating basis as headquarters staff. Since we worked right through the week with only a minimum of days off, this gave the students at least one day off the barge each week. The headquarters staff had light duty consisting of running errands, helping the cook, and monitoring the radio in case of an emergency message from the barge at the wreck site.

The dive course was conducted in Austin, and, after loading up the equipment, we drove to Port Mansfield on June 9. The next several days were spent unloading and organizing. Then while the barge was being readied for sea, we carried out a surface survey of the island opposite the wreck sites in order to investigate the possibility of finding the camp sites of the Spanish survivors and salvagers. A magnetometer survey of the third 1554 wreck at the Mansfield Cut was also attempted during the fitting out period without success, owing to high winds and seas.

SURVIVORS–SALVAGE CAMP

We spent four days investigating the areas behind the beach opposite two of the wrecks (41 KN 10 and 41 WY 3), searching the surface for any indication of the camp sites of either the survivors of the wrecks, who remained in the area briefly before beginning the trek south, or the salvagers, who spent about 3 months in the area. The area behind the dunes opposite the middle wreck (41 WY 3) yielded only a potsherd and an encrusted spike, nothing that could be considered firm evidence of a camp.

Most time was spent in the low, bare dunes behind the initial small dunes with vegetation which face the sea. In this area we located and plotted with plane table and alidade (Figure 10) 41 objects, consisting of 31 stones and 10 other objects of glass, encrusted iron, bone, and a sandstone abrader. Most of the last 10 objects probably postdate the wreck, but the stones are certainly ballast stones from the wreck since there are no naturally occurring igneous rocks on Padre Island. They range in maximum diameter from 5 to 13 cm and are irregularly ovoid or flat and round in shape. They weigh from 28.6 to 657.1 gm and average 189.4 gm (1–23 oz, average 6.6 oz).

Although the distribution of the ballast stones is scattered, it is not totally random. There are two closely grouped clusters, one of five stones within a radius of 12 m and another of 13 stones within a radius of 32 m. With the first cluster was found a sandstone abrader, and with the second, two oxidized square nails and a small oxidized spike.

There are a number of possible explanations for the presence of these ballast stones behind the dunes. It has been suggested that they could have

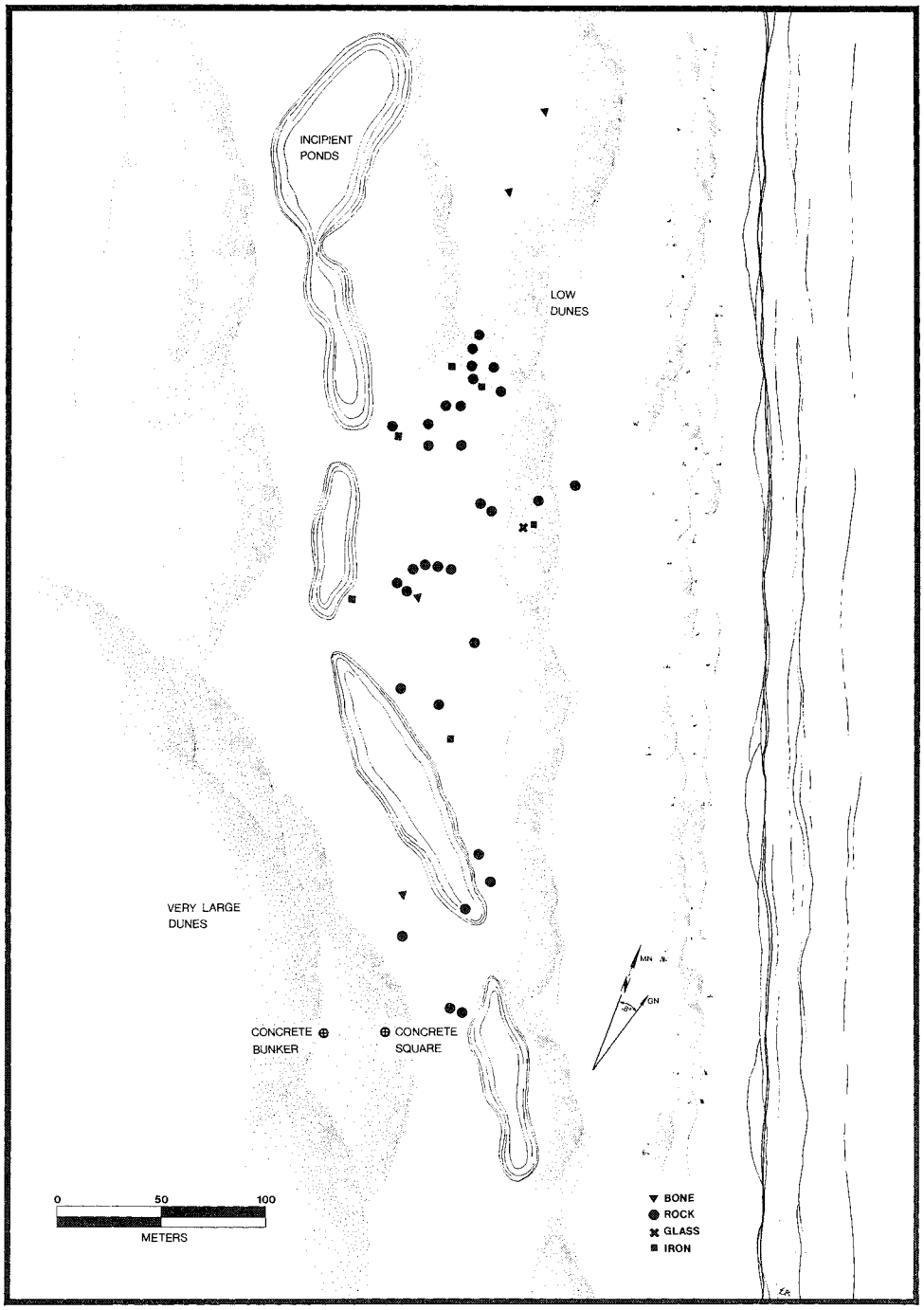


FIGURE 10. Map of surface finds from possible salvage camp opposite 41 KN 10.

washed in from the wreck in severe storms, although the ballast stones we found on the fore-beach were always much smaller and lighter than these. It would also seem clear that they would probably be much more scattered if they were washed in by the waves. Nails and spikes could easily be deposited on the island after washing in while still attached to planks. The sandstone abrader, on the other hand, is definitely an artifact and would seem to indicate human activity related to the clusters of ballast stones. On the basis of this one item the supposed camp could have been aboriginal as easily as Spanish. No other indication of Indian activity was noted, but on a rockless island the stones themselves might have been worth retrieving from the wreck sites by survivors, salvagers, or aborigines.

The only other evidence relating the identification of this area as a survivor–salvage camp are the stories told by local treasure hunters about silver disks and coins being found in this area.

Taken in balance, the evidence is skimpy at best, but I feel that there is a slight tilt toward supporting the identification of this site as a salvage camp. The survivors did not stay in the area long enough to leave a perceptible trace. Further work in the area, including a controlled magnetometer and metal detector survey, would undoubtedly throw more light on the situation.

BEACH FINDS

One of the most prevalent treasure stories in south Texas is related to these shipwrecks. The "coin beaches" of Padre Island are famous as highly productive areas from the treasure hunting point of view. Of course since the establishment of the National Seashore on Padre Island, it has been an illegal activity which the National Park Service has worked hard to suppress. We were able to confirm the obvious fact that coins do indeed wash in to the beach opposite those wrecks by finding three Carlos and Johanna coins while working on the island during surveying and other activities. A 2-real Carlos and Johanna coin was recovered near the jetties, one near the middle wreck (41 WY 3) and one opposite the northern wreck (41 KN 10). Other objects found on the beach near this site include a piece of beeswax and two small pieces of lead. Near the middle wreck (41 WY 3) was found an encrusted object, which, when x-rayed, proved to be part of an iron spike including the head of a form appropriate for the 1554 wreck.

1973 EXCAVATIONS

On June 30 all was in readiness, and the barge was towed to the site. The first dives were conducted the next day. On that day and for the next

several days we worked in an area that turned out to be beyond the southwest edge of the main body of the wreck. Scattered artifacts, including silver disks (Nos. 84, 86, 89, 91, 94), silver coins (Nos. 85, 95–97), a rectangular brass block (No. 87) which we later learned was a coak (Manwayring 1644:27), lead strapping, a clump of silver coins, and several conglomerates (Nos. 98, 102, 103, 107), including one consisting of a complete barrel hoop and a pickax (No. 106). After working around the periphery of the site, we relocated the main body of the wreck with a portable magnetometer, and, on July 15, uncovered an anchor (No. 159) which was found slightly to seaward of the main body of the wreck (Figure 11). With the anchor were three modern cast iron window weights. Together with a piece of polypropylene line, which was tied through the ring of the anchor, this constituted further evidence that the site had been disturbed to some extent by treasure hunters. The anchor lay under the usual sand and shell, but this gave way to about .6 m (2 feet) of very soft spongy dark gray clay which had been noticed in parts of the site previously overlying the light gray and very firm Pleistocene clay upon which the artifacts rested. This find indicated that the soft dark clay was of very recent deposition. The peripheral area to the southeast of this anchor (No. 159) was thoroughly investigated, and as we moved in a northwesterly direction past the anchor, we came again on July 17 to the heavy concentration of ballast, large conglomerates, and keel section, which constituted the main body of the site.

Work continued, but on July 22, the social event of the season took place at the Red Dog Saloon in Port Mansfield. The Red Dog was the only water hole in town and, lacking all the amenities of the twentieth century aside from electricity and cold beer, it was quite Hemingwayesque, very homelike in atmosphere, and a very popular spot for all of us. The shuffleboard table was the chief cultural highlight of the establishment, and on this evening it served as the runway for the Miss Port Mansfield Contest. Formal gowns had been acquired for the contestants from a used clothing store in nearby Raymondville at the exorbitant rates of from 50¢ to $2 each, and in a town where the rowdy goings-on of shrimpers and commercial fishermen are commonplace that night is still fondly remembered. The competition was intense among the female students of our crew, but a good time was had by all, and in the end, David Backer was crowned "Queen of the Cut."

The excavation and provenience recording techniques developed in 1972 continued in use, and the only difference in recovery was the raising of medium sized conglomerates with the flotation supplied by 55-gallon drums and lifting by an A-frame at the rear of the barge.

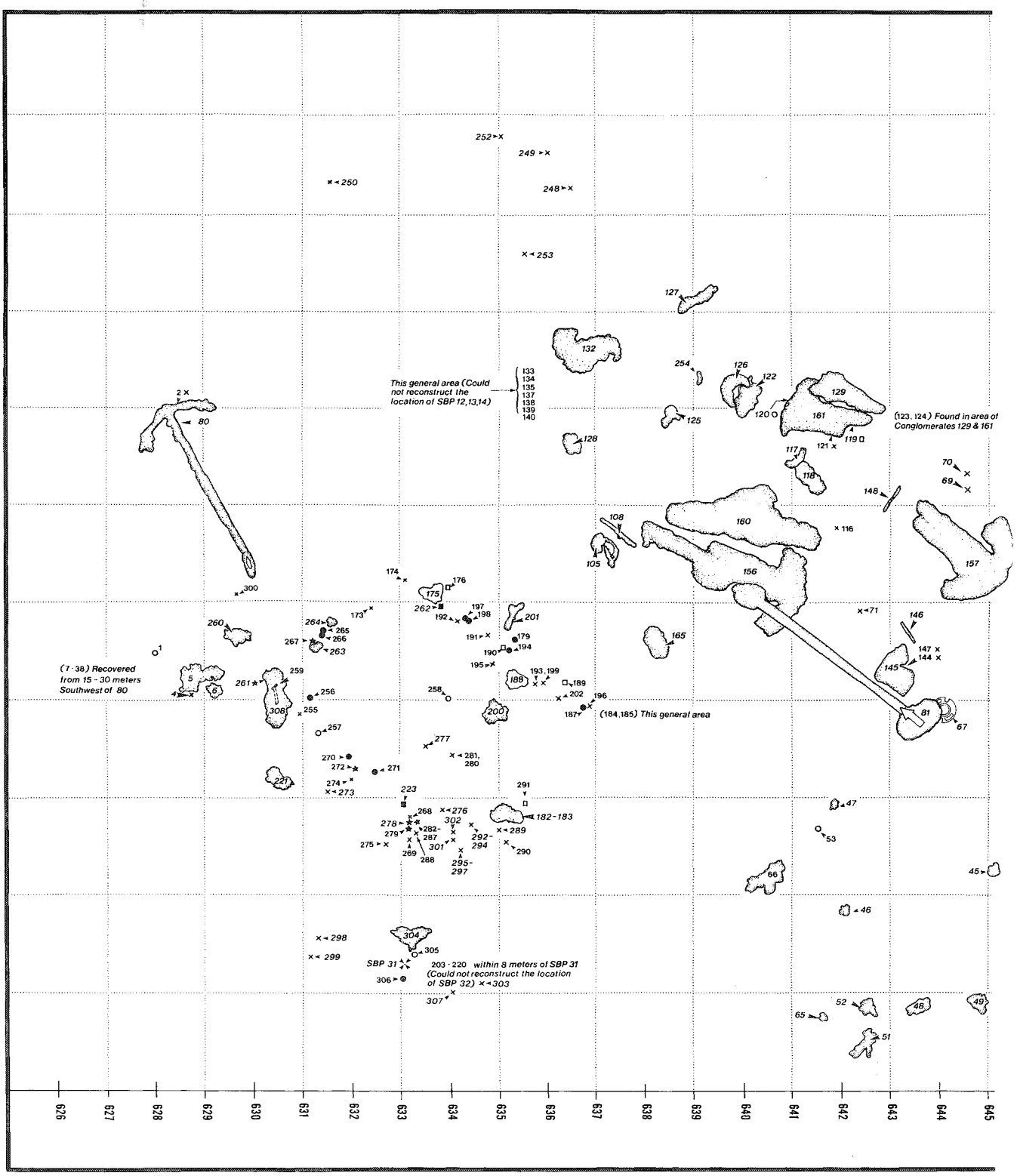
In late July and early August KLRN, the Austin-San Antonio educational television station, sent their motion picture laboratory staff, under the direction of Earl Miller, to film a documentary on the excavations. The film,

entitled "Graveyard of the Gulf," was narrated by Ricardo Montalban and shown on NET.

Near the keel, and running roughly parallel to the position in which we found it, we noticed a troughlike feature. This trough was somewhat similar to the depressions around the large conglomerates which are probably the result of scouring during those periods when they were exposed without the usual sand overburden or perhaps during storms when much of the sand was in suspension owing to heavy seas. The trough measured about 4 m long by .25–.70 m wide by .04–.06 m deep, and may have been related to the keel in its original location before a slight shift which could have occurred after being exposed by the treasure hunters. It could also be related to a missing large conglomerate removed by the treasure hunters. In the bottom of this trough and in fact barely showing above the sand was the end of a piece of rope (No. 167). About .6 m (2 feet) of the rope were excavated from just below the surface of the clay by carving away the clay with a diver's knife. This piece of rope had been preserved by being pressed into the clay during or after the wreck by some considerable weight. This instance of organic preservation is unusual at this site and is no doubt due to the anaerobic conditions provided by the covering of clay. Also found beneath the clay in the trough was a pintle (No. 168), and the pintle might suggest that the trough could represent a point of heavy contact around the stern area relatively early during the wreck. The pintle could have broken from its mounting and been pounded into the clay along with the rope as the hulk was pounded against the bottom by high seas. The hypothesized depositional process would have occurred during a storm either just after the original wreck, or, more likely, during the disaster itself. This would also provide for the absence or suspended state of the overburden necessary for these items to be forced into the clay.

We again had the *Longhorn* on loan for the heavy lifting from July 29 through August 1. After this we uncovered and brought up two wrought iron guns and a breech chamber while investigating the northern periphery of the site. The keel was floated with 55-gallon drums and towed into port. Next the edge of the ballast pile was investigated from the western end to the eastern end along the southern side. During this operation many small artifacts were recovered, including the gold bar and a brass finger ring. On the last day or two while checking out the southwest edge of the ballast, the sea state deteriorated and visibility dropped to inches due to a tropical storm in the western Gulf of Mexico. One conglomerate was recovered in the area of SBP 33, and it was realized that this was a productive area, but operations were halted when visibility dropped to zero.

The barge was towed into port that afternoon, and the process of packing up began. It was August 18. On August 23 we departed for Austin.


This general area (Could not reconstruct the location of SBP 12,13,14)
133
134
135
137
138
139
140
(123, 124) Found in area of Conglomerates 129 & 161
(7 - 38) Recovered from 15 - 30 meters Southwest of 80
(184,185) This general area
203 - 220 within 8 meters of SBP 31 (Could not reconstruct the location of SBP 32)
SBP 31
182-183
292-294
295-297
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645

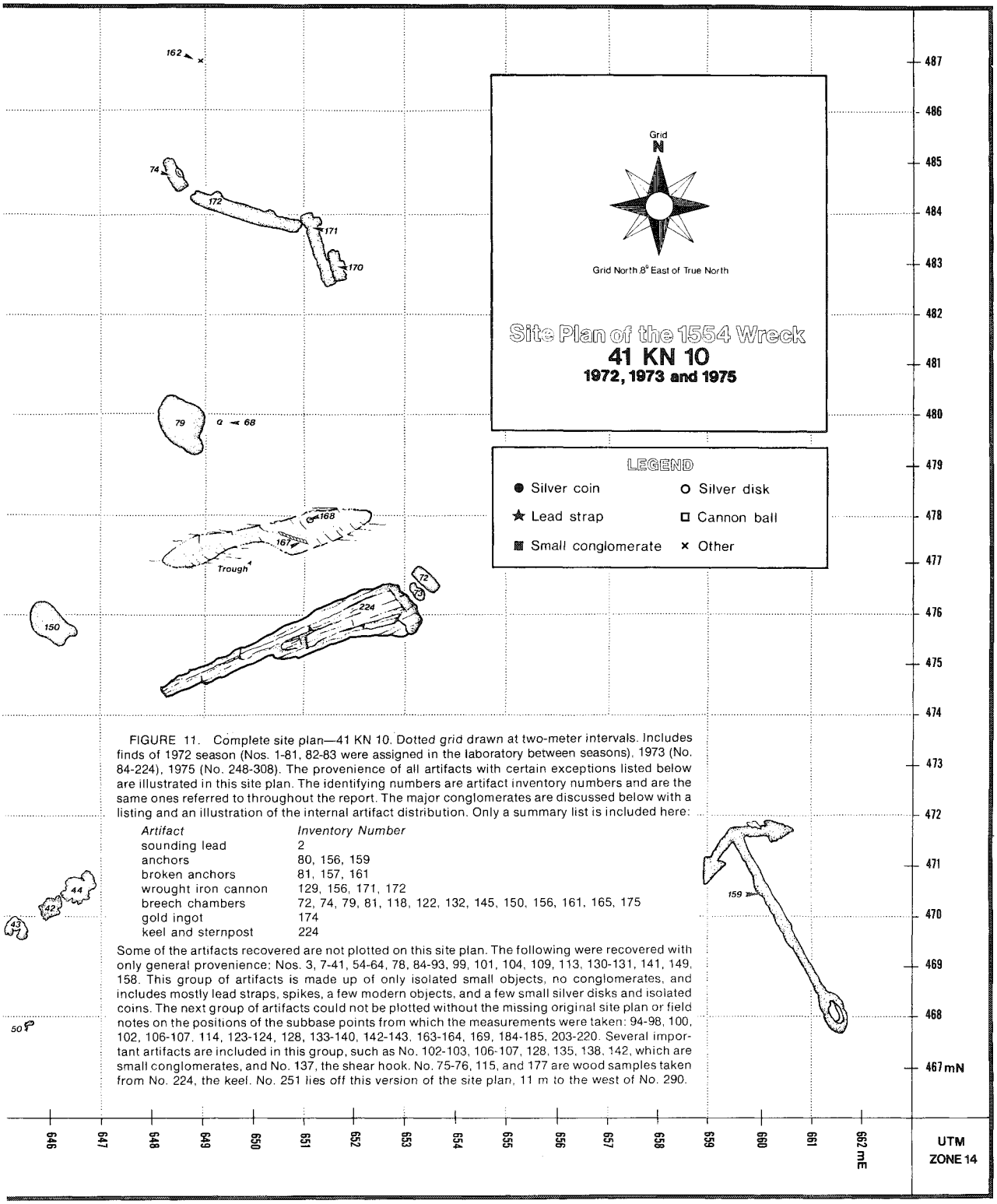


FIGURE 11. Complete site plan—41 KN 10. Dotted grid drawn at two-meter intervals. Includes finds of 1972 season (Nos. 1-81, 82-83 were assigned in the laboratory between seasons), 1973 (No. 84-224), 1975 (No. 248-308). The provenience of all artifacts with certain exceptions listed below are illustrated in this site plan. The identifying numbers are artifact inventory numbers and are the same ones referred to throughout the report. The major conglomerates are discussed below with a listing and an illustration of the internal artifact distribution. Only a summary list is included here:

Artifact	*Inventory Number*
sounding lead	2
anchors	80, 156, 159
broken anchors	81, 157, 161
wrought iron cannon	129, 156, 171, 172
breech chambers	72, 74, 79, 81, 118, 122, 132, 145, 150, 156, 161, 165, 175
gold ingot	174
keel and sternpost	224

Some of the artifacts recovered are not plotted on this site plan. The following were recovered with only general provenience: Nos. 3, 7-41, 54-64, 78, 84-93, 99, 101, 104, 109, 113, 130-131, 141, 149, 158. This group of artifacts is made up of only isolated small objects, no conglomerates, and includes mostly lead straps, spikes, a few modern objects, and a few small silver disks and isolated coins. The next group of artifacts could not be plotted without the missing original site plan or field notes on the positions of the subbase points from which the measurements were taken: 94-98, 100, 102, 106-107, 114, 123-124, 128, 133-140, 142-143, 163-164, 169, 184-185, 203-220. Several important artifacts are included in this group, such as No. 102-103, 106-107, 128, 135, 138, 142, which are small conglomerates, and No. 137, the shear hook. No. 75-76, 115, and 177 are wood samples taken from No. 224, the keel. No. 251 lies off this version of the site plan, 11 m to the west of No. 290.

THE 1975 SEASON

In the summer and early fall of 1975 we conducted an extensive period of site test excavations in the area around the sites of the three 1554 wrecks. This activity followed two magnetometer surveys, each of 1 month duration, which systematically covered the entire area between the surf zone and the 9-m (30-foot) depth line from the mouth of the Rio Grande for 80 km (50 miles) north to a point about 18 km (11 miles) north of the Mansfield Cut (Arnold 1976). The purpose was to determine if any of the magnetic anomalies represented scattered wreckage from the sites, evaluate what remained of the two sites that we had not worked, and identify the site of the small vessel lost during the salvage expedition in the summer of 1554, about which we had found out from the historical documents. There was also a 20γ anomaly remaining at the site (41 KN 10) which we had excavated in 1972 and 1973 which we wanted to investigate.

We found that nothing remained of the wreck at the jetties. It had been obliterated by the dredging and construction activities involved in the creation of this artificial opening through Padre Island. Three substantial anomalies remained in the area of the middle wreck (41 WY 3). A closely spaced inshore group, which lay just outside the surf, turned out to be the wreck of a modern shrimp trawler. The other two anomalies were related to the 1554 wreck. One was a large modern steel water or fuel tank which we hypothesized the treasure hunters placed in order to be able to relocate the site magnetically after the large ferrous elements had been removed. The other was the ring and about half the shank of a broken anchor (No. 309) from the wreck. Perhaps the shank snapped after this anchor was deployed in a vain attempt to avert disaster. Nearby we recovered six silver Carlos and Johanna coins also from the wreck. The main ballast area must have been completely stripped of its ferrous components since no anomaly of greater than 2–3γ was associated with it. The main concentration of ballast proved elusive since the contour plots of the magnetic data from an in-site survey of the area were not yet available. Our rough field plots did not indicate the very subtle anomaly to be expected from the ballast alone.

About 300 m from the northern wreck (41 KN 10) we had detected an anomaly that looked rather interesting. Upon investigating, we found a sixteenth-century anchor (No. 310). It is hard to imagine how this anchor could be associated with the wreck we had been excavating, since it lay far inshore and a considerable distance to the south. It is, therefore, tentatively associated with the small vessel lost during the salvage expedition and the site designated 41 KN 16. There was a 15–20γ anomaly remaining after the anchor was removed, indicating further iron artifacts. The anchor, while probably too large for the small vessel itself, may have been on board as salvage from one of the three wrecks.

The 20γ anomaly remaining at the northern wreck site (41 KN 10)

turned out to be related to the area we had been investigating when operations were discontinued in 1973. A medium-sized conglomerate (No. 308) containing the oxidized remains of three sets of chains, the item of hardware which later evolved into the chain plate, was recovered along with several smaller conglomerates, a few coins, silver disks including the largest yet recovered from the site (Nos. 260–261), one leg of a set of brass dividers (No. 274), and the base of a broken glass bottle (No. 255). While we were at the site in 1975, we resurveyed each of the old subbase points we encountered to aid in tying in with and reconstructing the 1972–1973 site plans.

ARCHIVAL RESEARCH AND TRANSLATION

Realizing the need to learn more about the background of the ships being excavated, the Texas Antiquities Committee in 1973 contracted with the Old Spanish Missions Historical Research Library in San Antonio to investigate the major archives of Spain, Portugal, France, and England for documentation on the ships and to translate any such documentation which might be found. The library's competence and its informal affiliation with the Roman Catholic Church particularly suited it to the task at hand.

In August, 1973, three investigators went to Spain. Two of the researchers remained 5 months; the other, 8. During this time, some 15,000 pages of pertinent manuscripts and a fine collection of sixteenth- to nineteenth-century maps of Texas were copied. Materials were located in 15 archival institutions in Seville, Madrid, Simancas, La Coruna, Barcelona, and Lisbon; other archives were investigated but yielded nothing.

Back home, the research team printed the microfilmed documents pertaining to the shipwreck and began translation. Three translators worked a total of 44 months, producing some 1000 pages of typed translations previously unavailable in print.

Copies of the translated documents went to the Texas Antiquities Committee archeologists as work progressed. Then, armed with new knowledge, one researcher returned to Seville, Paris, and London for 6 months' additional work in 1975. More documents were found, copies sent home, printed out, and translated.

In July of 1976 one researcher visited several archives in Mexico City with negative results.

MANAGEMENT DATA

The direct costs of the fieldwork of 1972 and 1973 are summarized in Table 1. Table 2 shows the dollars per bottom time minute compiled, which

TABLE 1
Direct Costs of Fieldwork for 1972 and 1973 Not Including Antiquities Conservation, Documentary Research and Translations, or Analysis and Reporting

	Salaries	Operating Expenses & Expendible Supplies	Equipment	Total
1972	$13,475	$10,376	$ 68,728	$ 92,576
1973	$21,364	$ 7,447	$ 32,275	$ 61,086
TOTAL	$34,839	$17,823	$101,000	$153,662

TABLE 2
Bottom Time Statistics

	Total Bottom Time Hours = Minutes	Total $/Bottom Time	Corrected[a] $/Bottom Time
1972	147	8,820$10.50/minute	$5.96/minute
1973	530	31,800$ 1.92/minute	$1.22/minute

[a] Two major items of capital expenditure bias these statistics. In 1972 we acquired a 34-foot aluminum-hulled twin diesel powered crew boat and in 1973 a 60 × 24 × 5-foot steel barge. If these items are left out of the calculations, as they could have been for another project not designed to be an ongoing operation, the figures would be modified as shown.

I have found particularly useful in evaluating the efficiency of an underwater archeological excavation. The large size of this statistic for 1972, when compared with 1973, reflects the capital expenditures to acquire the equipment necessary to begin the project, such as $8000 for scuba gear and $4400 for cameras and photographic equipment. The 1972 season was also something of an experiment; the small crew was intended to get the feel of operations off the Texas coast.

For comparison, the Texas Antiquities Committee's site test excavations (Arnold 1976) following the magnetometer surveys of 1974 and 1975 ran $1.71 per minute of bottom time.

The monies required to enable the fieldwork to take place at all came from appropriations of state revenues made for the agency by the state legislature. These amounted to $250,000 in 1972 and 1973 for the Texas Antiquities Committee and a little over $30,000 from the Texas Historical Commission. The direct costs in Table 1 came from the $250,000. The indirect costs cover the items usually provided by an institutional umbrella, such as salaries and office space for the small permanent staff necessary to plan and execute the excavations and conduct the analyses and prepare reports on the findings. Other indirect costs are ongoing. From 1972 through August, 1976, $97,000 was expended on conservation which was

conducted under contract to the Antiquities Conservation Facility of the Texas Archeological Research Laboratory, University of Texas at Austin. In the same period $54,000 went for documentary research and translations performed by the Old Spanish Missions Research Library in San Antonio, Texas. A further $40,000 was expended in 1977 for the design and production of an exhibit of the shipwreck artifacts which is now touring the major cities of the state.

RECONSTRUCTING THE SITE PLAN

The most important of the documents missing from our files is the original site plan, which was drawn in the field as each artifact was found and measurements plotted. With only fragmentary provenience data remaining to us, the reconstruction is incomplete and, of necessity, somewhat approximate. The basic materials for the reconstruction of the site plan came from views of the plan recorded in the documentary film on the 1973 excavations. When these sequences were shot, the plan was about 80% complete, and almost all of the major artifacts and large conglomerates are shown. Also gleaned from the film were the locations of several of the subbase points from which trilateration measurements were taken. Also of help was a slide taken about 2 weeks after the movie was filmed. With this information, it was possible to plot the original location of all but about a dozen of the smaller artifacts, those for which subbase points were placed after the date of the filming.

It was possible to reconstruct about 95% of the site plan from the 1972 excavations with the major problem being that, although the crown of anchor No. 80 is accurately placed, the exact bearing of the shank is only approximate, being reconstructed from memory. Tying the 1972 and 1973 data together was no problem.

We returned to the site briefly in 1975 during the site test excavations, following up a magnetometer survey that covered the area. A 20γ anomaly had remained at the site, and I wanted to discover its cause. We found a small unexcavated area of the site. While working in the area, I made it a point to triangulate from our survey shore stations the location of each 1973 subbase point we encountered (Nos. 26, 29, and 31) and make measurements from them to the subbase points placed in 1975. As a result, I am able to tie in the 1975 data with the rest and in addition to calculate the UTM coordinates for the site, the original data for which are also missing.

Aside from the position of a few of the widely scattered artifacts, the only major item which must remain missing is the extent and quantitative distribution of the ballast. The delineation of the southern and eastern edges of the main ballast concentration was carried out after the film and slide were shot. The 1975 work helps to fill this gap, and the rest is reconstructed from memory, a regrettable necessity, but better than nothing.

Chapter 14

THE ARTIFACT COLLECTION

With a few small but notable exceptions, the artifact collection recovered from this shipwreck site consists mainly of nonperishable metal items. Two environmental factors of the site make this inevitable. First, the breaking waves of the surf zone are relatively close, and during storms, the site is undoubtedly subjected to intensive wave action. Second, owing to the marine organisms that inhabit the warm waters of the gulf, the bulk of organic components of a wreck are soon dispersed or consumed. Counterbalancing these two factors is a third factor. The corrosion products that build up around the metallic artifacts eventually entrap and preserve a few organic items.

The collection is summarized in Appendix C. The artifacts and other remains are described and discussed in this chapter, and their intrasite relationships considered in Chapter 15. For comparison, the inventory collection from site 41 WY 3, the middle ship of the three 1554 wrecks, is presented in Appendix D. The collection is considered under three major and several minor functional categories. The major divisions are the ship and its accessories (by far the largest category), the cargo, and personal possessions of the passengers and crew. Measurements and basic statistics on many of the artifacts appear in Appendix J.

THE SHIP AND ITS ACCESSORIES

WOOD AND FIBER REMAINS

The single most important wooden object recovered was 5-m (16-foot) section of the ship's keel (Figure 12), or *quilla* in sixteenth-century Spanish (Pontillo 1975:67). This fragment of the ship can be described as planked dead wood and includes part of the stern post or *codaste* (Pontillo 1975:56) and a number of other important diagnostic features, which are the basis of size estimates and enable partial reconstruction of the ship. The keel was examined by experts, and their detailed analyses and findings are presented in two reports (Appendixes E and F). The only other evidences of the ship's fabric are a few fragments and impressions of beams preserved in the encrustation of large conglomerates.

The estimates on size and capacity for this ship (41 KN 10) were calculated independently and using different characteristics. One of the consultants arrived at an overall length of 30 m (97 feet) with a displacement of 286 tons; the other, at a somewhat smaller 20 m (66 feet) and 164 tons. By way of comparison, Peterson (1974:241) describes the remains of another later sixteenth-century ship wrecked in the Bahamas. He estimates that it was a 200-ton vessel, but the drawing of the keel and stern post he presents is obviously of much lighter construction than that of the Padre Island ship. Based on the same criteria as the 30-m estimate for the Padre Island ship, the Bahaman wreck's overall length may have been about 20 m (66 feet), and her displacement around 105 tons (Doran, personal communication).

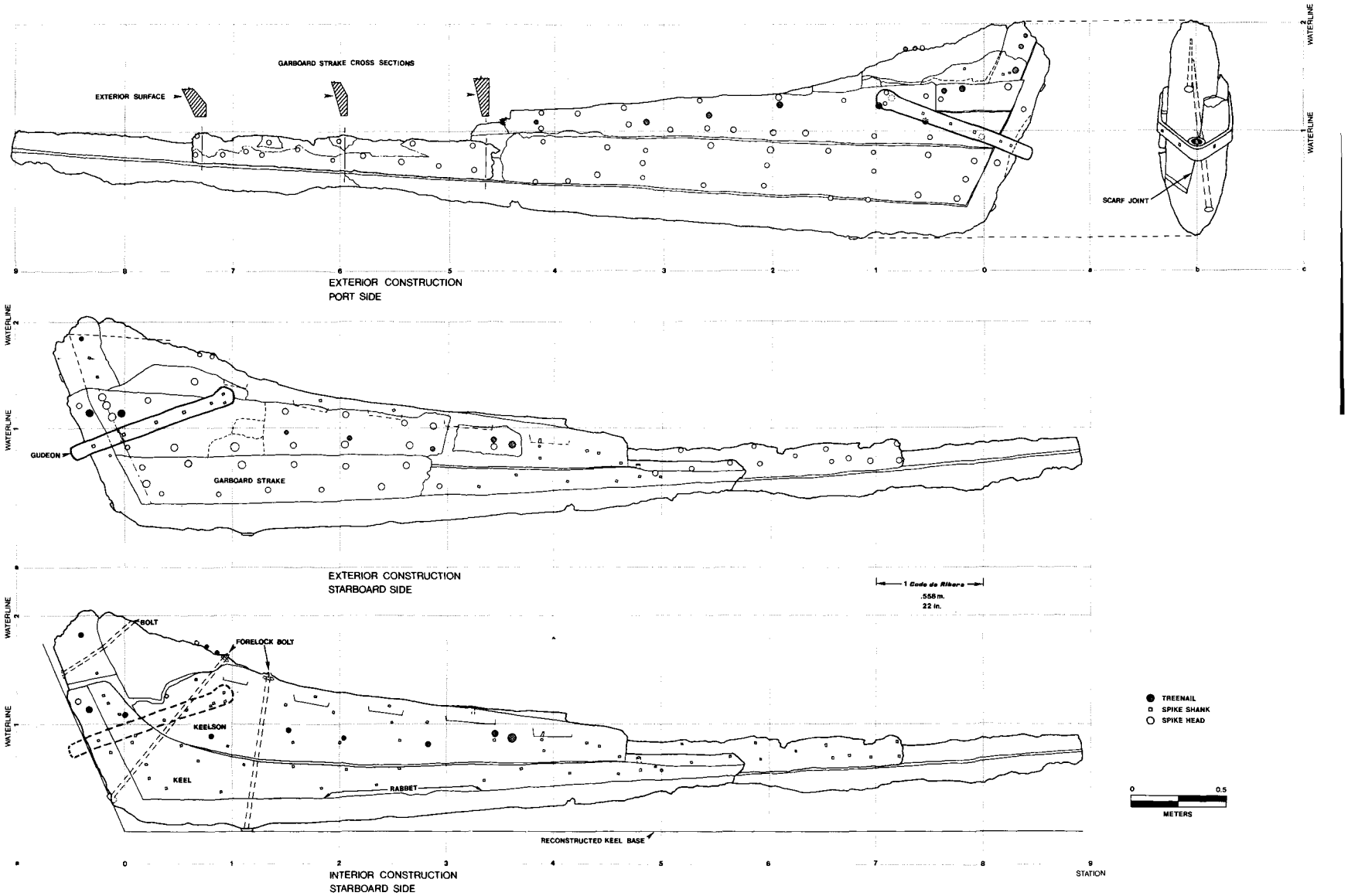
Also present in the collection are fragments of wooden containers for cargo or supplies. Fragments of barrel staves, boxes, and an odd wood-and-basketry combination of split-cane-wrapped wood were recovered, although not in sufficient sizes to reconstruct the original containers.

While little enough remains for an interpretation of the ship herself, it is possible to discuss in a general way the state of the maritime art for the period. The sixteenth century was a period of rapid change in maritime thinking and ship construction. "The conspicuous technical feature of the maritime revolution which in the sixteenth century transferred the focus of the naval art from the Mediterranean to the Atlantic is the transition from the galley warfare to warfare under sail . . . [Corbett 1898:1]." Naval warfare before this period consisted at first simply of land battles fought at sea by soldiers using boarding tactics. Early in the sixteenth century, the guns were small breech loaders for repelling boarders or preparing the enemy's decks for boarding. By the end of the century, these guns were considered secondary armament (Corbett 1898:23–34). As the middle of the century was approached, heavy guns had been introduced aboard larger vessels and "the development of broadside fire was a question of gunnery, of naval

architecture and of seamanship [Corbett 1898:25]." Baker (1962:29) mentions three reasons for the transitions of the sixteenth century: (*a*) the strength requirements due to the increasing size of ships and weight of armament, (*b*) better protection against gunfire from the newly introduced ship-killing guns, and (*c*) a growing difficulty in the procurement of timber of the proper shapes and sizes. In terms of the guns themselves it is a period of moving from the bombard, the typical gun of the Middle Ages, to cast bronze armament (Robertson 1923:173–174). In terms of rigging, the most important improvement after the middle of the sixteenth century was the "fitting of topmasts which could readily be struck and set up again, thus making it safe to carry them higher and increase the area of canvas set [Nance 1955:297]." By 1550, the topsails had developed to the point that they could be set above a furled mainsail. By the end of the century they were no longer mere auxiliaries (Nance 1955:290, 297).

Ships' names of the period are an interesting side light. Early sailors were very conscious of the dangers of the sea, and religious names were prevalent. At one time, Spain required that every ship have a religious name, and this probably led to the common nature of the surrogate or nickname. The nickname was often a feminized form of the owner's name as was the case with the *Niña* and *Pinta*, now only known by their nicknames (Kennedy 1974:52, 130). Of the 1554 fleet the only possible example of this is in the frequent reference to the *Espíritu Santo* as *La Genovesa*. This could be a surname referring to a person from Genoa, or the ship herself could have been of Genoese origin. In other cases, when a reference other than the formal name is made to the ships, they are called the "ship of _____" with the name of the master inserted.

The historic documents relating to the 1554 wrecks shed some light on the nature of the containers from which the surviving fragments came. Silver coin and bullion, as well as other commodities, were shipped in boxes, and consignments for the crown had distinctively different boxes. Some *partidas* of silver were simply sewn and tied in cloth or packed in cloth-lined cane trunks (Ojos 1554). The king's boxes were of "thick boards of serrated pine which looks like the wood that is brought from the mountain range of Agua del Perote to Veracruz from which the coffers for the silver of His Majesty are made [Alvarado 1554]." These coffers were both tied with ropes and nailed shut (de Urrutia 1568). A cochineal shipment was sent in two boxes, one eight palms and the other seven palms, presumably square, and each containing 40 arrobas (Ojos 1554). Other boxes were carefully described in the account of the Spanish salvage expedition in hopes of identifying the owner. One was a small box with some painting characteristic of Michoacan drawn on it. Another was like those from Mexico City of thin carved boards. A third was a square box of carved wood, the type that usually comes from Mexico City. It had a piece of oilcloth under the top and was nailed and tied with its ropes. Some shipments contained a written voucher wrapped in


GARBOARD STRAKE CROSS SECTIONS
EXTERIOR SURFACE
SCARF JOINT
WATERLINE 2
WATERLINE 1
9 8 7 6 5 4 3 2 1 0 a b c
EXTERIOR CONSTRUCTION
PORT SIDE
GUDEON
GARBOARD STRAKE
EXTERIOR CONSTRUCTION
STARBOARD SIDE
1 Codo de Ribera
.558 m.
22 in.
BOLT
FORELOCK BOLT
KEELSON
KEEL
RABBET
RECONSTRUCTED KEEL BASE
TREENAIL
SPIKE SHANK
SPIKE HEAD
0 0.5
METERS
0 1 2 3 4 5 6 7 8 9
STATION
INTERIOR CONSTRUCTION
STARBOARD SIDE

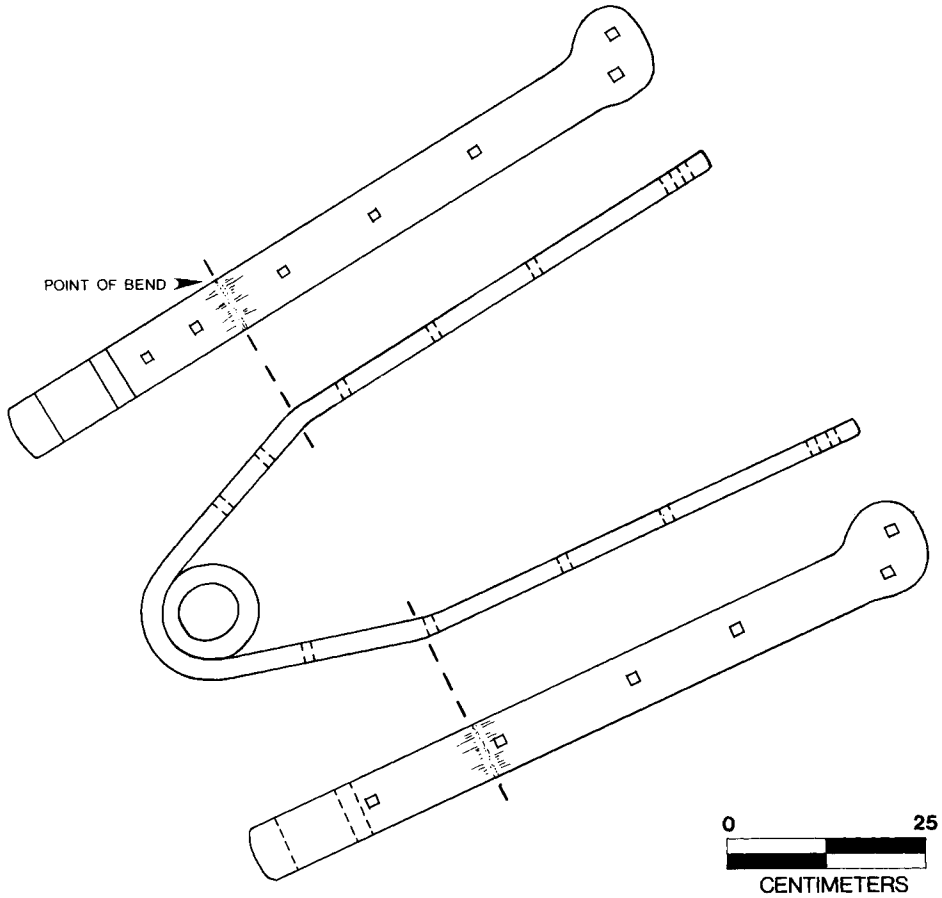


FIGURE 12. (Top) No. 224. Section of keel and sternpost. (Bottom) No. 224-12. Gudgeon, part of the hardware for mounting the rudder.

oilcloth specifying shipper, recipient, and contents. This precaution was not in vain since, even after several weeks under water, such vouchers were still legible to the salvagers (Alvarado 1554).

Miscellaneous wood fragments include sections of a log and several branches split in half. The log and split branches may have been fuel and kindling for cooking, or possibly both were dunnage which would have been placed in a layer over the ballast to keep the cargo stored above it dry. There is also a small sample of cane or reed and various impressions and small fragments from the conglomerates. Wood identifications by the Forest Products Laboratory are summarized in Table 3.

Twisted fiber items include oakum gaskets and caulking material, touch-hole plugs, and rope. The gaskets were found under the heads of iron bolts and were probably intended to prevent leaking. Caulking material found with lead straps was probably oakum or tarred hemp.

Oakum, or *estopa* in sixteenth-century Spanish (Pontillo 1975:60), is defined by Manwayring (1644:71) as follows:

TABLE 3
Wood samples from 41 KN 10
U.S.D.A. Forest Products Laboratory, Center for Wood Anatomy Research (by R. B. Martin, Botanist)

Artifact No.	Description	Identification
76	Structural part of ship	White oak group (*Quercus* sp.)
80-2	Anchor stock fragment	White oak group (*Quercus* sp.)
81-15	Barrel stave	White oak group (*Quercus* sp.)
106-3	Pick-adze handle fragment	Ash (*Fraxinum* sp.)
129-38	Possible chest board	White oak group (*Quercus* sp.)
129-39	Plank fragment	Turkish hazel (*Corylus colurna*) and spruce (*Pices* sp.)
132-14	Verso breech chamber plug	Definitely a tropical species, perhaps *Buchenavia, Conocarpus,* or *Laguncularia* in the Combretaceae; seems to be from a branch
145-13	Possible chest board	White oak group (*Quercus* sp.)
156-24	Bombard undercarriage	White oak group (*Quercus* sp.)
157-34	Miscellaneous wood fragments	White oak group (*Quercus* sp.)
157-86	Samples of branches	Turkish hazel (*Corylus colurna*)
157-138	Possible chest board	White oak group (*Quercus* sp.)
160-1	Structural part of ship	White oak group (*Quercus* sp.)
160-3	Structural part of ship	White oak group (*Quercus* sp.)
161-19	Miscellaneous wood fragment	Turkish hazel (*Corylus colurna*)
172-2	Bombard undercarriage	White oak group (*Quercus* sp.)
224-1	Keel	White oak group (*Quercus* sp.)
224-2	Keelson	White oak group (*Quercus* sp.)
224-3	Outer plank	White oak group (*Quercus* sp.)
224-10	Keel treenail	White oak group (Quercus sp.)

> *Oakham.* Is nothing but old-roapes, or others untwifted, and fo pulledout as it were into loofe flax againe, alfo, toe, or flax being fo imployed about a Ship, is called white Ock-ham; The ufe of this is to drive into the feames, and to all parts where they fufpect water may come in, as the heads of the treenells, &c. White Ock-ham is beft to drive firft into the feame next the water, when it is rowled-up, fo as when the calker drives it, in it is rowled a thred of Ock-ham.

Small twists of hemp were also found in the touch holes of the breech-loading cannons' powder chambers. These were intended to keep the powder charge inside dry until needed. At that time they would be removed, the priming powder poured into the touch hole, and the piece fired. Similar usage is reported from the *Trinidad Valencera* (Martin 1975:221).

A few pieces of rope survived, including parts of the lashings holding the cannons to their troughlike wooden mountings and the wrappings of the anchor rings which prevented chafing of the anchor cable.

Other organic remains include two samples of hair, one used as caulking and one from inside a textile fragment. Cow hair has been confirmed as caulking material at the site of an unidentified vessel in England, investigated by Lovegrove (Mariners Mirror, Vol. 50:117), which dates no later than the end of the sixteenth century. Manwayring (1644:23) also mentions spun hair used for caulking.

A small piece of resin was found adhering to the interior of a large potsherd. The resin may have been part of an interior coating to waterproof the porous pottery for storage of liquids or could have been a medicinal resin, either part of the ship's supplies or cargo.

Small fragments of cloth turned up here and there among the conglomerates. They are considered separately and in detail in Appendix G together with the rope fragments. The context of one cloth scrap still impregnated with resinous material found under a lead strap over a seam indicates that it may have been used as parcelling. Manwayring (1644:73) defines this process as follows:

> *To Parcell,* or *Parcelling.* Is to take a little Canvas (about the breadth of a hand) and fo lay it over a Seame, which is firft Caulked-and it is moft commonly ufed alongft the Ships-fides, over the Cabbin. Then heate a little Pitch, and Tar very hott, and power upon this Canvas, and all this together is called Parcelling a Seame.

The sixteenth-century Spanish term for covering with tar or pitch is *alquitranar* (Pontillo 1975:50). Microscopic examination of the cloth edges revealed that it had been cut to size to fit under the lead strap.

EQUIPMENT AND RIGGING

Anchors

Seven anchors (*anclas* or *áncoras,* according to Pontillo 1975:51) were recovered from this site, and two others from neighboring sites (Figures 13–19). Three were broken midshank with both halves stored side by side. Two other anchors were also in the ballast, one on top of the other. The one on top was in questionable condition with part of one palm missing. The large percentage of broken anchors, and the perceptible double bends apparent in the shanks of some of the others, brings to mind the saying, "as meagre as a Spanish anchor," a nautical expression which originated in this period (Wignal 1975:253).

The register of the *Santa María de Yciar* includes an abbreviated list of the quartermaster's equipment at the outset of the voyage to Spain. He had aboard four anchors, five cables, and sufficient sails and rigging (Ojos 1554).

These anchors are of iron and forged rather than cast. But is this the only reason for so frequent failures, and how were both halves of the broken anchor retrieved? Indications are that other factors are also involved. A rope and buoy or *boya* (Pontillo 1975:54) attached to the flukes was a common fixture, according to Manwayring (1644:3), and was used in handling the anchor by small boat. This accounts for the ability to recover the distal end of a broken anchor (Figure 20).

Waters (1958:8) explains that the late sixteenth and early seventeenth centuries were a period of evolution and improvement in ground tackle. Some centuries before anchors had assumed the general form which was to persist until the 1800s, but they were underweight, and the scope allowed for the cables was too short to be efficient. In the sixteenth century an appreciation of longer cables was achieved, and weights increased in the early seventeenth century. Aside from dragging anchor, these inadequacies of the ground tackle do not account for the breakage which undoubtedly contributed to the ill-fame of Spanish anchors.

Tinniswood (1945) also discusses at great length the proportions of various parts of the anchor to each other. His conclusions are based on contemporary art work, and to some extent on early written sources, and are listed below.

1. length of shank = 4–4¾ flukes
2. length of fluke = ½ length of arm
3. diameter of ring = slightly less than length of fluke
4. Before about 1550 the angle from fluke to crown to shank tended to be around 45° and after that date around 60° (average 53°, range 40° to 70°).

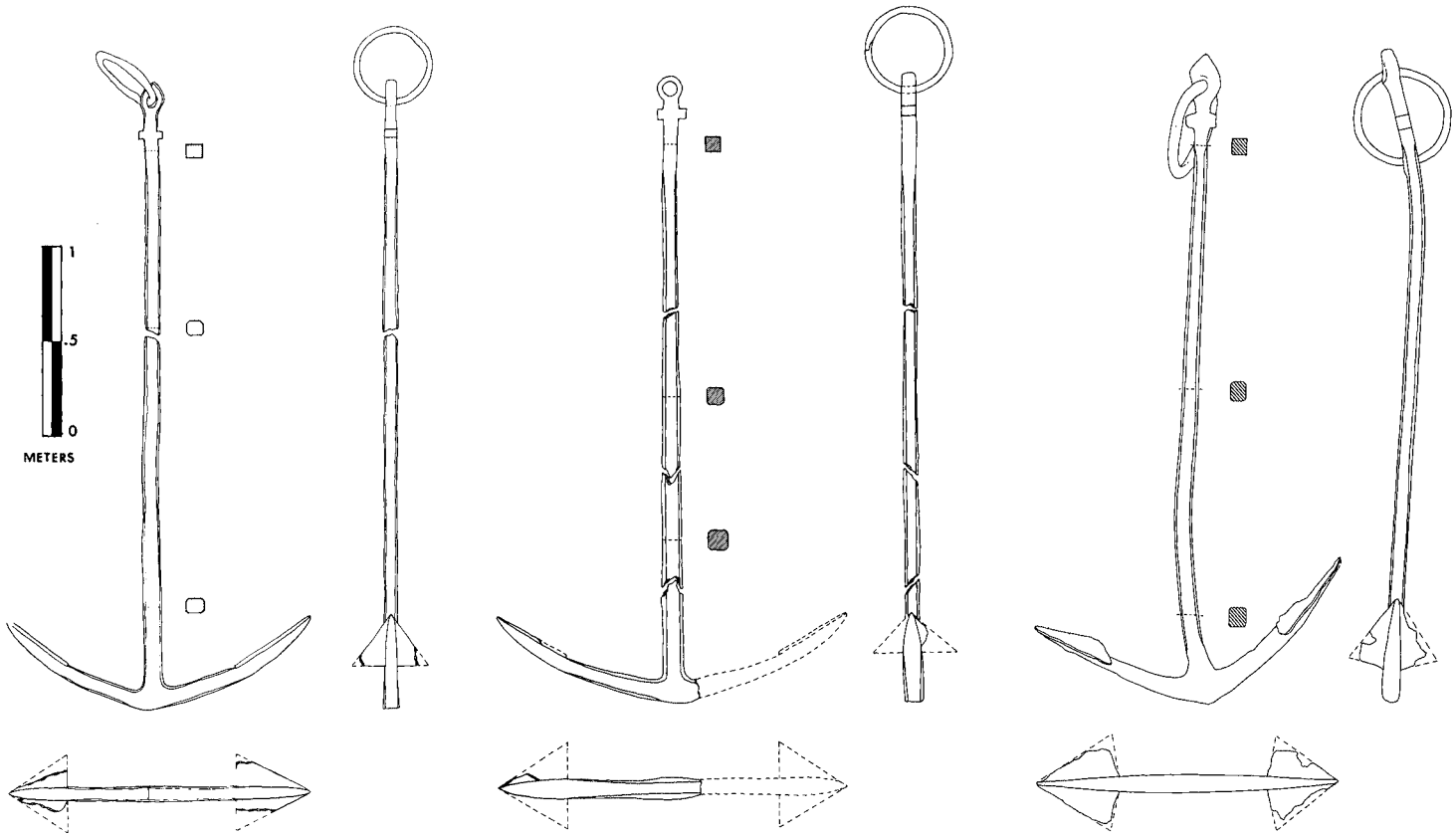


FIGURE 13. Wrought iron anchors. No. 157 (left), No. 161 (center), and the Raymondville anchor.

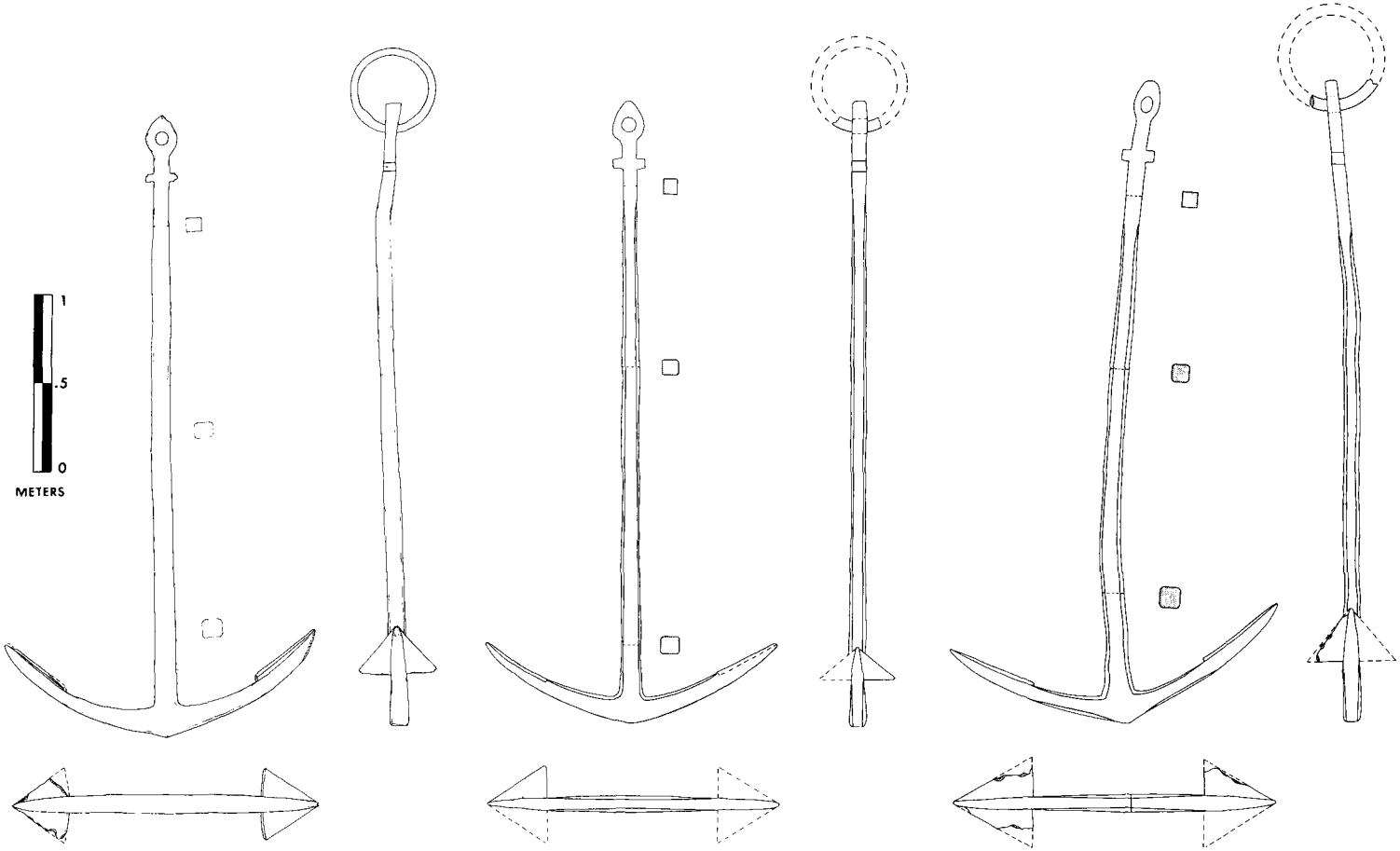


FIGURE 14. Wrought iron anchors. No. 80-1 (left), No. 156-1 (center), and No. 156-2.

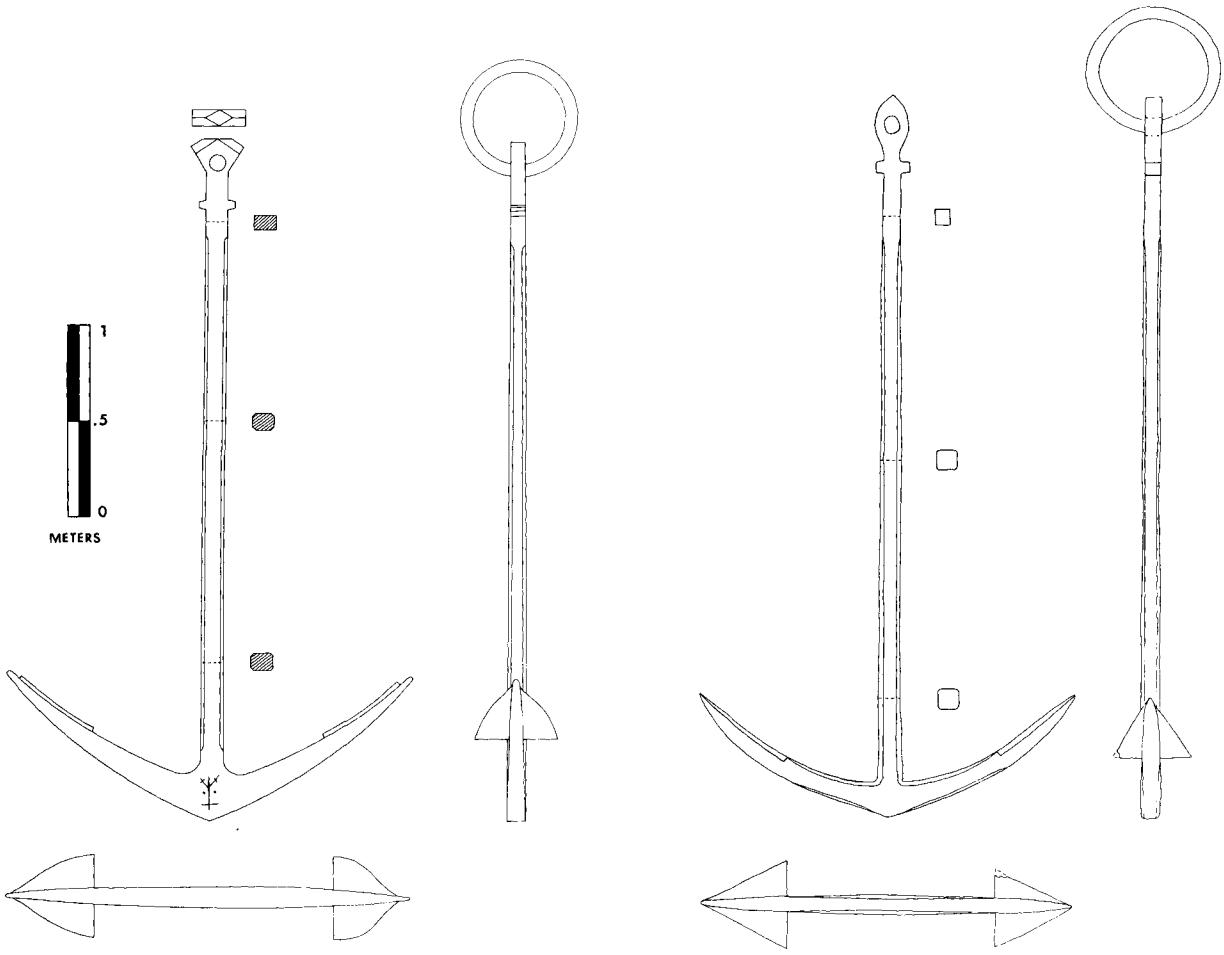


FIGURE 15. Wrought iron anchors. Jetties anchor (left) and No. 159.

These assertions can be viewed as testable hypotheses since, in addition to the seven anchors from this site, we have two others which are associated with the 1554 disaster. From this collection (see Appendix J) it is apparent that the length of the fluke, while being approximately half the length of the arm, could vary in length more or less than half in relation to the arm (but less in most instances). The smaller flukes would significantly reduce the holding power of the anchor. Greater variability is exhibited by the angle from the fluke to crown to shank. In almost every case this angle is closer to the 60° expected after 1550 rather than the 45° usual for the period before that date, even though these ships left Spain in 1552, and many of the anchors can reasonably be assumed to have been manufactured before 1550.

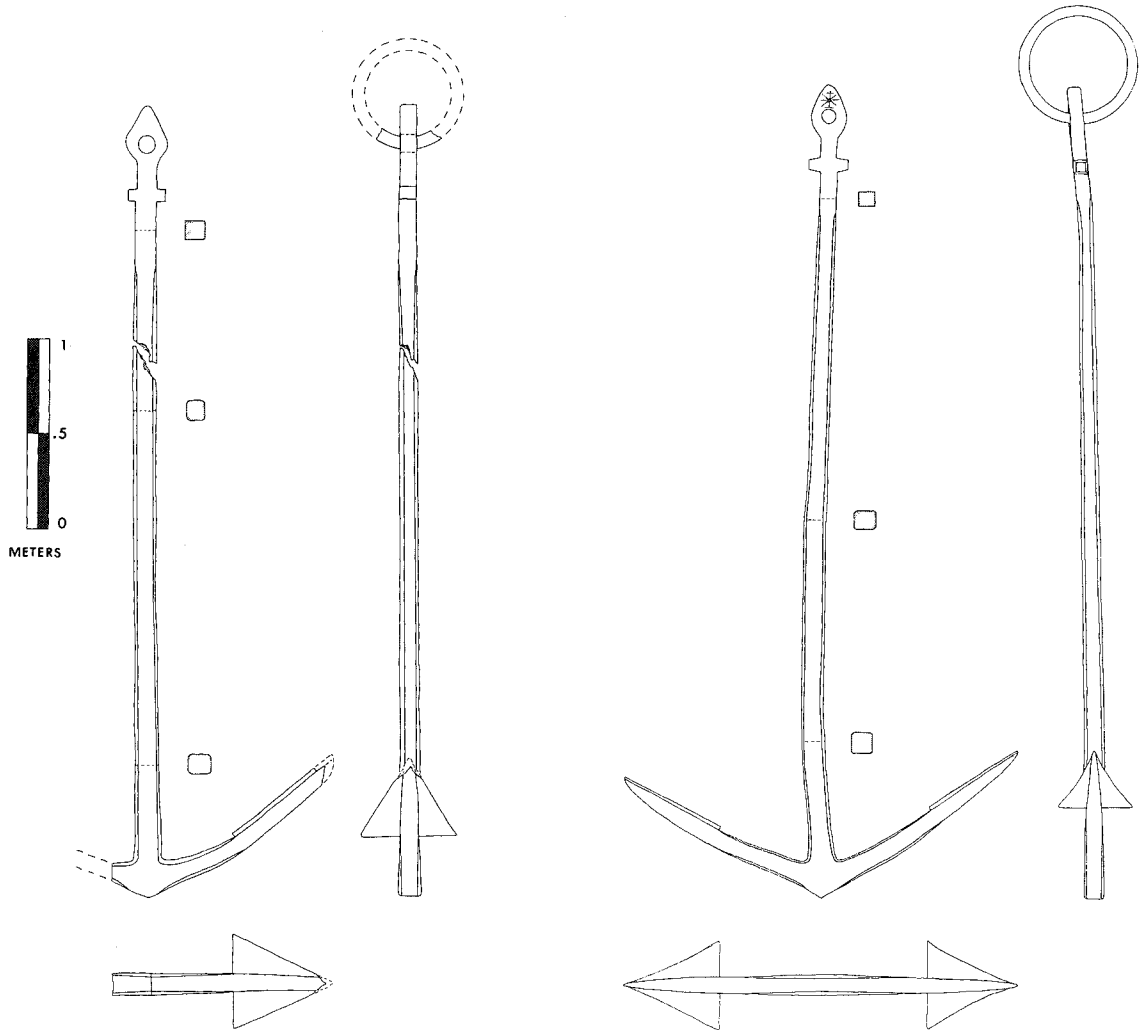


FIGURE 16. Wrought iron anchors. No. 81-1 (left) and No. 310 (41 KN 16).

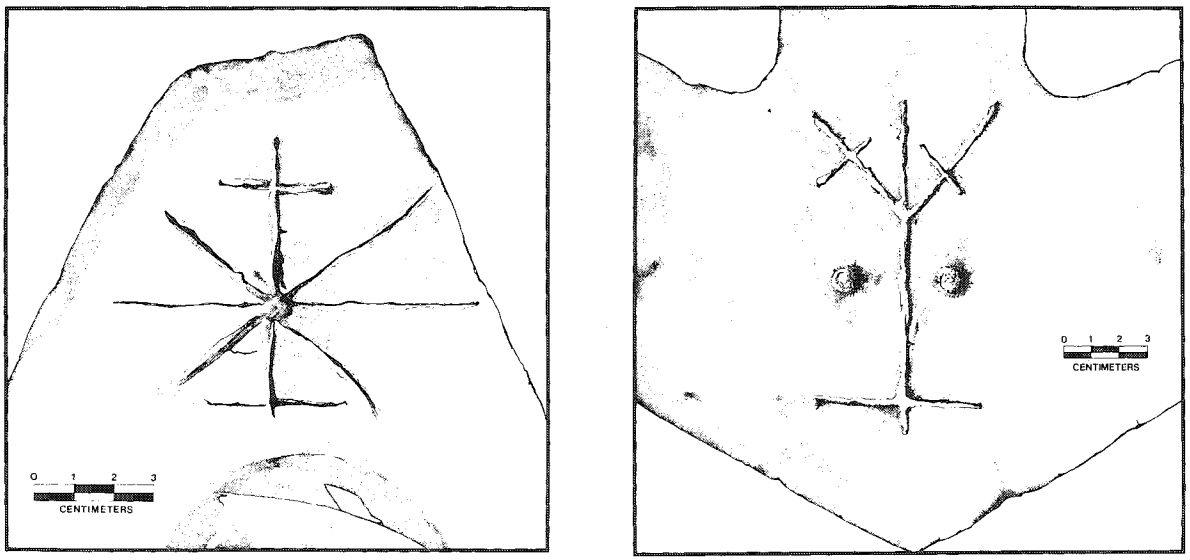


FIGURE 17. Marks on anchors. No. 310 (left) and Jetties anchor.

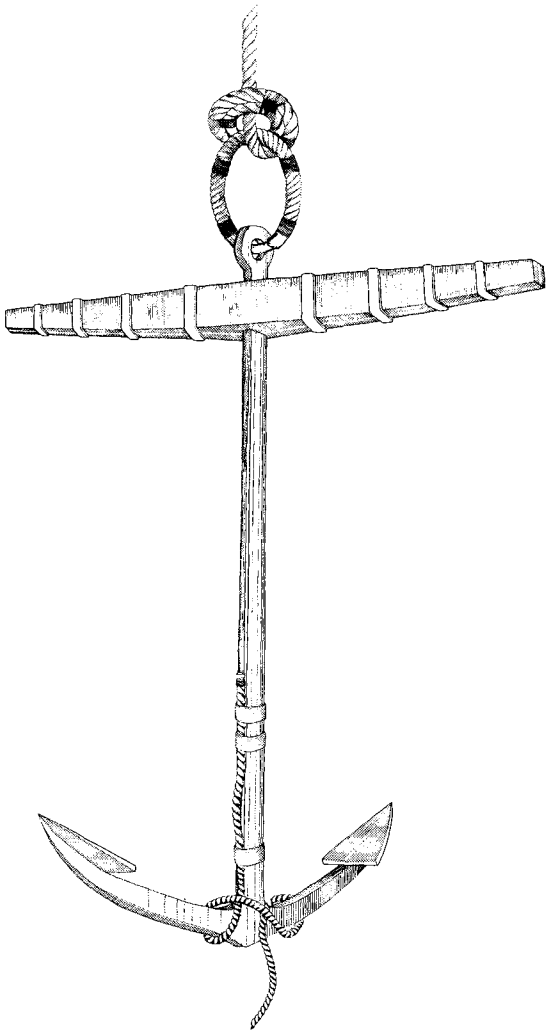


FIGURE 18. Anchor reconstruction illustration. Wrought iron anchor shown with perishable elements restored.

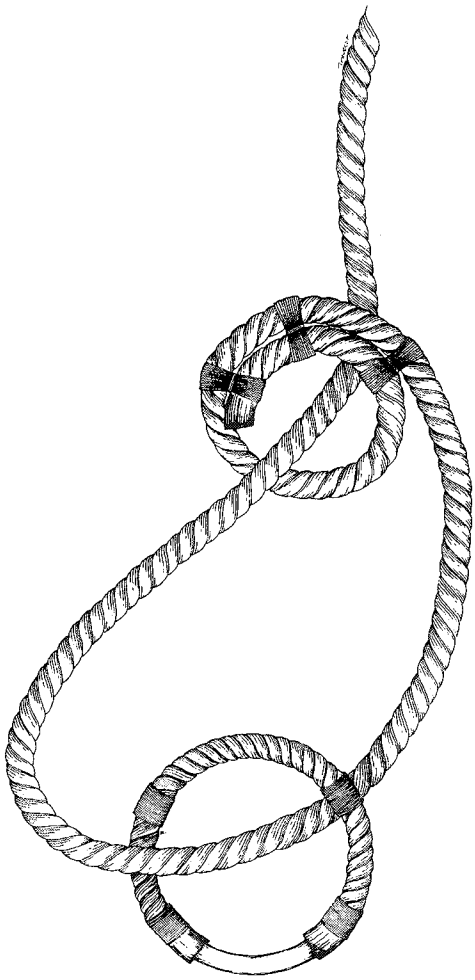


FIGURE 19. Anchor cable fastening configuration.

The average angle in this collection is 57.4°. Perhaps it was the artistic convention for drawing anchors that changed around 1550, following an earlier alteration in anchor construction. Also, the diameter of the ring does not correspond closely to the length of the fluke.

The most important point is the relationship of the shank to the fluke and arms. Disregarding the length of the flukes, since they vary considerably, and measuring the shank in the ideal one-half arm units, which the flukes supposedly represent, we find that the length of the shank is surprisingly

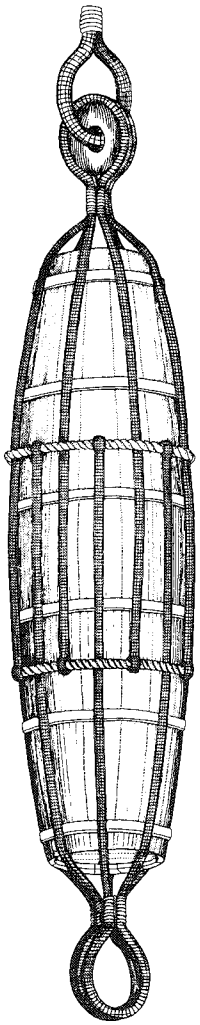


FIGURE 20. Anchor buoy.

longer in every case than it should be according to Tinniswood. According to his interpretation of Manwayring (Tinniswood 1945:86), the proper shank in about 1600 would equal $4\frac{3}{4}$ flukes or half arms. It is possible that the overly long shank of the Spanish anchors, as indicated in this collection, created an undue stress and resulted in the bends and breakage exhibited in this collection. The shank and ring of another broken anchor was recovered in 1975 from the middle wreck (41 WY 3) (Arnold 1976).

Another interesting aspect relating to these anchors is the remains of the rope wrappings from the ring of one of the anchors (No. 310). These ropes are intended to prevent chafing of the anchor cable and are called puddings in Manwayring (1644:78), ". . . the Sarving of the King of the Anchor, which roapes, to ſave the clinch of the cabell from galling aginſt the iron. . . ." The fragments which remained protected by the anchor's encrustation are of three-strand hemp, 1.5 cm in diameter with the individual strands .5 cm in diameter.

Bits of the anchor stock or *cepo* (Pontillo 1975:56) are similarly preserved in one case (Nos. 80–1), and the wood was identified as of the white oak group (*Quercus* sp.) (Forest Products Laboratory, U.S.D.A.) and was located at the point of joining of the stock and shank of the *cruz* (Pontillo 1975:57).

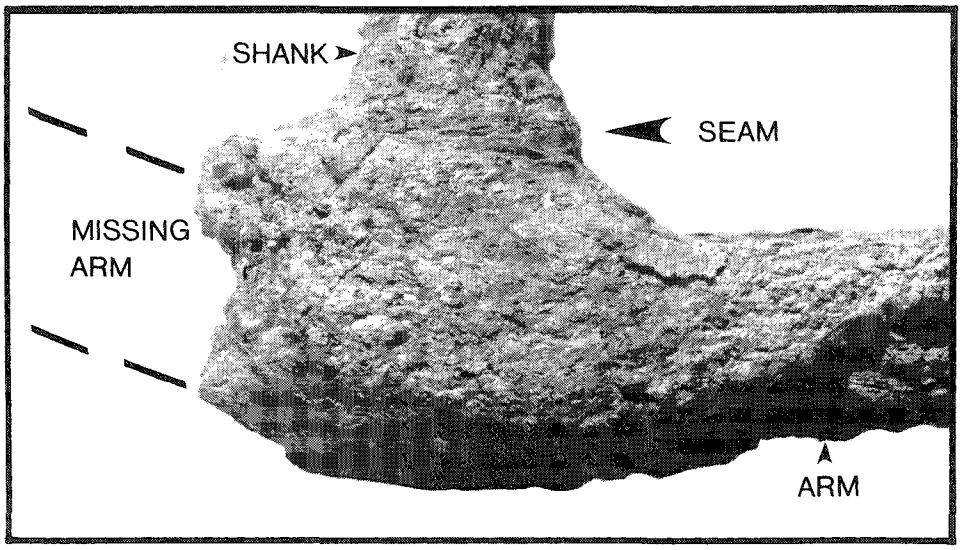
The method of construction for these large anchors became apparent in the case of two very badly corroded specimens (Nos. 157–1 and 161–1). The arms are welded onto the shank, and this was done in at least two different ways, as illustrated in Figure 21.

Like three other sixteenth-century Spanish anchors described by Peterson (1974:234–236) those from the 1554 fleet have the distinctively shaped "Gothic finial" of the shank. The position of the stock keys relative to the arms and flukes is also a diagnostic characteristic of these early anchors. Their direction is parallel to the arms and flukes, contrary to the later practice of having them perpendicular. Exactly when the change took place is not clear, but Tarlton (1977:79) illustrates a large French anchor dating to 1769 with the keys parallel to the arms and flukes.

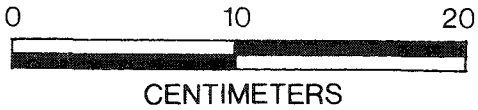
Fastenings

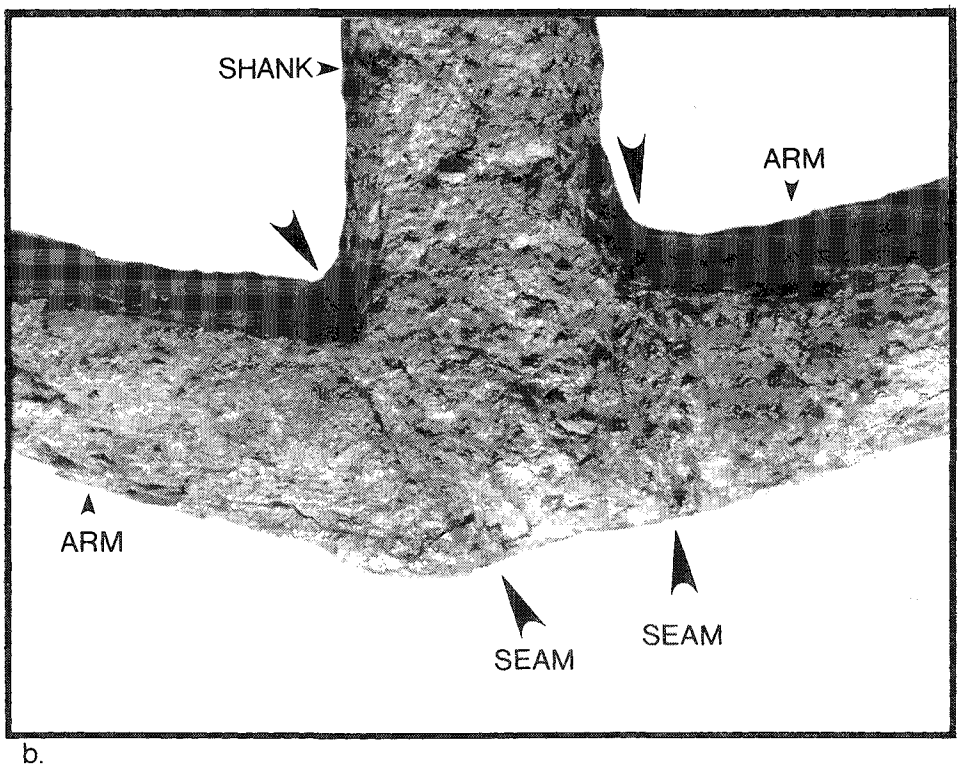
The fabric of the ship was held together by several types of fastenings (*clavazon;* Pontillo 1975:56), including treenails, wrought iron forelock bolts, planking spikes, nails, and tacks (Figure 22). The wooden pegs or treenails are preserved in the keel and identified as white oak (*Quercus* sp.) (Forest Products Laboratory, U.S.D.A.) Manwayring (1644:110) gives some details on treenails.

> *Tree-nells.* (*Quaſi* nailes made of tree) Are the long wooden pins made of the hart of Oake, wherewith they faſten all the plancks



a.





b.

FIGURE 21. Anchor fabrication details. a. No. 161-1 shank joined to arms constructed of single piece. b. No. 157-1 shank joined to arms constructed of two separate pieces.

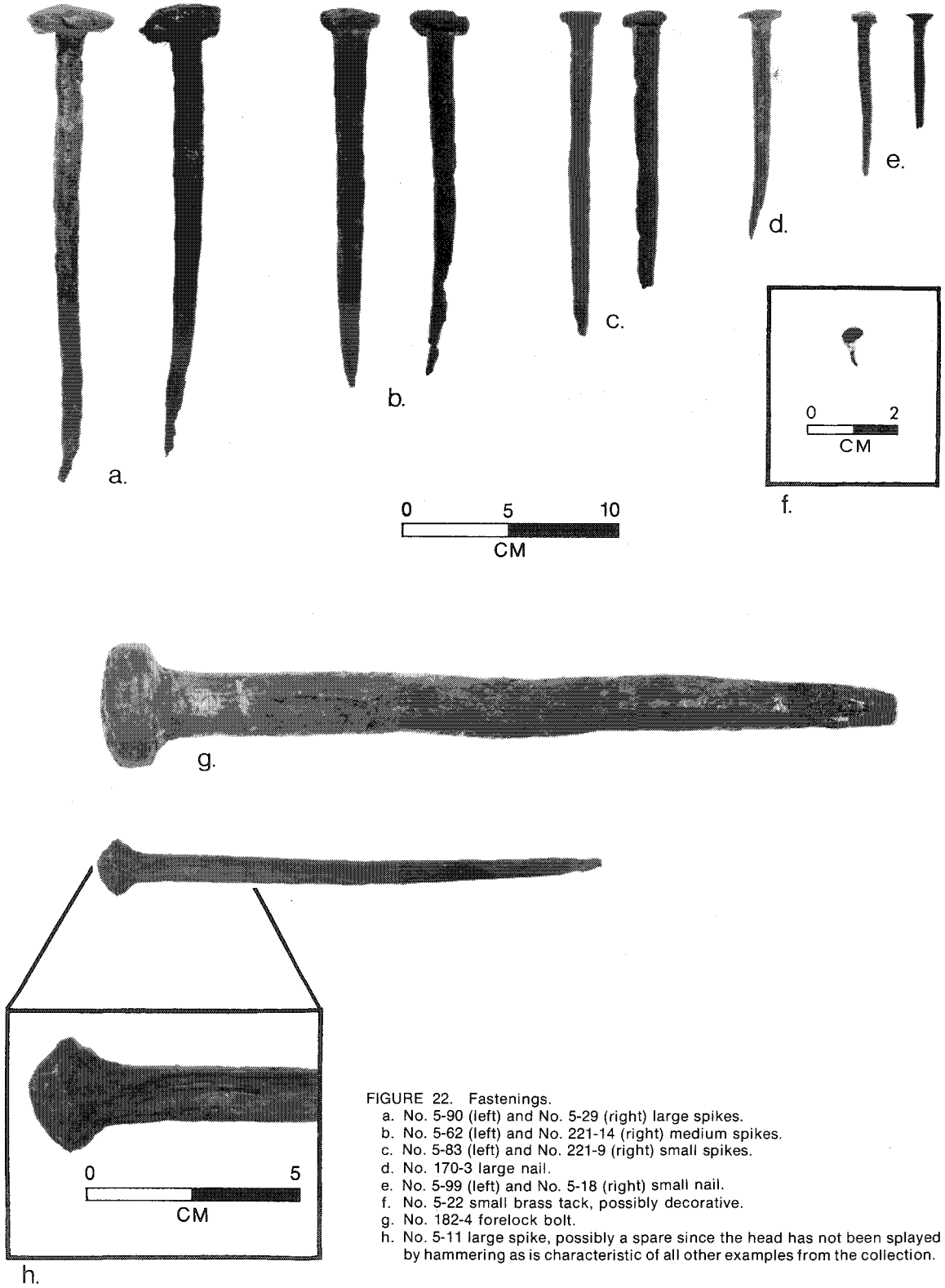


FIGURE 22. Fastenings.
a. No. 5-90 (left) and No. 5-29 (right) large spikes.
b. No. 5-62 (left) and No. 221-14 (right) medium spikes.
c. No. 5-83 (left) and No. 221-9 (right) small spikes.
d. No. 170-3 large nail.
e. No. 5-99 (left) and No. 5-18 (right) small nail.
f. No. 5-22 small brass tack, possibly decorative.
g. No. 182-4 forelock bolt.
h. No. 5-11 large spike, possibly a spare since the head has not been splayed by hammering as is characteristic of all other examples from the collection.

> unto the timbers, for though we bolt the bulke-heads for the better aſſurance and ſtrength, yet the tree-nells are they which doe moſt faſten the plancks (for we doe uſe as little Iron under water, as we may conveniently, leaſt the ſhip ſhould grow iron-ſick.) Theſe tree-nels, muſt be well ſeaſoned, and not ſappy, for then the ſhip will be continually leakie, and it will be hard to find: If a ſhip by any beating upon the ground, doe make a-give-back, and come a little out againe, they terme it ſtarting of a tree-nell.

The forelock bolts are colorfully described by Manwayring (1644:11) as ". . . made at the end with an eye, whereunto a fore-lock or iron is driven over a ring, to keep it faſt from ſtarting-back." One separate forelock, the small wedge of iron driven into the eye, was also found. Peterson (1974:234) illustrates similar forelock bolts measuring 25–45 cm (10–18 inches) from a wreck in the Bahamas.

Two historical documents are of particular interest in relation to the variety of spikes and nails used in mid-sixteenth century ships. The spare nails and spikes purchased for Carreño's *capitana* in 1552 are enumerated as follows (Demanzera 1552):

clout nails—2000
tacks (*tachuelas*)—400
nails and scupper nails—1150
small nails—700
spikes with rings for fastening (forelock bolts)—10
nails for battening—173

Another source is J. Bankston's (personal communication) English translation of García de Palacio, originally published in 1583, which gives a complete list of spare parts which has a heavy emphasis on nails and spikes:

sheathing nails—400
scantling nails—2000
medium bottom nails—2000
side and medium side (nails)—1000
pointed drift bolts—5000
wedge-bolts (forelock bolts)—20
rings (clinch rings for forelock bolts)—50
wedges (forelocks for forelock bolts)—50

This Palacio list seems to be in ascending order of size. The nails and spikes of the 41 KN 10 collection under discussion fall into the following categories:

large headed tacks (sheathing)
nails—small square
nails—large square
spikes—small

spikes—medium
spikes (or bolts)—large
forelock bolts
eye bolts (also with forelocks)

These categories are based on length and comparative dimensions of the nail in cross section. Aside from the forelock bolts and eye bolts, only the large spikes are round in cross section near the head, but become roughly square as they taper to a point, obviously having been wrought from round iron stock. These might be of sufficient size to be considered bolts rather than spikes. The spike heads seem to have been badly battered and misshapen during the process of driving and have further suffered from corrosion. The few which do offer a clue of their original shape seem to have been roughly square. One specimen (No. 5–11) retains a conical head and may represent one of the spares that was not yet flattened and distorted by being driven in by a hammer.

Three brass tacks were found, and were possibly decorative in nature. The scarcity of brass in the collection indicates its value and may argue against a mundane functional use.

Chains

Five sets of iron chains with eye bolts are among the artifacts recovered (Figure 23). Four of these are completely oxidized, but their purpose is clear nevertheless. They are the chains which anchored the shrouds or *obenques* (Pontillo 1975:65) and stays supporting the masts. There is also one smaller piece of iron chain with a staple. Peterson (1974:234) illustrates similar eye bolts measuring about 29 cm (11.75 in.). None of the deadeyes survive from the Padre Island wrecks, but Peterson's Bahamian wreck yielded one. It had a triangular hole and measured about 16 × 30 cm (6.5 × 12 in.), and the chain links were about 28 centimeters (11.25 in.) long.

Rudder Fittings

Of the rudder (*timon*) (Pontillo 1975:70) fittings, one iron gudgeon with fragments of its straps plus fragments of wood and lead straps in place was recovered (Figure 24). Two iron pintles were found, one of which fit an iron strap or rudder iron (Manwayring 1644:87) with spikes located separately (Figure 25). There are also two other fragments of straps or for pintles or gudgeons.

Other Fittings

Other iron objects include a small hinge with holes for three nails of a size appropriate for a gun port or *portañola* (Pontillo 1975:67) hinge, one iron

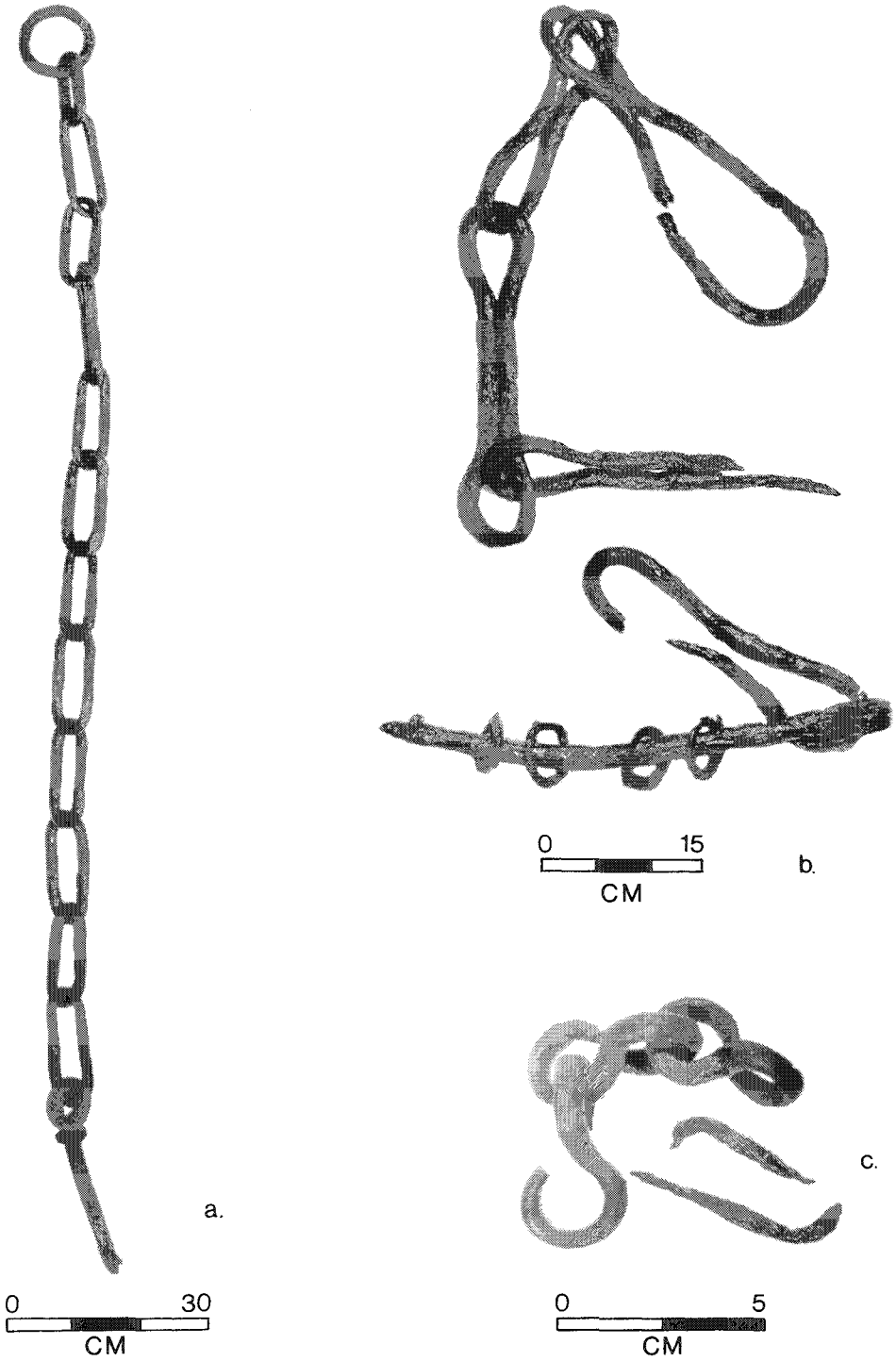


FIGURE 23. Wrought iron chains.
a. No. 182-13.
b. 41 WY 3, No. 323-1 (top) and part of No. 315.
c. No. 182-3. Note the forelock in the tip of the tip of the eye bolt of a and b and the clinch rings used to adapt an over long bolt in b. The expanded upper loop of b would have held a deadeye.

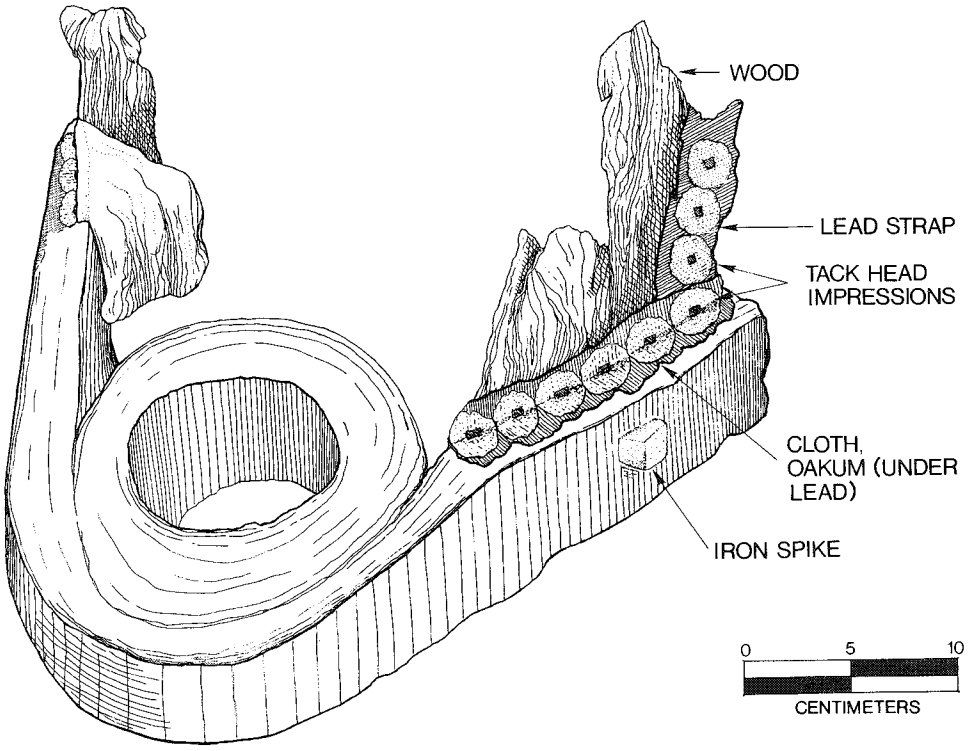


FIGURE 24. No. 43, wrought iron gudgeon with fragments of arms.

shear hook, and one brass bearing (Figure 26). The shear hook or *taja relingas* (Bankston, personal communication), a long curved blade, is described by Manwayring (1644:43):

> Are great hookes of Iron (about the bigneſſe of a ſmall ſickle, and more) they are ſet into the yard armes of the maine and foreyards: The uſe whereof is, that if a ship under ſaile come to boord her that hath these hookes, ſhe will cut her ſhrowdes, or teare her ſailes downe with theſe hookes; ſome doe use them, but they are moſt unuſefull and unneceſſary things, and dangerous for the breaking of a yard, if the hook should catch in the other ſhips mast.

Although in the early seventeenth century Manwayring seems to have considered the shear hook obsolete, they were common from about 1450 to 1600 (Nance 1955:298). They were still in use by the Spaniards in 1588, and a shear hook 37.5 cm (15 in.) long was found at the site of *El Gran Grifón,* an Armada wreck (Martin 1975:185). Martin (1975) points out that the shear hook was also used on the end of a long pole and wielded by hand to

FIGURE 25. Pintle and pintle arm. No. 168, pintle, and No. 108, pintle arm, were found separately but had originally been joined in one piece which broke during or shortly after the wreck.

counteract the enemy's antiboarder netting. The specimen from our site is broken at the end which would be attached to a pole or yardarm. Similar, but blunt, hooks were fitted to the yardarms of fire ships to serve as grappling hooks (Nance 1955:298).[1]

[1] Shear hooks appear in contemporary artwork depicting ships and can be seen in the following works:

1. Landström 1969:96, 98–99—*Henry Grâce à Dieu*—two at each end of main and foreyard.
2. Corbett 1898
   a. Vol. I, facing page 82—the great ship *Jesus of Lubeck*—two at each end of the main and foreyards—reproduced from Anthony's First Roll.
   b. Vol. I, facing page 390—an Elizabethan great ship or galleon—four at each end of the main and foreyards—reproduced from Visscher's Series, circa 1588.
   c. Vol. II, facing page 366—a Spanish treasure frigate or *gallizabra*—two at each end of the main and foreyard, drawn with the curved cutting surface facing out, opposite of all the others.

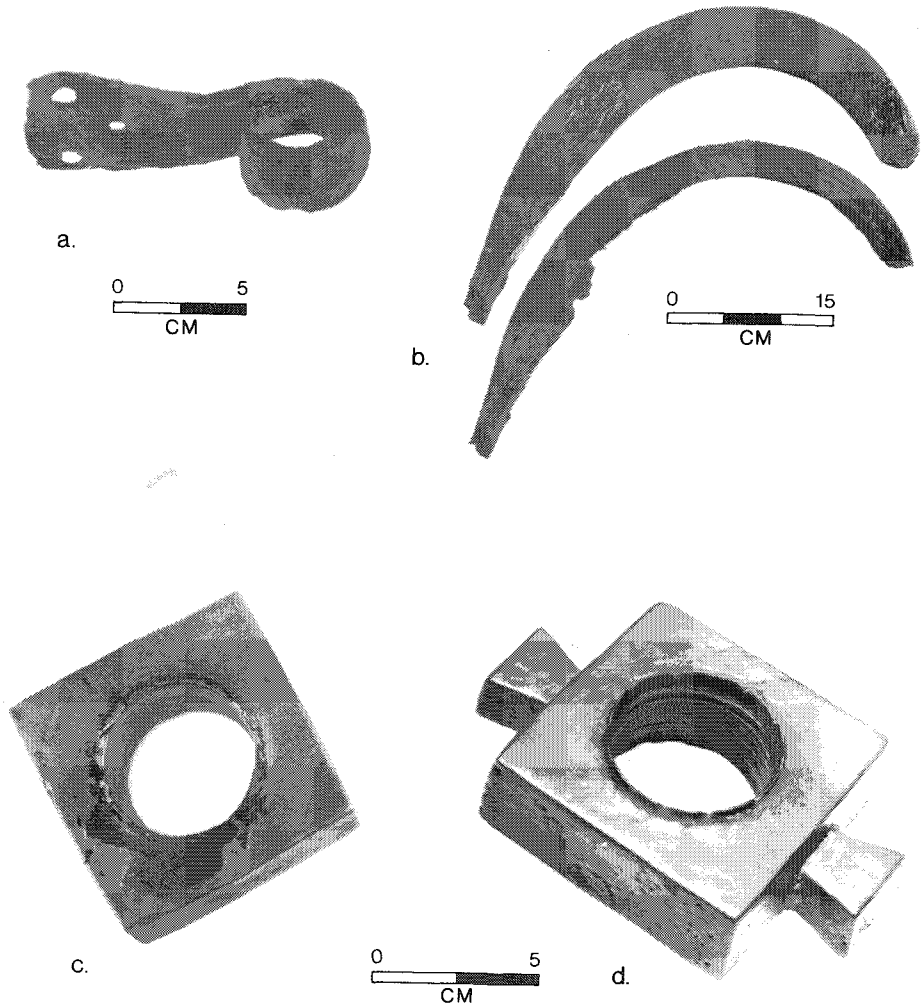


FIGURE 26. Miscellaneous fittings.
a. No. 182-9, wrought iron hinge.
b. No. 137, wrought iron shear hook, corroded remains (bottom), cast made from mold in encrustation exhibiting original form and dimensions (top). Note the semicircular indention in the base. This shear hook broke at one of the holes used to attach it to the yardarm.
c. No. 86, brass coak.
d. 41 WY 3 No. 1498. Brass coak from the neighboring 1554 wreck illustrated for comparison.

The brass bearing is a part of a sheave or pulley wheel (*roldana;* Pontillo 1975:68). Manwayring (1644:27) refers to these as "Cocks. Are little ſquare things of brasse with a hole in them, put into the middle of ſome of the greatest wooden ſheaves, to keep them from ſplitting and galling by the pin of the block whereon they turne." Similar cocks, or coaks as they are called in modern usage, have been found at the sites of *El Gran Grifón, Trinidad*

Valencera, and *Girona,* all 1588 Spanish Armada wrecks (Martin 1975:182–183). The coak from this site and another from the neighboring 1554 wreck (41 WY 3) clearly display the necessity for their use. Such heavy weights were lifted that the brass has been scoured and splayed. A wooden pulley wheel alone would, no doubt, have cracked and split under the strain.

The inventory of the *Great Bark* of 1531, which is reprinted in the *Mariners Mirror* by Laughton (1918:21–22), makes special distinction between the pulleys with "ſhyvers of Brasse," or complete brass wheels, and those with wooden sheaves. The practice of making complete pulley wheels of brass fell out of favor according to Manwayring (1644:93):

> *Sheevers.* There are two ſorts of Sheevers uſed, either of braſſe or wood; the braſſe ſheevers are now little uſed but in the heeles of the top-maſts: the wooden ſheevers are either of one whole peece; and theſe they uſe for all ſmall pullies, and ſmall blocks: but in the Knights and winding-tackles-blocks, they uſe ſheevers which are made of quarters of wood let-in to each other; for theſe will hold when the whole Sheevers will ſplit, and are called quarter-ſheevers.

Brass coaks in combination with wood for pulley wheels were also an early application, however, as is indicated by Oppenheim (1961:373) in the inventory from 1514 of the equipment of the *Henry Grâce à Dieu.* (Here we have yet another permutation of the term "coak"; it is spelled "colk" in this early document.) Of the many references to coaks, the most revealing are the following: "Single polles with a colk of Braſſe. . . . j. Polles with colkes of Braſſe and oone of wode. . . . vj [Oppenheim 1961]." There are several other entries that support Manwayring's description of the manner in which coaks were used. A single coak was set into the sheave or pulley wheel, not one on each side of the wheel in the pulley or block itself as has been suggested by Olds (1976).

It is even possible to speculate on the use of the pulley reinforced with a coak since, although there are many pulleys in the rigging of a sailing ship, there was only one coak recovered from each of the 1554 shipwrecks excavated. They may have been from the winding block, which, according to Salisbury and Anderson (1958:61), was the most heavy duty of all, and used to set a mast or heave things of great weight. The term "winding block" has some longevity as it also appears in the 1514 inventory cited above (Oppenheim 1961:379) where it is referred to as the "Wyndyng Shever." Alternatively, the coaks found in the 1554 wrecks may have been used in the blocks used to work the courses. The practice of furling the courses without lowering the yard came about around 1600. Up to that time, in order to lengthen or shorten the sail it was necessary to add or remove a bonnet, or extra strip of sail, tied to the bottom of the courses. Striking the course involved lowering the yards, which were tremendous weights (Nance

1955:290). The coak could have been used to keep the pulley wheel from splitting. There are several sixteenth-century Spanish words for "pulley," such as *polea, carrilo,* and *aparejo* (Pontillo 1975:51, 55, 66). They probably refer to different types of pulleys, but only *aparejo* is identified. It is defined as a pulley used to hoist and may therefore be somewhat comparable to the winding block.

Tools

An interesting assortment of tools was carried aboard this ship. Most are now in fragmentary or oxidized condition. Included in the artifact collection are an auger, a light-weight reamer or auger, a hand vise or pincers, a small pick-adze with fragments of its handle, and a problematical thimble-like object with a piece of leather inside (Figure 27). Many of these are from the carpenter's tool kit with which, according to Palacio (Bankston, personal communication), he was supposed to be able to construct a long-boat or a *chalupa.* Palacio's list of tools included saws, axes, adzes, chisels, gouges, augers, mallets, hammers, files, a saw-set, planes, and trowels.

ARMAMENT

Verso or Swivel Guns

One badly oxidized verso or light wrought-iron swivel gun (Figure 28) was found in a position which indicated that it had been stored as ballast. The presence of 17 iron breech chambers (Figure 29), which contained powder charges for versos of two other sizes, indicates that other examples of this kind of gun had been aboard and perhaps had been removed by the contemporary salvagers or scattered with the upper works of the ship. Two fragmentary iron wedges or forelocks used to secure the breech chamber during firing were also recovered. A cone-shaped iron object, which might be a fragment of the pintle of a verso swivel mounting, was found.

Manwayring's (1644:69) comments on swivel guns are of interest at this point.

> *Murderers.* Are ſmall Iron or Braſſe Peeces with Chambers: In Marchant-men they are moſt uſed at the Bulk-heads of the fore-caſtle, half-deck, or ſteeridge; and they have a Pintell, which is put into a ſtock, and ſo they ſtand and are traverſed, out of which they uſe Murdering-ſhot, to ſcower the Decks, when men enter, but Iron Murderers are dangerous for them which diſcharge them, for they will ſcale extremely, and endanger their eyes much with them, I have known divers hurt with ſhooting them off.

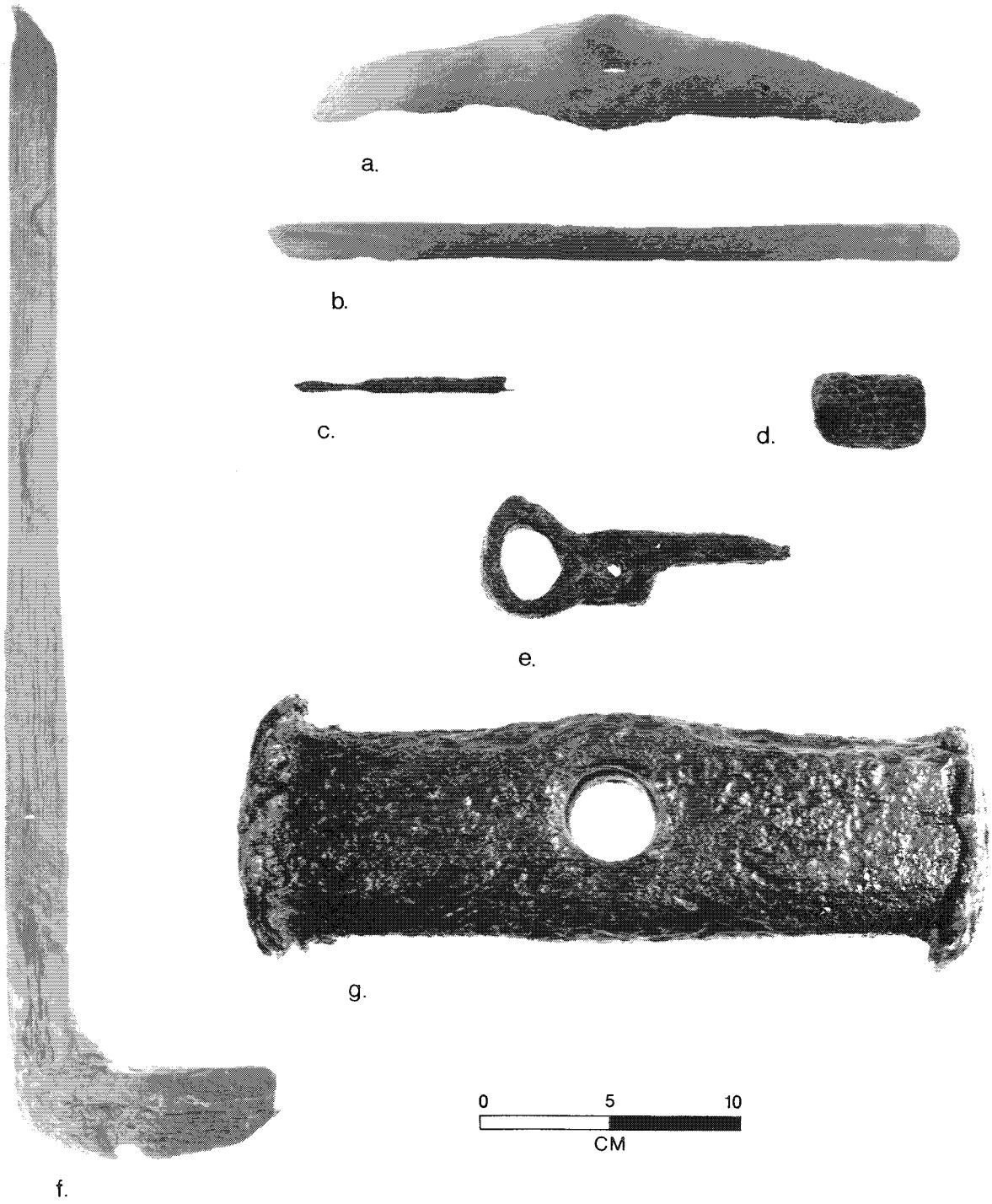


FIGURE 27. Tools.
a. No. 106-2. Pick-adze.
b. No. 102-1. Auger.
c. No. 5-53. Reamer.
d. No. 5-78. Problematical thimble-like object.
e. No. 79-34. Pincers.
f. 41 WY 3 No. 69. Caulking tool.
g. 41 WY 3 No. 110-1. Sledge hammer.

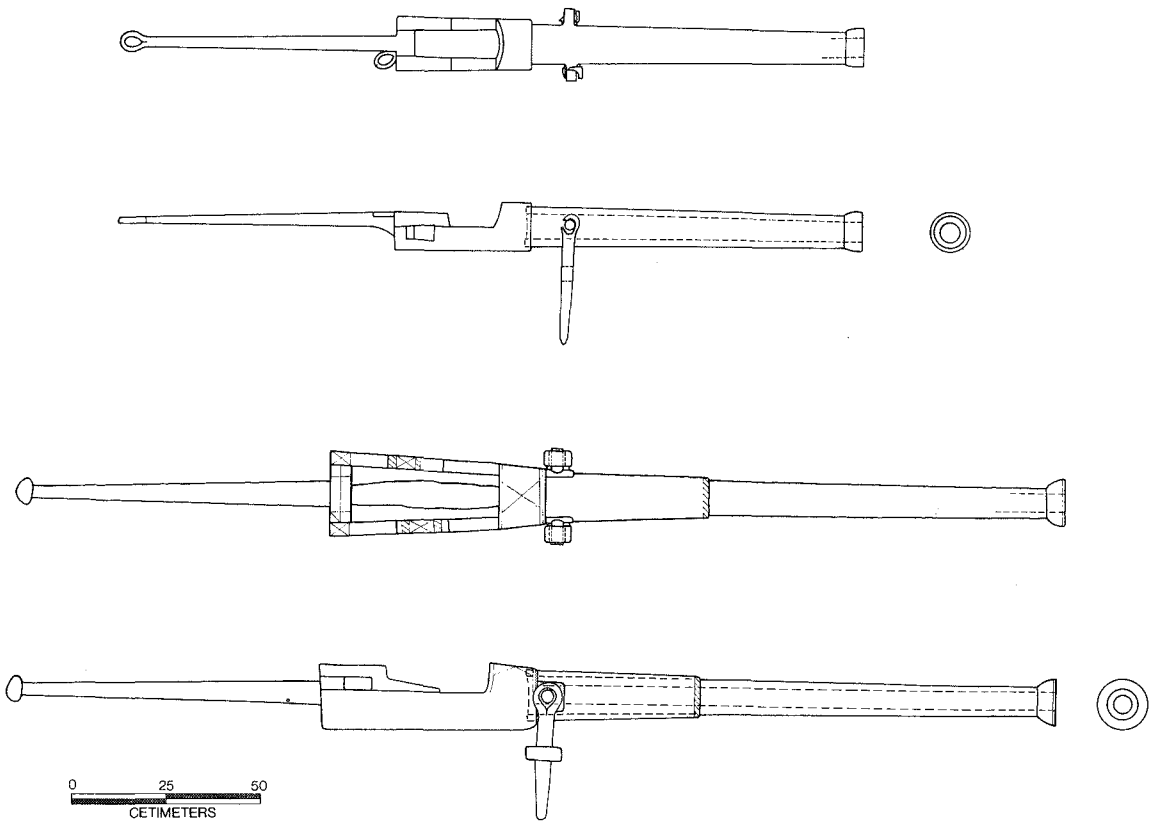


FIGURE 28. Verso or swivel guns. 41 WY 3 No. 1611 (top), bore 5.1 cm, weight 41.7 kg; No. 333 (bottom), bore 4.5 cm, weight 97.2 kg. One broken swivel gun (No. 71-1) was recovered from 41 KN 10 but in a very badly oxidized condition. No. 71-1 was about the same size as the smaller of the two guns illustrated here. In action, a ball and wadding would be placed in the breech end of the tube, a loaded breech chamber placed into the slot and secured by an iron wedge that fit across and rear of the slot through two holes in its sides.

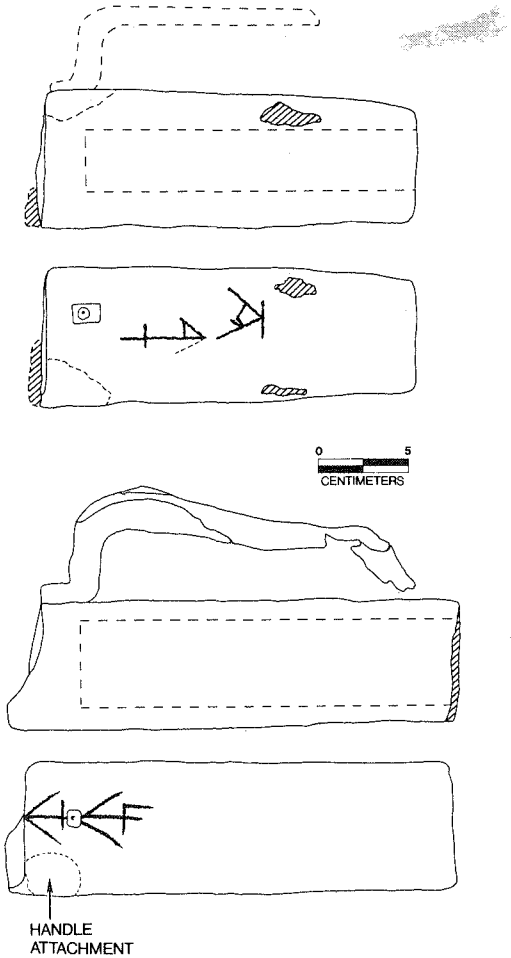


FIGURE 29. Verso breech chambers. No. 132-3 (top) and No. 132-8 (bottom) illustrate two sizes in the 41 KN 10 collection. In comparison with those from 41 WY 3 these have a particularly squared off open end. Those from 41 WY 3 are generally tapered.

Light guns of similar appearance are noted as early as 1388, in an example at Rouen. The earliest varieties shot arrows weighing about half a pound (Greener 1910:20). By the end of the fourteenth century, wrought iron swivel guns and bombards were also adapted for shipboard use. By the end of the fifteenth century, it was common for merchantmen to carry two or more bombards, and by the early sixteenth century, bombards were fixed to the deck and fired through ports, and swivel guns were mounted on the rails of the waist and in the ship's castles (Figure 30) (Greener 1910:22, 37, 39). Breech-loading guns lost favor in the late sixteenth century (although they continued in use for considerable time) along with shear hooks and other measures such as stones to throw down from the tops and wearing armor on shipboard, probably owing to a growing emphasis on heavier artillery in naval warfare. Also, with the reduction in the castles on newer ships, the best places for mounting these guns disappeared (Corbett 1898:391).

Few examples of this kind of gun have survived. One interesting piece is described by Robinson (1919:10–14) which he dates to 1550–1600. The chamber was not recovered with the gun, and the hypothetical reconstruction with a key to fit the slot in the receiving trough is probably incorrect, as the examples from the 1554 wrecks illustrate. Vigon (1947), working from both archival data and surviving examples in Spain, offers one of the best discussions of both versos and bombards or lombards. He also anticipates McKee's (1974:27) "discovery" that the breech chambers were plugged with a wafer of wood after the powder was loaded, a characteristic we have also observed.

There were at least two methods of wedging the breech chamber against the gun tube. The swivel guns from the two 1554 wrecks are all fitted for a forelock. A different arrangement was reported from *La Trinidad Valencera* (Martin 1975:222), in which a butterfly-shaped iron wedge was simply driven in from the top behind the chamber. Martin also reports that this wedge had a folded leather pad behind it, possibly to obtain a tighter fit and to absorb some of the recoil. A similar instance of padding is mentioned by Laughton (1960:283). In 1554 wrecks, the pads were of lead. Figure 30 is a sketch of a verso in action.

Bombards or Built-Up Guns

The Texas Antiquities Committee found three bombards or built-up wrought-iron-hooped-barrel breech-loading guns (Table 4, Figure 31), referred to in the contemporary literature as lombards because of their Italian origin (Bankston, personal communication) and by Vigon (1947) as bombardetas defined by their size. One was stored in ballast, and two were probably in use. One has remnants of its wooden stock and the ropes with which the gun tube and stock were lashed together. There are 15 breech chambers for bombards, one of which has a brass reinforcing band that may represent a repair (Figure 32). Their number makes it clear that originally

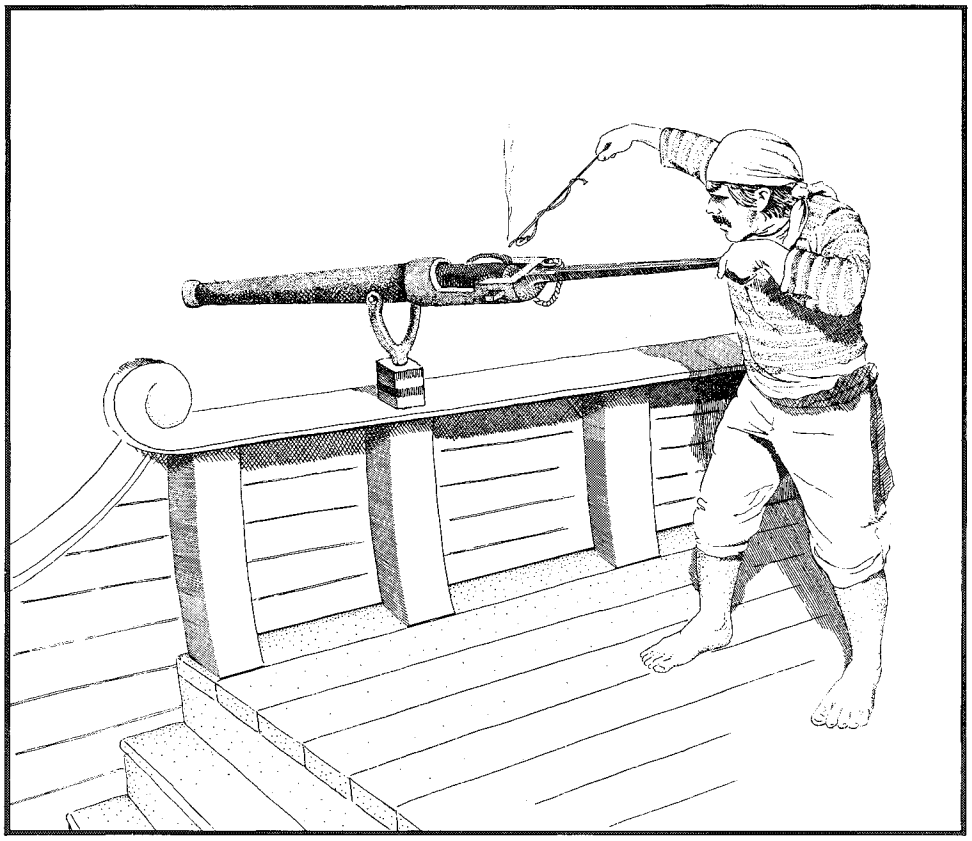


FIGURE 30. Reconstruction of a verso in action.

there had been several more guns for them to serve. The register of the *Santa María de Yciar* (Ojos 1554) indicates that she was equipped with 32 versos, 10 heavy pieces of artillery (probably mostly bombards), 9 barrels of powder, 500 cannon balls, 100 *arcabuzes,* 21 shields, 16 crossbows, and 250 spears and lances. She was the smallest of the four 1554 ships. The other ships would probably not have been armed very differently, and it is apparent that either most of this wreck's (41 KN 10) armament was widely scattered as the ship broke up or, more likely, was salvaged by the Spaniards.

These were primitive guns indeed (Figure 33). One of the most succinct discussions of their construction appears in Hogg (1963:9–12):

> The original wrought iron guns were known as *bombards,* a word derived from *bombos* meaning a loud humming noise. Primarily squat in shape like a mortar they soon developed a more tube-like appearance and took on the more convential outline of a modern piece.
>
> Their method of construction was simple. Each was hand-made by a

TABLE 4
Wrought Iron Guns

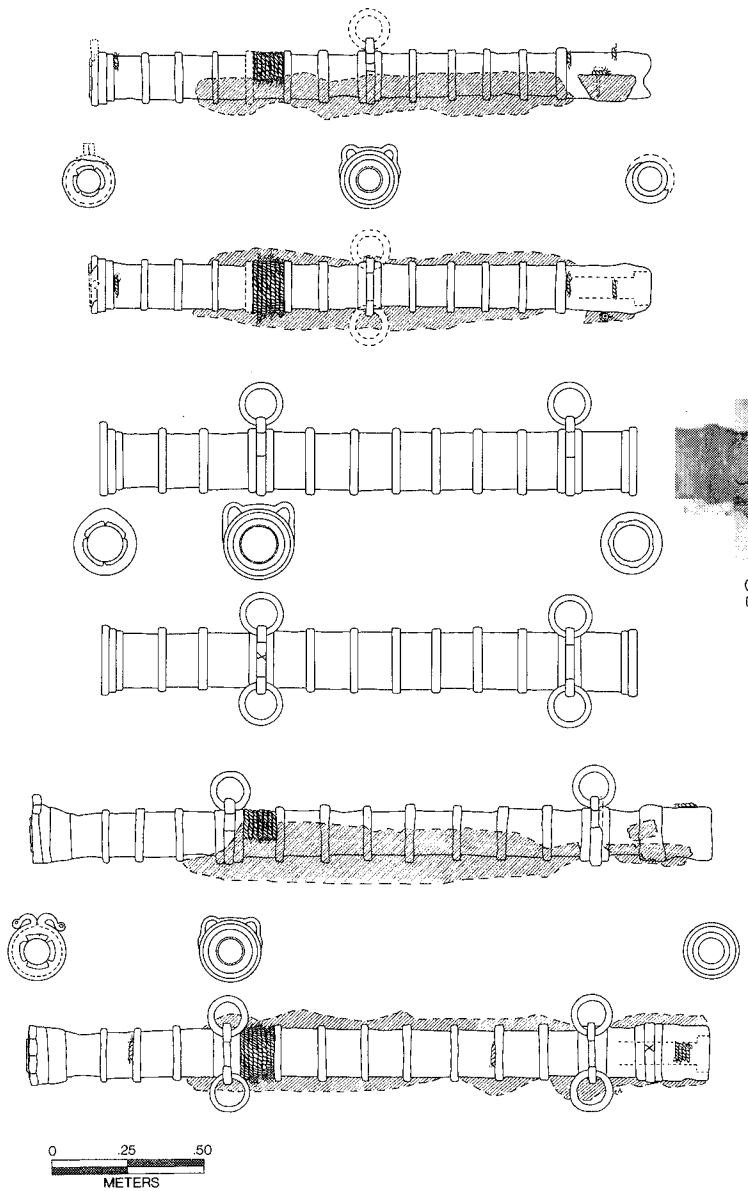
Specimen Number	Remarks
129-1	Broken verso or swivel gun stored in ballast, detached "rat tail" stored along side. Overall length 174 centimeters.
156-3	Bombard or built-up gun with carriage and lashings; two ring handles near center; site[a] at muzzle composed of extensions of last reinforcement ring; 184.3 centimeters long; 8.1 centimeters bore 22.75 calibres); depth of indention for neck of breech chamber 4.7 centimeters; inner tube constructed with bars.
171-1	Bombard or built-up gun with four ring handles (two near breech, two farther back from muzzle), last ring at muzzle brought up into a site; 173 centimeters long; 12 centimeters bore (14.42 calibres), mark at breech end. No indention for neck of breech block, but the necks would fit into the bore; inner tube constructed with bars.
172-1	Bombard or built-up gun with remains of wood carriage and rope lashings; four ring handles (two near breech and two farther back from muzzle); rings with eyes for ring handles completely encircle tube situated on an unusually wide reinforcement band (or two adjacent bands—true for all three cannons); 222 centimeters long; 8.3 centimeters bore (26.75 calibres). Depth of indention for neck of breech chamber 4.0 centimeters; inner tube constructed with bars.
Construction note: Thin bars run the length of the tube on inside, next wide bands adjacent without gaps, then thin reinforcement bands at the seams of the wide bands.	

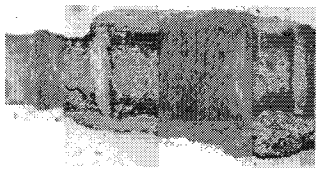
[a]Referred to by Vigon (1947:64) as the *joyas de panteria*, literally "aiming jewels," although *mira* was the customary term.

smith to conform to the size required, and though rough and ready to modern ways of thinking they did perform their purpose satisfactorily according to the standards of the time. The only equipment the craftsman needed was a forge, a hammer, a mandril and supplies of water for quenching his metal.

Rods of wrought iron were bound closely round the circumference of the mandril and over these were passed a series of white hot rings which when chilled shrunk on to the rods and held them in a vice-like grip. Ring after ring was added until the exterior of the barrel assumed a comparatively smooth appearance and the whole became a rigid hollow cylinder. Sometimes melted lead was poured into the interstices. The chamber portion was then forged out of the solid with a tapered end to fit the breech. This double operation was necessary as the artificer of that day found it impossible to make a barrel without a mandril; consequently it had to be open at both ends. That is why this early type of gun was normally a breech-loader.

Wrought iron guns continued in production up to the beginning of the 16th century though by then the practice of casting for all types and sizes of ordnance was rapidly coming to the fore. The modern artilleryman looks upon breech-loading as a *sine qua non* and in this merely voices the opinion of his predecessors, but the latter, whilst appreciating its advantages, found it





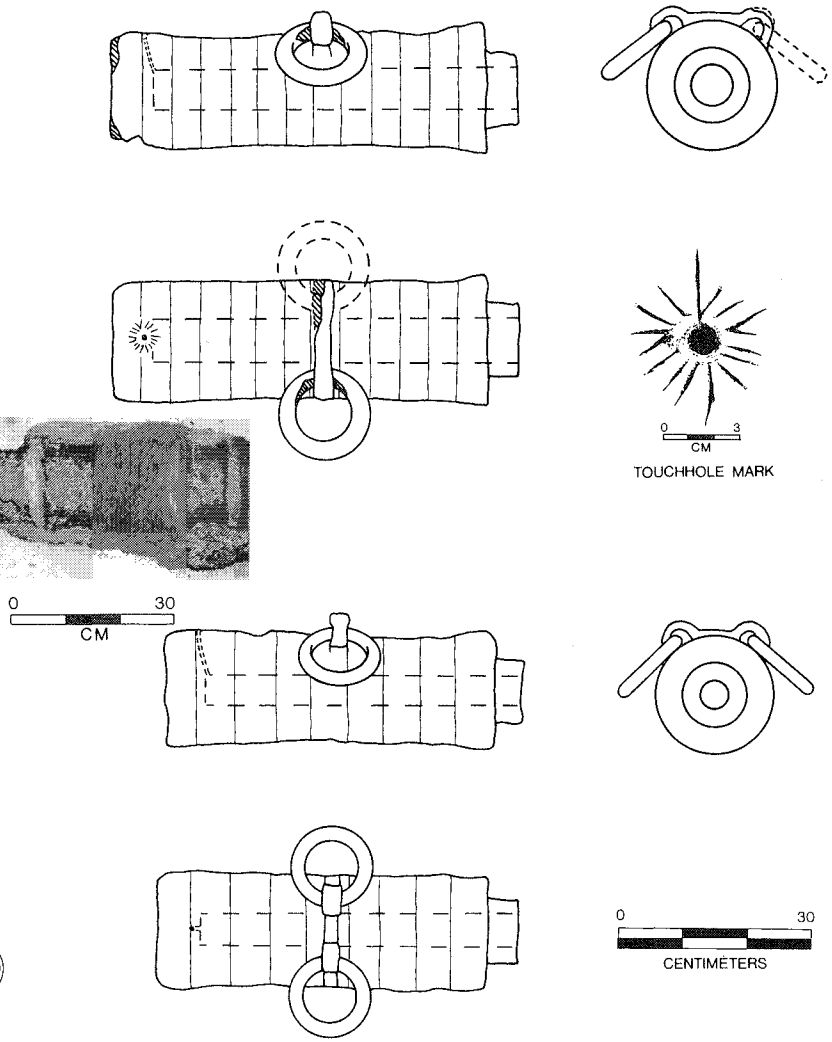


FIGURE 31 (left). Bombards. No. 156-3 (top), No. 171-1 (center), and No. 172-1 (bottom). Illustrated here are the three wrought iron bombards from 41 KN 10. The shaded areas represent the remains of the wooden carriages or stocks. Cross sections are also provided. The inset shows a detail of ropes used to lash the gun tube to the carriage (No. 156-3).

FIGURE 32 (above). Bombard breech chambers. No. 79-2 (top) and No. 72-1 (bottom) are representative of two of the three sizes in the 41 KN 10 collection. The third, the larger four ring size, is illustrated in Figure 3. A blow-up of the mark around the touch hole of No. 79-2 is also shown.

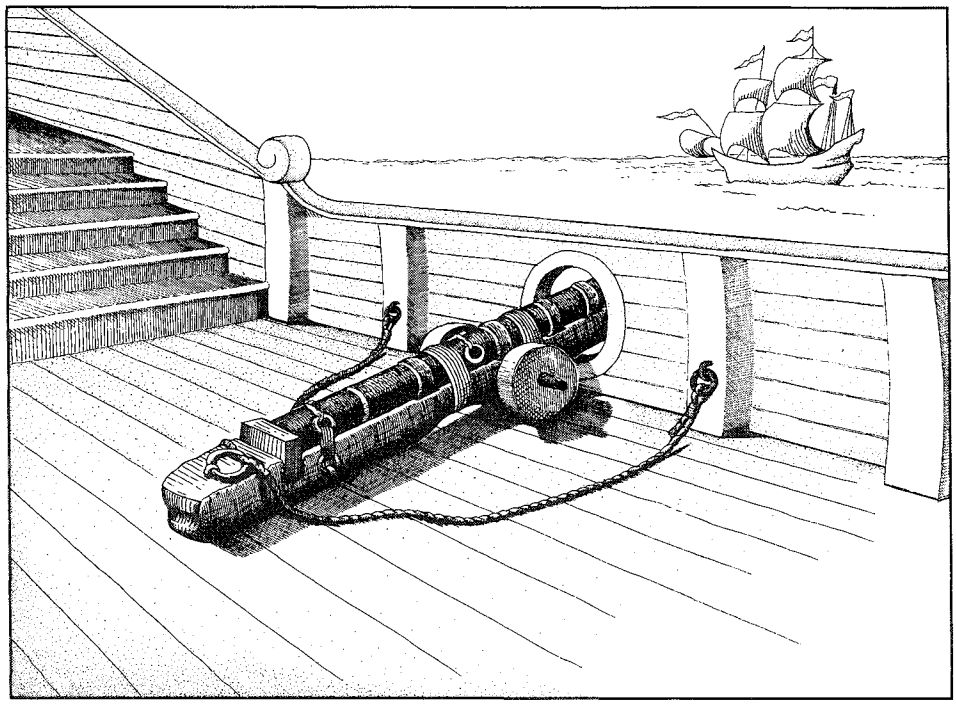


FIGURE 33. Reconstruction of bombard mounted for shipboard use.

extremely difficult to put into practice. It was the old story of man's ingenuity out-running his ability to manufacture.

Obturation, i.e., the prevention of gas escape past the breech, was at that time *terra incognita*: so the primitive examples just described were not only crude in design, they were apt to be dangerous in action. The reign, therefore, of original breech-loading pieces was short and this system of gun configuration lay fallow till the middle of the 19th century. Gun-founders soon adopted casting, a method of manufacture which by its very nature made muzzle-loading a necessity.

In addition, it is now clear that occasionally a solid sheet of iron was forged into a cylinder and its edges welded to form the inner core of the gun tube. This should not be particularly surprising, since the barrels of the verso were constructed of a single welded sheet. This welded inner sleeve occurs side by side with tubes (*caña;* Vigon 1947:37) constructed in the better-known manner described by Hogg above at one of the 1554 wrecks (41 WY 3). The *Mary Rose* (McKee 1974:262–263) also had both welded and traditional pieces.

One form of the carriage for this variety of wrought-iron gun was described by Robertson (1923:173–174): "It was mounted on a baulk of timber furnished with small trucks or wheels, the baulk or carriage being

provided with a stout flange at its rear end, projecting upwards. This flange took the force of recoil. For breech-loading, the section of the gun nearest the flange was made removable, to serve as a chamber . . . and when loaded, was secured in position again by a spigot at its front end, and a wedge driven tightly between it and the flange of the carriage."

Very few wrought iron guns have been found with parts of the carriage surviving. We have a few fragments. A wreck from the early to mid-sixteenth century in England has yielded a specimen with its carriage largely intact. It is illustrated in a report by Carpenter, Ellis, and McKee (1974:8). Instead of being tied down, the tube is held in place by iron straps. The chamber, which has a handle like that of a verso, is held in place by a wedge or forelock fitted beneath two flanges of iron attached to the end of the stock. Another piece of iron is affixed to the stock behind the forelock to shield the stock from the full force of the recoil. The bore of this gun is 4–5 cm in diameter (McKee 1974:7).

The bombard breech chambers (*trompa, recámera, masculo,* and *servidor* are four Spanish terms used for these artifacts by Vigon) recovered from this site are all constructed with an inner sleeve forged of a single sheet and lap welded. There is also an outer layer of adjoining reinforcing bands. The after end is closed by a plug of iron. The verso breech chambers were similarly constructed but without reinforcing bands. The spigot, referred to by Robertson in the preceding quote, which fits into the gun tube seems to be a continuation of the inner sleeve covered with a reinforcing band or ring, much less thick than those making up the remainder of the outer tube—in one case measuring only 1.1 cm thick. The inner sleeve is very thin compared with the reinforcing bands. The touch hole (*fogón* or *oide;* Vigon 1947:37) of the chambers in this collection consistently falls on a seam between two reinforcement bands.

Several of the chambers bear identifying numbers or marks. Some of the gun tubes have similar marks which may indicate which chambers went with which guns Figure 34). That the chambers were not completely interchangeable among guns is indicated by similar marks on chambers from *La Trinidad Valencera* and by a quotation from Spanish fleet orders issued in 1597, provided by Martin (1975:221), ". . . have a care of your powder and cartridges to be kept below in ballast, and a careful man to have charge of them and to have numbers set down upon every cartridge according to the piece. . . ."

Vigon's (1947:35, 64–67) archival sources indicate several interesting and surprising details regarding these wrought iron breech-loaders. For example, he relates that, before firing, the chamber had to be tied to the carriage (*afustes*) with ropes. He also mentions that, as a general rule, the chamber was filled to three-fifths of its volume with powder, and one-fifth was taken up by the wooden plug (*tapón* or *taco*). The plug was placed after the powder had been moderately compressed, and it was always to be of light

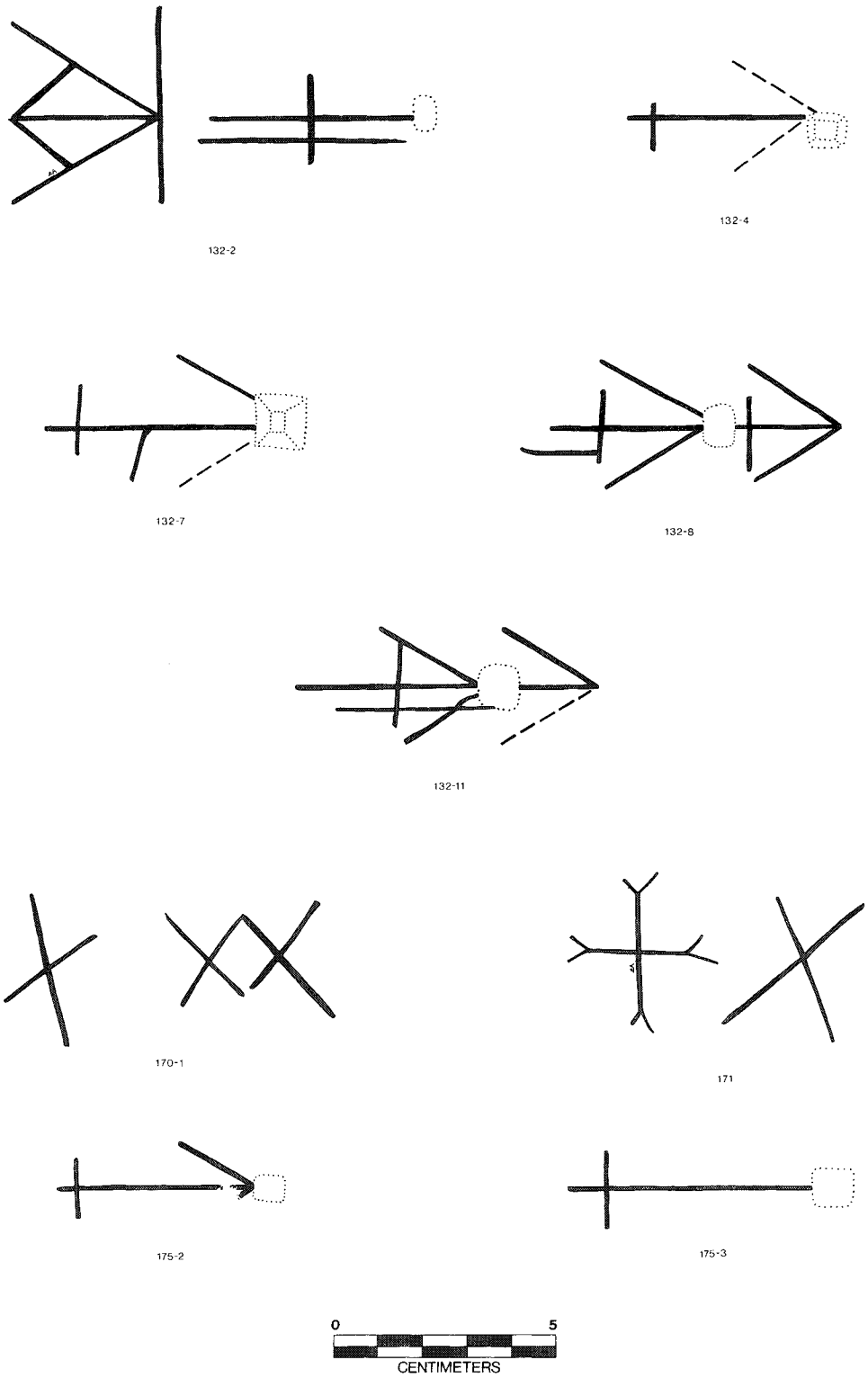


FIGURE 34. Marks on guns and breech chambers. Locations of touch holes are indicated for those examples from breech chambers.

wood (like liden, pine, or willow) because it was thought that heavier woods might increase the risk of bursting, which was common enough to be a good reason for having more than one chamber per gun aside from increasing the rate of fire. In our case the wood of one plug was identified as that of a tropical species (see Table 3), indicating replacement of supplies in the New World. Without stating a reason, Vigon mentions that the ball was loaded from the mouth of the tube, not the breech end, and then was wedged into the center of the bore with pieces of wood or with rags impregnated with wax. Furthermore, under the most favorable conditions he says that the rate of fire was probably no greater than four times per hour. There was hemp wadding around the balls of loaded pieces from the 1554 wrecks and from the *Mary Rose* (McKee 1973:260).

Wrought iron bombards and versos similar to those in this collection are illustrated by Bass (1972:256–257, 270, 276) and by Peterson (1974:241).

Shot

Four varieties of shot were used for ammunition for the guns of this ship (Figure 35). For the bombards there were stone balls called *bolaños,* usually of limestone (Vigon 1947:45). One limestone example was found. There are wrought iron balls of two sizes called *pellas* (Vigon 1947), the 26 small ones appropriate for versos and the nine large ones for the bombards. The lead-covered iron cannon balls called *bodoques* (Vigon 1947) for the versos were usually found with the square iron core completely oxidized, leaving a cavity visible through crevices left when the lead was hammered around the iron core. According to Vigon (1947), the iron was to be from one-sixth to one-third the total weight of the ball. One iron cube which may have been intended for a *bodoque* core was found. The iron cubes themselves were also fired in numbers as an antipersonnel measure.

There are also four very small cast lead balls, and one large stone ball for which no weapon of appropriate bore was recovered. The small lead balls could have been used as ammunition for *arcabuzes,* which probably formed part of the armament.

Laughton (1960:268) mentions that around 1555 (and we now know somewhat earlier) smaller stone-shooting wrought iron guns, which he refers to as fowlers, of 3–5-inch (7.6–12.7 cm) bore came into use. He says,

> It is doubtful if it was worthwhile to shoot stone from the smallest of these guns, for a stone shot from a 3-inch gun would weigh only about one pound, and from a 4-inch gun about two pounds. As has been noticed, no shot so small as this has been found. For this reason it is much more likely that the fowlers, and indeed their ancestors the smaller stone guns, were usually used to shoot "dice of iron" often described as "hail shot.". . . The name "hail-shot piece," frequently met with after—but not before—1515, apparently connotes the smaller stone guns, and confirms the supposition that to fire stones from them was not worthwhile.

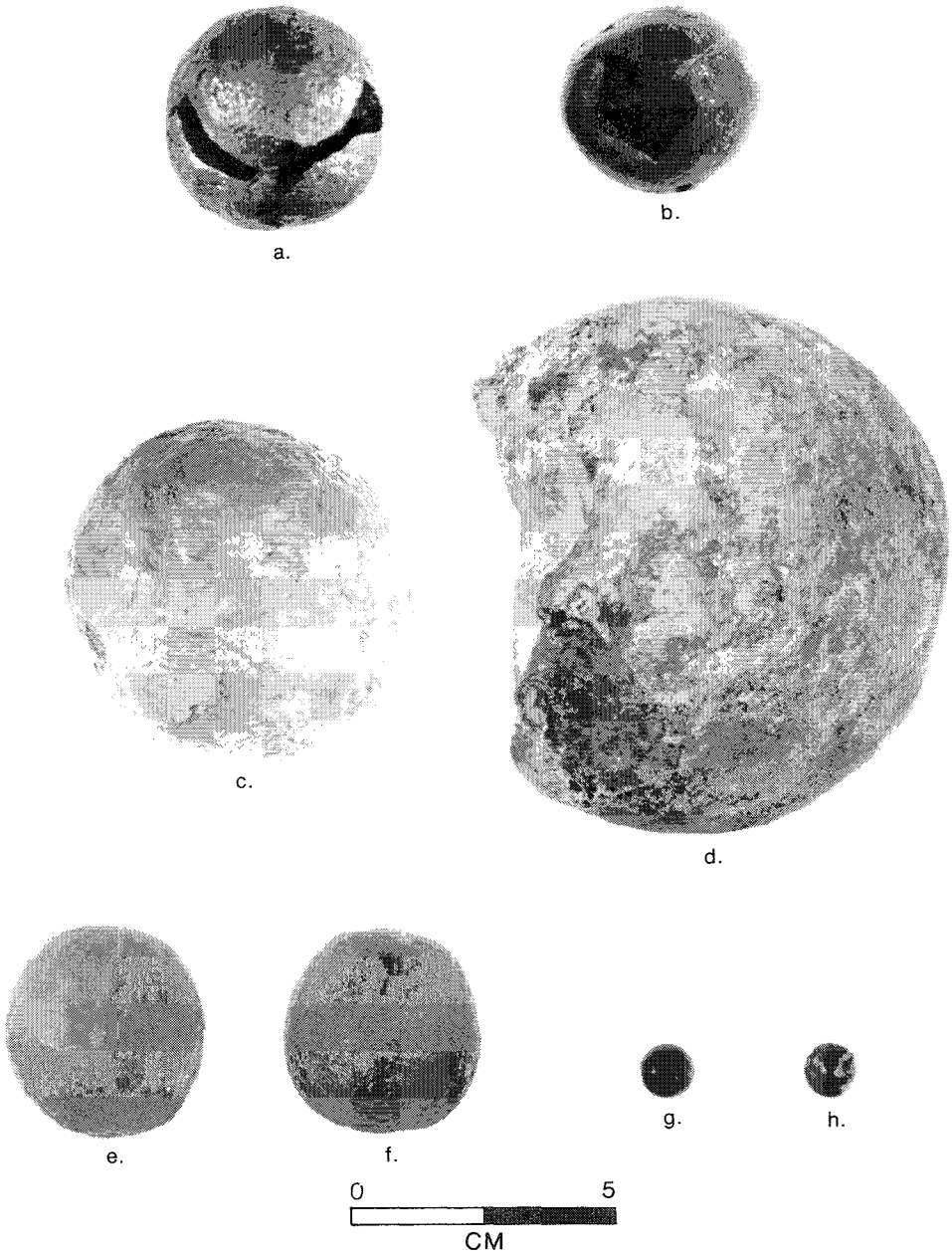


FIGURE 35. Cannon balls and shot.

a. No. 81-6, Lead-covered iron.
b. No. 119, Lead-covered iron.
c. No. 161-8, Large wrought iron.
d. No. 81-10, Large stone.
e. No. 52, Small wrought iron.
f. No. 45, Small wrought iron.
g. No. 5-4, Small cast lead.
h. No. 5-5, Small cast lead.

The square cavity in b was left by the complete oxidation of its iron core. *Note:* The 41 WY 3 collection includes cast iron cannon balls.

Although various types of shot were fired from these guns, we do now have an example of stone shot from the 1554 wreck measuring 9.9 cm (3.96 inches) and weighing 1147.3 gm (2.5 lb). Laughton (1960:268N) goes on to say that neither the fowlers not the large port pieces (bombards) fired solid iron shot. We have examples of wrought iron shot, most measuring about 6.5 cm in diameter, which would have been appropriate for two of the bombardettas (No. 156–3, with a bore of 8.1 cm, and No. 172–1, with a bore of 8.3 cm). This would seem to invalidate his second assertion as well. Vigon (1947:45) states that forged iron projectiles were used in the wrought iron guns of small bore and stone in those of larger bore. The collection from the other 1554 wreck also contains small cast iron balls of appropriate size for the versos she carried, and one verso was actually found loaded with a cast iron ball (Olds 1976). In relation to cast iron shot, it is interesting to note that they were already in use in 1554, whereas Peterson (1974:235–236) mentions that the lead balls with an iron core were replaced by cast iron balls in the late 1560s and 1570s.

Gun Powder

Samples of gun powder (*polvora;* Pontillo 1975:66) were recovered from several of the loaded breech chambers. The powder was prevented from spilling out by wooden plugs, 12 of which survived. The proportions of saltpeter, sulfur, and charcoal for gun powder varied considerably in the sixteenth century, according to Vigon (1947:45). Exhaustive analyses of these powder samples by spectrograph, neutron activation, and chemical analyses shed no light on the problem, however, after so many years underwater. The saltpeter had been completely leached away, and the trace of sulfur present could well be from the iron corrosion products. Only the charcoal remained. Vigon (1947:65) mentions that the powder charge should weigh about one-ninth the weight of the ball.

Other Arms

We know from the historic documents and by comparison with the collection from the other 1554 wreck (41 WY 3) that light crossbows were a part of the arms carried aboard these vessels. However, from this wreck (41 KN 10), the only evidence of their presence is the cast of an oxidized hook (Figure 36) or part of the claw frame which grabs the bowstring (Payne-Gallwey 1958:86) from a goat's foot lever, the cocking mechanism of the crossbow.

NAVIGATIONAL AIDS AND INSTRUMENTS

According to Palacio, whose work was published in 1587, the pilot's equipment should include a chart, astrolabe, cross-staff, quadrant, two

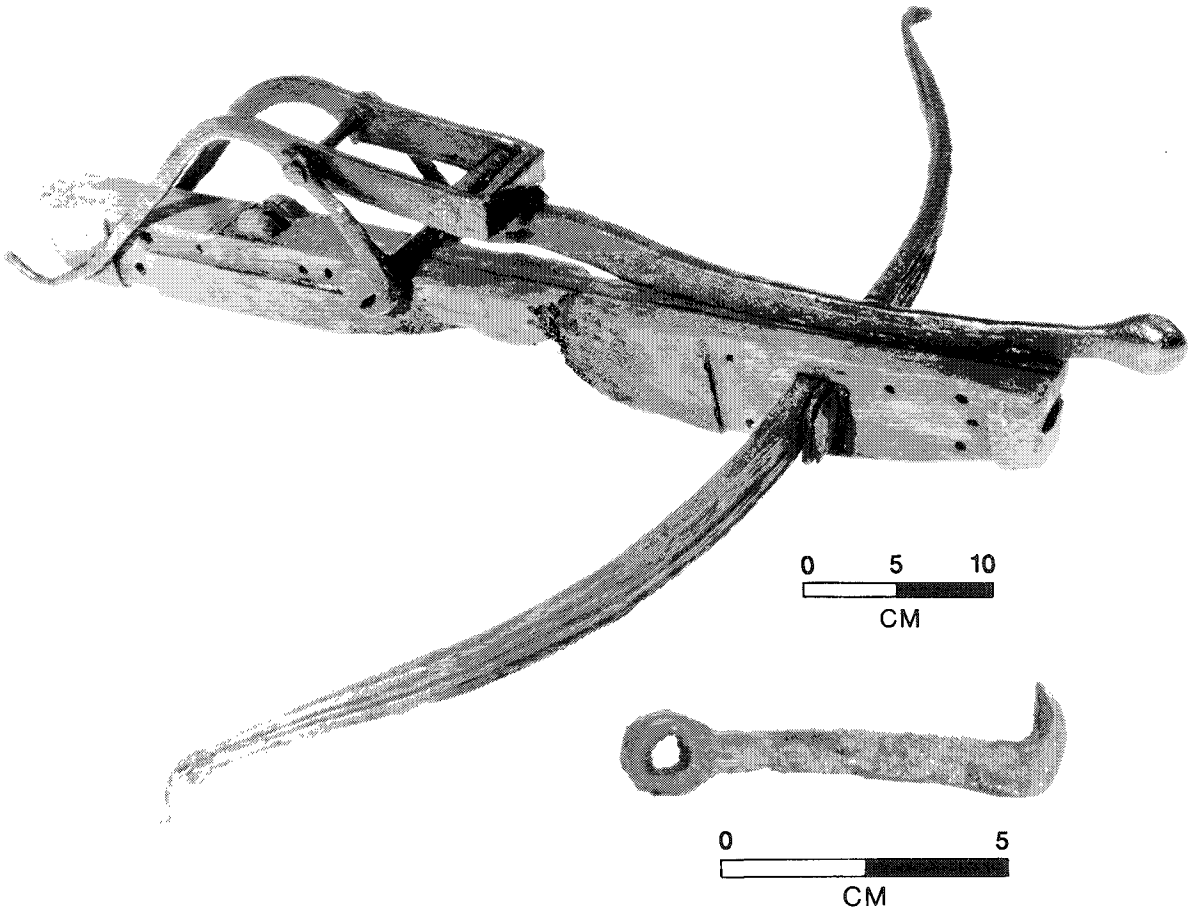


FIGURE 36. (Top) Crossbow and goat's foot lever, a cocking mechanism, from 41 WY 3 (No. 1510). (Bottom) Claw frame, a piece of a goat's foot lever, from 41 KN 10 (No. 107-13).

clocks, two pairs of sea-compasses, hour glasses, a copper latern, and a sounding line and lead (Bankston personal communication). Some traces of this tool kit were recovered from this site.

Brass Dividers

One of the most interesting artifacts recovered was one leg of a set of brass navigational dividers (Figure 37), perhaps bent and broken from the interlocking bifid ringed hinges and other leg during the wreck. This find closely parallels a complete specimen recovered by Martin (1975:Plate 14) from one of the 1588 Spanish Armada ships and one from a late-sixteenth-century wreck illustrated by Bass (1972:257, 269). The decoration on the rectangular (in cross section) upper portion of the dividers' leg is similar,

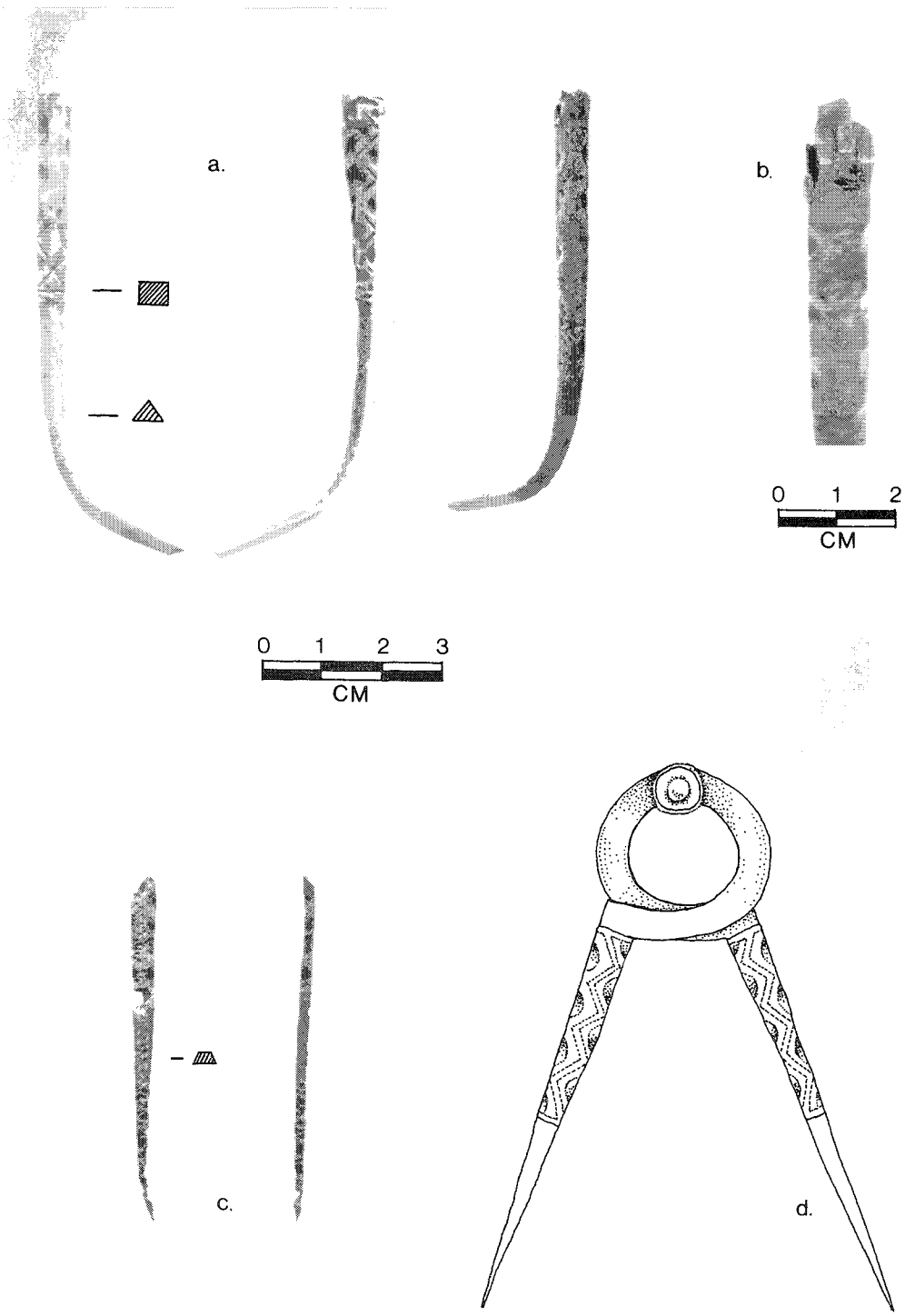


FIGURE 37. Navigational dividers.

a. No. 274. Front, side, and back views of one leg of a set of brass navigational dividers. On the front and side views, note the extra strip of metal soldered into place—most likely a repair—which partially obscures the decoration.

b. Enlarged oblique view of same leg, illustrating point of attachment for interlocking ring hinges at the top of this variety of dividers.

c. No. 280. Front and side views of a partial leg of another set of brass dividers.

d. Reconstruction of dividers.

although the roughly triangular (in cross section) undecorated portion of the leg extends about three-quarters of the length from the point in the 1588 specimen as compared to a little less than two-thirds of the length from the point in the 1554 example. Sténuit (1974:232–233) discusses specimens of similar dividers from the *Girona* (Spanish Armada 1588), the *Curaçao* (Dutch 1729), and illustrates a pair from the *Lostdorager* (Dutch 1653). He calls them "chart compasses" as in an early eighteenth-century marine dictionary. They are called "bow type" dividers by Price and Muckelroy (1974:264), who recovered a pair from the *Kennermerland* (Dutch 1664). Later, but essentially similar dividers, dating to about 1700 and made of steel, are illustrated in Brewington (1963:92, Plate XLV) and described as "one hand" dividers because they could be opened and used with one hand by squeezing the sides of the hinge rings at the top.

The second brass artifact is probably a piece of a different set of dividers or some similar instrument (Figure 37). Its more gracile form resembles a set of dividers from the wreck at Jutholmen, Sweden, illustrated by Ingelman-Sundberg (1976:Figure 3), unfortunately without a scale.

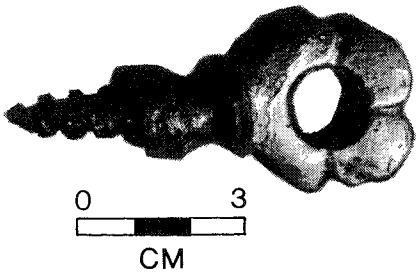
Brass Set Screw

The purpose of the brass set screw (Figure 38) is conjectural, but the fact that it is made of brass, a metal in great demand, leads to the belief that it must have been relatively important. One possible use would have been for securing the sliding cross pieces of the navigational instrument known as the cross-staff. A seventeenth-century work by Dudley (1646) illustrates a number of similar instruments with set screws securing sliding parts (Figures 39 and 40). Brewington (1963:6, Plate IV) illustrates and discusses such an instrument made in the mid-eighteenth century. It, too, possesses set screws on the cross pieces. The cross-staff was intended to measure the angle between a star or the sun and the horizon (as was the astrolabe) to ascertain latitude (Waters 1958:53–55). There are no astrolabes in the 41 KN 10 collection, but there are three very important examples from the 41 WY 3 collection (Figure 41). See Olds (1976) for a complete discussion of these most important instruments.

Sounding Weights

Two lead sounding weights (*sonda* or *sondalle;* Pontillo 1975:69) were recovered. Together with the three from the other wreck site (41 WY 3) they give an excellent sample of sixteenth-century sounding leads. They offer no surprises and confirm the often-expressed assertion that these tools remained essentially the same for several hundred years and in fact down to the present. This is illustrated by the inclusion of a specimen we recovered from a wreck dating to the mid-twentieth century (41 WY 4) (Arnold 1976)

FIGURE 38. Brass set screw, No. 1693. Recovered by the Underwater Institute during test excavations at 41 KN 10.



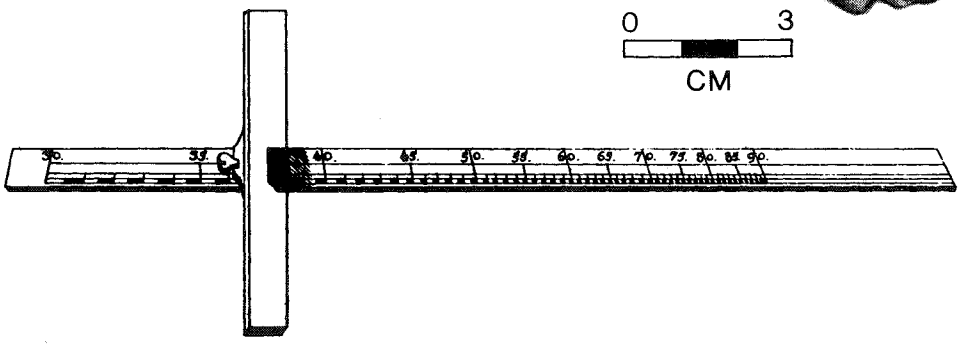


FIGURE 39. Dudley's cross staff illustration—*Balestriglia de Marinari.* Note the set screw which secures the cross piece. Reproduced by the kind permission of the Humanities Research Center Library, The University of Texas at Austin, Austin, Texas.

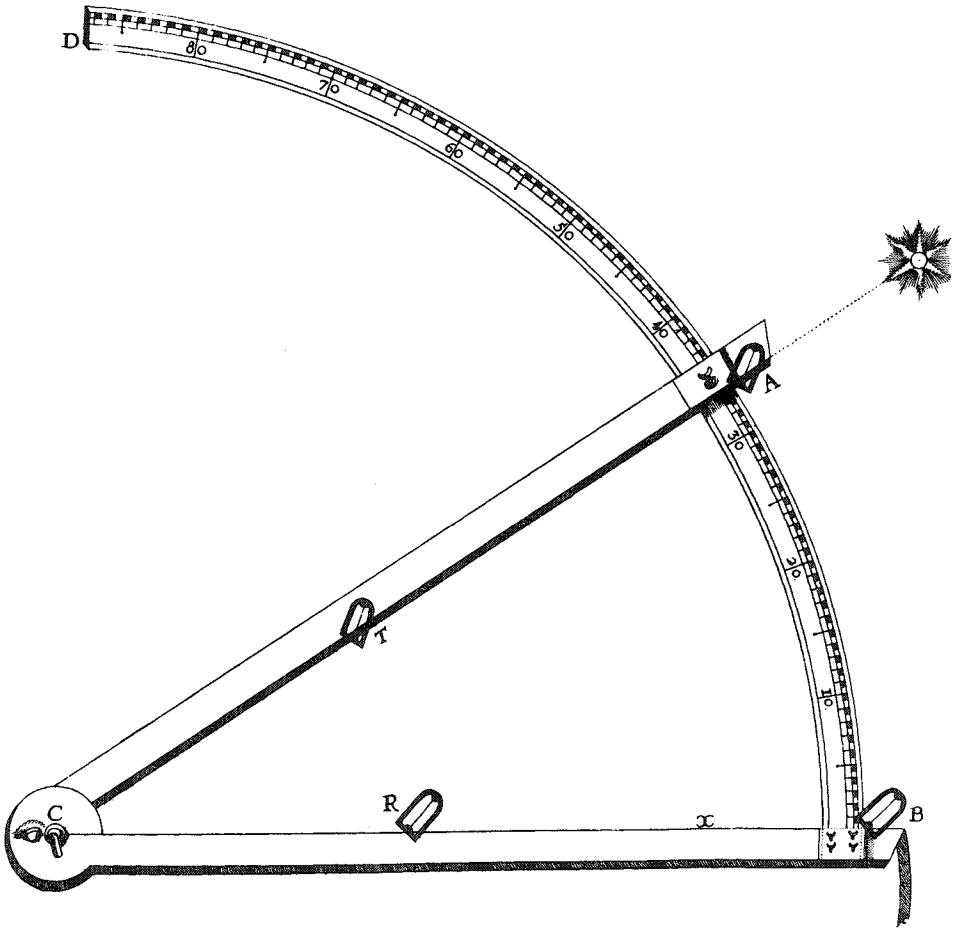


FIGURE 40. Dudley's quadrant illustration. Note the set screw which secures the upper sighting arm. Reproduced by the kind permission of the Humanities Research Center Library, The University of Texas at Austin, Austin, Texas.

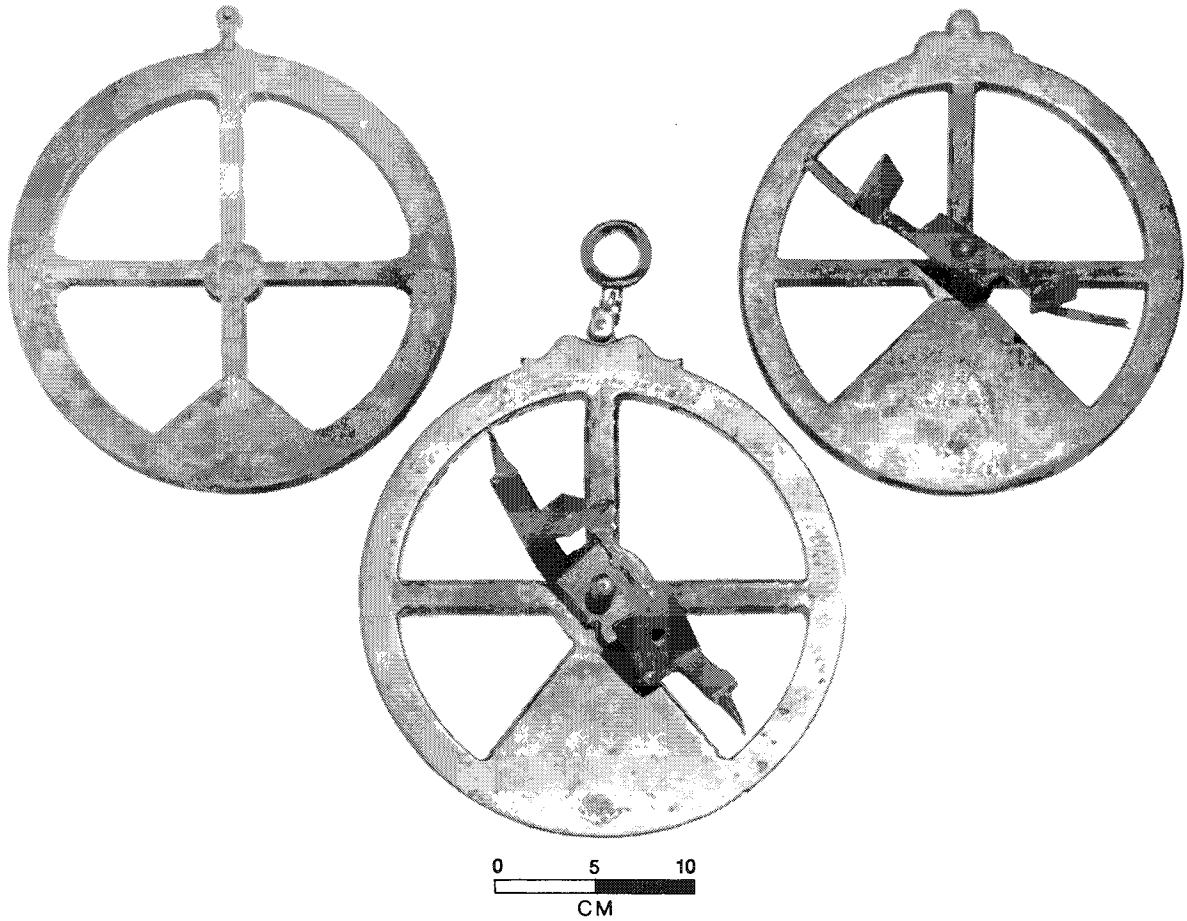


FIGURE 41. Astrolabes from 41 WY 3. No. 1446 (left) dated 1550, No. 1449 (center) dated 1545, No. 1448 (right) dated 1550.

in Figure 42. Concerning these weights, Manwayring (1644:34, 97) is most informative:

> *Deep-Sea-Lead.* Is the Lead which is hung at the deep-ſea line, to ſinck it downe; the waight whereof is commonly 14 pounds; this hath ſome hard white tallow laid upon the lower end of it, which brings up the ground, and ſo by the differences of the ground, we know where and upon what coaſt we are: But in Ozie ground, we uſe a white woolen cloth upon the lead, with a little tallow, without which cloth, the Ozie would not stick unto the tallow.
>
> *Sounding-lead.* Is as the deep-ſea-lead; only it is commonly but ſeven pound weight, and about 12 inches long.

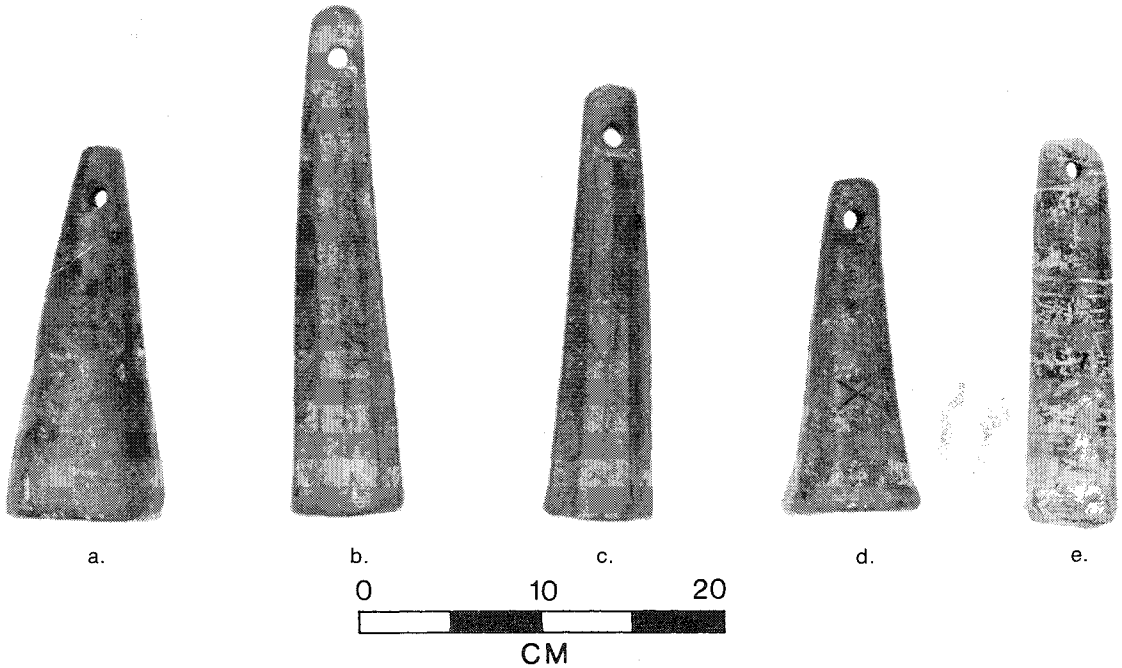


FIGURE 42. Sounding leads from 41 KN 10, 41 WY 3, and 41 WY 4. 41 WY 4 is an early to mid-twentieth century wreck, but the changes in form have been minor since the sixteenth century.
a. No. 1636 (41 WY 3).
b. No. 1637 (41 WY 3).
c. No. 1509 (41 WY 3).
d. No. 2 (41 KN 10).
e. No. 333 (41 WY 4).

Water (1958:19) informs us that the 7-lb lead was used in shoal waters of 20 fathoms or less.

PROVISIONS, COOKING GEAR, AND ASSOCIATED EQUIPMENT

Some indication of the rations carried on board is provided by the various bone fragments found preserved by corrosion products in various encrustations. These include those of pig, fish, and turtle. Some of the meat may have been stored on the hoof as the presence of part of a horn suggests. This was not an uncommon practice in the prerefrigeration days of the age of sail. On the *Santa María de Yciar* (Ojos 1554) the provisions for 67 passengers and crew attested to just before departure from San Juan de Ulúa amounted to 50 *quintales* (5000 lb or 11,111 kg) of *bizcocho* (hardtack or ship's biscuit), two barrels of meat, 50 barrels of water, beans, olive oil, and vinegar.

Cooking aboard wooden sailing ships was always a tricky business since

the ships were extremely vulnerable to fire. A brick fireplace or oven arrangement was usually provided for preparation of hot meals, and three brick fragments found were probably part of this facility.

Replenishing supplies at sea was possible, and contemporary historic documents (Torre 1973) confirm the practice of fishing as a popular pastime on voyages to the New World. Fresh fish would make a very welcome change from salt meat. Six small lead weights (Figure 43) of appropriate sizes for fishing were recovered. An alternate function for the weights as plumb bobs for such instruments as gunners' quadrants is also a possibility.

Wrought iron barrel hoops (*arcos de hierro*) (Figure 44) represent the only remains of the wooden kegs and barrels undoubtedly in use to store food and drink. They were perhaps the most ubiquitous artifact at the site, usually fragmentary, badly corroded, or completely oxidized with only a mold in the encrustation remaining. There were 147 fragments recovered and only two complete specimens. An idea of what the barrels were like is available from the historical documents (Ojos 1554). One shipment of sugar was contained in 13 barrels, each with ten hoops and each containing 485 *panes* or cone-shaped lumps.

Glass and ceramic containers and serving and eating vessels were in use aboard this ship. Four glass sherds and a bottle base (possibly intrusive) were recovered. Potsherds were more numerous, comprising 110 plain, 50 glazed, and two Cologne ware sherds (Figure 45). Examples of the oak leaf and acorn motif nearly identical to these from sixteenth-century Cologne ware are illustrated by Von Gisela Reineking-Von Bock (1976:199–208). The glazed sherds include some very exciting examples of early majolica (Figure 45). Many of the plain sherds were from olive jars. One sherd (No. 52–2) has the distinctive green glaze mentioned by Goggin (1964:262) as characteristic of the early style olive jar. The appropriate nature of their name, at least in some instances, is indicated by the presence of four olive pits in the collection, although other commodities were stored in such containers. Possibilities include nuts—a few nut shell fragments were found—and even grains—several unidentified seeds were also present. One sherd (No. 129–20) is possibly aboriginal in origin.

Martin (1975:105–106) reports several dozen pot sherds from the *Santa María de la Rosa* (1588) mostly small "rather poorly fired red earthenware with a gaudy green or brown internal glaze." Peterson (1972:272) illustrates some majolica from the *San Antonio* (1621) with a "floral" pattern at the rim rather similar to our blue-on-white examples. We received expert advice on the specimens with simple blue lines on white. The glaze is stanniferous over a light paste, and the encircling lines are cobalt. This appears to have been a common low-grade majolica style, probably made in Seville from the late fifteenth into the early seventeenth centuries (Figure 46) (Lister and Lister, personal communication). The polychrome examples have a design painted in blue, green, and orange, applied in that order.

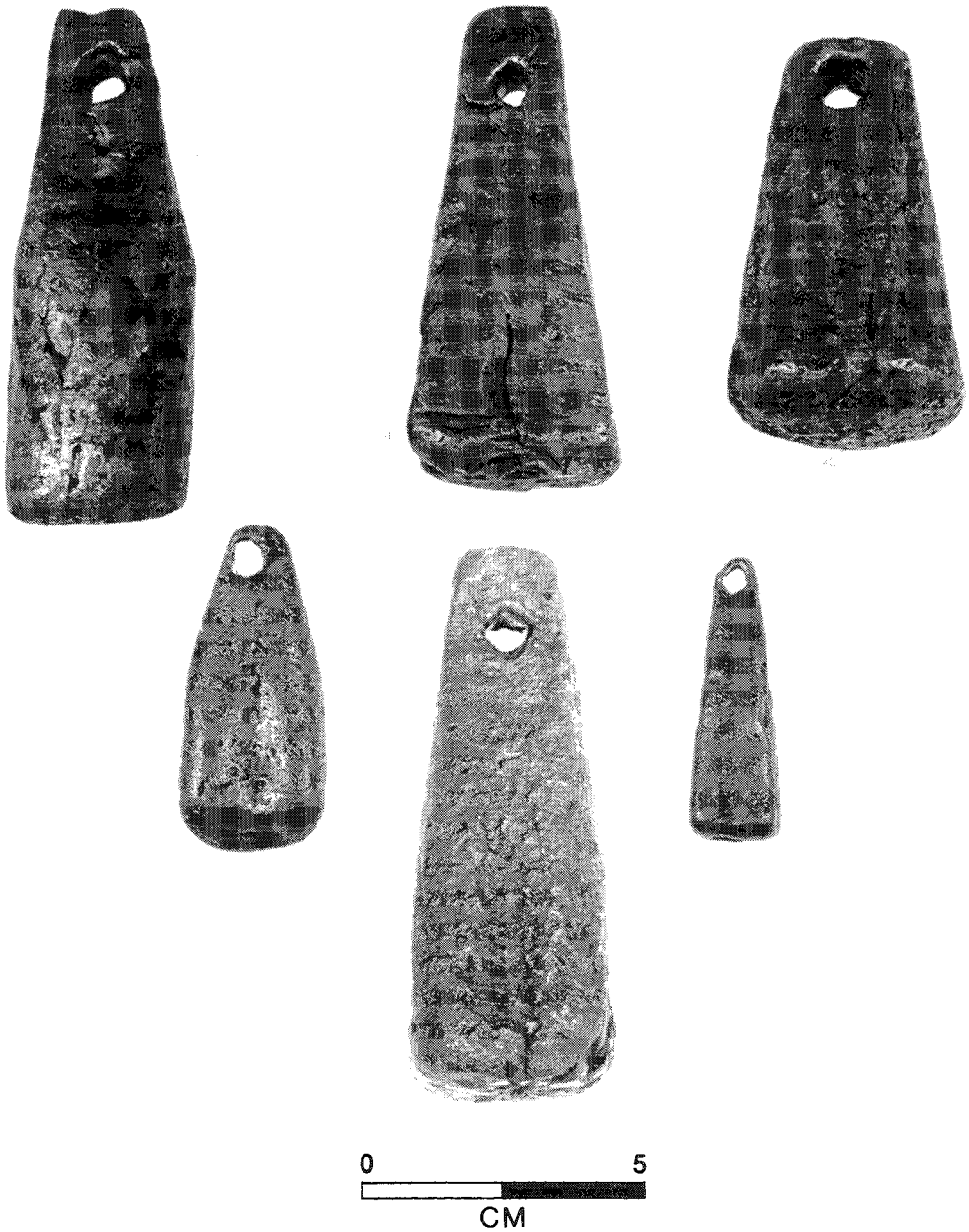


FIGURE 43. Small lead weights. Upper row left to right No. 122-3, No. 136, No. 173, bottom row No. 124, No. 268, No. 130.

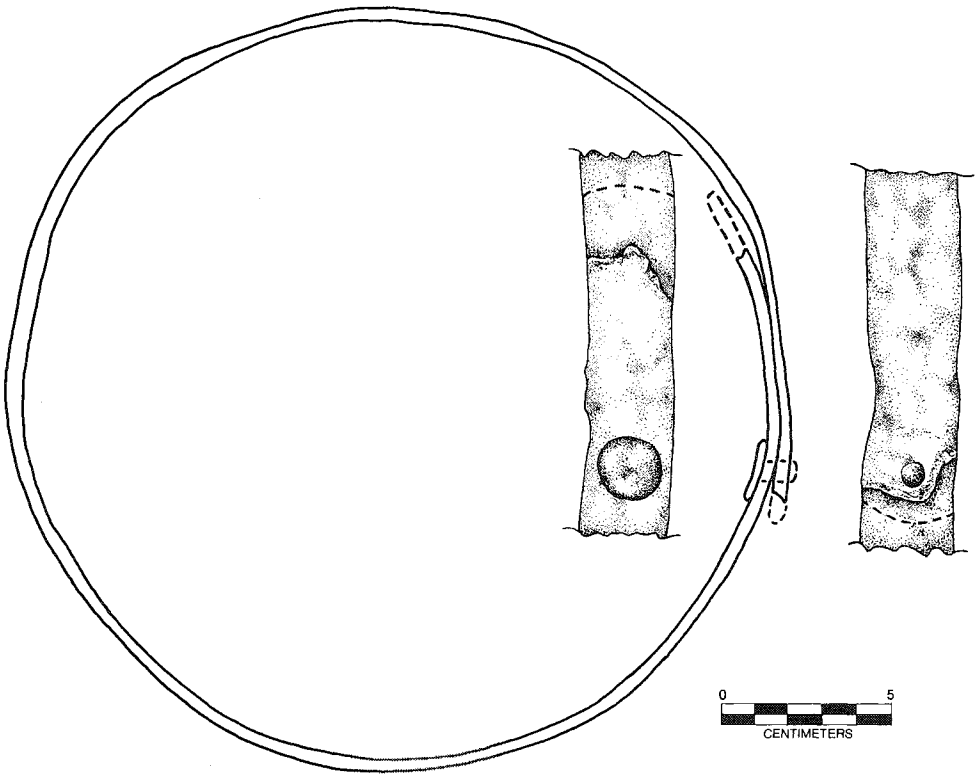


FIGURE 44. No. 216. This iron barrel hoop had been completely oxidized leaving only a mold in the encrustation. This mold was injected with a latex casting compound to reveal the details illustrated.

MISCELLANEOUS OBJECTS

Lead was used extensively aboard this ship. Two nearly identical small lead artifacts (No. 5–88 and No 184) have the look of implements about them. Aside from numerous slivers and scraps, the most important lead artifacts are the lead straps (Figure 47). All have closely placed square nail holes, and some have the impression of woven fabric or wood grain on the opposite side from that of the nail heads. These objects were frequently found with one side encrusted (that of the nail heads) and almost perfectly clean on the other side. This is a result of the corrosion of the iron nail heads, which undoubtedly began before the wreck and by this time has totally destroyed the nail heads. A natural mold of one of these tacks (No. 79–33) yielded measurements of 2.7 cm long, .3 cm shank cross section and 2.5 cm for head diameter. Finding two of these straps *in situ* on the keel and with a gudgeon (see Figures 24 and 29) confirmed the supposition that they were used in connection with the caulking of the ship. The keel section consisted

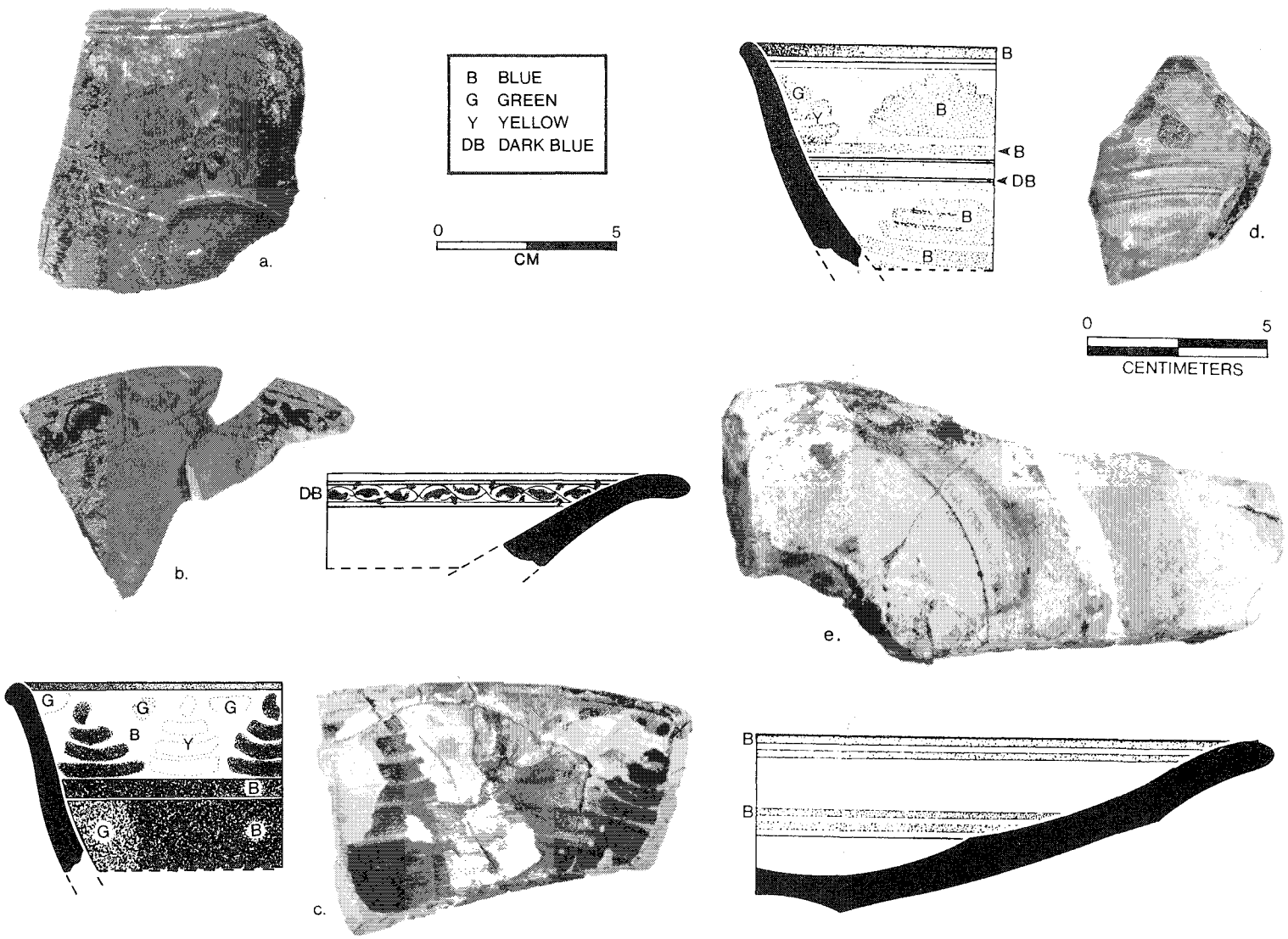


FIGURE 45. Cologne ware and majolica pottery sherds.
a. No. 213-2 cologne ware. Note the oak leaf and acorn design (color—yellowish brown 10 YR 5/6).
b. No. 200-1 majolica blue on white plate, diameter 19 centimeters (colors—blue 2.5 PB 5/6).
c. No. 129-33 majolica polychrome (colors—orange 10 YR 7/10, blue 5 PB 4/8, green 7.5 G 7/6).
d. No. 129-32 majolica polychrome (colors—orange 10 YR 6/10, pale blue 7.5 B 7/4, gray blue 10 B 4/4, green 2.5 G 6/8).
e. No. 129-36 blue on white plate, diameter 27.5 cm (color—blue 10 B 6/6). Paste colors vary from 10 YR 9/1 to 2.5 YR 7/6.
All colors are designated in Munsell notation. Munsell Book of Color, Neighboring Hues Edition, Matte Finish Collection, 1970 by the Munsell Color Company, Inc.

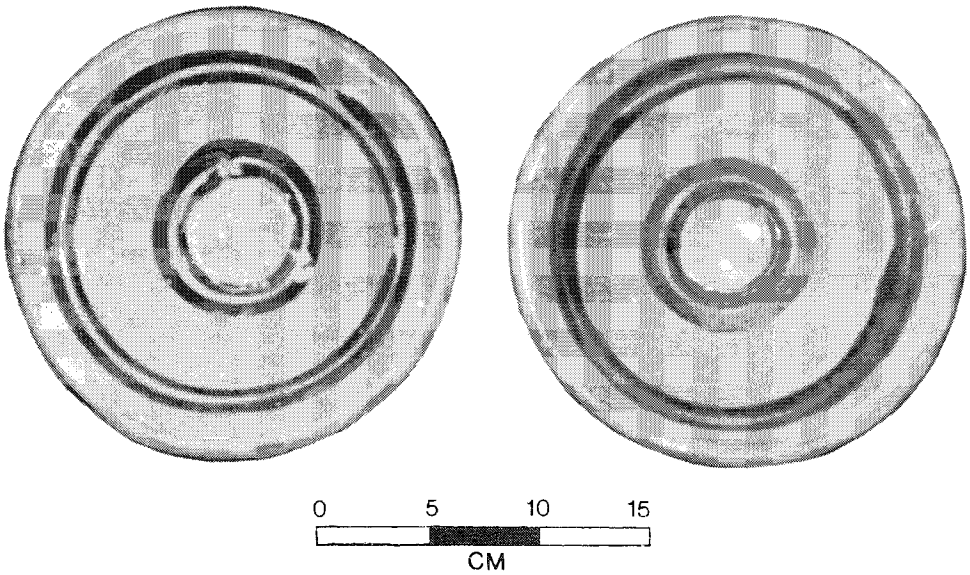


FIGURE 46. Blue on white majolica vessels from Spain. Photo reproduced courtesy of Robert and Florence Lister and the Museo de Bellas Artes.

of planked dead wood. The small nails were hammered through the lead into tightly "horsed" caulking in the seam, not into the wood. Their purpose in this case was probably to stop a slow leak which developed through the planked dead wood. The tack itself was termed "*estoperol*" in contempory Spanish. The word is defined as a "short round-headed nail" by Pontillo (1975:60), who also provides a citation from Minshev published in 1617, which describes these as "Nailes of yron to stop or fasten the tow in caulking of shippes [Pontillo 1975:268]." For comparison, seam ribbands of wood,

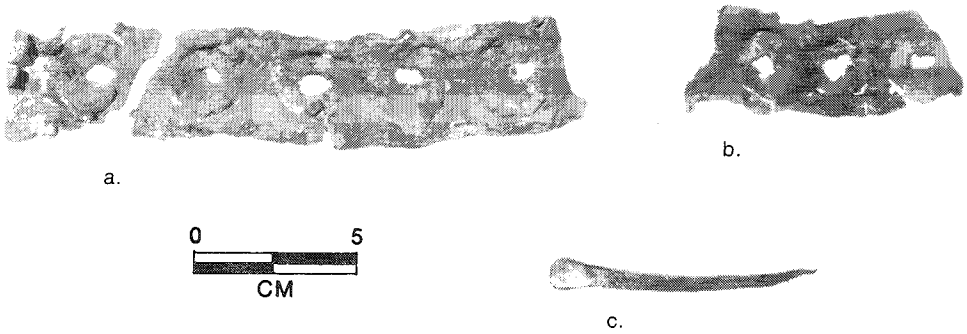


FIGURE 47. Miscellaneous lead objects.
a. No. 283 lead strap.
b. No. 279 lead strap.
c. No. 5-88 lead implement.

used in an effort to keep the Woolwich ship tight, are reported by Salisbury (1961:85–87). The ship dates to the first half of the sixteenth century and is assumed to be of English construction. Salisbury (Salisbury 1961:86–87) states,

> Seam ribbands of some kind may have been used at various dates in endeavour to keep an old ship tight. When carvel building was first introduced in the northern countries, however, the art of caulking the seams must have presented novel difficulties until the shipwrights learnt exactly what space should be left between the planks. (In the Italian arsenals the caulkers put on the planking and caulked the seams.) Several devices must have been tried, and the wreck of the Swedish *Elefanten* built in 1554 has battens between the frame timbers in the wake of the seams. These battens acted as stops for the caulking, but the seam battens of the Woolwich ship were probably meant to keep the caulking in the seams. These were caulked with pitch and oakum.

Other miscellaneous iron objects include a nondescript wedge-shaped piece and six examples of bar stock. There were also four small fragments of brass and one small S-shaped piece of drawn wire.

Examples of the unwanted shipboard pests, which no doubt were rampant, are provided by eight cockroach exoskeltons and one egg case, a detailed analysis of which can be found in Appendix H.

Ballast stones (*lastre* or *hierro;* Pontillo 1975:62, 63) in thousands of sizes were recovered in encrustations and some individually for geological study. Pontillo (1975:305) indicates that iron was used along with stone for ballast, thus the term *hierro*—and this site provides an excellent example of an early instance of the practice in the broken anchors stored as ballast. According to Oppenheim (1961:127) a large quantity of rock or gravel ballast was necessary in these early sailing vessels. Since it was seldom changed and became soaked with bilgewater and the general waste of the ship, it "was a source of injury to the vessel and of danger to the health" of the crew. It also prevented inspection of the wood and ironwork beneath.

OTHER PERISHABLE EQUIPMENT, SUPPLIES, AND CARGO

A few evidences of the supplies and provisions carried on board this vessel were preserved by chance by the corrosion products which formed around iron artifacts. These include bones, nut shells, horn, seeds, and olive pits (Figure 48).

Many of the perishable items of equipment and supplies were not recovered at this site, owing to the adverse conditions for preservation. However, we do know something of the items carried aboard from the cargo register for one of the 1554 wrecks, the *Santa María de Yciar.* A summary of the register is presented in Appendix A. Two other documents retrieved from

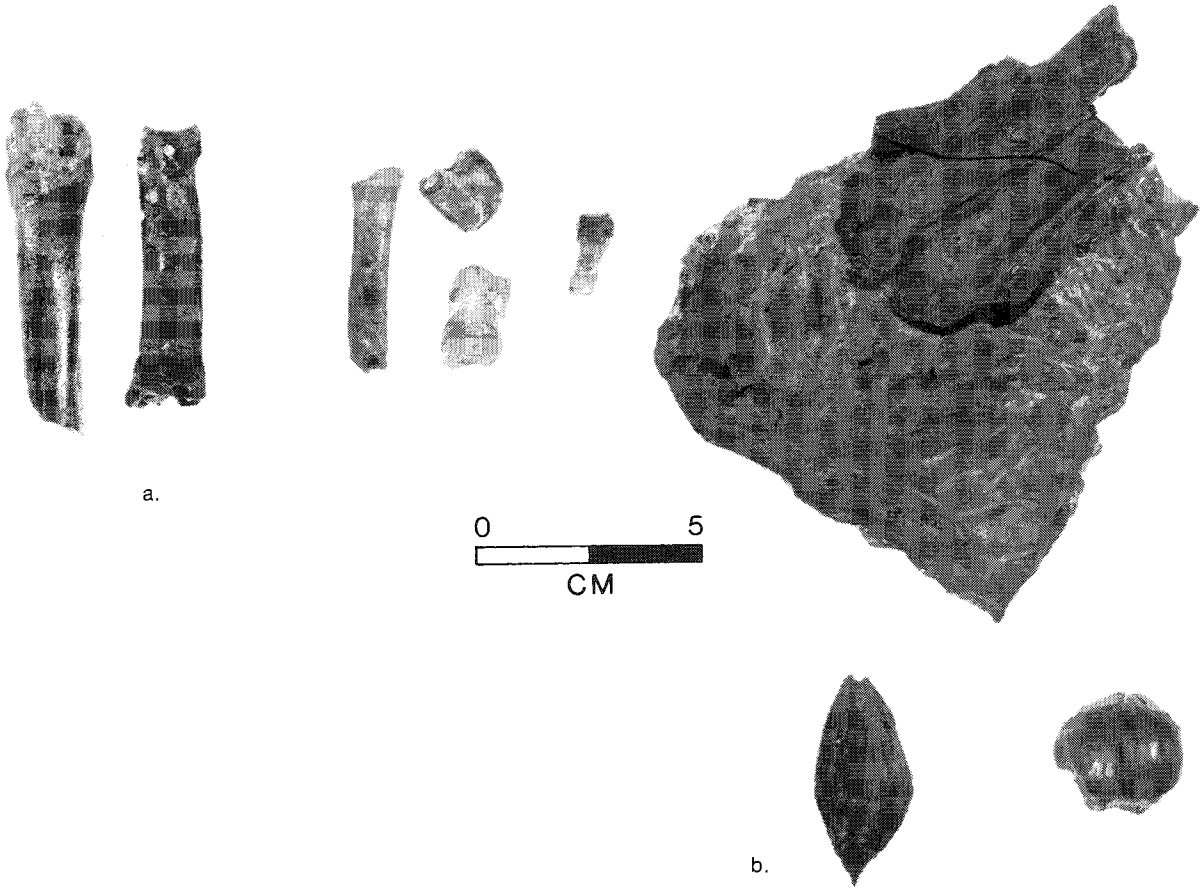


FIGURE 48. Remains of provisions. (Above)—left: No. 129-4; center: No. 129-11; right: No. 81-41, bones of swine. (Opposite)—left: No. 81-14, olive pit; right: No. 128-2, nut shell.

the Spanish archives also help to throw considerable light on this aspect of the ship's equipment. One, a group of letters, covers the effort to dispatch an armada to the New World and gives an amusing perspective of the administrative problems involved in addition to data on provisions and salaries. The other is a fascinating listing of the medical supplies and equipment provided for an armada on another occasion. The document is composed of two lists of items, apparently acquired and inspected on two successive days.

The majority of the records recovered from the Spanish archives by our researchers come from the files of bureaucrats. This particular document (Casa de Contratación 1567) is a summary of the critical data relating to an armada going to Tierra Firma in 1550. The first half of the document

contains the critical paragraphs of nine letters from the king to the Board of Trade for the Indies regarding the dispatch of the fleet. The second half of the document contains an accounting of the cost of provisions, salaries, and vessel leases. The replies from the Board of Trade to the king are not reproduced. However, a sufficient recap is presented in the king's letters so that both sides of the interchange are apparent. It would appear from the point of view of these documents that the trials and vicissitudes of dispatching the fleet were every bit as great for the bureaucrats involved as the actual dangers of the passage to and from the New World were to the personnel of the ships.

In the first letter, dated November 2, 1549, the Board of Trade was commanded to prepare the artillery, weapons, and ammunition and to purchase all the provisions and supplies needed for eight *naos* and caravels to travel to Tierra Firme. The fleet was to be composed of three *naos* of from 200 to 300 tons burden, two caravels of the best tonnage possible and the three ships which were currently at sea under the command of Pedro de las Roelas. De las Roelas's command was composed of one *nao* and two caravels. The officials were commanded to accomplish all this "with the greatest diligence, secrecy and dissimulation," making it appear that the preparations were intended to increase the activity against the corsairs. Another interesting statement directs that the artillery be "prepared and mounted (if this has not already been done) so that it can be used at sea" which indicates that there were different carriages for artillery to be used at sea and on land. In closing, the fleet was ordered to leave by the end of March, 1550.

On December 6, 1549, the king wrote again to see that supplies were purchased for a 10-month round trip. The composition of the fleet had also been changed to five *naos* and six caravels in the interim. As in all these letters, the king stressed the need for haste. Some of the discussion about the composition of the fleet was recapped and changed for a third time,

> You can say that you agree that as we commanded five ships (five *naos*) and six caravels go, but suggest that one ship of from 200–250 tons burden instead of the two caravels. You maintain that instead of these two caravels, two seagoing ships of from 100 to 120 tons each should go because the caravels for our armada are like those which the king of Portugal orders made for his armada. They are large and strong. The best are chosen for their use in trading merchandise. Yet no matter how good they are they cannot deal with bronze artillery but with only small cannons. Furthermore for such a long trip the *naos* are much better to carry people as well as supplies than are the caravels. Also this will promote the security of the very goals in question. For fighting purposes the *naos* are better if one meets with other ships as you point out. Accordingly instead of the

> two caravels get a *nao* of 200–250 tons of burden ready and instead of the other two caravels, take two other *naos* of from 100 to 120 tons of burden as you deem fit.

On January 28, 1550, another letter was sent to the officials commenting on the progress of preparations. There were eight *naos* and one caravel which were being readied with one caravel to be added later if possible. All the ships were being careened, and the king specified that no salary would be earned until this was completed. He also mentioned that 200 quintals of powder for bronze cannons and 30 quintals of powder for *arcabuces* had been requisitioned from Malaga for the fleet.

The appointment of Sancho de Biedma as captain-general of the armada was announced in a letter of March 11, 1550. The king further exhorted the officials to get the armada off on time and to keep him informed but to use their best judgment. In other words, they were to get the fleet off on time but if anything went wrong, it would be their necks.

On March 19, there was a letter indicating that everyone realized the fleet would not get off in March, and the fleet would leave by the end of April. Apparently there was trouble finding sufficient crew for the fleet, and on March 29, the king wrote the official and told them to hurry and get the sailors and gunners together but without displeasing the masters or anyone else. On April 27, there was a letter stating that the ships were ready by mid-April and sailed to Sanlúcar and were ready to leave by the end of April. There was also a mention that the artillerymen for the fleet had been brought from Lisbon. The letter of May 2 indicated that the armada was held up because the contingent of 300 soldiers recruited in Úbeda, Baeza, and the vicinity were waiting for traveling money to come to Sanlúcar. The king pointed out that traveling money had never been authorized and would not be authorized on this occasion for this purpose. The salary of the soldiers did not begin until they embarked from Sanlúcar. They would, however, be provided with boats on which to travel to Sanlúcar and something for maintenance along the river. This seems to be a contradiction or at least partial compromise. The officials were not to wait for the soldiers from Úbeda, however, and if they were not there on time, they were to recruit from those available in Sanlúcar of whom there were sufficient to choose from, and again they were to get the fleet off as soon as possible. The officials were to provide provisions for 1250 people, including soldiers, sailors, artillerymen, and other officials for a 9-month round trip, which, according to their calculations, was the period of time required if the gold and silver was ready and waiting in Nombre de Dios. The appointment of Hernando Blas was approved as *almirante,* or second in command. The officials suggested that his salary should be 150,000 maravedís, which was one and a half times that of a captain, and this was approved. Apparently there was trouble recruiting pilots for the ships because there was an ordinance in force

which specified the pilot's salary to be 115 ducats for the round trip, which was apparently quite out of date due to inflation, and adjustments had been made for past armadas. On merchant ships, the pilots got about another 200 ducats through subrosa arrangements, and the officials were having trouble finding pilots since they thought they would be paid only the rate required by law; many of them had left town or feigned sickness. The king gave approval for an increase in pay to a reasonable and moderate level for the pilots.

On May 22, the king acknowledged a letter from the officials informing him that the caravel sent by the king of Portugal had arrived with sailors and supplies for the armada. Apparently the king of Portugal had forgotten to tell the sailors that they were going to be going to the New World, and when they learned of the situation, they were very unhappy. The king gave approval that they be given some assistance to persuade them to go along—in other words, some money. All the ships involved were also listed by name, captain, and tonnage. The *Sancta Barbola,* a *nao,* was the capitana of the armada and was of 400-ton burden. The *San Miguel,* also a *nao,* was to serve as the *almiranta,* and was of 350-ton burden. The other six *naos* were of 450, 350, 350, 300, 190, and 170 tons. The two caravels were of 110 and 96 tons burden. Apparently the armada left sometime around the end of May.

The second half of the document deals with an accounting of the cost of preparing the armada. The entries listed in what follows are not subdivided by type of purchase or reason for expenditure, but apparently by periods of time or individual purchasing trips by the various factors involved in preparing the armada.

6,626,635 maravedís:	supplies and weapons, repair of the ships, items to make incendiary devices and freight charges, mail, ballast, medicines and other items of provisions
536,244 maravedís:	assistance to artillerymen and sailors from Lisbon and fifers and drummers
481,369 maravedís:	meat and fish, pay of pilots and crews, flour, sail canvas, and other provisions
104,976 maravedís:	assistance for crew from Lisbon
15,442 maravedís:	certain cartage and wages
15,457 maravedís:	soldiers, freight charges, meat
94,709 maravedís:	sardines, anchovy, vinegar, almonds, and other provisions—spent in Malaga
340,554 maravedís:	salt pork and garlic and other provisions from Ronda
6,000 maravedís:	agent for purchasing salt pork and cheeses
1,041,975 maravedís:	hard tack, wine and other provisions and for weapons and freight charges—at Villa of Port of Santa Maria
1,794,739 maravedís:	wines and other provisions bought in Xerez
42,466 maravedís:	shields and canvas to make sacks for them from Cadiz
2,618 maravedís:	freight for wine from Xerez to Horcadas where the armada was waiting

152,458 maravedís:	hardtack, freight and renting sacks to take it to the ships—in Villa de Puerto Real
60,625 maravedís:	lima beans and chickpeas bought in Villa of Bejer
1,025 maravedís:	three quintals of hardtack bought in Santa Maria
11,789 maravedís:	cartage, sacks, repairing kegs, wages, etc., to send hardtack and wine
18,750 maravedís:	purchasing agent's salary (Juan Ambran)
12,064 maravedís:	baked bread for the soldiers who threatened to go looking for some themselves, bought in Xerez
63,883 maravedís:	tar, fish, tallow bought in Cadiz; a refund of 2,710 maravedis was returned due to rocks and bricks being found in the tar bought from Francisco Ferrin, an Englishman
3,217 maravedís:	for powder from Malaga received in Cadiz and for reinforcing barrels
48,558 maravedís:	spent in Cadiz, Santa Maria, and San Lucar for tar, burlap, and boards and freight charges
30,767 maravedís:	expenses of purchaser for travel to Cadiz, freight charges, boat fares, etc.
651,736 maravedís:	salary for artillery sergeants and men
2,080,381 maravedís:	for masters, officials, sailors, cabin boys, pages, and other ship personnel
2,479,462 maravedís:	salary of captain-general, other captains, gentlemen, platoon corporals, soldiers, drummers, fifers, and other war personnel
2,427,010 maravedís:	payment of the rates for the naos and caravels from the time they embarked to the end of May and two months advanced pay for June and July
302,625 maravedís:	pay for "pilots" as salary for their term of service in the said armada
19,434,927 maravedís:	TOTAL
12,808,954 maravedís:	December 31, 1552—to complete the payment of the captain-general, captains, soldiers, and sailors for expenses incurred during the trip for supplies, etc. Armada returned in 1551
1,831,947 maravedís:	March–December 31, 1552—for lease of ships. This does not complete the lease fees for some ships since their accountings have not yet been verified.

The documents listing the medical supplies for the armada of Captain-General Diego López de las Roelas (Roelas 1549) are quoted in full. As well as providing an idea of what were thought to be important medical supplies, these give valuable evidence for economic history since the price of the items is also listed.

At the time of the Conquest, Aztec knowledge and "employment of medicinal herbs amazed the Spaniards, who readily acknowledged Indian superiority in this field [Schendel 1968:15]." Spanish medical practice was strongly influenced by the ancient Arabic works on the subject, and this knowledge was the most advanced in Europe by the sixteenth century

(Schendel 1968:85). In the early post-Conquest period, a fusion of the copious knowledge and pseudoscience from the New and Old Worlds took place. There was soon a thriving export trade in Mexican plants and remedies, and, for the next 250 years, a large proportion of the new medical therapies in Europe was based on these new medicines (Schendel 1968:87–88). In the lists that follow, a few items are readily identifiable as ingredients introduced from Aztec medicine: wax, egg white, egg yolk, scorpion oil, plantain water, honey, resins, and turpentine (Schendel 1968:62–80). Others are self-apparent; Indian electuary and cochineal pills, for example. The *Santa María de Yciar*'s register (Ojos 1554) indicates two medicinal substances which were being shipped to Spain: tacamahaca, a type of gum or resin, and sarsaparilla which the Aztecs used in treating respiratory diseases (Ojos 1554:66). Large quantities of cochineal were also being shipped on the *Santa María de Yciar*, in all probability for its properties as a dye, but perhaps partly for medicinal uses.

Copy of a list of the medicines provided for the armada of Captain General Diego López de las Roelas. Seville, September 6, 1549. (Seville, AGI, Contaduría 292)

Medicines consigned to the officials of the armada at the end of December. Diego López de las Roelas

THE MEDICINES WHICH I HAVE FOR HIS MAJESTY'S ARMADA TOGETHER WITH OTHER THINGS WHICH I HAVE PURCHASED FOR ITS ROYAL SERVICE ARE THE FOLLOWING:

[Medicines]	[Amounts]	[Value in maravedís]
Cana fistula	12 pounds	1,000
Agaric	1 ounce	204
Rhubarb	2 ounces	750
Aloes from Levante	4 ounces	136
Turpeth mineral from Levante	2 ounces	272
Scammony	4 ounces	544
Rose essence electuary in opiate form	4 pounds	460
Rose essence electuary in salve form	1 pound	340
Dia cathalicon	6 pounds	1,836
Dia prunis laxative	4 pounds	1,300
Dia prunis simple	6 pounds	1,125
Indian electuary	2½ pounds	935
Dia phenicon	5 pounds	875
Confeccion hamech	4 pounds	3,264
Hiera pigra	8 pounds	1,087
Benedicta	4 pounds	750
Philomo Romano	1½ pounds	561
Rose ointment	9½ pounds	1,938
Marciaton ointment	1 pound 2 ounces	229
Agrippa ointment	4 pounds	340
Oppilative ointment	3 pounds	255

[Medicines]	[Amounts]	[Value in maravedís]
Sandalwood ointment	1 pound	187
Dialthea ointment	1½ pounds	159
Basalt ointment [*Unguento basalico*]	10 pounds	600
Unguento apostoloza	10 pounds	1,530
	I mean 9 pounds.	
Turpentine	19½ pounds	380
		23,052
Egyptian ointment	5 pounds	300
Gold ointment	1 pound	136
Unguento de minio	11 pounds	705
White ointment	14 pounds	840
Lead ointment	5½ pounds	561
Hysopo humido	6 pounds	408
Diaquiton mayor	16 pounds	960
Dia Palma	12 pounds	760
Emplasto de meliloto	6 pounds	2,040
Emplasto de oxicrocio	6 pounds	2,856
Emplasto de centaurea	3 pounds	515
	less 4 ounces	
Emplasto de geminio	2 pounds	204
Emplasto de fily zacharie	2 pounds	500
Emplasto de estomaticon	1 pound	340
Powdered *dia margariton ff°*	2 ounces	272
Powdered *dia Rhodon*	2 ounces	238
Powdered *triasandalos*	2 ounces	204
Powdered *aromatico rosado*	2 ounces	340
Powdered *dia zimino*	2 ounces	136
Powdered contrasim de mesue	3 ounces	714
Trociscos de Harabe	2 ounces	204
Trociscos de terra sigillata	1 ounce	119
Powdered *restrictibos*	12 ounces	300
Powders from Juannes de Vigo	8 ounces	1,088
Sief albuz rasis	1 ounce	102
Aggregatibas pills	4 ounces	680
Alsaieret pills	4 ounces	408
Aureas pills	4 ounces	476
Sumoterre pills	4 ounces	544
Cochias pills	4 ounces	544
Rasis pills	4 ounces	272
Azucar rosado	2 pounds	1,125
Ox tongue conserve	4 pounds	476
Borraccis conserve	6 pounds	714
Rose syrup	21½ pounds	1,025
Rose honey	20 pounds	1,400
Simple *Corpimel*	12½ pounds	637
Syrup from Granada	22 pounds	1,125
Syrup [*jarabe*] *acetoso*	22 pounds	1,122
Syrup *biolado*	22 pounds	1,122

[Medicines]	[Amounts]	[Value in maravedís]
Syrup of *culantro*	25 pounds	1,275
Syrup of quince	14½ pounds	739
Brandy [*Agua ardiente*]	6 pounds	206
Agua fuerte	10½ pounds	178
Rose water	7½ azumbres	1,020
Orange blossom water [*Agua de hazar*]	5½ azumbres	561
Chicory water	11 azumbres	374
Plantain water	8 azumbres	408
Collirio de lanfranco	5½ azumbres	748
Agua de borracas	11 azumbres	374
Rose head water	2 azumbres	204
Agua de Ynoxo	11 azumbres	474
Rose oil	19 pounds	969
Camomile oil	8 pounds	320
Dill oil	8 pounds	320
Mirto oil	10 pounds	400
Quince oil	9 pounds	360
Oil of *lombrizes*	7 pounds 4 ounces	290
Violet oil	8 pounds	544
Bitter almond oil	3 pounds 4 ounces	165
Scorpion oil	2 pounds less 8 ounces	179
Roses	2 pounds	272
Violets	1½ pounds	204
Camomile blossoms	1 pound	51
Senna	½ pound	60
Epithem	1 pound	102
Saffron seed	1 pound	60
Pomegranate	1 pound	136
Myrtle seed	2 pounds	60
Wire	2 pounds	30
Candenillo	1 pound	144
Bolo armenico	2 pounds	34
Terra siguillata efeta	1 ounce	34
Seed of *ynojo*	1 pound	17
Anis seed	½ pound	10
Incense	1 pound	102
Myrrh	½ pound	136
Mastic	1 pound	400
Resin	½ pound	153
Anymonycico	½ pound	102
Galbanum [*galbano*]	½ pound	120
Beef tallow	8 pounds	680
Licorice	6 pounds	34
Yellow wax	1 pound	68
White wax	1 pound	85
Ground massicot [*almartiga*]	2 pounds	34
Barley flour	4 pounds	68
Five bolts of silk and bundles of flax at 15 maravedís each		75

[Medicines]	[Amounts]	[Value in maravedís]
Two quires [*manos*] of white paper		25
De fensilo from Joanes de Vigo	4 pounds	408
Plaster of Paris [*yeso quemado*]	8 mrs.	8 mrs.
Polipodio	1 pound	34
Six pounds of rose oil which are separate for the *cayetas* of the caravels		306
Three hundred bunches of dill and camomile		150
One quire of white paper	12 mrs.	12
Two quires of spleen paper [*papel bazo*]	20 mrs.	20

Most esteemed Gentlemen:

By order of his Majesty, we inspected the medicines contained in this account, and everything tallied very well. After inspecting them, we set the tax according to the sums designated with the approval of the apothecary of this city, Cristobal de Sancta Cruz. The medicines, containers, and other items bought according to the account total 71,807 maravedis. Done in Sevilla on September 5, 1549.

DOCTOR LORENCIO SUAREZ AND DOCTOR MONARDES CRISTOBAL DE SANCTA CRUZ.

What I have spent for things which were bought for the service of His Majesty's armada is the following:

To bring the boxes from the warehouse [*atarazanas*] to take out the medicines listed: a real and a half	51
For jars with their wax-sealed tops, oil containers [*alcuzas*] bought to hold the waters, oils, and syrups	1,048
For *burnyas*, pots, jars, and two-handled baskets	564
To take the three boxes from the carpenter's house to the apothecary shop: 1 real	34
For four small boxes for the caravels at 6 reales apiece	816
To take the said small boxes: ½ real	17
For twelve pounds of thin oakum which was bought for the ships and caravels at 20 mrs. per pound	80
More than four additional pounds of oakum that was needed	80
More than twenty-four iron clamps made for the corners of the boxes at 8 maravedís apiece	192
For nails with which to nail them: ½ real	17
For the carpenter to nail them: real	17
For a metal mortar weighing nine pounds at 1½ real per pound	459
For some colanders with their spoon: fifteen reales	510
For three spatulas: three reales	102
For two large new syringes: fourteen reales	476
For twenty and a half dozen eggs for the caravels and ships at twenty-four mrs. a dozen	502

For six barrels to contain the eggs	204
For a half fanega of salt for them [the eggs]: twenty mrs.	20
For a $\frac{1}{8}$-ounce scale for weighing	119
For two one mark weights each weighing one half pound: three reales	102
For two small copper saucepans—six and half reales	221
For a sheet bought to use for bandages: six reales	204
For parchments to cover all the containers: five reales	170
For cork boards: one real	34
For one pestle to a mortar: two reales	68
For three sheets to be used for bandages: fifteen reales	510
For two large shirts *para ylas*: six reales	204
For a leg of sheet [sic *de una pierna de sabana*]: a real and a half	51
To transport the barrels from the home of the cooper: one real	17
To transport the containers from Triana to the apothecary shop: one real	34
To transport the three large boxes and four small containers to the river: six and a half reales	221

In the city of Sevilla on September 6, 1549, Bernaldino of Burgos, apothecary of this city of Sevilla, stated that he is satisfied with and paid by Francisco Duarte, his Majesty's factor. From the latter Bernaldino received 71,089 maravedis in payment for the medicines which he has provided for his Majesty's armada of which Diego Lopez de las Roelas is Captain General. This amount includes the containers and other necessary equipment for the said medicines as is reported on these four sheets comprising the entire document. In addition, it covers the taxation on the said medicines and expenses levied by Doctors Luis Suarez and Monardis, physicians, and by Cristobal de Sancta Cruz, apothecary, for the amount given them in the bank of Domingo de Dicararas, public bank of this city.

He affixed his signature.

WITNESSES: PEDRO DE CALBA AND JUAN FRANCISCO
BERNALDINO DE BURGOS, JUAN DE JAEN, *Scribe*

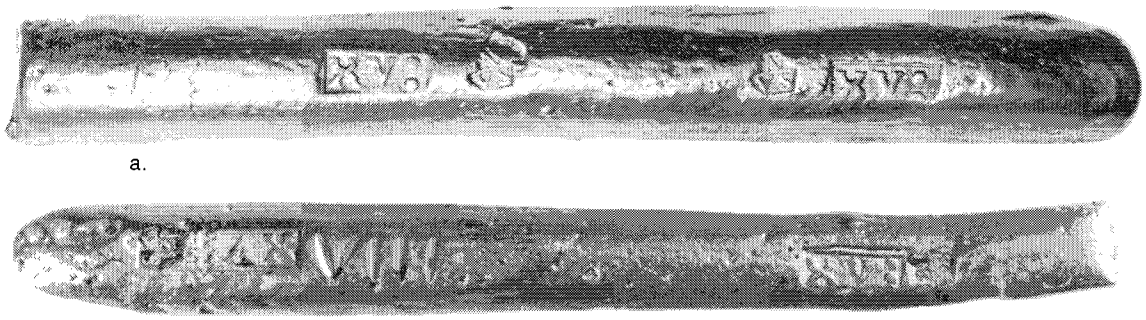
Checked with the original taken by the treasurer. [rubric]

CARGO

Bullion and coin of precious metal were the most important components of the cargo and virtually the only ones surviving. Documents listing the cargoes were found in the Spanish archives and are discussed in Chapter 2. In this section, the gold and silver bullion and the silver coins that were recovered from this site will be discussed.

GOLD BULLION

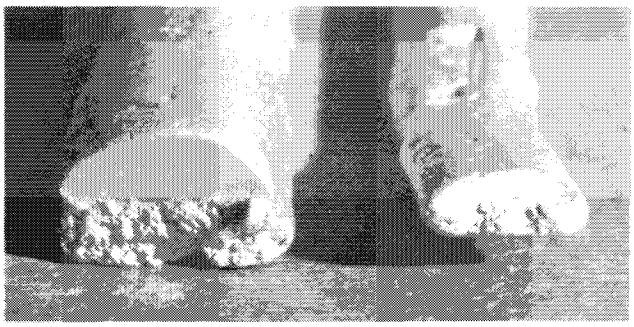
The collection includes one gold bar known colloquially as a "finger bar" because of its size and shape (Figure 49). One end has been chopped



a.

b.

0 3
CM



c.

FIGURE 49. Gold bars from 41 KN 10 and 41 WY 3. (Top): No. 174. (Bottom): 41 WY 3, No. 143F. (Opposite): No. 174 (left) and 41 WY 3 No. 1437 (right). No. 174 measures about 1.5 cm across. Note that both bars have been chopped part way through and then broken.

partially through and then broken off, a feature shared with the single specimen of gold bullion from 41 WY 3. It seems clear that just the tip was cut off rather than this being just one end of a much longer strip, because of an entry in the Spanish salvage records (Alvarado 1554) which lists the recovery of three 17-carat gold bars that are described as having had their tips cut off. This chop may have been made to assure the assayer that the bar was indeed solid gold. The bar has been stamped four times, twice with each of two stamps, one indicating the fineness of the gold in carats and the other certifying the metal as gold. This bar was 15½ carats, the half being indicated by two dots. The stamps were applied once on each end, perhaps anticipating that the bar would be chopped in two once again in Spain. The second stamp, indicating gold (AVS), is somewhat curious in that the Latin noun for gold is *aurum,* which would more appropriately be abbreviated AVR. The adjectival form of gold, golden, is *aureus* (Traupman 1966:407) and is probably the source of the abbreviation. On the flat side of the bar the Roman numeral XVII is faintly scratched, probably a tally mark similar to the Roman

numéral VIII found chiseled into the example from 41 WY 3, a 15¾-carat bar. The salvage document (Alvarado 1554) also records the recovery of a long piece of gold with V marked on it, perhaps like the one just mentioned. Both bars were poured into semicylindrical molds, the flat side representing the upper surface in the open mold. Concerning the shapes in which gold bullion was shipped, the salvage document (Alvarado 1554) offers further information in describing a round piece of 20 carats, probably similar to the better-known later examples recovered in Florida and elsewhere. Several from the Bahama wreck of 1594 are illustrated by Peterson (1972:270–271).

SILVER BULLION

All the silver bullion recovered was formed into flat disks of various sizes or, for the smaller pieces, irregularly shaped flat fragments and scraps (Figures 50 and 51). The disks are called *planchas* in the ship's register (Ojos 1554). The question immediately arises as to why the silver was not formed into bars, as was the practice later. It was not because the concept was not in use since there is a fragment of a large regularly shaped lead ingot in the 41 WY 3 collection. Also, the gold bullion was in an ingotlike form. It could be simply that it was most convenient to pour the molten silver onto the ground, thus producing the characteristic disk shape. The reason may lie in the use to which the silver was to be put. Much of it was to be coined either in Mexico or in Spain. In his description of the production of the flans or blanks which were afterward struck with the designs of the dies by hand hammering, Nesmith (1955:29–31) mentions that taxed *bars* could be purchased at the foundry and brought to the mint for coining. He then states that at the mint the bars had to be remelted into thin bars which could be hammered or rolled into strips of appropriate thickness for a coin, and then cut and rounded. Nesmith apparently was not aware of the disk form of the silver bullion in the early period in New Spain. He does mention that the early coins produced by the Mexico City mint, the Carlos and Johanna coins, were fairly even in thickness and well rounded, in fact better than many of the later coins struck at the same mint. By later coins I presume he refers to the "cob" coins which were produced in a much more haphazard fashion by cutting the flans from irregularly cylindrical bars of approximately the correct diameter.

It may be that the disks are already thin enough to hammer or roll to the correct thickness for cutting out the circular flans. This eliminates two steps in Nesmith's proposed outline, the original casting into a bar at the foundry and the recasting into a bar thin enough to hammer or roll at the mint. This might seem a reasonable functional explanation, but trace analysis of the metals present indicates as much as four times as much lead in the disks as in

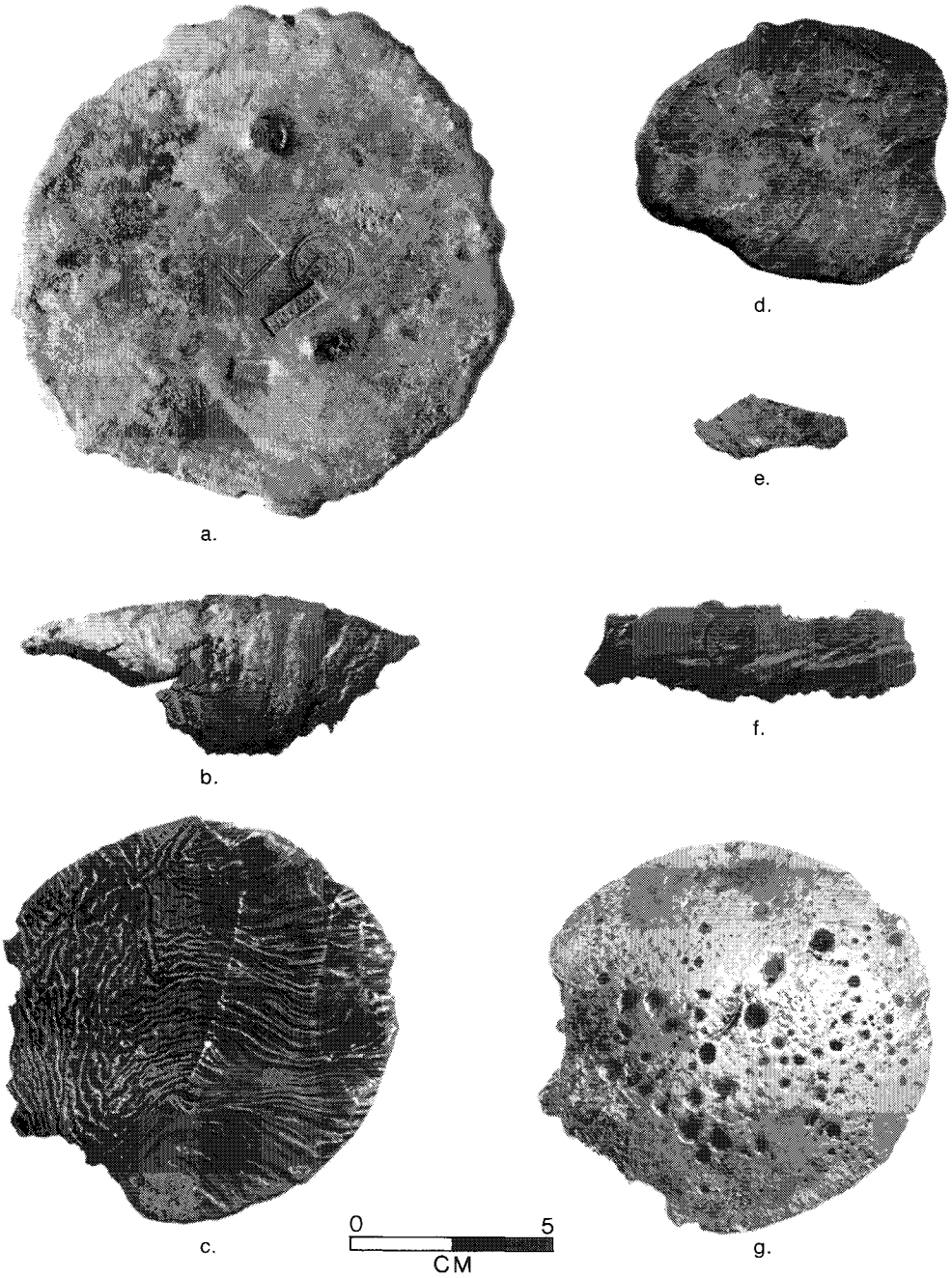
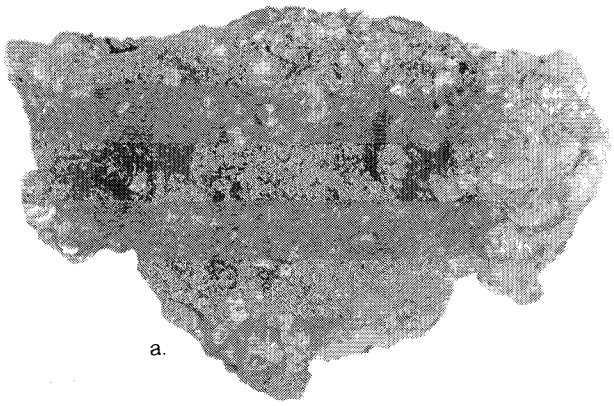
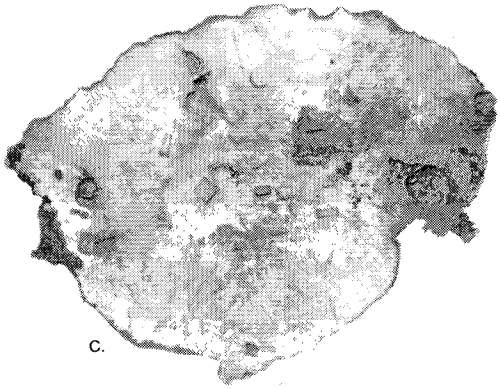


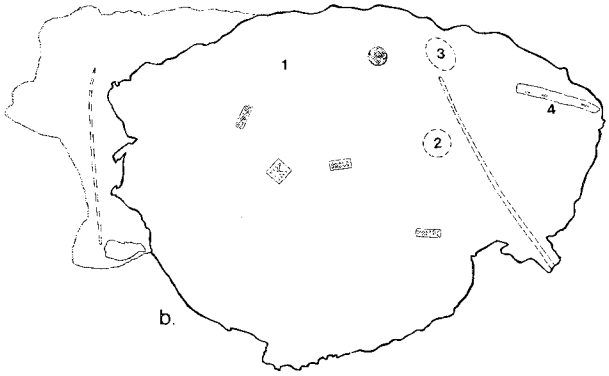
FIGURE 50. Silver bullion.
a. No. 87. Silver disk.
b. No. 120. Small silver disk.
c. No. 118-2. Small lump of silver.
d. No. 91. Fragment of silver disk.
e. No. 94. Fragment of silver disk.
f. No. 141. Top of silver disk.
g. No. 141. Bottom of silver disk.



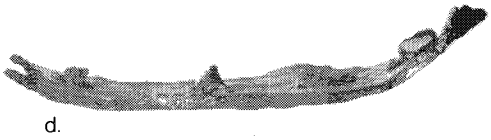
a.



c.

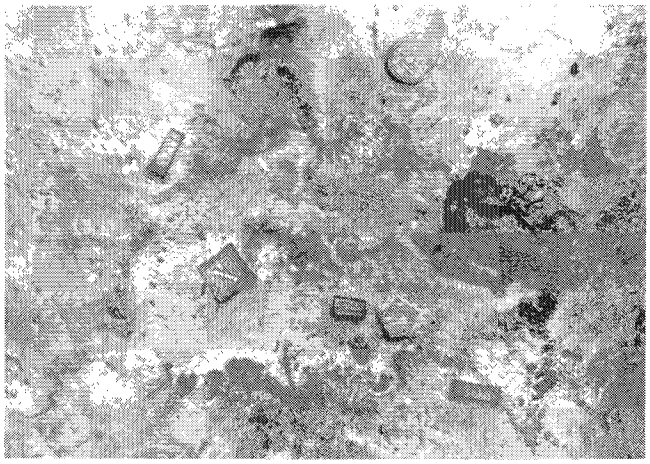


b.



d.

0 10 20
CM



e.

0 3
CM

FIGURE 51. Conglomerate No. 260.

a. Photograph of encrusted conglomerate as recovered.
b. Drawing of internal composition of conglomerate showing two oxidized iron straps and artifacts (No. 260-2) 2-real coin, (No. 260-3) 4-real coin, and (No. 260-4) lead strap.
c. No. 260-1. Large silver disk, weight 4620 gm, maximum diameter 37 cm, maximum thickness 1 cm.
d. No. 260-1. Side view.
e. Enlargement of section of silver disk (No. 260-1) with stamps and mint marks.

the coins. This is a strong indication of another step in refining between the disk and the finished coin, and supports the assertion that more manageable bars were produced before hammering into sheets and cutting out the flans.

Bullion shipped from Mexico had to be taxed, and several stamps indicating that taxes have been paid appear on the disks along with stamps indicating the mining district in which the silver was produced and possibly owners' marks or marks of another unknown nature (Figure 52).

COINS

The silver coins of Carlos and Johanna from site 41 KN 10 consist of 4-real, 2-real (*real de a dos*), and 1-real (*sencillo*) pieces almost exclusively from the Mexico City mint. Of the total of 358, 100 were completely converted into sulfide. Twenty-eight of these were examined by x-ray only and remain encrusted for display purposes. Other coins include two silver 4-real of Carlos and Johanna from the Santo Domingo mint and a copper 4-maravedís from the same mint. There is also one specimen of a silver 1-real Ferdinand and Isabella coin from the Seville mint (Figure 53). Seventy-three coins were recovered in one particularly interesting lump (Figure 54).

Of the identifiable assayers' marks on the Mexico City coins 84% are assayer (*ensayador*) Ls of the late series. Nesmith (1955:38) asserts that the late series went into production in 1556. This collection indicates that the change must have occurred somewhat earlier, perhaps 1553 at the latest. A detailed numismatic study has not been done, and it is hoped that such a survey can be accomplished in the future. For the present, a series of photos with a cross section of the Ls and a more complete coverage of the other assayers will be presented (Figures 55–58).

The proportions of 1-, 2-, and 4-real coins in the collection are interesting. In Mexico in 1540 the viceroy had ordered that the "coinage of the mint was to be one-third in pieces of 4 reales, one-third in pieces of 2 reales, and one-third in pieces of 1 real and ½ real (Nesmith 1955:37). It is apparent from our sample of the cargo that either this edict was being ignored by 1554 or that those having their silver coined before export were having the lower denominations changed to 2s and 4s before preparing their shipments. The former seems more likely than the latter. In any case, the larger denominations would certainly have expedited the counting involved in the exhaustive cargo registration process.

The fineness of the silver for these coins was the equivalent of 930.51 thousandths (Pradeau 1938:37). The weight of each individual coin was not critical within limits as long as 57 reales equaled 1 mark (230 gm), and the coins were checked by weighing them in groups (Nesmith 1955:43). This comes out to about 3.433 gm for a 1-real coin, 6.865 gm for a 2-real coin, and 13.731 gm for a 4-real coin. The measurable (i.e., relatively complete)

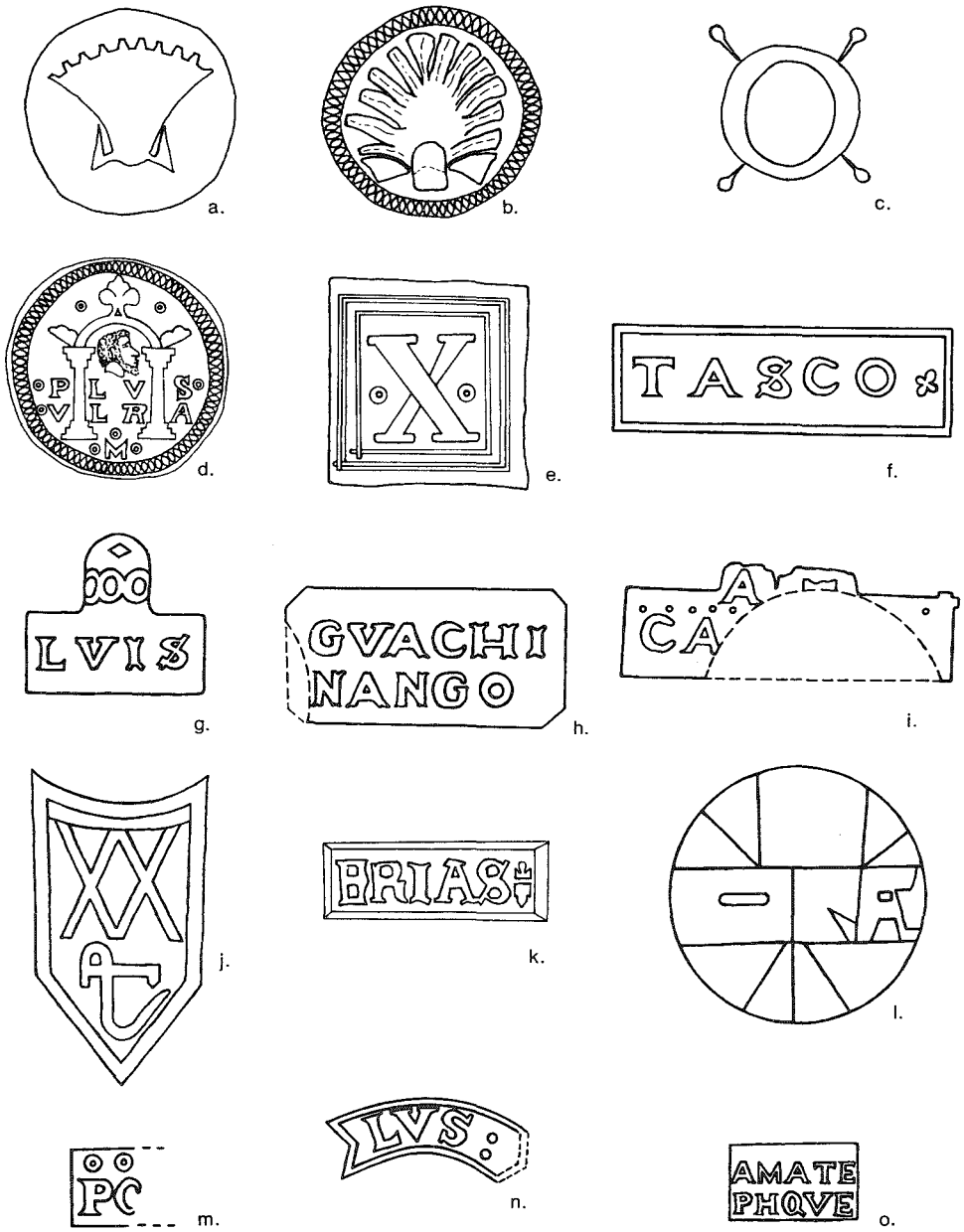


FIGURE 52. Silver stamps from 41 KN 10 and 41 WY 3. These are the stamps which appeared on the silver bullion. The first 10 were initially recorded from the 41 WY 3 collection. Several of these and five more were recorded from the 41 KN 10 collection.

a, b. Possibly official marks representing the shell of St. James, the symbol of Spain's patron saint.
c. A circle with four evenly spaced projections of unidentified significance.
d. An official stamp with many elements borrowed from the coinage design, the pillars of Hercules, the motto, and the Mexico City mint mark.
e. This X may represent a Roman numeral ten and thus the *diezmo* or special 10% tax rate rather than the usual 20% or *quinto*.
f. This stamp indicates the area of production, Tasco, a mining district established in 1543.
g. This is probably the mark of the assayer Luis Rodriguez.
h. Another production area stamp, this time for Guachinango, also established in 1543.
i. An unidentified mark partially obliterated by an over stamp of mark d.
j. Unidentified mark with two X's and a rubric.
k. Unidentified mark resembling the production area marks in form.
l. Unidentified rubric containing the letters ORA, possibly an owner's mark.
m. Unidentified mark partially obliterated by an over stamp of mark d.
n. Possible misrepresentation of assayer Luis Rodriguez's name.
o. Possible production area stamp.

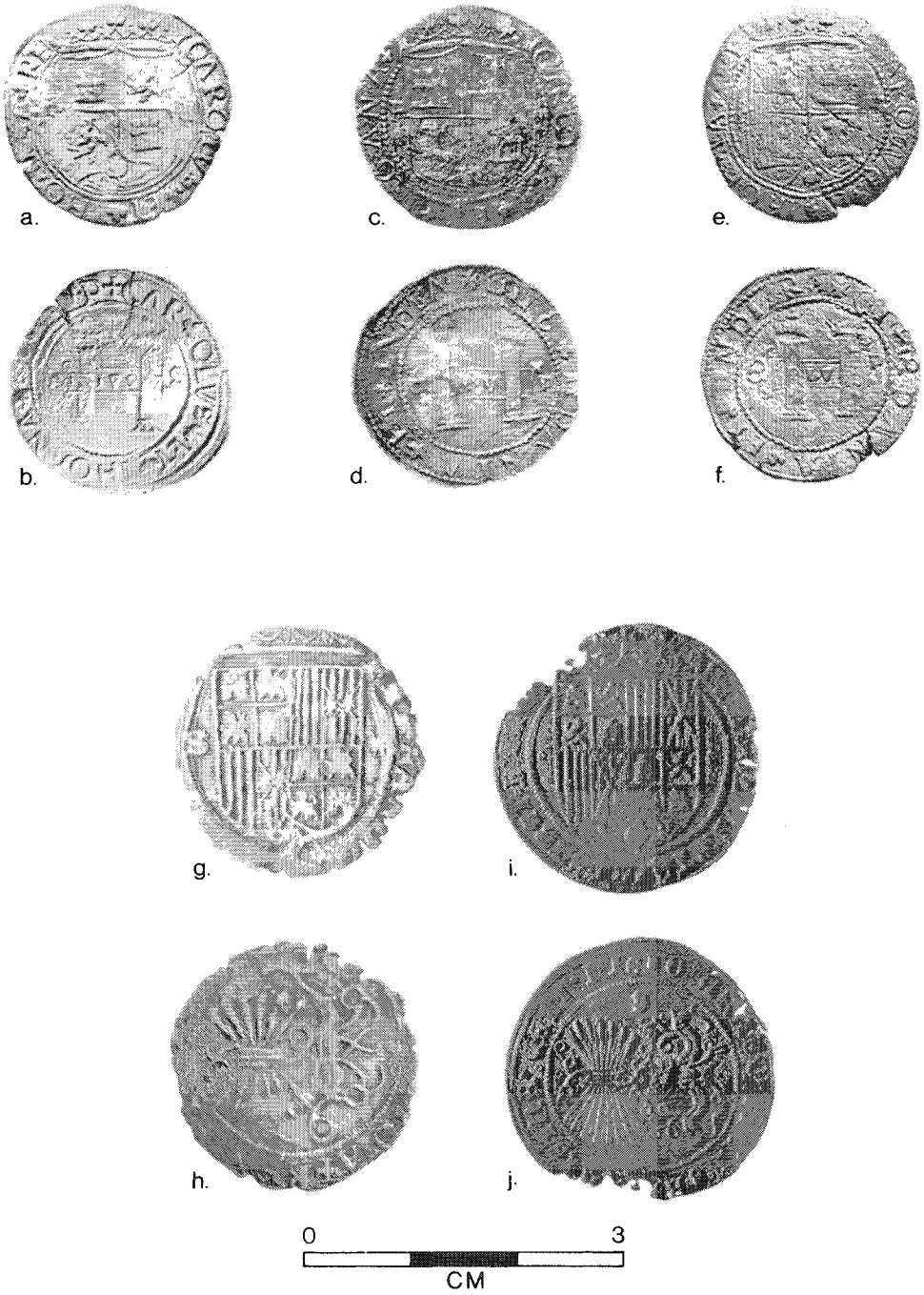


FIGURE 53. Santo Domingo and Seville Coins.

a, b. No. 100-4 Santo Domingo Carlos and Johanna, 4 reales, assayer F.

c, d. No. 157-114 Santo Domingo Carlos and Johanna, 4 reales, assayer F.

e, f. No. 8-1 (41 WY 3) Santo Domingo Carlos and Johanna, 4 reales, assayer unknown.

g, h. No. 161-46 Seville Ferdinand and Isabella silver coin with the arms of Castile and Leon quartered with those of Aragon and Naples and Sicily with Granada's pomegranate at the bottom on the obverse and the arrows and yolk on the reverse.

i, j. Seville Ferdinand and Isabella silver coin similar to g. and h. except that the mint mark, S, has been moved from the obverse on the left of the shield to the reverse above the arrows.

Coins a–f are 85% of actual size; g–h are according to scale.

FIGURE 54. 1-, 2-, and 3-Real Carlos and Johanna silver coins from Mexico mint.
a, b. No. 107-7 late series 1 real, assayer L.
c, d. No. 157-30 late series 2 reales, assayer L. Note reversal of assayer's initial and mint mark compared to c.
g, h. No. 8-3 (41 WY 3) early series 3 reales, assayer R.
Coins are shown actual size.

coins in this collection averaged 4.8 gm for a 2-real coin and 9.8 gm for a 4-real coin. Some loss of weight from corrosion can be assumed (see Table 5).

Some of the terms for denominations, weights, and measures presented a problem (Ojos 1554) since they were used interchangeably in the historical documents and in many instances in a rather haphazard manner. Pradeau (1938:37) helped clarify the situation to some extent. He provides the information that 1 mark of silver equals 8 oz, 1 oz equals 8 *ochavas,* 1 *ochava* equals 6 *tomines,* and 1 *tomín* equals 12 grains. The term "*tepuzque* gold" was another problem. The register of the *Santa María de Yciar* (Ojos 1554) made it clear in a number of places that this term was being applied to silver coin. Before the mint was established in 1536 *tepuzque* were slugs of gold stamped with their fineness, which circulated as money. Pradeau (1938:21–22) says that they circulated until the reign of Phillip II. If the original meaning still applied in 1554, then it seems certain that gold slugs would have been

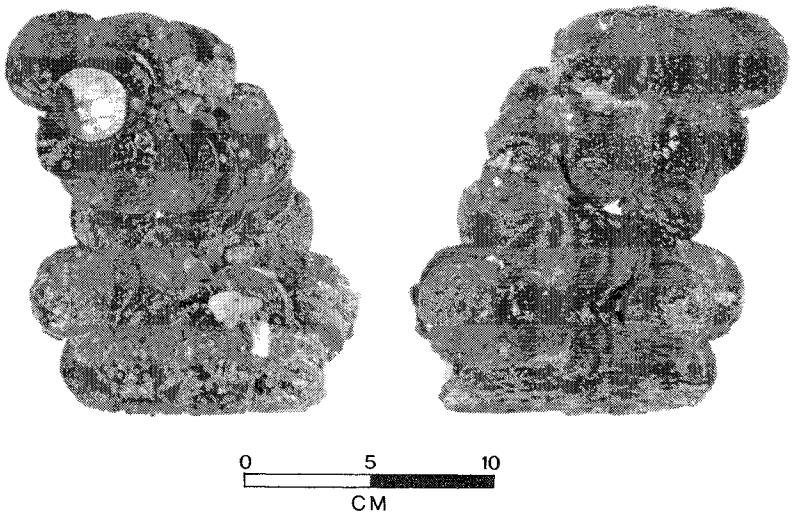


FIGURE 55. Clump of silver coins No. 100, 73 silver coins encrusted in one clump. The pattern of the wood grain of the shipping box is preserved in the sulfide corrosion products of the bottom of the neatly stacked cluster of coins.

FIGURE 56. 4-Real coins from Mexico mint, assayer L. (Left): No. 157-108; (center): No. 100-41; (right): No. 100-54. Coins are shown actual size.

FIGURE 57. Early series silver coins from Mexico City. (Left): No. 157-143 2 reales, assayer R; (right): No. 106-1 4 reales, assayer P. Coins are shown actual size.

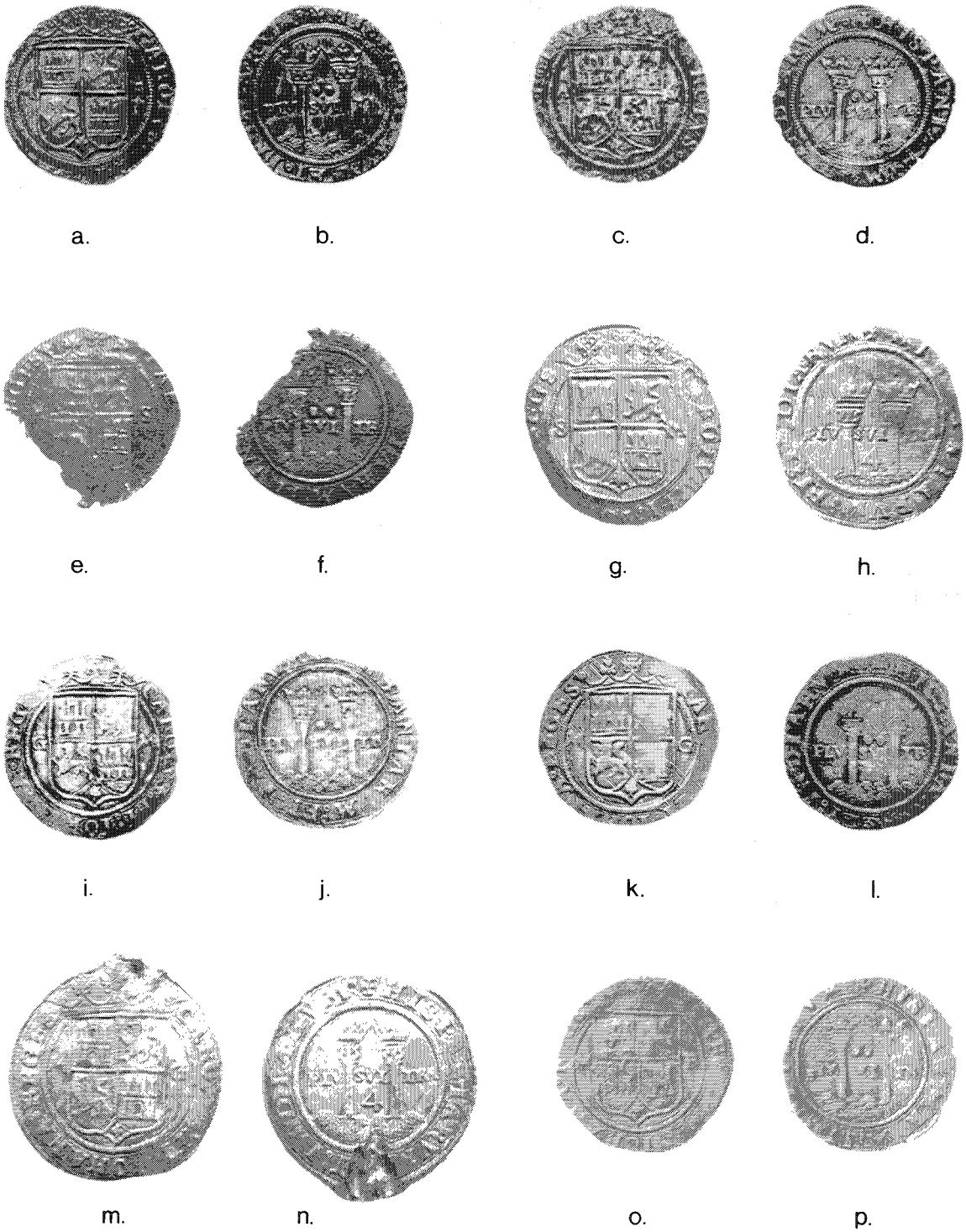


FIGURE 58. Late series coins by various assayers from Mexico mint.

a, b. No. 157-105 2 reales, assayer A.
c, d. No. 157-128 2 reales, assayer A.
e, f. No. 157-129 2 reales, assayer S.
g, h. No. 100-19 4 reales, assayer S.
i, j. No. 157-106 2 reales, assayer G.
k, l. No. 161-18 2 reales, assayer G.
m, n. No. 161-22 4 reales, assayer G.
o, p. No. 129-9 2 reales, assayer R.

TABLE 5
Silver Coins of the Mexico City Mint by Demonimations and Assayers

	Assayers Early Series		Late Series						
	R	P	G	A	R	S	L	Unknown	Total
Denominations									
1-real							1		1
2-reales	2		14	5	4	2	59	28	114
4-reales		1	4			4	162	38	209
Total	2	1	18	5	4	6	222	66	324

recovered at one of the two wrecks from which artifacts have been recovered, but none was found. The salvage document also made a point of mentioning the carat weight of all gold found, and nothing but bullion is mentioned. The term *tepuzque* must have developed a colloquial usage equating to reales, since the value was set in 1536 as 1 *tomin de tepuzque* (12 grains) equal to 1 silver real. It would have been a useful term for a shipment of mixed 2- and 4-real coins, which would reference the total value irrespective of the number of coins. The register contains references to shipments that do specify the type of coin, such as those in *tostones* or 4-real coins.

ANALYSIS OF TRACE ELEMENTS IN THE SILVER

Several silver coins and disks were analyzed nondestructively by energy dispersive x-ray spectrometry. Tests were performed under interagency contract by the Nuclear Engineering Program of the Department of Mechanical Engineering, the University of Texas at Austin. A quote follows from a letter by Andrzej Pradzynski, radiochemist,

> Each object was placed in front of a Si(Li) detector of an energy dispersive x-ray spectrometer. A radioisotope source Cd-109 was used for x-ray excitation. Data were processed by an on-line computer. Intensities of fluorescent x-rays from elements Fe, Cu, Au, and Pb were measured by integrating areas under their peaks in the spectrum.
>
> RESULTS
>
> Due to lack of standards for silver analyses having elemental composition similar to the objects measured only qualitative results could be obtained. In order to make rough, semi-quantitative comparisons between the samples intensities of all the elements in one sample are compared in a qualitative way only because of same sample. The results are shown in Table 6. Although the numbers in Table 6 are related with element concentrations, these relationships are obscured by interelement absorption—and enhancement effects. Comparisons of intensity ratios can be made between samples for single elements. Intensity ratios between elements in one

TABLE 6
Intensity ratios of element peaks to Ag-peak in silver artifacts

Artifact Number	Description	Fe (iron)	Cu (copper)	Au (gold)	Pb (lead)
100-4	4-real coin, Santo Domingo mint	1.4	20.7	0.8	6.5
157-114	4-real coin, Santo Domingo mint	0.9	11.2	0.7	5.5
100-8	4-real coin, Mexico mint, L assayer	0.7	12.4	0.9	4.6
100-68	4-real coin, Mexico mint, G assayer	0.3	19.2	0.4	3.3
106-1	4-real coin, Mexico mint, P assayer	0.6	9.9	2.2	4.6
107-07	4-real coin, Mexico mint, L assayer	0.7	18.3	1.4	5.4
161-46	2-real coin, Seville mint	0.3	46.2	—	5.4
94	Small disk, stamp #1	0.7	3.2	0.5	31.6
5-10	Small disk	1.0	2.9	0.6	20.9
84	Medium disk, stamp #6, Tasco	1.0	2.4	1.2	8.8
87	Medium disk, stamps #4, 5, 13, and 14	0.7	1.7	4.9	2.2
1423	Medium disk (41 WY 3), stamp #8, Guachinango	0.6	11.5	—	11.0
260-1	Large disk, stamp #4, 5, 13, and 14	0.6	1.4	5.4	38.0
1417	Large disk, (41 WY 3), stamp #6	2.8	2.7	0.2	35.2

sample are compared in a qualitative way only because of different excitation factors of each peak (in addition to absorption and enhancement effects).

The results obtained can be summarized as follows:

1. Fe (iron) occurred in all specimens in low concentrations. The range between lowest and highest value was a factor of 9.
2. Cu (copper) occurred in all specimens. The range between lowest and highest values was a factor of 33. Coin 161–46 showed the highest value for Cu, higher by a factor of >2 than in coins: 100–4, 100–68, and 107–07. Disks, except 1423, showed lower Cu values than coins.
3. Pb (lead) occurred in all specimens. The range was a factor of ~17. The highest values were shown by specimen 260–1, 1417, and 94, the lowest by disk 87. The range of Pb values in coins was a factor of ~2.
4. Au (gold) was detected in all but two specimens. Coin 161–46 and disk 14–23 did not show gold. The range was a factor of ~10.
5. Hg (mercury) was detected in one sample, disk 1423.
6. Zn (zinc) was not detected. If present, its concentration was below the lowest concentration of Fe.
7. The specimens, especially the disks, were largely inhomogeneous. Results obtained from different spots of the same sample showed significant differences.

Among the interesting trends indicated in these figures is a much larger presence of lead in the bullion than the coins. Conversely there is a much higher concentration of copper in the coins than in the bullion which may indicate that copper was added to cut the purity to the desired level for coinage. Of special note is the complete lack of gold in the coin from Seville and the disk from Guachinango, and the generally higher level of gold in the bullion than in the coins. The absence of gold in the Guachinango disk may

be related to the fact that this was the only sample in which traces of mercury were found. Could this be indicative of early introduction of the more efficient patio process of refining which involved mercury amalgamation in that mining district?

PERSONAL POSSESSIONS

Comparatively little was recovered that can be identified with certainty as personal possessions. It would seem that, aside from the silver and gold in the cargo, the passengers brought very few items which were nonperishable. Among the most interesting are the aboriginal artifacts, which include four obsidian blades, a mirror of polished iron pyrite, and possibly a bead of the same material. The obsidian blades (Figure 59), when examined microscopically, exhibit heavy edge-battering and wear. However, whether this is a result of use or simply the result of the ravages of time and extraction from the conglomerates, it is impossible to tell. The iron pyrite mirror (Figure 60) was manufactured from a nodule, the edge beveled, and the surface highly polished.

Also especially noteworthy are a matched pair of pewter porringers (Figure 61) made in England. They bear the crowned Tudor rose stamp, but unlike the similar marks on the pewter plates from the 41 WY 3 collection (Figure 62) it is not combined with the initials which indicate a marker's proper touch. During this period, the plain crowned Tudor rose was the mark for goods exported guaranteeing quality of "the Mark of the Hall" (Cotterell 1963:47).

A broken wooden cross (Figure 63) partly covered with gold is another unusual object. More mundane artifacts include an iron key with a copper-covered shank (Figure 64). There are several possible uses for the padlock for which this key was probably intended. Chains and padlocks were used to seal hatches. Palacio lists padlocks just after chains for hatches in his list of essential spare parts for a crossing to the New World (Bankston, personal communication). The copper-covered shank of the key might indicate the desire not to strike a spark which would be associated with the storage of gun powder. A prison pillory with a padlock and key were part of the equipment procured for Carreño's capitana (Demanzera 1552).

Also recovered were brass straight pins and a sheath (Figure 65) used in place of buttons and zippers in fastening clothes. This find pushes back the date for the appearance of this variety of pinhead considerably as can be seen from the following discussion of brass pins by Hume (1974:254–255).

> In the sixteenth century brass pins became common but retained the large head in solid or hollow-cast brass; but by the beginning of the seventeenth century the head, though still rather large, was fashioned from a

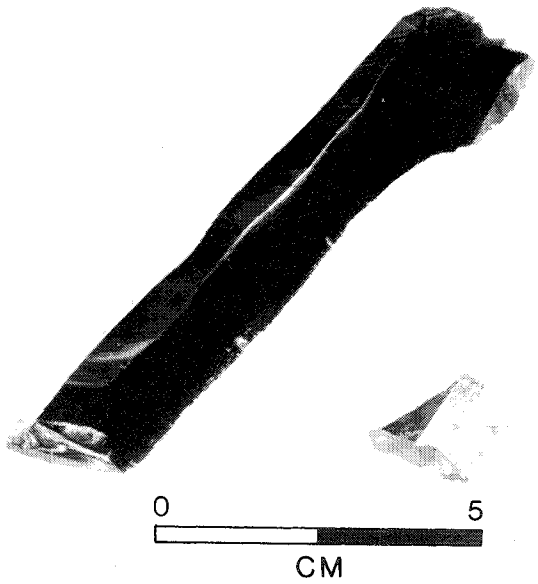


FIGURE 59. Obsidian blades. (Right): No. 146-9 obsidian blade fragment; (left): a complete obsidian blade for comparison.

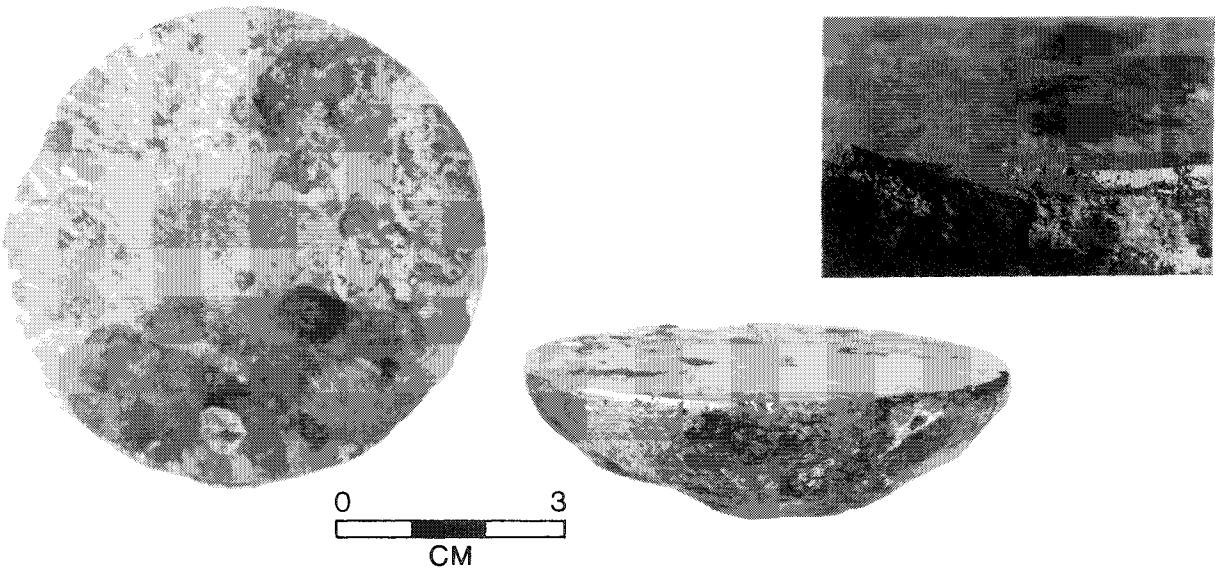


FIGURE 60. No. 5-60. Iron pyrite mirror of aboriginal manufacture. (Left): front view; (right): side view. Inset shows an enlargement of the beveled edge.

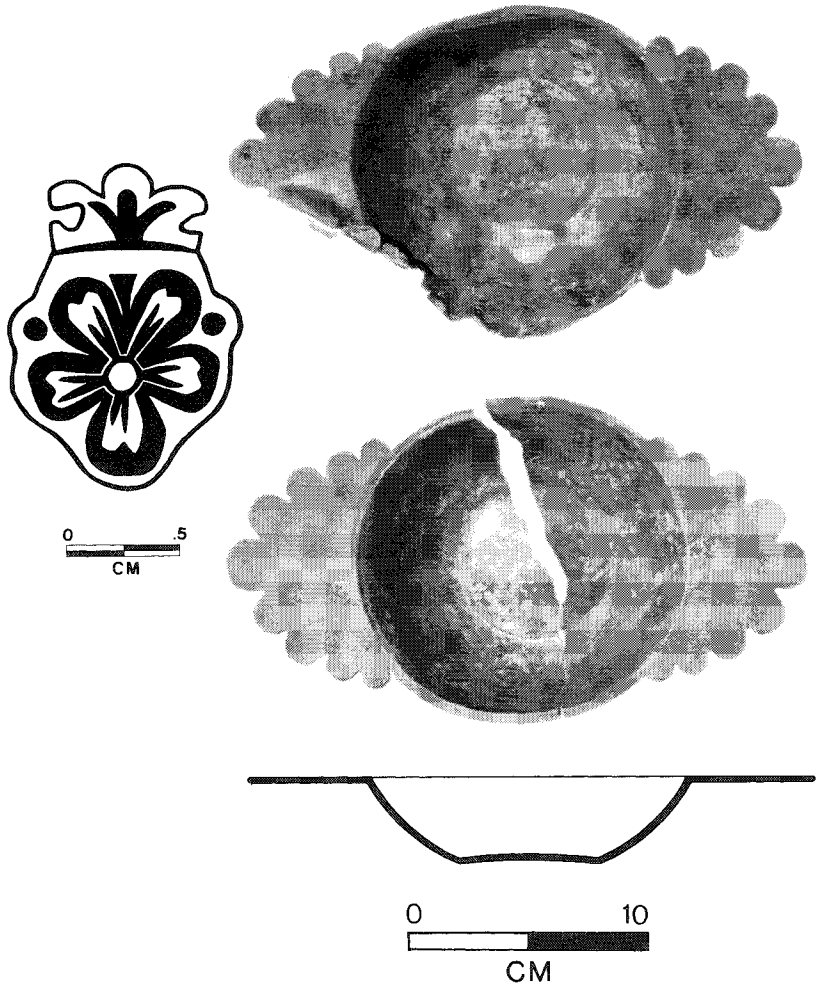


FIGURE 61. Pewter porringers. Matched pair of pewter porringers. (Top): No. 81-7; (right): No. 129-5. The stamped mark that appears on both is shown at left. The mark is located on the lower handles in this photograph on the central scallop of the handle.

second piece of wire wrapped around the shank. The head usually consisted of three turns and was anchored by means of a blow from a treadle-operated stamp that spread the top of the shank. . . . This method continued in use until the early nineteenth century, when an American, Lemuel W. Wright, secured an English patent (1824) to make a solid-headed pin that was stamped out in one process.

Seventeenth- and eighteenth-century pins vary greatly in size, ranging from lengths in excess of 5″ (hairpins) down to less than $\frac{3}{4}$″, the latter sometimes being hardly thicker than a hair. . . .

Along with the brass pins one sometimes finds small, tapering, brass tubes, some of which are elaborately decorated with stamped ornament. They resemble minature dagger sheaths and were in fact containers for two pins to enable them to be carried in the pocket. It is assumed that a small number of sheaths or cases were supplied with each paper of pins.

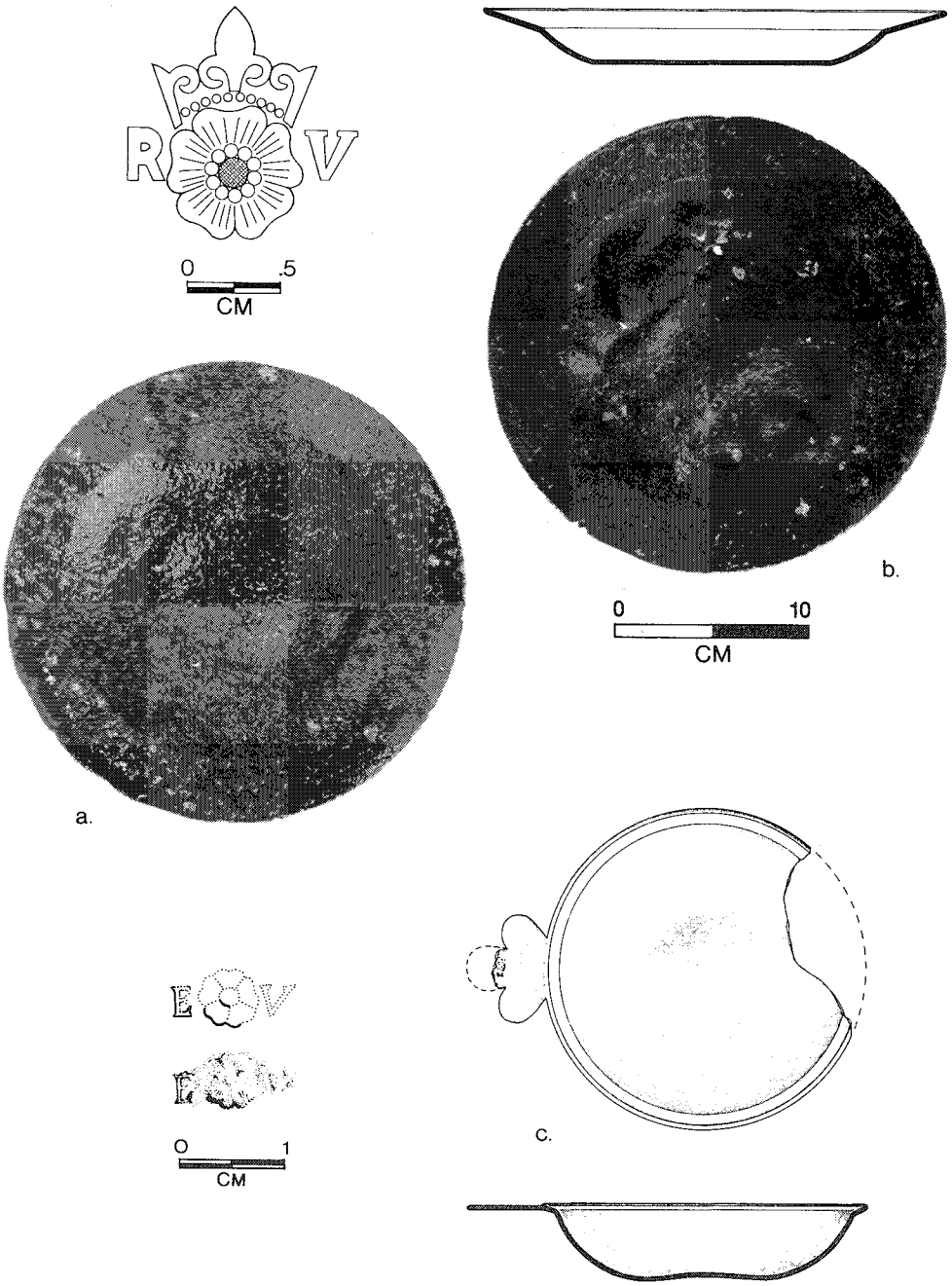


FIGURE 62. Pewter plates from 41 WY 3. Matched pair of pewter plates (a. No. 1618 and b. No. 1619) illustrated with the stamped mark which appeared on the back rim of both. A pewter porringer (c) was found in a damaged condition on the beach about 200 m north of the Mansfield jetties, one of the few artifacts assignable to the third wreck. It is illustrated here in approximately the original contours instead of its twisted and bent current condition. The same reconstructed aspect is presented in the cross-sectional view of the plates.

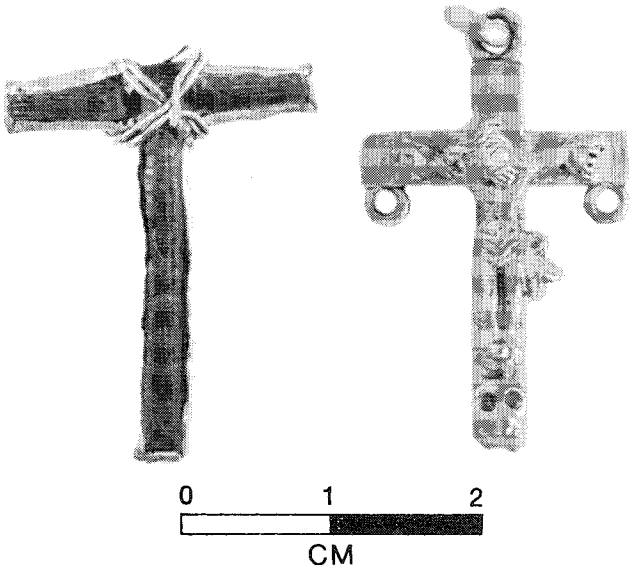


FIGURE 63. Gold covered wooden cross (41 KN 10, No. 129-2). Sheet gold lines the edges and is secured by gold wire. Right: Gold crucifix (41 WY 3, No. 1436). Jewels or small crosses would have been suspended from the loops below the arms, and one at the foot, now broken.

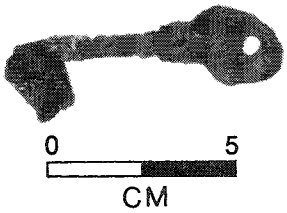


FIGURE 64. No. 5-37, badly oxidized iron key with copper-covered shank.

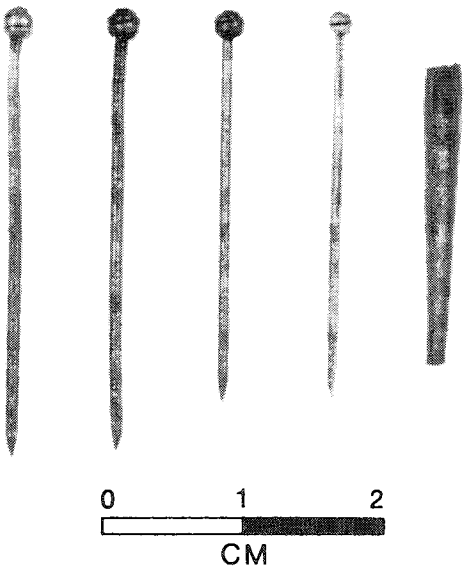


FIGURE 65. Brass straight pins and sheath. Left to right: No. 157-113, No. 157-115 a and b, No. 157-152, and No. 156-9. Bits of fibrous material were found inside the sheath, suggesting something into which to stick the pins to keep them from falling out of the sheath.

A brass buckle, a brass ring of problematical usage, a case knife with brass foil and pin, and a square quartz bead should also be included in the list of personal possessions (Figure 66). One other object which probably belongs in this classification is one of a set of nesting brass scale weights (Figure 67). It was found just below the remains of a wooden shipping case on top of one of the anchors (No. 81) which was stored as ballast. The weight of this

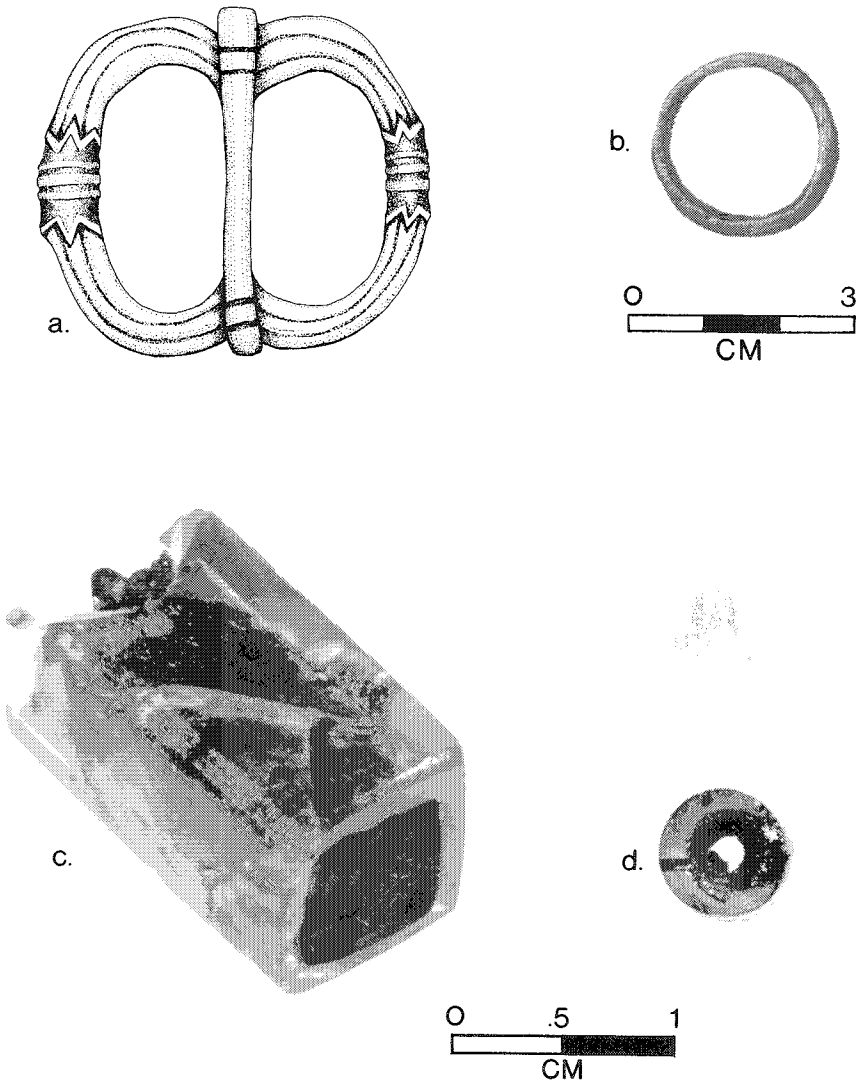


FIGURE 66. Miscellaneous personal possessions.
a. No. 156-5 brass buckle (shown actual-size).
b. No. 185 brass ring.
c. No. 157-10 quartz bead.
d. No. 157-96 pyrite bead.

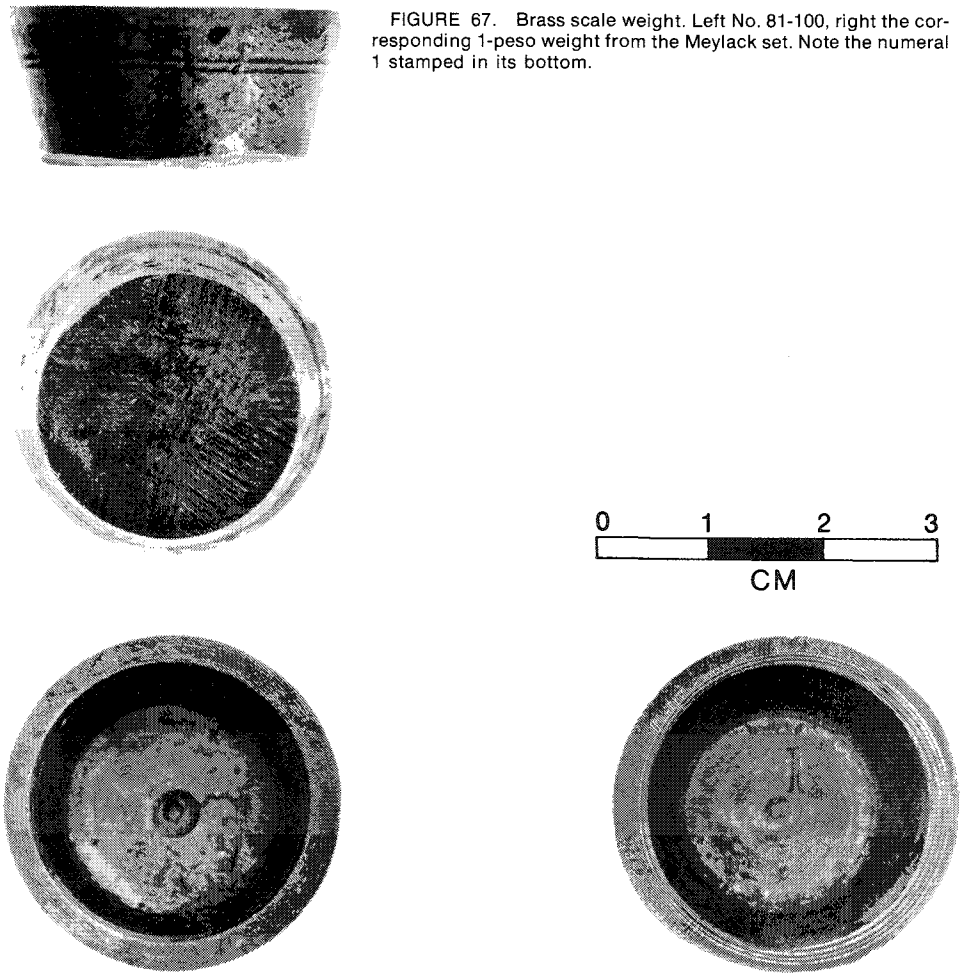


FIGURE 67. Brass scale weight. Left No. 81-100, right the corresponding 1-peso weight from the Meylack set. Note the numeral 1 stamped in its bottom.

specimen is 24.47 gm, very close to the 27.464 grams specified for 1 peso or 8 reales. It had been lathe-turned, probably from a casting, to the desired dimensions and then filed on the bottom to correct the weight. Two complete sets of this type of weight were recovered from one of the 1715 *flota* wrecks (8 UW 2) in Florida (Clausen personal communication). These may be the items illustrated by Peterson (1972:267) from the 1715 fleet. At least two other recoveries of nesting weights have been reported from shipwreck sites. One set is reported by Ericsson (1975:71) from the Imperial Russian 32-gun frigate *Nicholas,* which went down in 1790, and two others by Stenuit (1976:225–226, 228) from another Russian vessel, the *Eustafii,* wrecked in 1780. This type of weight was, therefore, in documented use for a period of at least 236 years.

A similar set of nesting weights was purchased as an antique in Ecuador within the last ten years by Mr. Martin Meylack of Miami, Florida. He was kind enough to loan them to my predecessor, and they are illustrated in Figure 68. The weights of the cups are shown in Table 7.

OTHER OBJECTS

Other objects recovered from the site include two fossils, a mammoth tooth and a piece of petrified wood, which could be chance finds of local occurrence. A number of modern objects were also recovered which pro-

FIGURE 68. Set of nesting brass scale weights.

TABLE 7
Weights of the Nesting Weight Set from Ecuador

1/16 cup	1.87 grams
1/8 cup	3.945 grams
1/4 cup	7.00 grams
1/2 cup	14.30 grams
1 cup	28.70 grams
2 cup	57.375 grams
4 cup	113.84 grams
case	229.31 grams

vide conclusive evidence of some activity by treasure hunters at this site. Among these are a fragment of a soft drink bottle, a galvanized pipe and pipe fitting, a tractor wheel weight, four cast iron window weights, a staple, two lead weights, and a rifle bullet.

OBJECTS LEFT ENCRUSTED

Fifty-five small conglomerates and encrusted objects were left as found for display purposes. X-rays revealed no objects of interest in these conglomerates, only ballast stones, small potsherds, lead, molds of oxidized barrel hoops, spikes, nails, and tacks.

ARTIFACT CONGLOMERATES

The artifacts described in the preceding sections rarely occurred individually. Often they were concreted together in more or less meaningful clumps and clusters. For instance, it seems clear that in some cases the contents of shipping containers have been trapped as a group by encrustation after the container had been crushed by shifting ballast. In other cases, stray nails, spikes, and barrel hoops from the disintegrating wreck were gathered together by chance currents perhaps in shallow depressions in the Pleistocene clay together with a few coins or other nonferrous items which became entrapped in the encrustation, a product mainly of iron corrosion products. The contents of the major conglomerates are discussed in what follows, along with a few of the more interesting smaller conglomerates. The numbers used to reference the conglomerates are the inventory numbers assigned as they were recovered, with individual artifacts within each conglomerate receiving subnumbers during processing in the conservation labo-

ratory (Appendix I). The inventory numbers can be referenced to the site plan (Figure 11).

NUMBER 79

This conglomerate (Figure 69) contained three breech chambers, the impression of two timbers, plus some wood planking impressions which may represent a shipping box. One oxidized iron strap runs along the axis of a board from this box. Perhaps it was bound with iron straps. The nonperishable contents of the box seem to have included several coins, brass pins (No. 79–55), and perhaps some of the pottery and the pincers. The timber impressions are no doubt from the fabric of the ship.

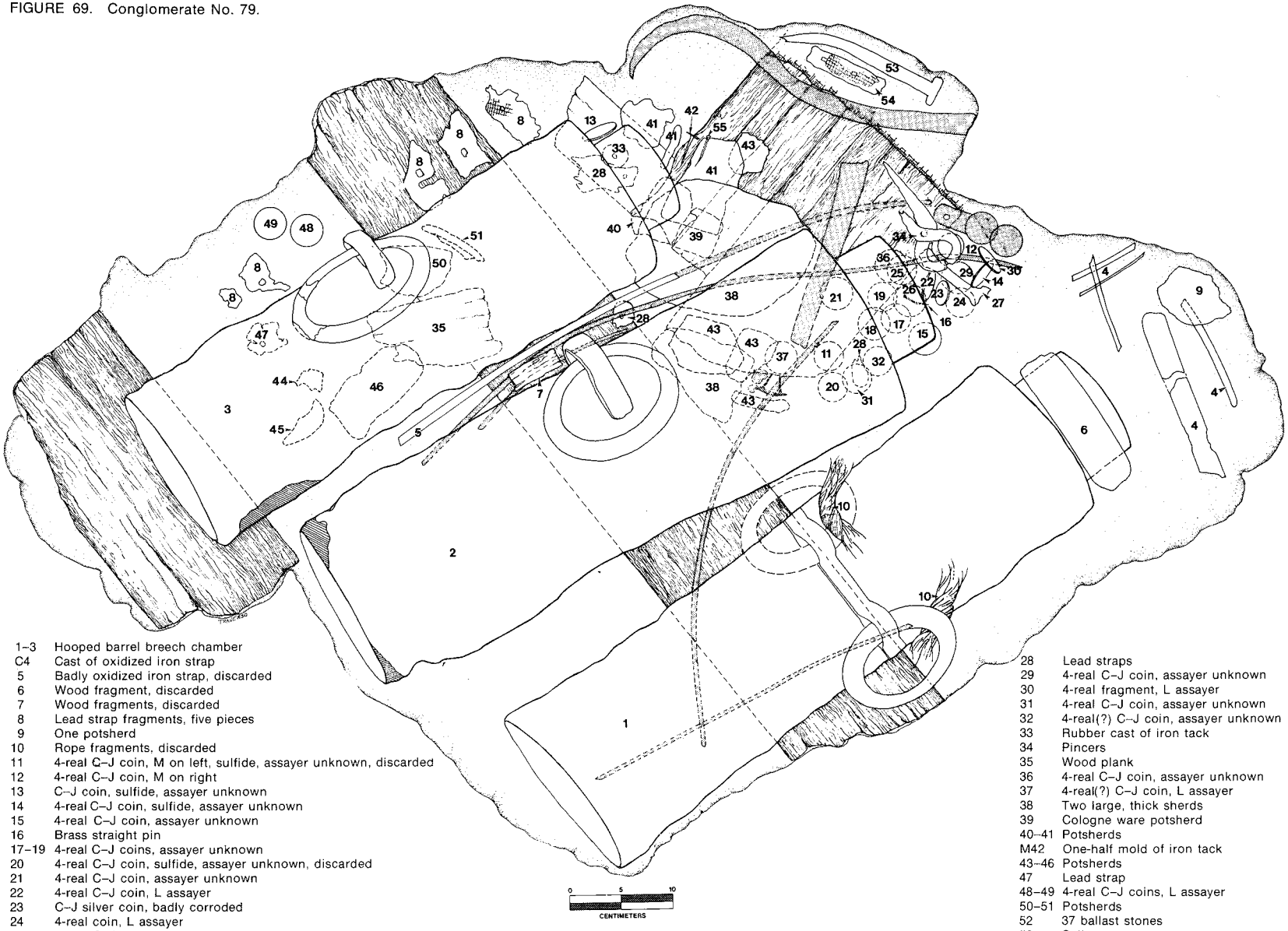
NUMBER 81

The main constituent of this conglomerate (Figure 70) was an anchor missing an arm and fluke. Considering the artifacts adhering to the fluke, especially the inside of the angle formed by the arm and fluke, it seems impossible that they could have become encrusted in that manner if the fluke had been vertical as it was found in 1972. This conglomerate must have been displaced to some extent in recent times. It also contains boards, which are probably from a shipping box. No doubt many of the coins, perhaps the porringer, and other items came from this box of someone's personal possessions. The coins and pottery are concentrated near the boards. As an example of some of the mixing that must have taken place actually during the wreck itself, there is a breech block that lies under the ring end of the anchor. It surely would not have been stored that way since easy access to the breech block would have been necessary for its use.

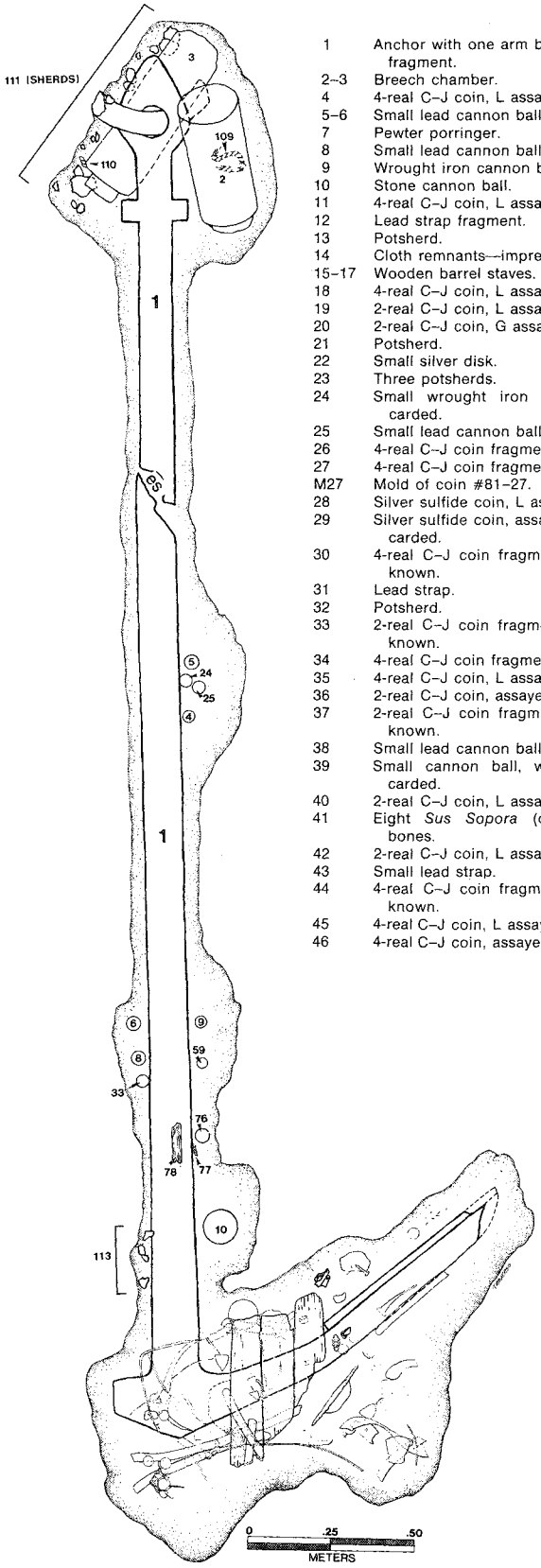
NUMBER 129

Number 129 contained a broken verso or swivel gun and possible contents of a shipping box or barrel, also remains of some boards from this container (Figure 71). The boards were barrel stave or chest size, about 1.5 cm thick. Several similar fragments were among the ballast stones. There were three coins, the gold-covered wooden cross, pewter porringer, and sherds (plain, glazed, and majolica). Along with the small boards were molds of small square nails or tacks which could have been used in the chest's construction. Another impression of a possible beam or ship's member was in this conglomerate along with the impressions of two boards or planks with a minimum width of 26 cm. Also present was a brass pin and a glass bottle

FIGURE 69. Conglomerate No. 79.



1–3 Hooped barrel breech chamber
C4 Cast of oxidized iron strap
5 Badly oxidized iron strap, discarded
6 Wood fragment, discarded
7 Wood fragments, discarded
8 Lead strap fragments, five pieces
9 One potsherd
10 Rope fragments, discarded
11 4-real C–J coin, M on left, sulfide, assayer unknown, discarded
12 4-real C–J coin, M on right
13 C–J coin, sulfide, assayer unknown
14 4-real C–J coin, sulfide, assayer unknown
15 4-real C–J coin, assayer unknown
16 Brass straight pin
17–19 4-real C–J coins, assayer unknown
20 4-real C–J coin, sulfide, assayer unknown, discarded
21 4-real C–J coin, assayer unknown
22 4-real C–J coin, L assayer
23 C–J silver coin, badly corroded
24 4-real coin, L assayer
25 4-real C–J coin, assayer unknown
26 4-real C–J fragment, L assayer
27 Pig metatarsal
28 Lead straps
29 4-real C–J coin, assayer unknown
30 4-real fragment, L assayer
31 4-real C–J coin, assayer unknown
32 4-real(?) C–J coin, assayer unknown
33 Rubber cast of iron tack
34 Pincers
35 Wood plank
36 4-real C–J coin, assayer unknown
37 4-real(?) C–J coin, L assayer
38 Two large, thick sherds
39 Cologne ware potsherd
40–41 Potsherds
M42 One-half mold of iron tack
43–46 Potsherds
47 Lead strap
48–49 4-real C–J coins, L assayer
50–51 Potsherds
52 37 ballast stones
53 Spike
54 Lead strap with oakum
55 Brass straight pin



1 Anchor with one arm broken off and ring fragment.
2–3 Breech chamber.
4 4-real C–J coin, L assayer.
5–6 Small lead cannon ball with iron core.
7 Pewter porringer.
8 Small lead cannon ball with iron core.
9 Wrought iron cannon ball, discarded.
10 Stone cannon ball.
11 4-real C–J coin, L assayer.
12 Lead strap fragment.
13 Potsherd.
14 Cloth remnants—impression.
15–17 Wooden barrel staves.
18 4-real C–J coin, L assayer.
19 2-real C–J coin, L assayer.
20 2-real C–J coin, G assayer.
21 Potsherd.
22 Small silver disk.
23 Three potsherds.
24 Small wrought iron cannon ball, discarded.
25 Small lead cannon ball with iron core.
26 4-real C–J coin fragment, L assayer.
27 4-real C–J coin fragment, S assayer.
M27 Mold of coin #81–27.
28 Silver sulfide coin, L assayer, discarded.
29 Silver sulfide coin, assayer unknown, discarded.
30 4-real C–J coin fragment, assayer unknown.
31 Lead strap.
32 Potsherd.
33 2-real C–J coin fragment, assayer unknown.
34 4-real C–J coin fragment, L assayer.
35 4-real C–J coin, L assayer.
36 2-real C–J coin, assayer unknown.
37 2-real C–J coin fragment, assayer unknown.
38 Small lead cannon ball with iron core.
39 Small cannon ball, wrought iron, discarded.
40 2-real C–J coin, L assayer.
41 Eight *Sus Sopora* (domesticated pig) bones.
42 2-real C–J coin, L assayer.
43 Small lead strap.
44 4-real C–J coin fragment, assayer unknown.
45 4-real C–J coin, L assayer.
46 4-real C–J coin, assayer unknown.
47–48 4-real C–J coins, L assayer.
49 C–J coin fragment, assayer unknown.
50 2-real C–J coin fragment, assayer unknown.
51 4-real C–J coin fragment, assayer unknown.
52 2-real C–J coin fragment, L assayer
53 2-real C–J coin fragment, R assayer, discarded.
54 2-real C–J coin, L assayer.
55 Three potsherds.
56 Strap mold with coin impression, discarded.
57 Iron strap fragment, oxidized.
58 Silver strap.
59–60 2-real C–J coin fragments, assayer unknown.
61 2-real C–J coin, L assayer.
C62 Wax cast of oxidized wrought iron cannon ball.
63 4-real C–J coin, assayer unknown.
64 2-real C–J coin fragment, assayer unknown.
65 4-real C–J coin, L assayer.
66 4-real C–J coin, L assayer.
M67/C67 Mold and cast of oxidized iron sheathing tack.
68 Sample of reeds.
69 Potsherd.
70 Small piece of brass.
71 2-real C–J coin, L assayer.
72 4-real C–J coin fragment, L assayer.
73 Four lead strap fragments.
74–75 4-real C–J coin, L assayer.
76 Small lead cannon ball with iron core.
77 Rope fragment.
78 Wood fragment.
79 2-real C–J coin, L assayer, discarded.
80 4-real C–J coin, L assayer.
81 2-real C–J coin fragment, assayer unknown.
82 C–J coin fragment, denomination and assayer unknown, discarded.
83 Oxidized wrought iron cannon ball, discarded.
C83 Wax cast of cannon ball.
84 Silver disk fragment.
85 Two potsherds.
86 2-real C–J coin fragment, L assayer.
87 2-real C–J coin fragment, assayer unknown.
88 2-real C–J coin, R assayer.
C89 Wax cast of oxidized iron strap fragment.
C90 Wax cast of oxidized iron strap with rivet.
91–96 4-real C–J coins, L assayer.
97 2-real C–J coin fragments, assayer unknown.
C98 Wax cast of oxidized iron planking spike.
99 Potsherd.
100 Brass weight cup.
C101 Wrought iron cannon ball (½ oxide, ½ wax).
102 4-real C–J coin, L assayer.
103 Silver piece.
104–105 4-real C–J coins, assayer unknown.
106 2-real C–J coin, L assayer.
107 Two C–J coins converted to silver sulfide, assayer unknown.
108 Potsherd.
109 Two rope fragments from breech chamber No. 81-2.
110 Rope fragments from breech chamber No. 81-3, discarded.
111 Potsherds from breech chamber No. 81-3.
112 Wood fragments from breech chamber No. 81-3, discarded.
113 Two potsherds.
114 ½ nut shell.
C115 Oxidized iron planking spike cast in latex.
116 807 ballast stones.
117 Cockroach exoskeleton.

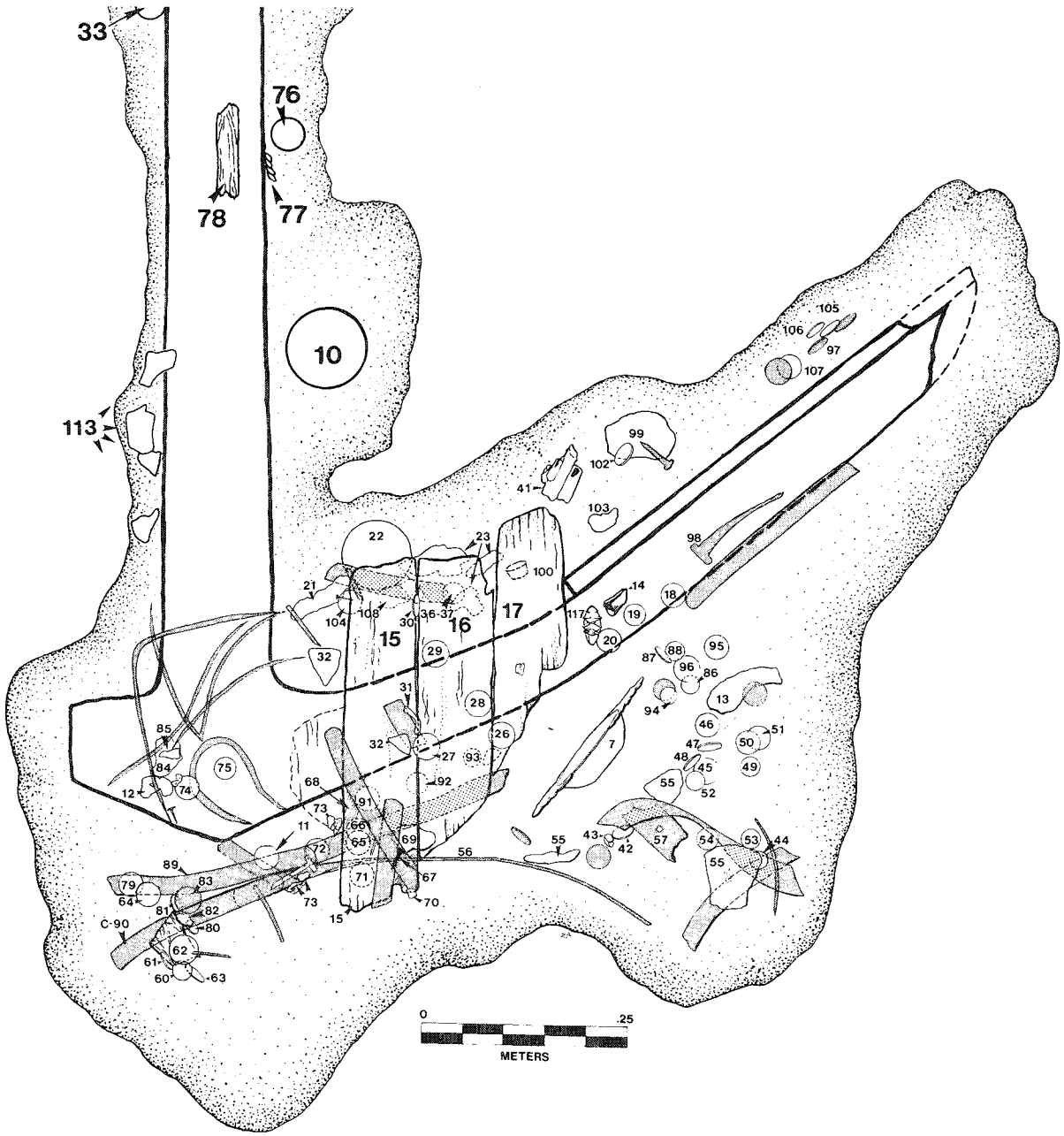


FIGURE 70. Conglomerate No. 81. This was a very large L-shaped encrustation, which served as a datum point. Opposite is a view of the entire conglomerate. An enlargement of the anchor base, showing individual subnumbers appears above. Shading indicates oxidized iron artifacts and coins completely converted to sulfide. Those not included on the drawing were found among the numerous ballast stones and encrustation after removal and their precise locations not recorded.

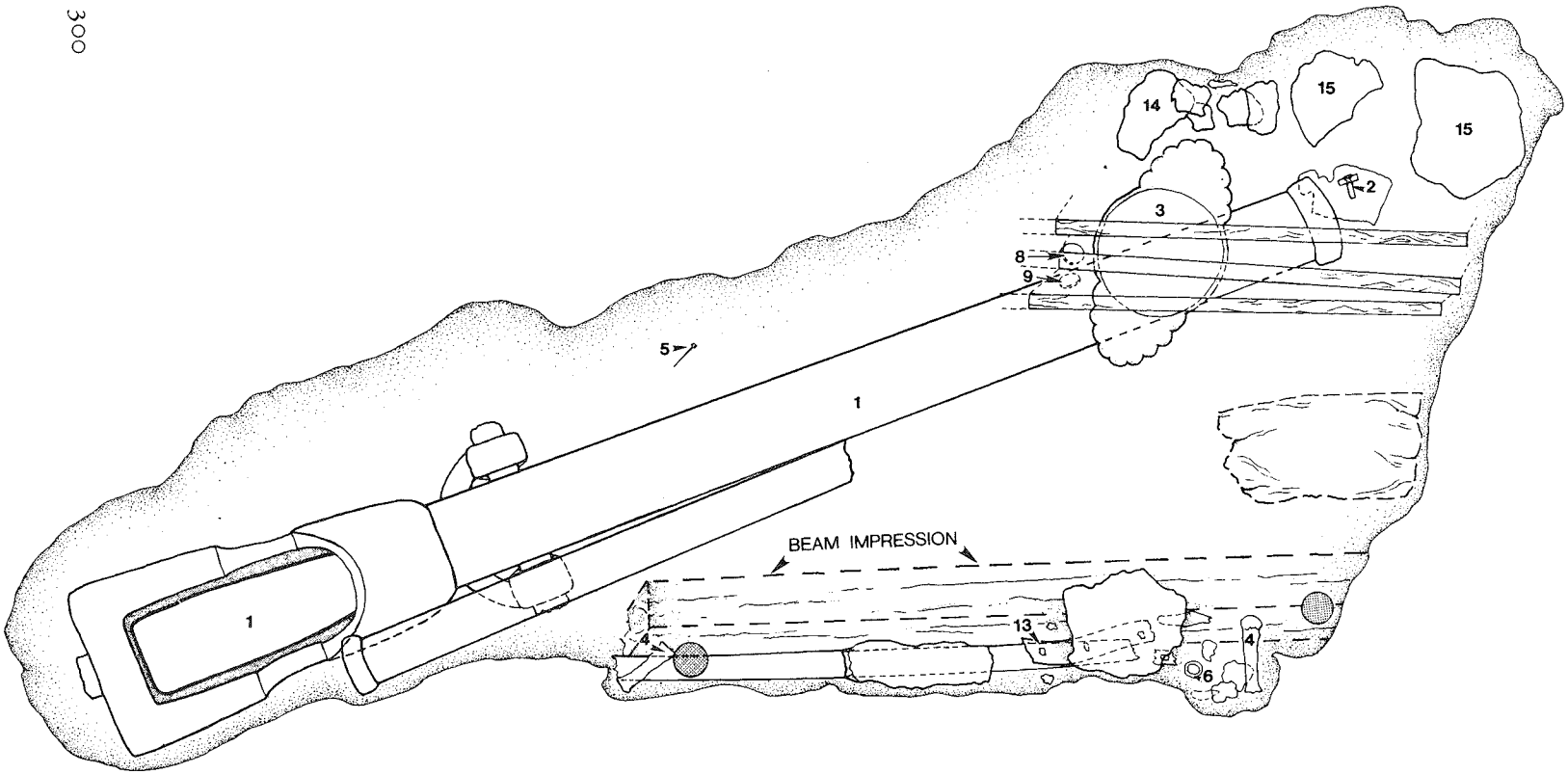


FIGURE 71. Conglomerate No. 129. *Note:* Subnumbers 7, 10, 11, and 16–39 were found among numerous ballast stones and encrustation after the other artifacts were removed, and their precise original locations were not recorded. Shaded circles represent silver coins completely converted to sulfide.

0 .125 .25
METERS

1 Oxidized cannon and small verso breech chamber, discarded.
2 Wooden cross with sheet gold.
3 Pewter porringer.
4 Two bones (one distal end of cannon bone, one metatarsal).
5 Brass straight pin.
6 Glass bottle rim.
7 4-real C–J coin, L assayer.
8–9 2-real C–J coins, R assayer.
10 Brass straight pin.
11 Four bones (one rib fragment, two phalanges, one metatarsal).
12 87 ballast stones.
13 Lead strap fragments.
14–36 Potsherds.
37 Bone.
38 Four wood fragments.
39 Wood fragments.
M40 Molds, assorted nails, spikes, tacks, discarded.

rim. Two coins were completely converted to sulfide. The porringer, a 2-real coin, numerous sherds, and the cross lay under the three thin boards, probably from a shipping box. The porringer lay between the chest boards and the cannon barrel. The cannon lay on the bottom of all this with a considerable amount of ballast on top.

NUMBER 132

Number 132 contained a large mass of ballast stones and eight loaded small wrought iron verso breech chambers, six of one size (Nos. 132–2, 132–4, 132–6, 132–7, 132–8, and 132–11) and two smaller ones (Nos. 132–3 and 132–5) (Figure 72). All of the six similar sized verso breech chambers were pointed in the same direction. Three of them (Nos. 132–6, 132–7, 132–8) had their handles together as if they had once been tied

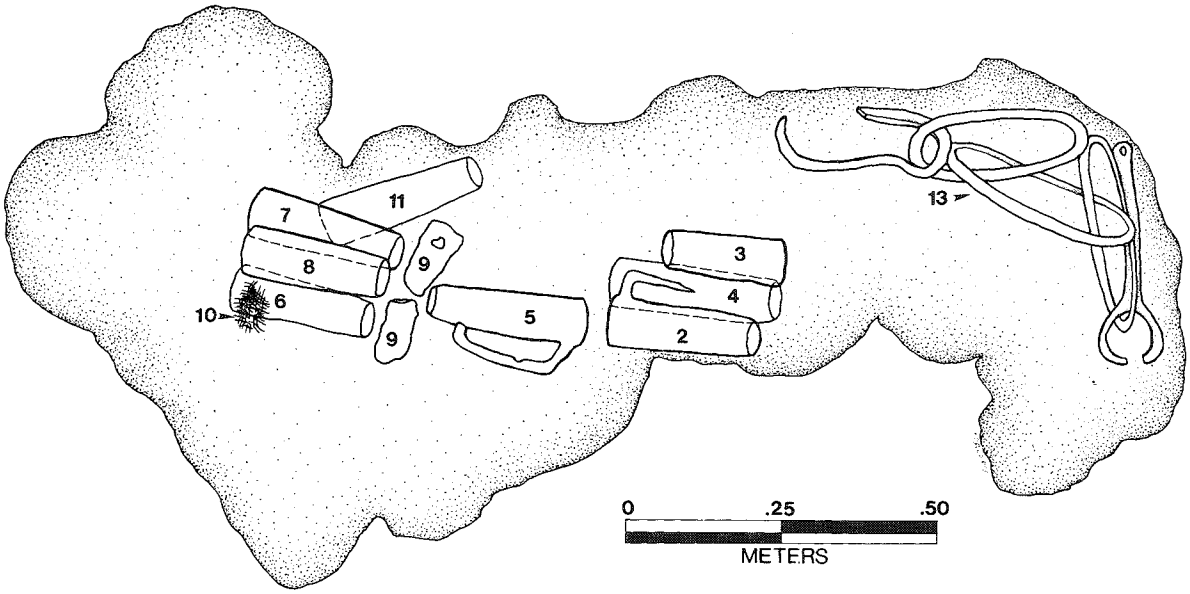


FIGURE 72. Conglomerate No. 132. *Note:* Subnumbers 1, 12, and 17 were recovered from the chipping debris after the other artifacts were removed, and their locations were not recorded.

1 Potsherd.
2–8 Wrought iron verso breech chambers.
9 Wrought iron breech wedge fragments.
10 Two cloth fragments.
11 Wrought iron verso breech chamber.
12 Potsherd.
13 Standing rigging, chain (four links), and bolt.
14 Wooden breech plug.
15 Gunpowder sample.
16 84 ballast stones.
17 Lead strap fragments.
18–23 Wooden plug for verso breech chamber and samples of residue of gunpowder.
24 Hemp touch hole plug.
25–28 Wooden plug for verso breech chamber and samples of residue of gunpowder.

together. The two smaller breech chambers were pointing in the opposite direction. Neither size breech chamber is similar in size to the oxidized breech chamber of the verso in conglomerate No. 129. The only other artifacts were two fragments of a breech wedge, cloth fragments, one sherd, standing rigging chain, and lead strap fragments.

NUMBER 145

This conglomerate contained one large bombard or hoop barrel breech chamber (No. 145–1) and three small verso breech chambers (Nos. 145–6, 145–7, and 145–8) of which the latter were completely oxidized (Figure 73). Number 145–6 is similar in size to the smaller examples in conglomerate No. 132; Nos. 145–7 and 145–8, to the larger ones. Two of the verso breech chambers were lying at right angles to two boards (No. 145–12). Cutting across at an angle above the breech chamber were fragments of a shipping box board. Just above the board were four coins, one by itself and three stacked together (Nos. 145–2, 145–3, 145–4). To the side of the board below and between verso breech chambers Nos. 145–6 and 145–7 were a single sherd with pitch on the interior and a prismatic obsidian blade. Perhaps the coins and obsidian blade were a part of someone's personal belongings from the shipping box represented by the fragmentary boards.

NUMBER 156

This conglomerate, the largest of all, contained two anchors and a hoop barrel gun with carriage remains (Figure 74). It also contained a set of oxidized forelock eye bolt and chains or standing rigging, rather different from the others from this wreck or from 41 WY 3 in that the links were square instead of oval. Other artifacts include a verso breech chamber, a hoop barrelled breech chamber, obsidian blades, a glass bead, and a brass sheath for straight pins.

NUMBER 157

This conglomerate formed around an anchor broken in half with the proximal end and ring lying against the remaining shank and arms (Figure 75). They may have been tied, although no evidence of ropes was found that might have lashed the two pieces together. The distribution of the artifacts within it is interesting in that the coins and brass straight pins are definitely associated and were mainly concentrated around one arm. There were a

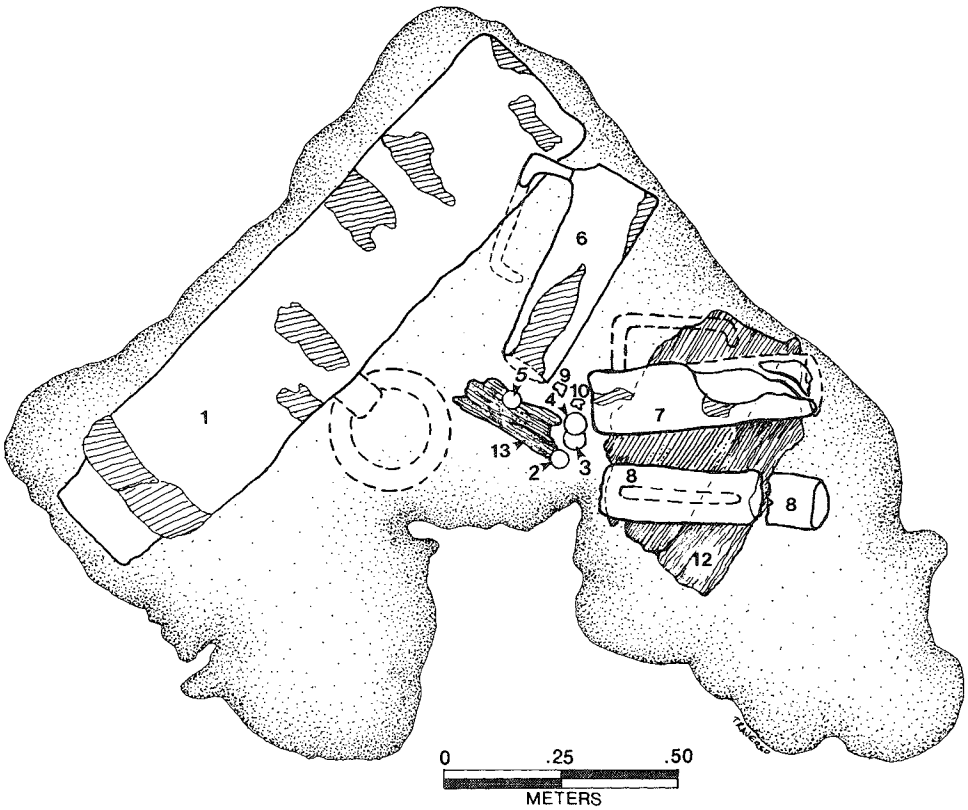


FIGURE 73. Conglomerate No. 145.

1 Hooped barrel breech chamber.
2 2-real C–J coin, L assayer.
3–4 4-real C–J coins, L assayer.
5 2-real C–J coin, L assayer.
6–8 Oxidized iron verso breech chambers, discarded.
9 Prismatic obsidian blade fragment.
10 Potsherd.
11 22 ballast stones.
12 One plank fragment.
13 Shipping box board fragment.

minimum of 102 coins present (89 recoverable, the rest converted to sulfide) and 13 brass pins. A very large number of cannon balls were found: 43 iron cannonballs, five large and 38 small (19 completely oxidized), and 16 small lead-covered iron cannon balls. The cannon balls were distributed across the conglomerate but were more concentrated along the shank and the arm opposite the coin concentration. Five sherds, three brick fragments, one bone, two spikes, three square nails, one tack, and a spike shank fragment were the only other artifacts. The spikes and nails were all completely oxidized and not recoverable but were located in the area of the coin concentration.

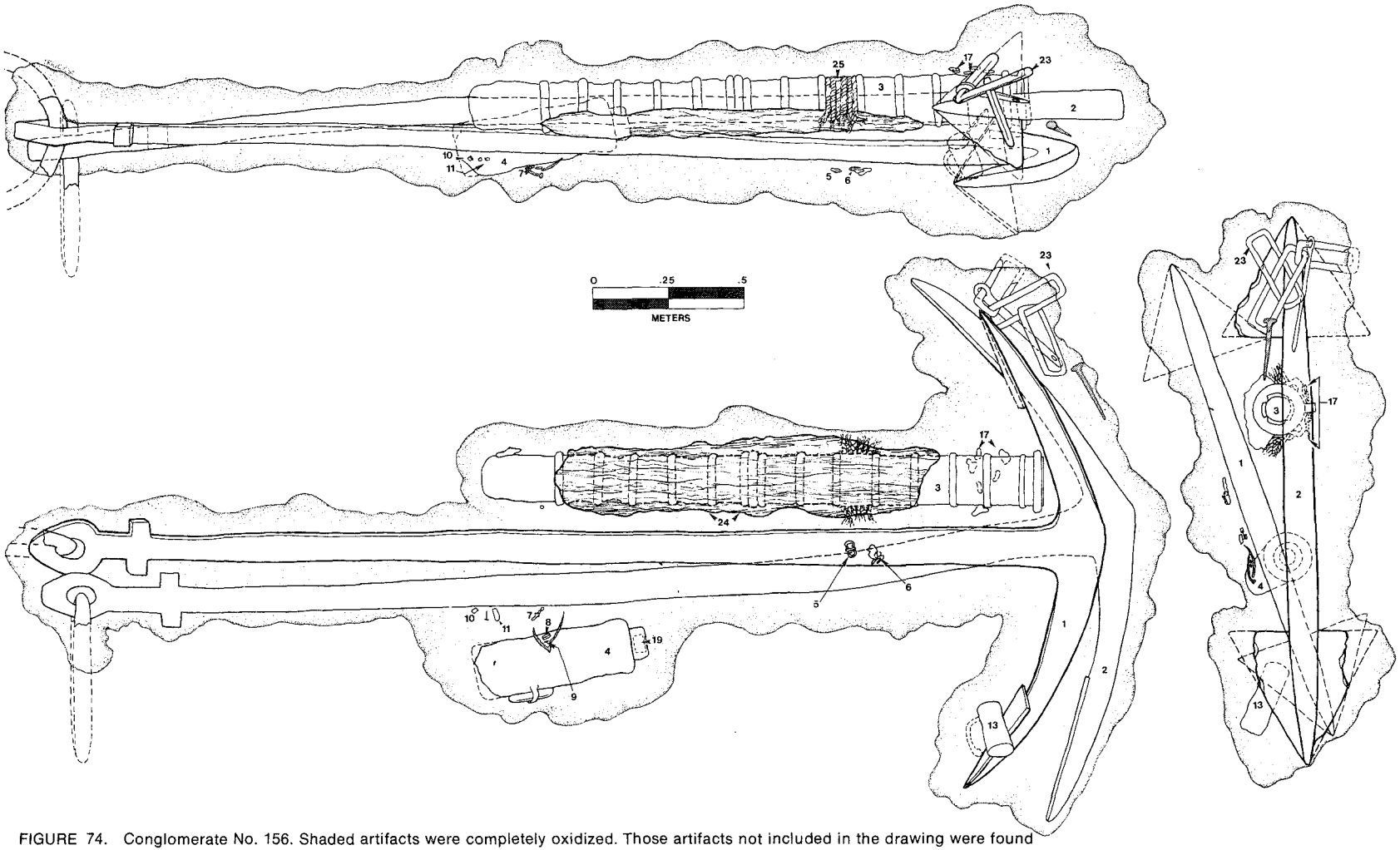


FIGURE 74. Conglomerate No. 156. Shaded artifacts were completely oxidized. Those artifacts not included in the drawing were found among the ballast stones and encrustation after removal and their precise locations not recorded.

1 Wrought iron anchor.
2 Wrought iron anchor.
3 Wrought iron bombard cannon.
4 Hooped barrel breech chamber, 2 ring.
5 Brass buckle.
6 Glass rim sherd and fragments.
7 Decorative brass fragments.
8 Obsidian blades.
9 Brass sheath for straight pins.
10 Square quartz bead.
11 Obsidian blade.
12 Two olive pits.
13 Wrought iron verso breech chamber.
14 Two cockroach exoskeletons.
15 Wood fragments.
16 Iron ring.
17 Resin.
18 Five potsherds (two vessels).
19 Wooden plug from verso breech chamber.
20 Cockroach exoskeleton.
21 Cloth fragment.
22 Potsherd.
23 Oxidized iron chain and bolt, discarded.
24 Wooden carriage from bombard.
25 Cockroach egg cases found under rope lashings.
26 Ballast stones.

NUMBER 160

Along the bottom of this large, elongated conglomerate (Figure 76) is a wooden section of the ship that consists of two large planks, end to end, total length about 3.5 m, with numerous treenail holes. The treenails seem to have attached the two planks to members crossing at right angles underneath. The only indication of these lower planks were two wood impressions. These lower members were about 28 cm in width and of undetermined length. The two planks lay between two long beams with alternating notches cut into the beams. The planks were apparently not attached to the beams. The beams may have been attached to planks below which did not survive and to planks on other beams to the side. That is, in the notches were spikes which secured the beams through the bottom, through the side away from the planks or both, not into the planks between the two beams. The large beams were lain directly on top of the two planks, and between the two beams were four lengths of square cross-sectioned wrought iron bar stock, each bent double. At a slight angle across one of the beams (No. 160–4) was a length of rectangular cross-sectioned wrought iron bar stock, also bent double. A shorter length of square cross-sectioned wrought iron bar stock, also bent double, lay off to one side. Directly on top of the square bar stock was a small log split in half with the ends diagonally cut on opposite sides. This log may have been a brace of some sort. The ends fit quite well into the notches of the beams along the bottom of the conglomerate, that is, just above the boards and bar stock. The ballast in this conglomerate was almost entirely of small cobbles and pebbles with a few larger ballast stones being located higher up in the conglomerate. Among the lower portions of the ballast were numerous small split branches (Nos. 160–12 and 160–13) and two pieces of wood wrapped in split cane or reed.

NUMBER 161

Number 161 contained both halves of a broken anchor and a breech chamber for a bombard. Number 161 also contained numerous artifacts with no readily discernible associations (Figure 77).

SMALL CONGLOMERATES

Many artifacts occurred in smaller conglomerates. Most of these represent scattered debris gathered in clumps and left undisturbed long enough for the iron corrosion products to begin the process of concreting them together. The number of the smaller conglomerates recovered precludes illustrating each of them, but the more interesting ones are shown in Figures 78–90.

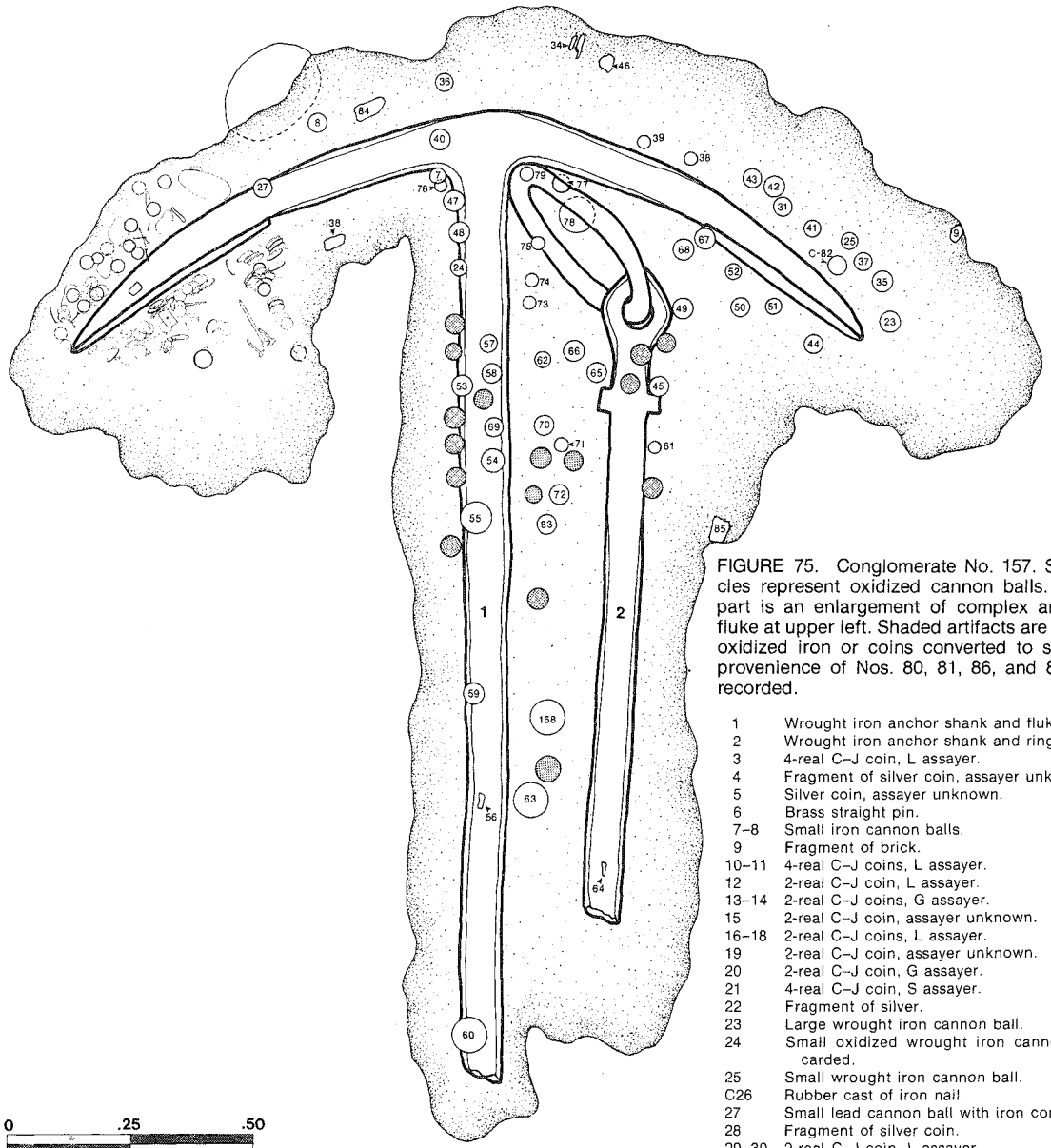
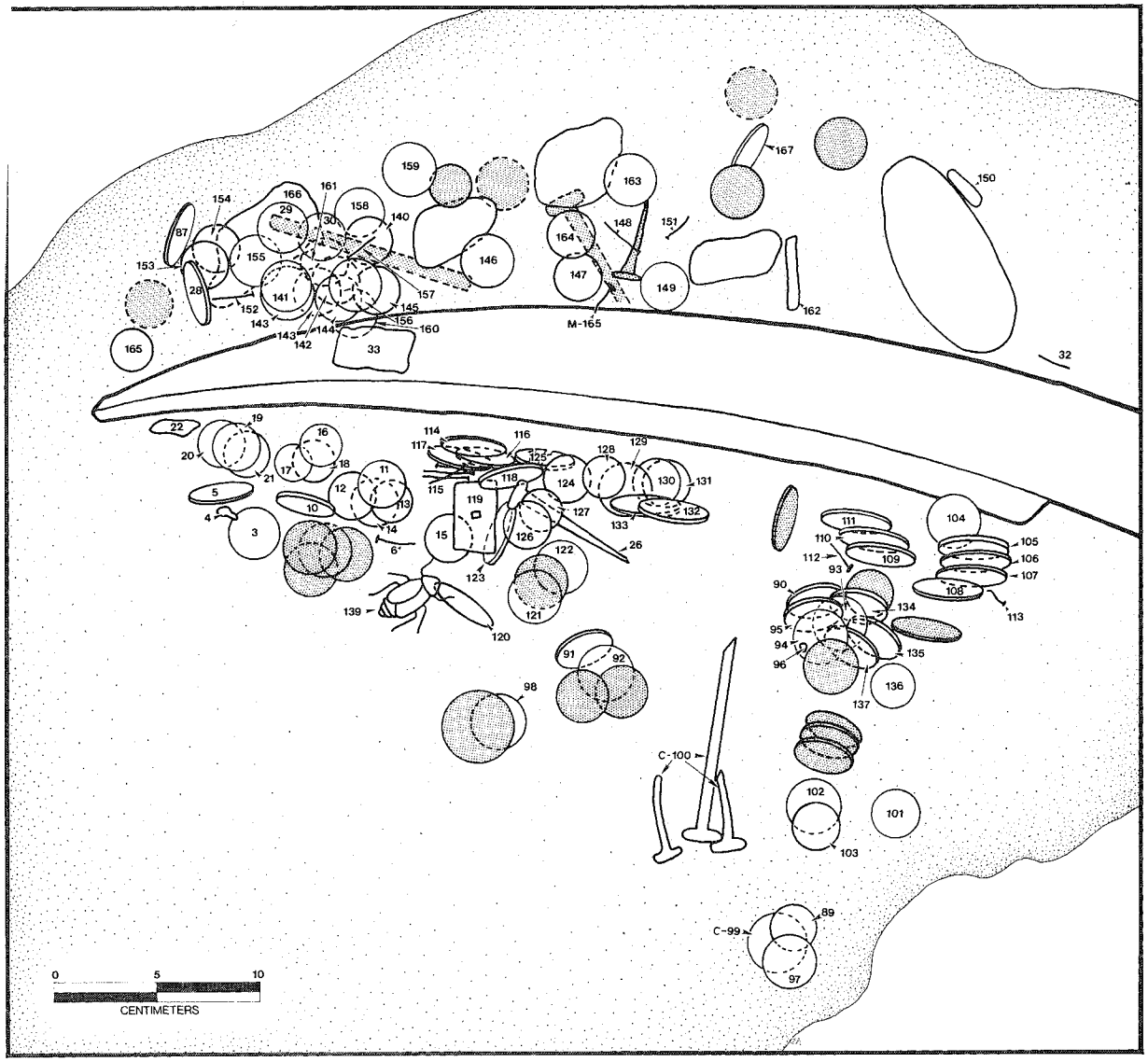


FIGURE 75. Conglomerate No. 157. Shaded circles represent oxidized cannon balls. The lower part is an enlargement of complex area around fluke at upper left. Shaded artifacts are completely oxidized iron or coins converted to sulfide. The provenience of Nos. 80, 81, 86, and 88 was not recorded.

1	Wrought iron anchor shank and flukes.
2	Wrought iron anchor shank and ring.
3	4-real C–J coin, L assayer.
4	Fragment of silver coin, assayer unknown.
5	Silver coin, assayer unknown.
6	Brass straight pin.
7–8	Small iron cannon balls.
9	Fragment of brick.
10–11	4-real C–J coins, L assayer.
12	2-real C–J coin, L assayer.
13–14	2-real C–J coins, G assayer.
15	2-real C–J coin, assayer unknown.
16–18	2-real C–J coins, L assayer.
19	2-real C–J coin, assayer unknown.
20	2-real C–J coin, G assayer.
21	4-real C–J coin, S assayer.
22	Fragment of silver.
23	Large wrought iron cannon ball.
24	Small oxidized wrought iron cannon ball, discarded.
25	Small wrought iron cannon ball.
C26	Rubber cast of iron nail.
27	Small lead cannon ball with iron core.
28	Fragment of silver coin.
29–30	2-real C–J coin, L assayer.
31	Wrought iron cannon ball.
32	Brass straight pin without head.
33	Two potsherds.
34	Wood fragments.
35	Small lead cannon ball with iron core.
36	Small wrought iron cannon ball.
37	Small wrought iron cannon ball.
38	2-real C–J coin, R assayer.
39	4-real C–J coin, L assayer.
40–41	Small wrought iron cannon balls.
42	Small lead cannon ball with iron core.
43–45	Small wrought iron cannon balls.
46	Potsherd.
47–49	Small lead cannon balls with iron cores.
50	Small oxidized wrought iron cannon ball, discarded.
51–52	Small wrought iron cannon balls.
53–54	Small lead cannon balls with iron cores.
55	Large wrought iron cannon ball.
56	Potsherd.
57	Small wrought iron cannon ball.
58–59	Small lead cannon balls with iron core.
60	Large wrought iron cannon ball.
61	4-real C–J coin, L assayer.
62	Small lead cannon ball with iron core.
63	Large wrought iron cannon ball.
64	Bone fragment.
65–69	Small lead cannon balls with iron cores.
70	Small wrought iron cannon ball.
71	4-real C–J coin, L assayer.
72	Small wrought iron cannon ball.
73	4-real C–J coin, L assayer.
74	2-real C–J coin, L assayer.
75	4-real C–J coin, L assayer.
76	2-real C–J coin, L assayer.
77	Small wrought iron cannon ball.
78	Large wrought iron cannon ball.
79	Small wrought iron cannon ball.
80	2-real C–J coin, L assayer.
81	Brass straight pin.
C82	Cast of small oxidized wrought iron cannon ball.
83	Oxidized wrought iron cannon ball, discarded.
84–85	Brick fragments.
86	Wood samples.
87	2-real C–J coin, L assayer.
88	4-real C–J coin, assayer unknown.
89–90	4-real C–J coins, L assayer.
91–92	2-real C–J coins, L assayer.
93–94	4-real C–J coins, L assayer.
95	2-real C–J coin, L assayer.
96	Iron pyrite bead.
97–98	4-real C–J coins, L assayer.
C99	Cast of oxidized wrought iron cannon ball.
C100	Cast of oxidized iron planking spike and two square nails.
101	2-real C–J coin fragment, assayer unknown.
102	4-real C–J coin, L assayer.
103	2-real C–J coin, assayer unknown.
104	4-real C–J coin, L assayer.
105	2-real C–J coin, A assayer.
106	2-real C–J coin, L assayer.
107	2-real C–J coin, L assayer.
108	4-real C–J coin, L assayer.
109	2-real C–J coin, L assayer.
110–111	4- real C–J coins, L assayer.
112–113	Brass straight pins.
114	4-real Santo Domingo coin, F assayer.



115 Four brass straight pins.
116 2-real C–J coin, A assayer.
117 2-real C–J coin, L assayer.
118 4-real silver coin, assayer unknown.
119 Lead strap fragment.
120 4-real C–J coin, L assayer.
121 2-real C–J coin, L assayer.
122 Fragment of C–J coin, assayer unknown.
123–124 4-real C–J coins, L assayer.
125 Tiny fragments of silver.
126–127 2-real C–J coins, L assayer.
128 2-real C–J coin, A assayer.
129 2-real C–J coin, S assayer.
130–131 2-real C–J coins, L assayer.
132 4-real C–J coin, L assayer.
133 2-real C–J (sulfide) coin, G assayer, discarded.
134 2-real C–J coin, L assayer.
135 4-real C–J coin, L assayer.
136 2-real C–J coin, L assayer.
137 4-real C–J coin, L assayer.
138 Four wood fragments.
139 Cockroach exoskeleton.
140 2-real C–J coin, L assayer.
141 4-real C–J coin, L assayer.
142 2-real C–J coin, L assayer.
143 2-real C–J coin, early series, R assayer.
144–145 4-real C–J coin, L assayer.
146 2-real C–J coin, A assayer.
147 2-real C–J coin, assayer unknown.
148 Brass straight pin.
149 Silver fragment.
150 Potsherd.
151–152 Brass straight pins.
153 2-real C–J coin, assayer unknown.
154 2-real C–J coin fragment, assayer unknown.
155 2-real C–J coin, G assayer.
156 4-real C–J coin, L assayer.
157 Brass straight pin.
158 2-real C–J coin, L assayer.
159 2-real C–J coin, G assayer.
160 2-real C–J coin, A assayer.
161 4-real C–J coin, L assayer.
162 Wood sample.
163 4-real C–J coin, assayer unknown.
164 4-real C–J coin, L assayer.
M165 Mold of small oxidized iron nail.
166 Potsherd.
167 4-real C–J coin fragment, assayer unknown.
168 Ballast stones.

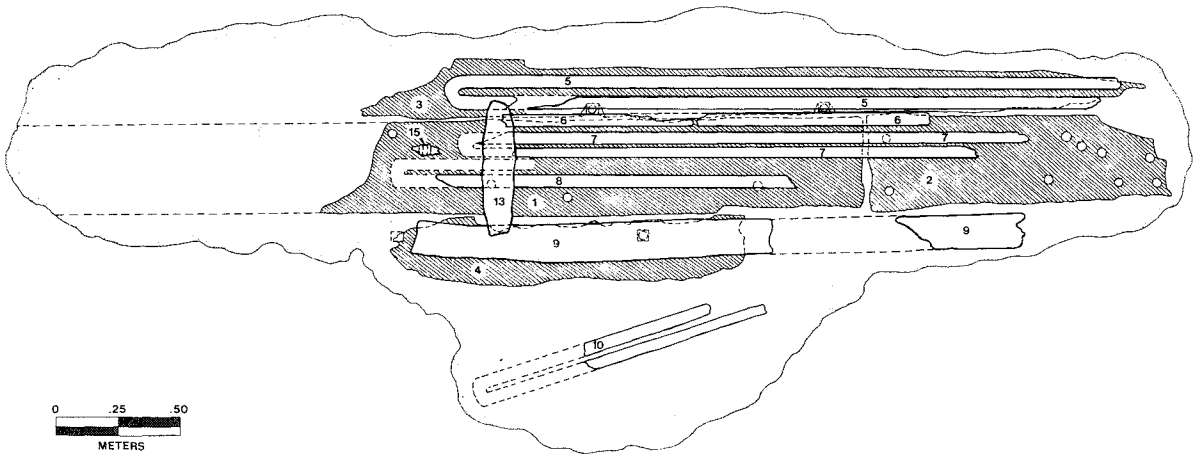


FIGURE 76. Conglomerate No. 160. *Note:* No. 18 was lying along the surface of the planks. Nos. 11, 12, 14, 16, and 17 came from among the vast amount of ballast in this conglomerate with exact locations unrecorded.

1–2 Large plank, end section.
3–4 midsection of beam with notches.
5–8 iron bar stock—square.
9 iron bar stock—rectangular.
10 iron bar stock—square.
11 wooden board end.
12 section diagonally cut wood.
13 ½ section split log "board."
14 ½ section split branch.
15 cane-wrapped wood.
16 wooden branch samples.
17 two bones (metatarsal and shank fragment).
18 hair/"caulking."
19 2233 ballast stones.

1 Wrought iron anchor.
2–3 4-real C–J coins, L assayer.
4–5 Wrought iron cannon balls.
6 2-real coin, L assayer.
7 4-real C–J coin, assayer unknown.
8 Wrought iron cannon ball.
9 2-real C–J coin, L assayer.
10 2-real C–J coin, assayer unknown.
11 4-real C–J coin, L assayer.
12 2-real C–J coin, L assayer.
13 4-real C–J coin, L assayer.
14 4-real C–J coin, assayer unknown.
15 Small silver disk.
16 2-real C–J coin, G assayer.
17 Potsherds.
18 2-real C–J coin, G assayer.
19 2-real C–J coin, L assayer.
20–21 4-real C–J coins, L assayer.
22 4-real C–J coin, S assayer.
23 Bone.
24 Oxidized large forelock bolt, discarded.
25 Potsherds.
26 Ballast stone.
27 Three potsherds.
28 4-real C–J coin, assayer unknown.
29 2-real C–J coin, L assayer.
30 4-real C–J coin, S assayer.
31 Cockroach fragment.
32 2-real C–J coin, L assayer.
33 2-real C–J coin, assayer unknown.
34 4-real C–J coin, L assayer.
35 2-real C–J coin, G assayer.
36 Olive pit.
37 4-real C–J coin, L assayer.
38 Nut shells.
39 Hooped barrel breech chamber, two ring.
40 2-real C–J coin, assayer unknown.
41 4-real C–J coin, L assayer.
42 Animal bone (rib fragment).
43 Wrought iron spike fragment.
44–45 4-real C–J coins, L assayer.
46 Ferdinand-Isabella 1-real coin, Seville Mint.
47 Brass pin.
48 Bone.
49 4-real C–J coin, assayer unknown.
50 Brass straight pin.
51 Two potsherds.
52 4-real C–J coin, L assayer.
53–55 2-real C–J coins, L assayer.
56 2-real C–J coin, G assayer.
58 Bone (phalange).
59 Potsherds.
60 4-reales C–J coin, L assayer.
61 Cockroach exoskeleton.
62 4-real C–J coin, L assayer.
63 2-real C–J coin, assayer unknown.
64 4-real C–J coin, L assayer.
65 Almond shell.
66 4-real C–J coin, L assayer.
67 Wrought iron cannon ball.
68 Cone-shaped iron object.
69 Wood samples, discarded.
70 Natural crystal.
71 Ballast stones.

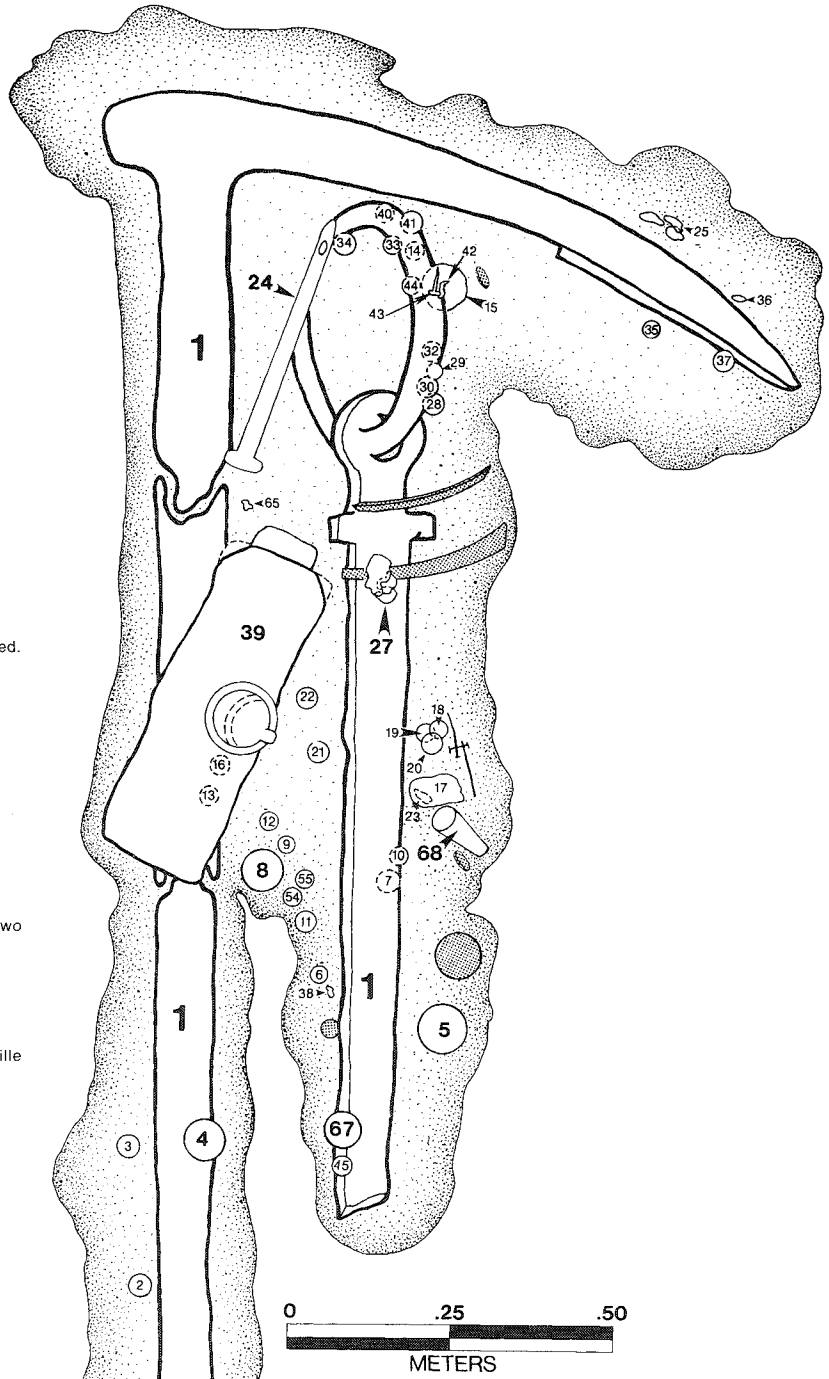


FIGURE 77. Conglomerate No. 161. Shaded artifacts without subnumbers indicate total conversion to oxide for iron straps and cannon balls and sulfide for silver coins. Several artifacts were recovered from the encrustation after its removal and their locations not recorded.

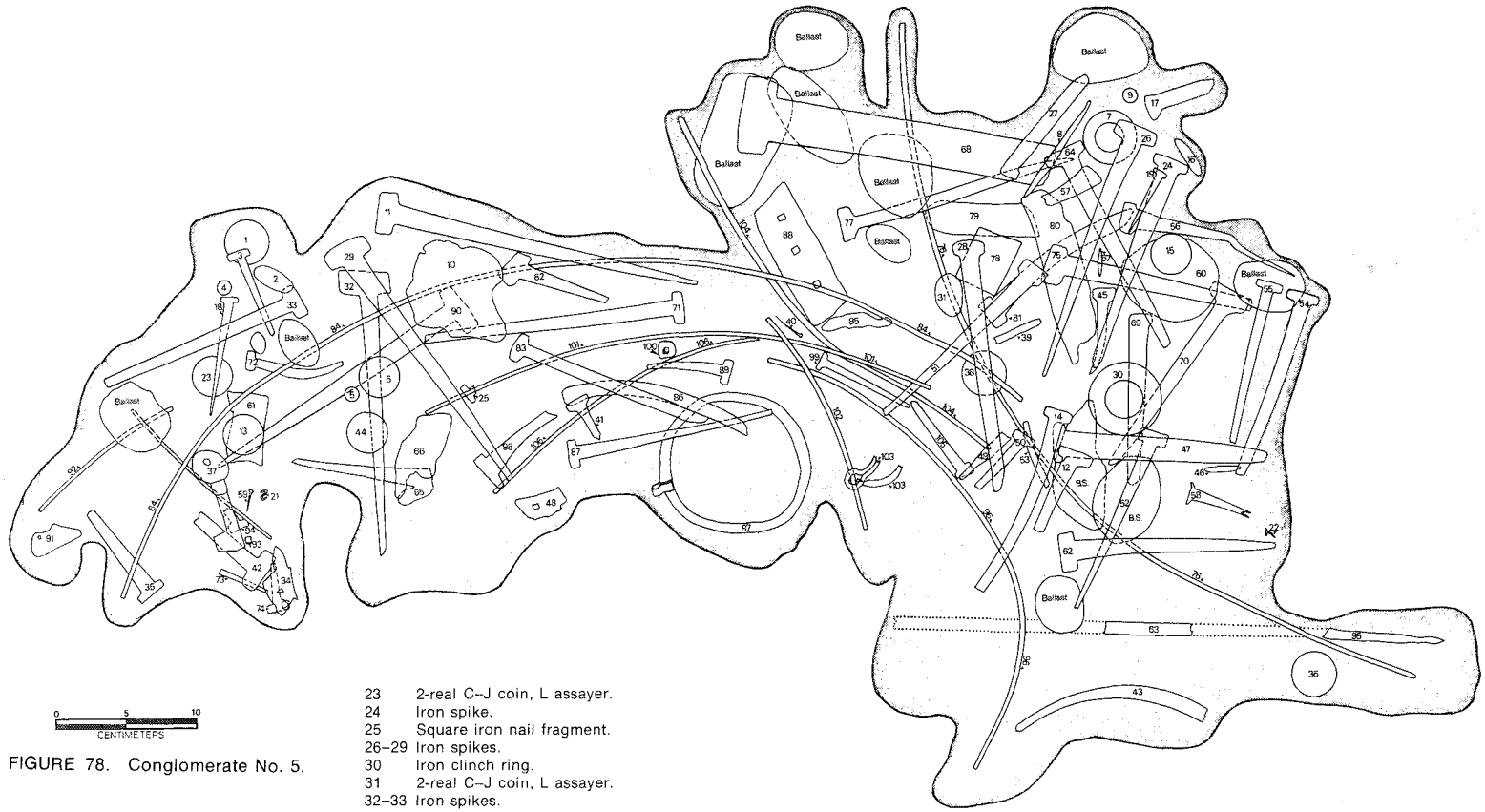
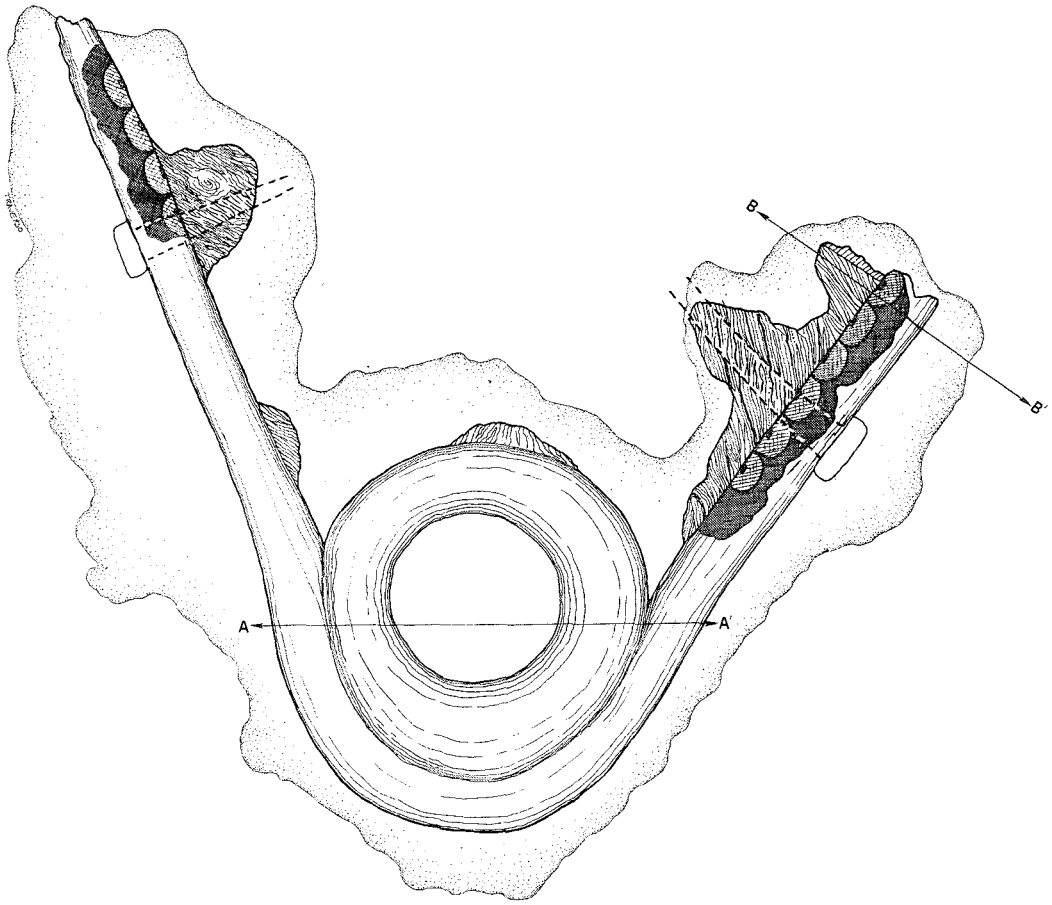
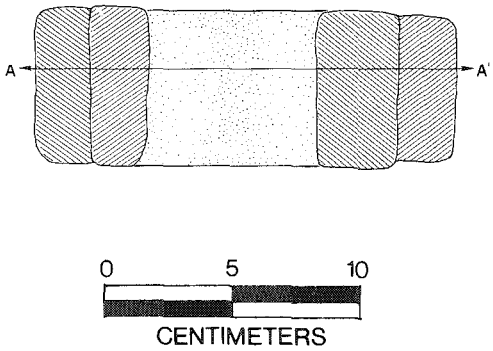


FIGURE 78. Conglomerate No. 5.

1 4-real C–J coin, L assayer.
2 2-real C–J coin, L assayer.
3 Badly Oxidized iron spike, discarded.
4–5 Small lead balls.
6 2-real C–J coin, G assayer.
7 Iron clinch ring.
8 Lead sliver.
9 Small lead ball.
10 Small silver disk.
11 Iron spike.
12 Iron spike fragment.
13 C–J copper coin, probably 4 maravedis, Santo Domingo Mint.
14 Iron spike.
15 2-real C–J coin, L assayer.
16 2-real C–J coin, G assayer.
17–19 Iron spikes.
20 25 ballast stones.
21 Brass wire chain link.
22 Brass tack.
23 2-real C–J coin, L assayer.
24 Iron spike.
25 Square iron nail fragment.
26–29 Iron spikes.
30 Iron clinch ring.
31 2-real C–J coin, L assayer.
32–33 Iron spikes.
34 Lead strap.
35 Iron spike.
36 4-real C–J coin, G assayer.
37 Iron key with shank covered with copper.
38 4-real C–J coin, L assayer.
39 Potsherd.
40 Brass straight pin.
41–43 Iron spikes.
44 4-real C–J coin, assayer unknown.
45 Iron spike fragment.
46 Badly oxidized fragment of iron, discarded.
47 Iron spike.
48 Lead strap.
49–52 Iron spikes.
53 Potsherd.
54–56 Iron spikes.
57 Iron forelock or wedge for forelock bolt.
58 Iron spike fragment.
59 Brass tack.
60 Polished iron pyrite hemisphere, aboriginal mirror.
61 Lead strap fragment.
62 Iron spike.
63 Part of oxidized haft of reamer (No. 5-95).
64 Iron planking spike.
65 Badly oxidized iron spike fragment, discarded.
66 Lead strap fragment.
67 4-real C–J coin, L assayer.
68 Large iron bolt fragment.
69–72 Iron spikes.
73 Badly oxidized square nail, discarded.
74–75 Iron spikes.
76 Iron barrel strap fragments.
77 Iron spike.
78 Iron thimble-like object.
79 Oxidized iron straps, discarded.
80 Iron strap fragment.
81–83 Iron spikes.
84 Iron strap section.
85 Lead fragment.
86–87 Iron spikes.
88 Lead strap fragment.
89–90 Iron spikes.
91 Lead strap fragment.
92 Two iron strap fragments.
93 Badly oxidized iron nail fragment, discarded.
94 Iron spike fragment.
95 Distal end of iron reamer.
96 Iron strap, two sections.
97 Iron ring with hinge attachment.
98 Iron spike fragment.
99–100 Iron square nails.
101 Partially oxidized iron strap.
102 Iron strap fragment.
103 Oxidized fragment of link of small iron chain (?), discarded.
104 Iron strap fragment.
105 Iron spike fragment.
106 Iron strap fragment.
107 Leather with hair from inside No. 5-78.





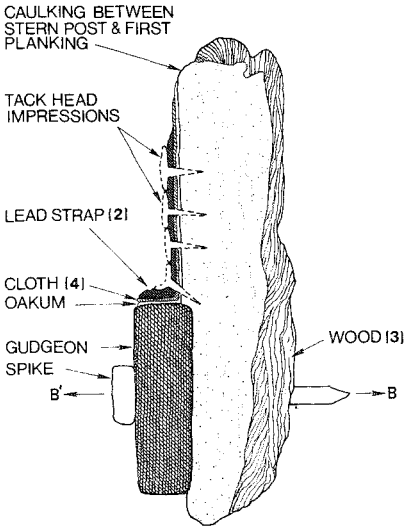


FIGURE 79. Conglomerate No. 43 (top). Cross section of gudgeon (bottom, left). Cross section of gudgeon arm (bottom, right).

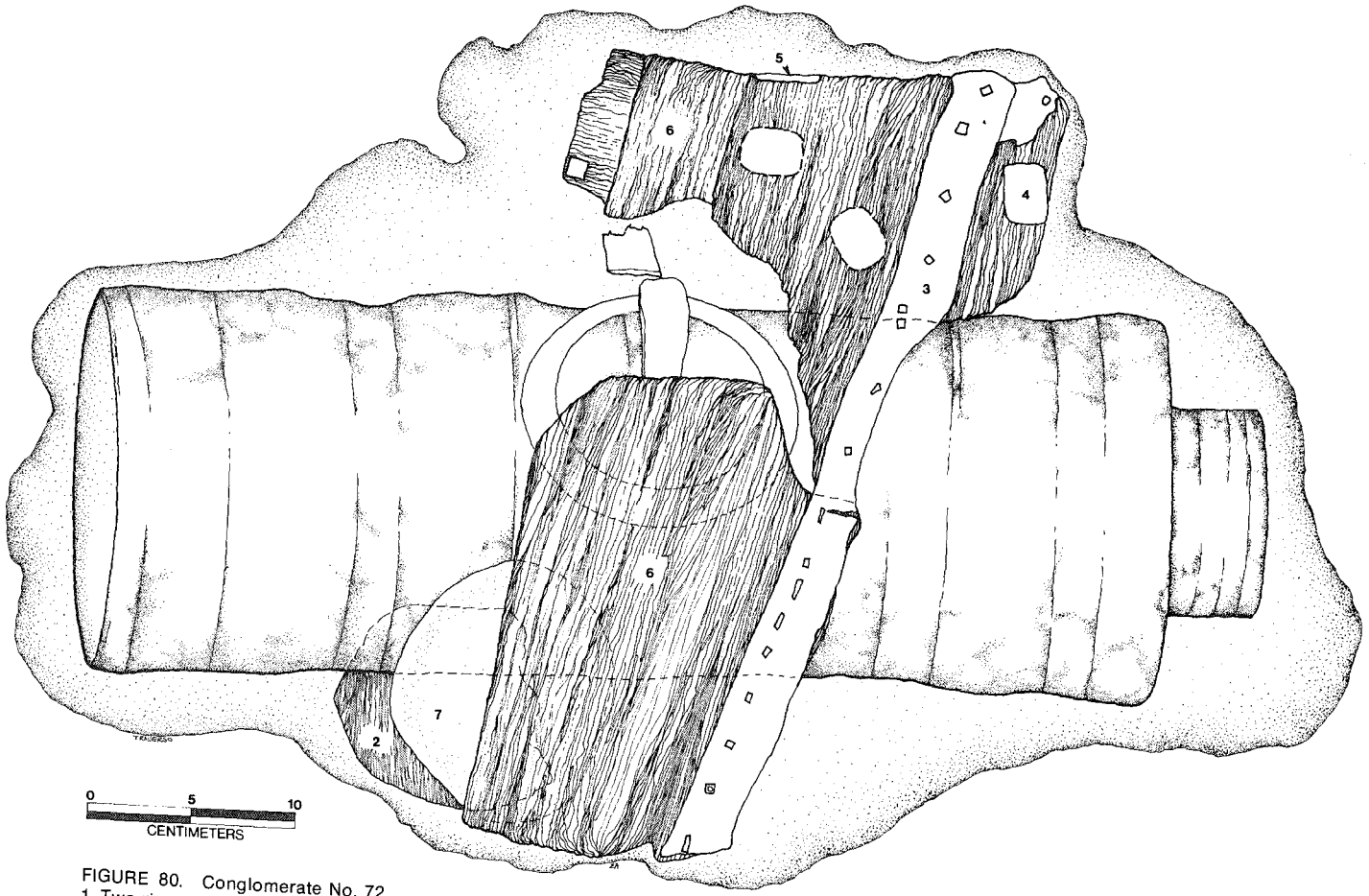


FIGURE 80. Conglomerate No. 72.
1 Two-ring wrought iron breech block.
2 Flat piece of wood.
3 Strip of lead sheathing.
4 Iron planking spike.
5 Piece of iron.
6 Wood.
7 Ballast stones.

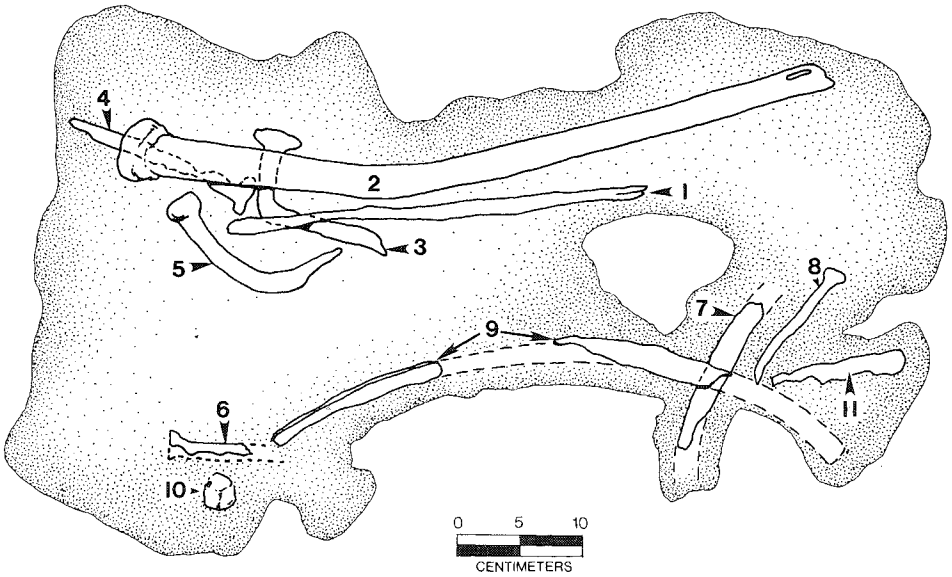


FIGURE 81. Conglomerate No. 102.
1 Iron auger.
2 Iron forelock bolt.
3–6 Iron spikes.
7 Iron strap.
8 Iron spike.
9 Badly oxidized iron strap, discarded.
10 Iron core for cannon ball.
11 Badly oxidized iron strap, discarded.

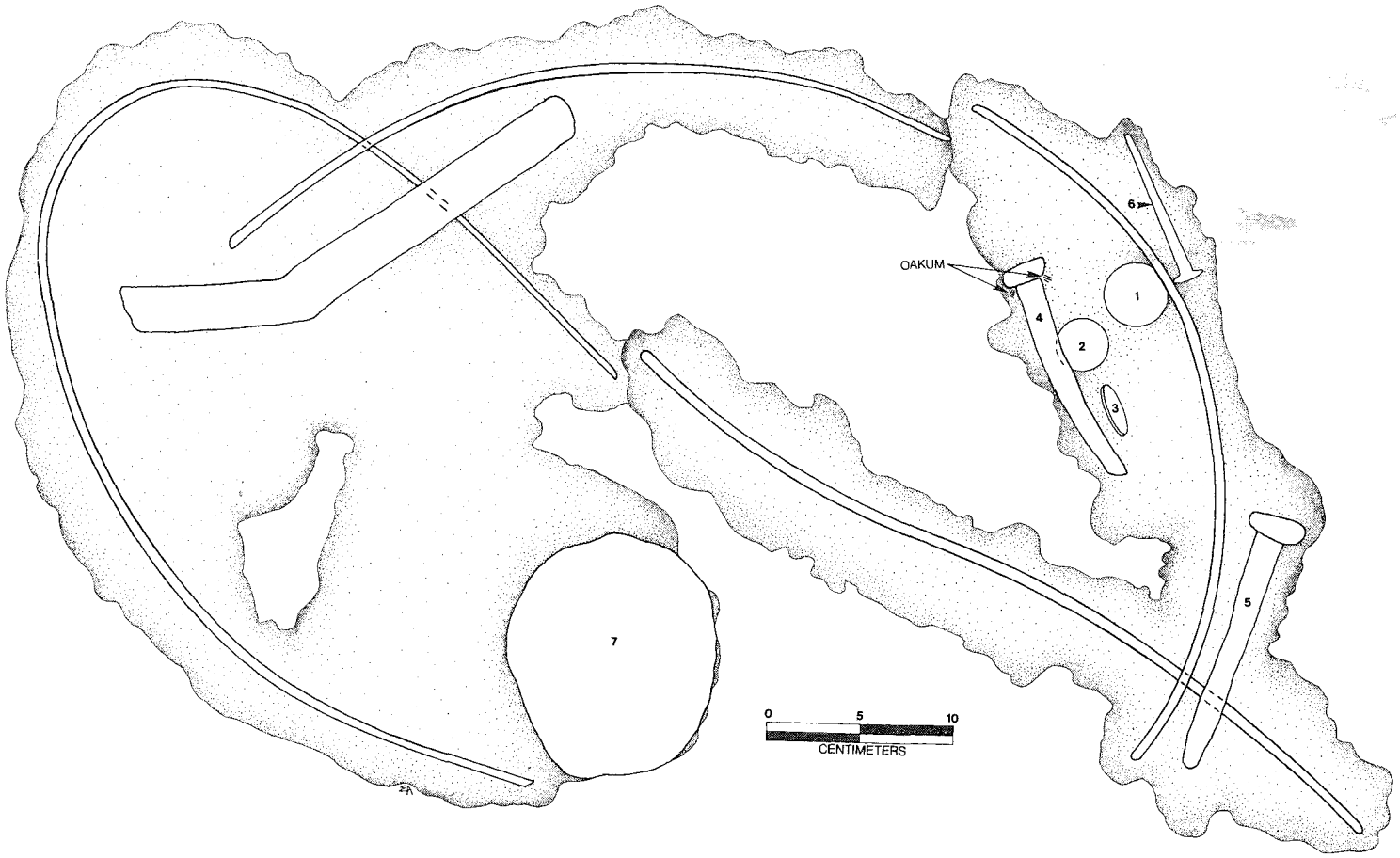


FIGURE 82. Conglomerate No. 105. In addition to the numbered artifacts, there were several oxidized iron barrel hoops.

1 4-real C–J coin, L assayer.
2 2-real C–J coin, L assayer.
3 2-real C–J coin, G assayer.
4–5 Iron spikes.
6 Oxidized square iron nail, discarded.
7 Ballast stone.

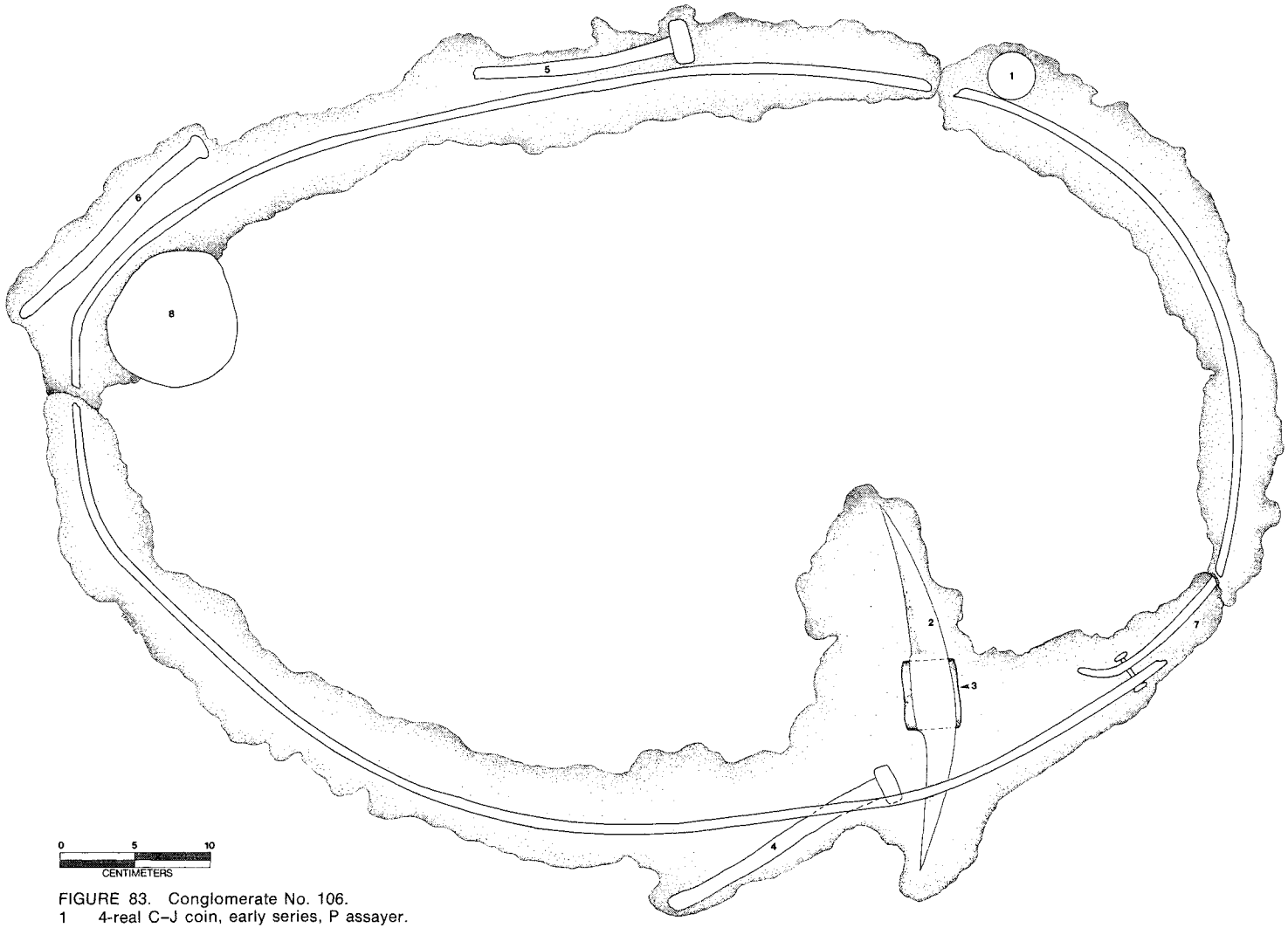


FIGURE 83. Conglomerate No. 106.
1 4-real C–J coin, early series, P assayer.
2 Small iron pick adze.
3 Wooden handle fragment.
4–5 Iron spikes.
6 Oxidized iron spike, discarded.
7 Complete barrel hoop.
8 Ballast stone.

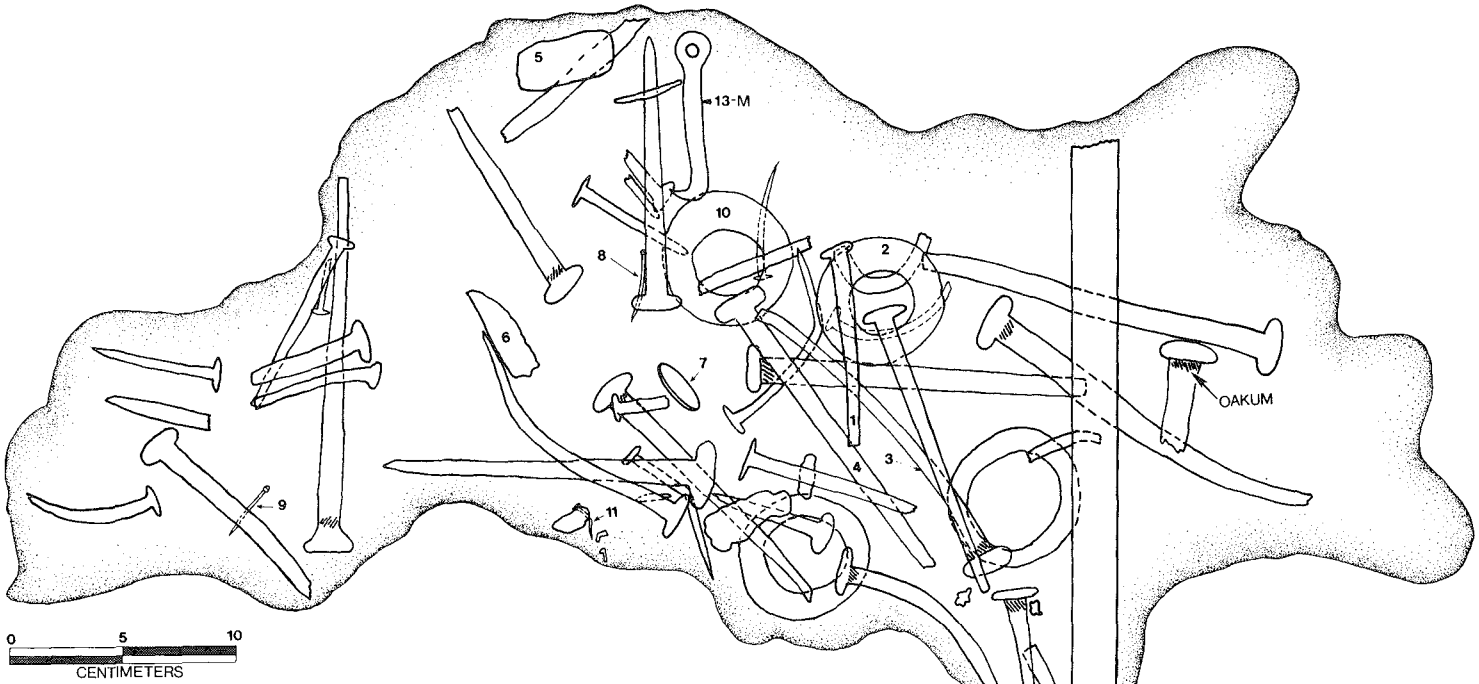


FIGURE 84. Conglomerate No. 107. Unnumbered artifacts were completely oxidized.
1 Iron spike, discarded.
2 Iron clinch ring.
3–4 Iron spikes, discarded.
5 Potsherd.
6 Brass rim fragment.
7 1-real C–J coin, L assayer.
8–9 Brass straight pins.
10 Iron clinch ring.
11 Brass tack.
12 Five small ballast stones.
M13 Natural mold in encrustation of oxidized claw frame of goat's foot lever.
C13 Cast of claw frame.

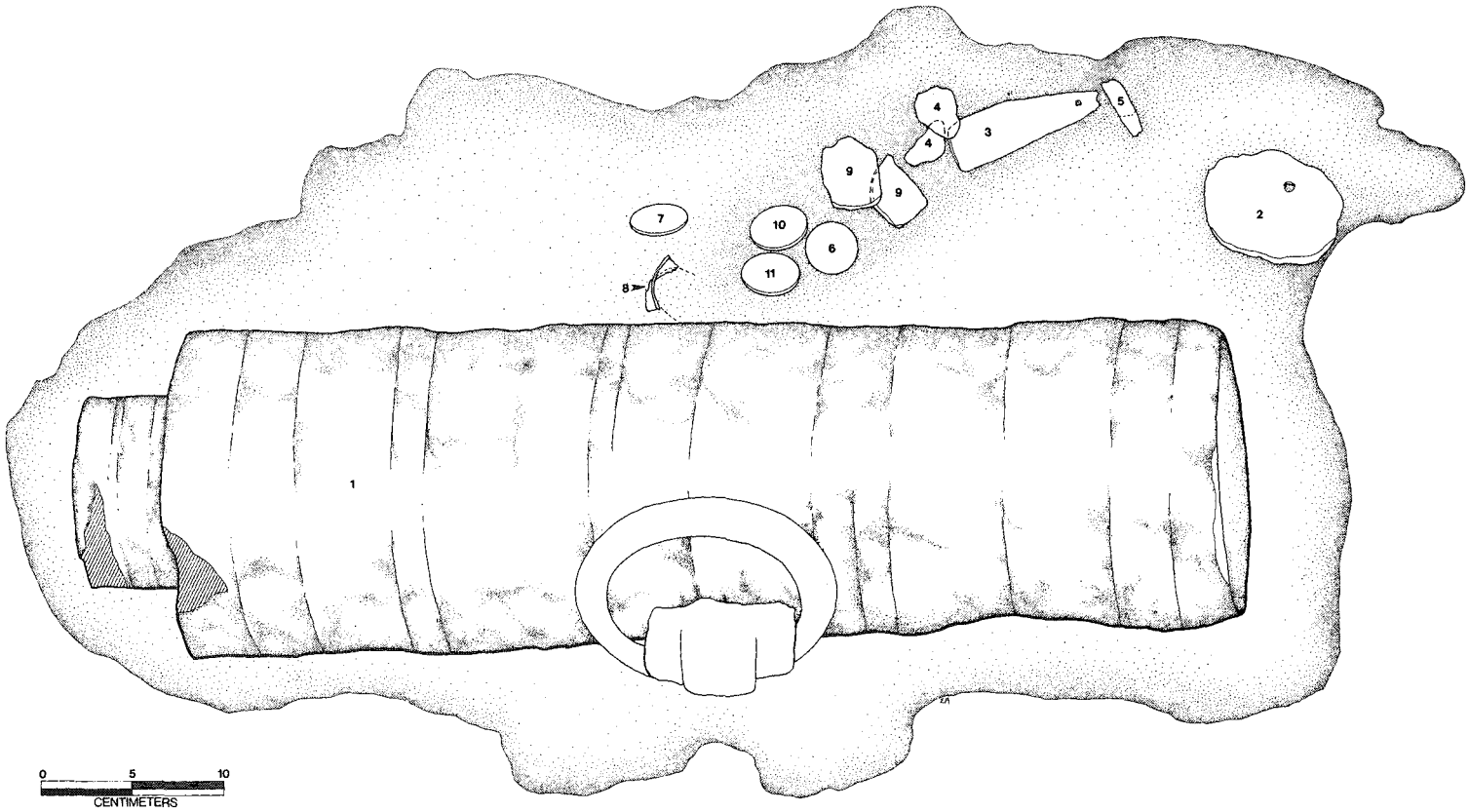
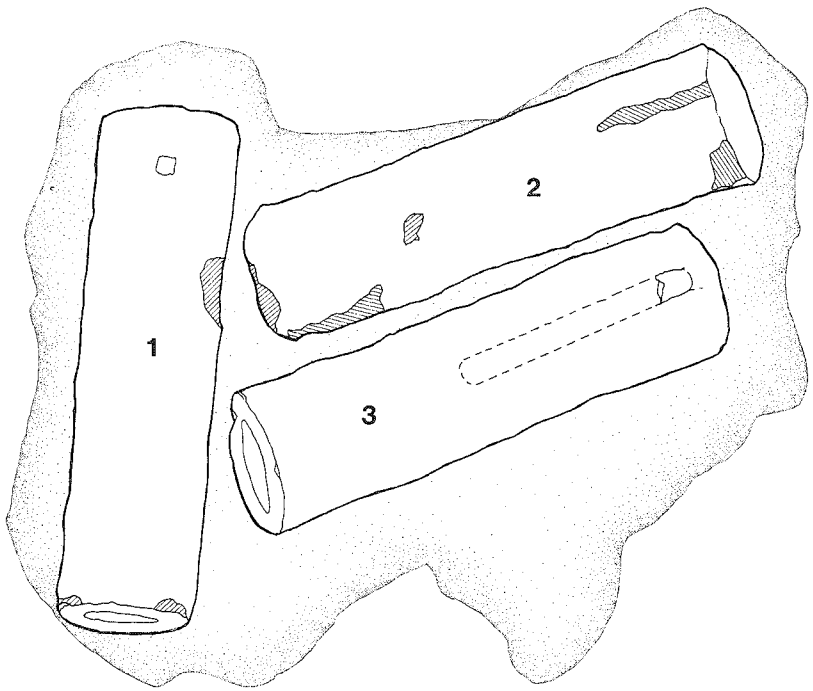


FIGURE 85. Conglomerate No. 122. Subnumbers 12–16 were recovered from the encrustation after processing, and their locations were not recorded.

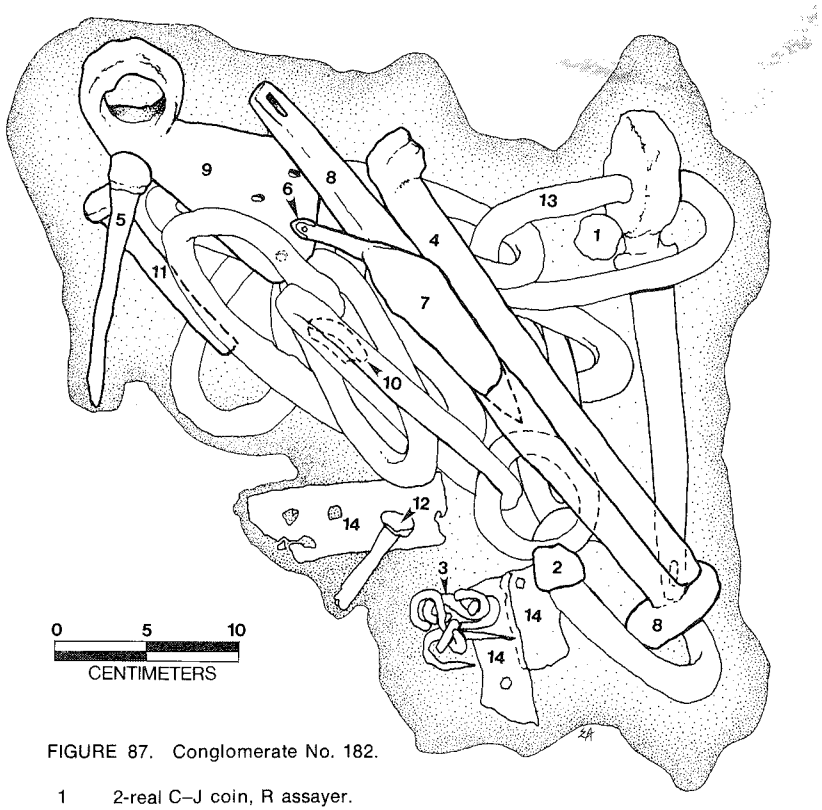
1 Two-ring wrought iron breech chamber.
2 Small silver disk.
3 Small lead weight.
4 Two small potsherds.
5 Oxidized iron spike shank fragment, discarded.
6 4-real C–J coin, L assayer.
7 4-real C–J coin, G assayer.
8 Brass fragment.
9 Two potsherds from different vessels.
10 4-real C–J coin (completely converted to sulfide), assayer unknown, discarded.
11 2-real C–J coin (completely converted to sulfide), assayer unknown, discarded.
12 Glass sherd.
13 Ceramic handle.
14 Three brass straight pins.
15 2-real C–J coin, L assayer.
16 Two potsherds.
17 17 ballast stones.



0 5 10
CENTIMETERS

FIGURE 86. Conglomerate No. 175.

1–3 Verso breech chamber, wrought iron.
4 Wooden breech plug for No. 175-1.
5 Wooden breech plug for No. 175-2.
6 Seven ballast stones.
7 Black gunpowder residue from breech block No. 175-1.
8 Black gunpowder residue from breech block No. 175-3.



0 5 10
CENTIMETERS

FIGURE 87. Conglomerate No. 182.

1 2-real C–J coin, R assayer.
2 Potsherd.
3 Small iron chain links with staple.
4 Iron forelock bolt.
5 Iron spike.
6 Brass foil and pin, part of No. 182-7.
7 Badly oxidized iron blade of case knife.
8 Iron forelock bolt.
9 Iron hinge.
10 Potsherd.
11–12 Iron spikes.
13 Iron chain with eye bolt and ring.

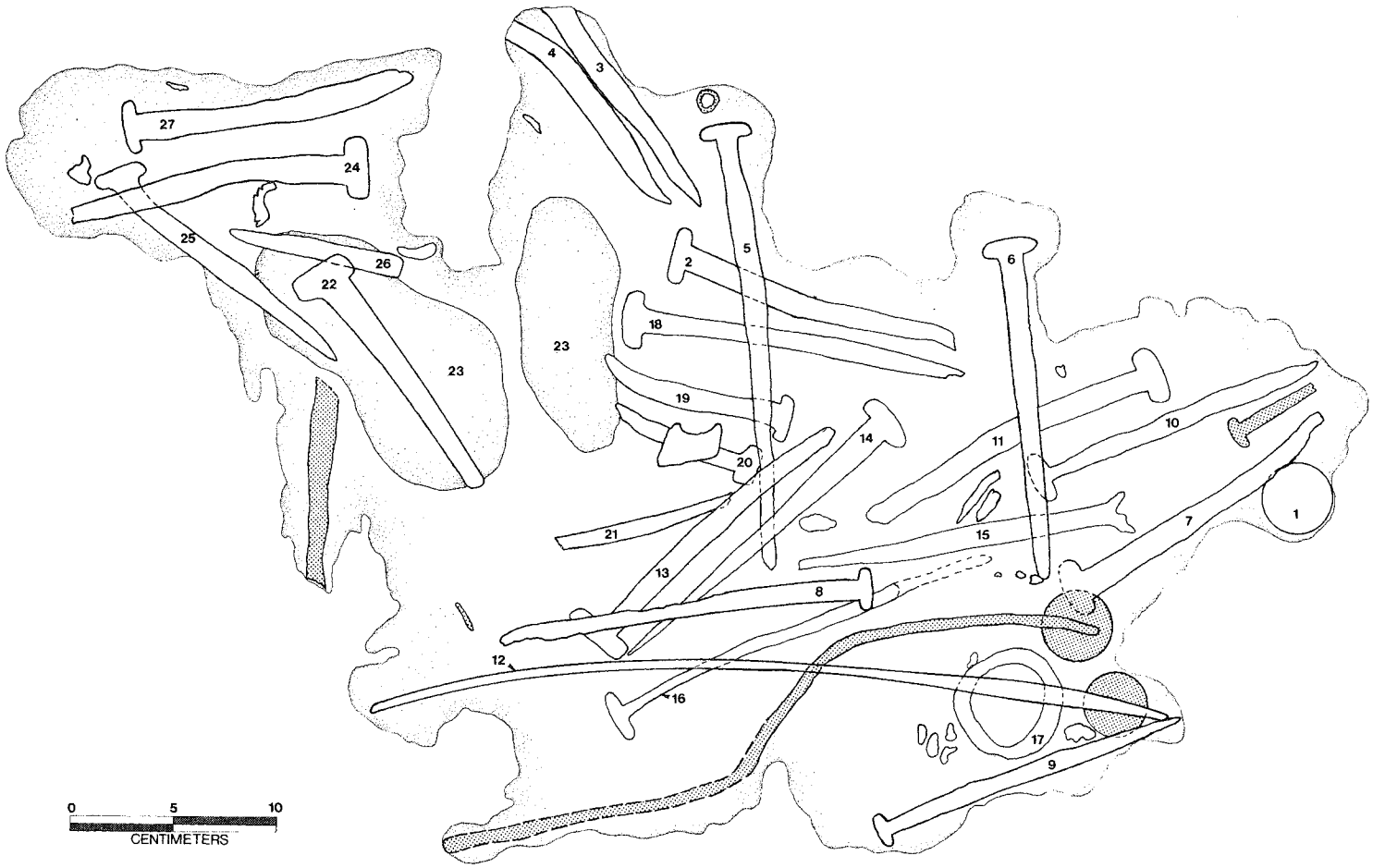


FIGURE 88. Conglomerate No. 221. Totally corroded coins and iron artifacts indicated by shading. Small unnumbered objects are scraps of lead.

1	4-real C–J coin, L assayer.
2–11	Iron spikes.
12	Iron strap, discarded.
13–16	Iron spikes.
17	Badly oxidized iron clinch ring.
18–22	Iron spikes.
23	Two ballast stones.
24–27	Iron spikes.

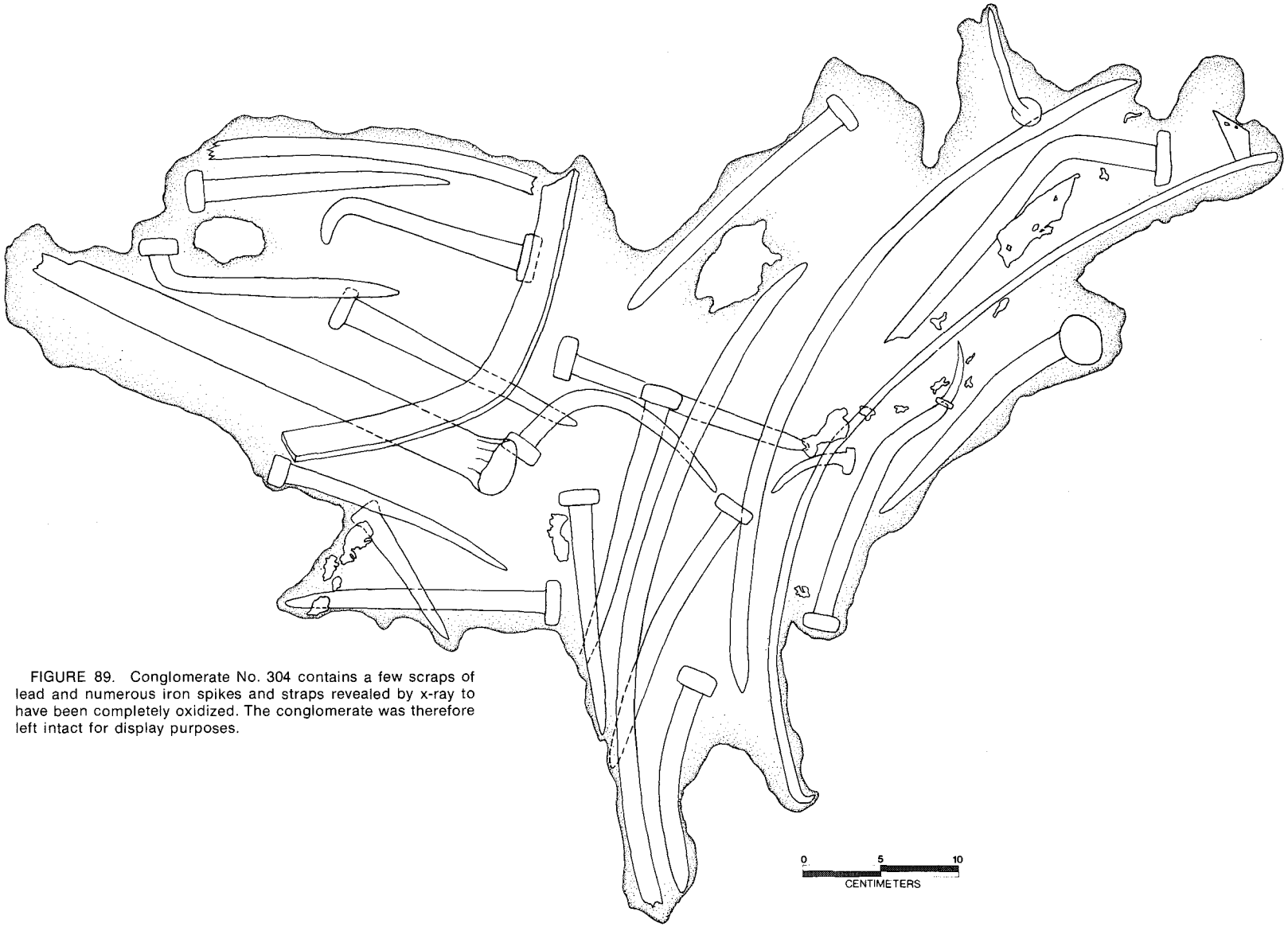


FIGURE 89. Conglomerate No. 304 contains a few scraps of lead and numerous iron spikes and straps revealed by x-ray to have been completely oxidized. The conglomerate was therefore left intact for display purposes.

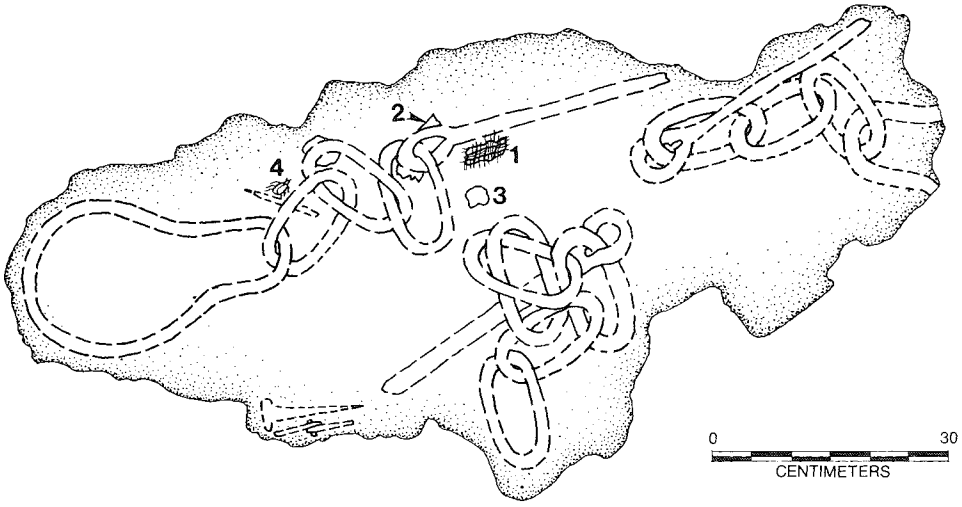


FIGURE 90. Conglomerate No. 308 containing oxidized iron spike, strap, and chain and bolts of standing rigging.

1 Fragment of cloth.
2 Fragment of iron.
3 Potsherd.
4 Cockroach.

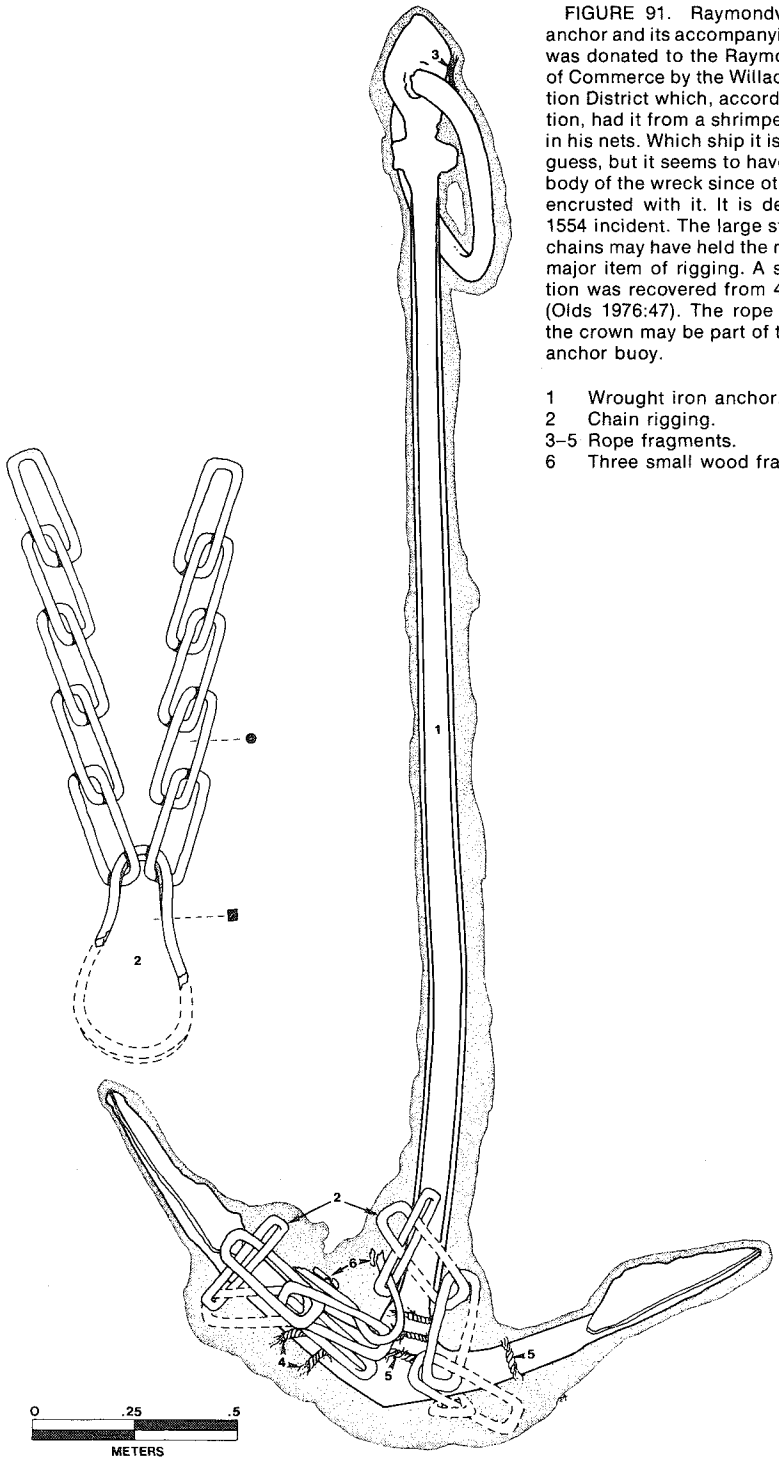


FIGURE 91. Raymondville anchor. This anchor and its accompanying conglomerate was donated to the Raymondville Chamber of Commerce by the Willacy County Navigation District which, according to local tradition, had it from a shrimper who snagged it in his nets. Which ship it is from is anyone's guess, but it seems to have lain in the main body of the wreck since other artifacts were encrusted with it. It is definitely from the 1554 incident. The large strope and double chains may have held the main stay or other major item of rigging. A similar configuration was recovered from 41 WY 3, No. 319 (Olds 1976:47). The rope wrapped around the crown may be part of the rigging for an anchor buoy.

1 Wrought iron anchor.
2 Chain rigging.
3–5 Rope fragments.
6 Three small wood fragments.

Chapter 15

CONCLUSIONS

The archeological conclusions possible from the work at this site are, in a sense, limited. The site had been disturbed and the collection biased by Spanish salvors, over 400 years of immersion and dispersion beneath the currents and occasionally the surf off Padre Island, and recent treasure hunters. Further problems were caused by the missing field notes and site plans. The artifact collection is significant in itself nevertheless. Interesting contrasts exist between the artifact collections from the two 1554 wreck sites (41 KN 10 and 41 WY 3). However, a broad consideration of the distribution of the evidence of the 1554 activities "in the ground" and of the tantalizing hints from the historic documentation allow for speculation on the identification of each of the sites with a specific vessel. The information remaining from the intrasite distribution of artifacts is also presented.

COMPARISON OF THE COLLECTIONS FROM 41 KN 10 AND 41 WY 3

The collections from these two 1554 wrecks are very similar in content, as would be expected. The relative size of the collections is not, however, 41 WY 3 having yielded a significantly larger collection. This is disturbing since

the ships were about the same size, but 41 KN 10 was probably more extensively salvaged by the Spaniards, as will be discussed later. There are a number of minor details which differentiate the two collections. The wrought iron verso breech chambers from 41 KN 10 are of three sizes and often have identifying marks cut into them, whereas those from 41 WY 3 are, excluding the brass specimen, of only two sizes and are invariably plain or unmarked. There were no majolica sherds from 41 WY 3. This may indicate that those found at 41 KN 10 were items of personal possession rather than standard ship's equipment. The construction of most of the bombard breech chambers from 41 WY 3 was slightly different from those from 41 KN 10 in that the former often exhibited a third discontinuous "layer" of thin reinforcing bands covering the joints of the underlying solid layer reinforcing bands. Cast iron cannon balls are present from 41 WY 3 but absent from 41 KN 10. Brass straight pins are present from 41 KN 10 but not from 41 WY 3.

Two other differences are more diagnostic of characteristics of the ships themselves and their construction. First, from 41 KN 10 there were lead straps only, from 41 WY 3 lead patches only. The lead straps from 41 KN 10 had been nailed over the seams and were a part of the caulking procedure at least of the planked dead wood of the after portion of the keel. This is an indication of an old, persistently leaking vessel for which normal caulking was not sufficient. On the other hand, the lead patches from 41 WY 3 were also probably for stopping leaks. The smaller ones may have been placed over treenails as was sometimes done to prevent leaks, but there were also larger patches which bespeak more severe problems. The larger pieces could also represent sheathing for the keel, but this is perhaps less likely since the quantity involved is small compared to what would be needed to sheath a keel. Second, there is the matter of the ballast. The ballast stones from 41 KN 10 included black flint, whereas that from 41 WY 3 collected entrapped in conglomerates did not. One would not expect the ballast from any two ships to be identical, owing to additions and subtractions from its contents which no doubt were a frequent necessity. The important point is that we can be assured that the 41 WY 3 collection does indeed contain artifacts from that site alone and not, as had been feared, a mixture of artifacts from more than one site.

ARTIFACT DISTRIBUTION

Careful study of the collection and the distribution of the artifacts from the reconstructable portion of the site plan reveals the profoundly disturbed and scattered nature of the site. Admittedly it is a grave handicap that the original site plan is not available, and many of the artifacts could not be

replotted on the reconstruction. Nevertheless, the positions of most of the major large conglomerates is fairly accurate, and these are virtually the only objects which can be assumed to have been relatively undisturbed. They are roughly aligned along what was presumably the longitudinal axis of the ship. The stern post and keel section may indicate the stern, but rudder fittings (Nos. 168, 43, 48, and 108) are scattered from the central part to the southern extreme of the site. The trough may indicate where the ship first struck or pounded herself to pieces during and after the storm, but the direction from which she came, which direction the bow was facing, and whether she pivoted on her stern and perhaps broke her back after striking are points which are probably beyond reconstruction from the existing evidence. These points would probably remain obscure even were all provenience data available. The seaward anchor (No. 159) is not aligned in a manner that indicates effective use. Perhaps it had been deployed but had fouled on the cable, however this is pure speculation. Similarly, it might be that the anchor on the shoreward side of the site (No. 80) had not been deployed but was in position on the bow. The location of the guns (Nos. 171 and 172) slightly away from the wreck might indicate that they were being utilized as anchors, but they are at an odd angle relative to anchor No. 159 if that were the case. The great majority of the smaller conglomerates and individual artifacts are located to the southwest of the main body of the wreck. This could indicate that the ship had come in on a norther or late winter storm with strong northeasterly winds and broke up immediately. It could just as well be that she did not break up right away and that lying outside the normal surf zone it was subsequent winter storms with northeasterly winds which finally dispersed the ship's remains. This is all idle speculation, however. Indication that disturbance and erratic artifact distribution was early and profound is readily available. Although some artifact concentrations appear to represent the contents of individual shipping boxes crushed by and trapped in ballast, the matched pair of pewter porringers found their way, perhaps originally from the same parcel, into large conglomerates (Nos. 156 and 129) across the breadth of the main site area. Chains and bolts from the standing rigging were found in conglomerates (Nos. 182, 132, and 308) appropriately at the sides of the site, but others were found in the center in conglomerate No. 156. When the evidence of modern activity and possible disturbance at the site is added, the imponderable nature of the clues from distribution is even more apparent. For example, conglomerate No. 81, the broken anchor with one fluke missing, was found in 1972 with the remaining fluke pointed straight up. This would have been interesting and possibly significant but for the fact that a modern tractor wheel weight, identified by local informants as having been a local treasure hunter's anchor, was found lying partially under one edge of the conglomerate. And why does most of the ballast lie to the south and west of the large conglomerates which must have originally been resting on top of

the ballast in the ship's hold since at least one of the anchors in No. 156 was usable, perhaps the sheet anchor? Was the ballast scattered as a result of the bottom bursting open during the wreck, or was it scattered to the southeast later when the hull gradually disintegrated? Or was it shifted recently by treasure hunters? Who can say? At any rate, owing to the incomplete remaining provenience data and the evidence of modern disturbance of the site, even a statistical study, such as the very interesting one presented for the analysis of scattered wreck sites by Muckelroy (1975), and any firmly drawn conclusions from the artifact distribution would probably be a mistake. The only provenience with even a particle of firmly graspable meaning is what scant information can be gleaned from the interrelationships of artifacts within conglomerates which were frozen relatively soon after the wreck.

IDENTIFICATION OF THE SHIPS

Four ships comprised the fleet returning to Spain from Mexico in 1554: the *San Esteban*, under master Francisco del Huerto; the *Espíritu Santo,* under master Damián Martín; the *Santa María de Yciar*, under master Alonso Ojos, with Miguel de Jáuregui, the owner, sailing as captain and pilot; and the *San Andrés*, under master Antonio Corzo. Corzo, the captain general, was separated from the other three by the storm and, apparently unaware of the plight of the rest, arrived in Havana in sinking condition. We know the location of the wreck sites of the other three ships. They are virtually equidistantly spaced about 4 km (2.5 miles) apart, with the southern of the three at the Mansfield Cut. The treasure hunters of Platoro, Ltd. worked the one lying in the middle, and the collection from that site is now in custody of the State of Texas and is described in a Texas Antiquities Committee–Texas Memorial Museum publication (Olds 1976). The third site was excavated in 1972, 1973, and briefly in 1975 by the Texas Antiquities Committee. The evidence for identifying which of the sites represents which ship is a problem from both the historical and archeological standpoint. The question to be considered here is what, if anything, was recovered which might aid in the identification? The greatest amount of pertinent information is to be found in the Spanish salvage log (Alvarado 1554) and the register for the *Santa María de Yciar* (Ojos 1554).

Perhaps the only artifacts recovered that could shed light on this problem are the two gold bars. The one from the middle wreck was stamped $15\frac{3}{4}$ carats, and that from the northern site was of $15\frac{1}{2}$ carats. The only shipment of gold registered for the *Santa María de Yciar* was of 18 carats. If smuggling had not been rampant, one might be tempted to think that this indicated that the ship lying to the south was the *Santa María de Yciar.*

It does seem likely that this ship was located at one of the extreme ends of the array of three with the *San Esteban* at the other end. The Spanish salvage documents indicates that upon arrival the only ship sufficiently intact to be visible above the waves was the *San Esteban*. We can assume that they set up camp on shore opposite this site. The other two had to be located by dragging, and they traveled 2 leagues to locate the *Santa María de Yciar,* a distance near enough to the actual 8 km (5 miles) spanned by the three. The *Espíritu Santo* had been located by dragging and salvaged previously and it would be reasonable to assume they would look for the closer middle wreck first.

The only evidence to indicate that the *San Esteban* was the northern and not the southern wreck, discounting the gold bars just mentioned, is in the location of the salvage camp, whose probable remains we investigated by surface collection opposite the northern wreck, and the location of the vessel lost during the salvage expedition's stay, the ship of Vergara. The anchor recovered at a location several hundred meters to the southwest and inshore of the northern wreck is probably from the wreck site of Vergara's vessel (Arnold 1976). She was probably anchored off the camp when a sudden squall sent her aground. The last day of work before the storm was August 22, and indications are that the day ended uneventfully. The next work day was August 26, and the reference is made to returning to the site of the *Santa María de Yciar* even though nothing more could be found on August 22 because it was hoped that the storm that sank Vergara's ship would have uncovered more of the cargo which it had. There is no evidence that a day's work was interrupted by the squall, and it can therefore be assumed that the ship was lost near the camp.

Comparing the collections from 41 KN 10, the northern wreck, and 41 WY 3, the middle wreck, one is soon struck with the fact that the middle wreck produced a much more substantial sample of artifacts than the northern one. This is especially evident in the relative number of coins and silver disks and in the number of guns, items which the Spanish salvors would have saved if they could. It could well be that this is a function of the middle wreck having been broken up and the hull of the northern wreck, 41 KN 10, intact as would have been the case if she were the *San Esteban.*

I do not feel that the evidence for identification is definitive, but unless further documentation turns up, it is the best we can do.

BIBLIOGRAPHY

Note: Documentary material cited was copied from archives in Spain and England by Sister Mary Christine Morkovsky, Sister Aqualina Martínez, and David McDonald. The materials were transcribed and translated by Sister Carmelita Casso, Sister Martínez, and McDonald of the Old Spanish Missions Historical Research Library, San José Mission, San Antonio, Texas, under contract with the Texas Antiquities Committee. Transcripts and translations are retained by the Research Library.

Acuña, Rodrigo Manrique de

1553 January 4. Letter to Prince Philip. Real Academia de la Historia, Colección Muñoz, A/113, folio 249r. Madrid.

Adler, Mortimer J. (Editor)

1952 Ptolemy, Copernicus, Kepler. *Great books of the western world,* Vol. 16. Chicago, London, Toronto: Encyclopaedia Britannica, Inc.

Alvarado, García de Escalante

1548 August 1. Relación del viaje que hizo Ruy López de Villalobos desde la Nueva España a las Islas de Poniente el año de 1542. Archivo General de Indias, Patronato 23, No. 10, Ramo 9. Sevilla.

1552a March 24. Letter to the emperor. Archivo General de Indias, México 168. Sevilla.

1552b December 28. Three letters to the emperor. Archivo General de Indias, México 168, Sevilla.

1553 May 12. Letter to the emperor. Real Academia de las Historia, Colección Muñoz A/113, folio 270r. Madrid.

1554 Buceo de las naos de Francisco del Huerto, Damián Martín, Alonso de Ojos y Miguel de Jáuregui que se perdieron en la Playa de Magdalena, costa de la Florida. Hecho por el capitán don García de Escalante Alvarado por comisión de S.M. Archivo General de Indias, Contratación 58. Sevilla.

1555 Expenses of the salvage expedition. Archivo General de Indias, Contratación 4919a. Sevilla.

Angulo, Gonzalo Pérez de

1552 January 14. El governador de Cuba contra el maestre Juan de Luxarra sobre la perdida del galeón de Cuba. Archivo General de Indias, Justicia 978, Sevilla.

1555 December 23. Letter to the emperor in the Council. Real Academia de la Historia, Colección Muñoz A/114, folio 315v. Madrid.

Antiquities Code of Texas

1969 The Antiquities Code of Texas, Article 6145-0. *Vernon's Texas Civil Statutes,* Vol. 17. St. Paul: West Publishing Company.

Anunciación, Domingo de la, *et al.*

1553 September 18. Letter to "muy poderosos señores." Archivo General de Indias, México 280. Sevilla.

Arnold, J. Barto III

1976 *An underwater archeological magnetometer survey and site test excavation project off Padre Island, Texas.* Publication No. 3. Austin: Texas Antiquities Committee.

Arnold, J. Barto III, and Carl J. Clausen

1975 A magnetometer survey with electronic positioning control and calculator-plotter system. *Nautical Archaeology* 4:353–366.

Avila, Rodrigo de

1555 January 22. Letter to ——? Real Academia de la Historia, Colección Muñoz, A/114, folio 303v–304. Madrid.

Baker, William A.

1962 *Colonial vessels: Some seventeenth century sailing craft.* Barre, Massachusetts: Barre Publishing Company.

Bakewell, Peter John

1971 *Silver mining and society in Mexico: Zacatecas, 1546–1700.* London: Cambridge University Press.

Barcia, Carballido and Andrés González de Zúñiga

1723 Ensayo Cronológico para la historia de la Florida. Nicolás Rodríguez Franco, Impresor de Libros, Madrid.

Bass, George F. (Editor)

1972 *A history of seafaring based on underwater archaeology.* New York: Walker and Company.

Biedma, Sancho de

1551 June 12. Letter to the emperor. Real Academia de la Historia, Colección Muñoz, folio 44r. Madrid.

Bienes de difuntos de los que se perdieron en el galeón de Jaun de Laxarra que se perdio en la florida en enero de 1552 vinienda de la Nueva España. AGI, Contraduría 317. Sevilla.

Bolton, Herbert Eugene (Editor)
1908 *Spanish Exploration in the Southwest, 1542–1706.* New York: Scribner's. [Reprinted 1963 by Barnes & Noble, Inc., New York.]

Branch, W. J. V., and E. Brook Williams
1942 *A short history of navigation.* Anapolis, Maryland: Weems System of Navigation.

Brewington, M. V.
1963 *The Peabody Museum collection of navigating instruments with notes on their makers.* Salem, Massachusetts: Peabody Museum.

Canedo, Lino Gómez
1961 *Los Archivas de la Historia de America.* Two volumes. México.

Carpenter, Austin C., K. H. Ellis, and J. E. G. McKee
1974 *Interim report on the wreck discovered in the Cattewater, Plymouth on 20 June 1973.* Maritime Monographs and Reports No. 13—1974. Greenwich: National Maritime Museum.

Carreño, Bartolomé
1552 Cargo y data de los maravedís que debaron de averías por las mercaderías que caragon en las naos de la armada y flota que fue a los Indias de que fue General Bartolomé Carreño, año 1552. Archivo General de Indias, Contratación 4339. Sevilla.

Carreño de Ribera, Francisco
1608 July 15. Don Francisco Carreño de Ribera pide el govierno de Cartagena o otro que este próximo para vacar. . . . Archivo General de Indias, Patronato 254, No. 18, Ramo 1. Sevilla.

Carter, Hodding
1963 *Doomed road of empire: The Spanish trail of conquest.* New York: McGraw-Hill.

Casa de Contratación
1552 April 27. Memorandum naming Bartolomé Carreño general of the fleet. Archivo General de Indias, Contratación 5010. Sevilla.
1553 January 28. Letter to Prince Philip. Real Academia de la Historia, Colección Muñoz, A/113, folio 249r. Madrid.
1555a January 21. Copy of letter to the emperor. Archivo General de Indias, Indiferente General 1093. Sevilla.
1555b February 10. Relación de los navíos en que venía el oro y plata de S.M. en que va puesto que dello es venido a esta casa y los navíos que van aportado a Portugal y los que hasta agora no han llegado y lo que se perdió en el mar. . . . Archivo General de Indias, Indiferente General 737, folio 124b. Sevilla.
1555c May 11. Relación de las partidas de particulares y pasageros que vinieron de las Indias en la flota que comenzó a llegar de ellas en Sevilla por el mes de enero de 1555 de que vino por capitán Cosme Rodríguez Farfán. Archivo General de Indias, Indiferente General 737, folio 121d. Sevilla.
1555d May 30. Letter to ——? Real Academia de la Historia, Colección Muñoz, A/114, folio 307v. Madrid.
1555e Letter to ——? Real Academia de la Historia, Colección Muñoz, A/114, folio 347v. Madrid.
1555f To Council of the Indies. Real Academia de la Historia, Colección Muñoz, A/114, folio 162r. Madrid.
1555g Lo que se a pagado para los 10,000 ducados que Su Magestad mandó repartir de lo

de la flota de Farfán que se han de descontar del cargo dello. Archivo General de Indias, Contratación 2926. Sevilla.

1555h October 23. Sale of the treasure brought in the fleet of Diego Felipe. Archivo General de Indias, Contaduría 277, Ramo 3, folios 25–30. Sevilla.

1556 November 4. Letter to the king. Archivo General de Indias, Indiferente General 2005. Sevilla.

1558 Itemized account of the treasure salvaged from *San Esteban, Santa María de Yciar,* and *Espíritu Santo* that was appropriated by the Crown. Archivo General de Indias, Contratación 4679. Sevilla.

1567 May 13. Copies, made by Ortega de Melgosa, of letters to the Casa de Contratación from the Crown, 1549–50; and Copies of Crown expenditures in 1550 for the armada of General Sancho de Biedma. Archivo General de Indias, Contaduría 293, Ramo 3, Folios 6 r.-12 v. Seville.

1573 April 21. Summary of the outbound registers of *San Andrés,* Antonio Corzo, master, and *Espíritu Santo,* Damián Martín, master. Archivo General de Indias, Contratación 4339. Sevilla.

1577 May 10. Copies of various documents pertaining to armadas from 1549 to 1552. Archivo General de Indias, Contraduría 293. Sevilla.

1579 Registros de ida y venida, 1504–1579. Archivo General de Indias, Contratación 2898. Seville.

Castañeda, Carlos Eduardo

1936–1950 *Our Catholic heritage in Texas, 1519–1936.* Seven volumes. Austin: Von Boeckmann-Jones.

Cespedes del Castillo, Guillermo

1945 *La Avería en el comercio de Indias.* Sevilla: Publicaciones de la Escuela de Estudios Hispano-Americanos de la Universidad de Sevilla.

Charles V

1553 April 21. Copy of letter to Zúñiga. Real Academia de la Historia, Colección Salazar, A-51, folio 70r. Madrid.

1555 August 3. An account of what came for His Majesty from New Spain on the four ships that arrived at Sevilla in July 1555, the amount taken for the Crown, and the manner of its distribution. Archivo General de Simancas, Contaduría General 3053. Simancas.

Chaunu, Huguette

1955–1959 *Seville et Atlantique, 1504–1650.* Eight volumes. Paris: A. Colin.

Clausen, Carl J., and J. Barto Arnold III

1976 The magnetometer and underwater archaeology: Magnetic delineation of individual shipwreck sites, a new control technique. *Nautical Archaeology* 5:159–169.

Colección de documentos inéditos relativos al descubrimiento, conquista y organización de las antiguas posesiones españoles de América y océano, sacados de los archivos del reino, y muy especialmente del de Indias. Competentement autorizada (Vols. 1–24, Archivo General de Indias), 1864–1884. Madrid.

Collard, Andrée (Editor and translator)

1971 *History of the Indies, by Bartolomé de las Casas. New York: Harper & Row.*

Corbett, Julian S.

1898 *Drake and the Tudor navy. With a history of the rise of England as a maritime power.* London: Longmans, Green.

Cortés, Hernán
1973 *Cartas de Relación.* Mexico: Editorial Porrúa, S.A.
Corzo, Antonio
1552 Relación de las mercaderiás y otras cosas que pro el registro de la nao nombrada Sant Andrés maestre Antonio Corzo que se despacho para la provincia de Nueva España el año pasado de mil y quinientos y cinquenta y dos años. . . . Archivo General de Indias, Contratación 4339. Sevilla.
1555 Relación de todas las partidas que venían registradas en el registro de Antonio Corzo que vino de la Nueva España. . . . Archivo General de Simancas, Diversos de Castillo 45, folio 21. Simancas.
Corzula, Vicente Paletino de
1559 Tratado del derecho i justicia de la guerra que tienen los Reyes de España contra las naciones de la India occidental. Real Academia de la Historia, Colección Muñoz, A/118, folios 47–61. Madrid.
Cotterell, Howard H.
1963 *Old pewter: Its makers and marks in England, Scotland, and Ireland; An account of the old pewterer and his craft.* Rutland, Vermont: Charles E. Tuttle Company.
Council of the Indies
1552 July 18. Letter from the Council president to the Casa de Contratación. Archivo General de Indias, Contratación 5010. Sevilla.
1555a March 16. Letter to the emperor. Archivo General de Indias, Indiferente General 737. Seville.
1555b July 2. Letter to Prince Philip. Archivo General de Indias, Indiferente General 737, Ramo 4, No. 132. Seville.
Daley, Robert
1976 The fabulous treasure of the Atocha. *Reader's Digest,* **108**(646):175–180.
Davies, Reginald Trevor
1965 *The golden century of Spain, 1501–1621.* New York: Harper and Row.
Dávila Padilla, Agustín
1596 Historia de la Fundación y discurso de la Provincia de Santiago de México, de la Orden de Predicadores, por las vidas de sus varones insignes, y casos notables de Nueva España. Pedro Madrigal, Madrid.
Dedera, Don
1975 Hunting for History Offshore. *EXXON USA,* **XIV**(2):27–31.
de Urrutia, Alonso Ortiz
1568 *November 5. Extracts Translated from the Accounts of the Treasurer, Fernando de Portugal.* Mexico (?). Seville: Archivo General de Indias, Contaduría 877.
Dudleo, D. Ruberto
1646 *Dell'arcano del mare.* Firenze: Nella Stamperia di Francesco Onofri.
Díaz Can°., Pedro
1555 February 2. Letter to ——? Real Academia de la Historia, Colección Muñoz A/114, folio 305r. Madrid.
Díaz del Castillo, Bernal
1956 *The discovery and conquest of Mexico.* Translated with an introduction and notes by A. P. Maudslay). New York: Farrar, Straus and Giroux.
Duarte, Francisco
1555 January 23. Letter to the Casa de Contratación. Real Academia de la Historia, Colección Muñoz, A/144, folio 304r & v. Madrid.

Ericsson, Christoffer H.
1975 The instruments for Her Imperial Majesty's frigate *Nicholas. Nautical Archaeology,* 4:65–71.

Espasa-Calpe
1958 *Enciclopedia Universal ilustrada Europeo-Americana. Madrid: Espasa-Calpe, S.A.*

Etorra, Juan de
1553 May 14. Register of the ship *Nuestra Señora de Guadalupe.* Archivo General de Indias. Contratación 2490, folio 184v. Seville.

Farfán, Cosme Rodríguez
1553 October 5. Interrogation of French corsairs captured by Cosme Rodríguez Farfán. Archivo General de Indias, Patronato 258, No. 5, Ramo 2. Sevilla.
1554 Breve relación de lo que a la armada de Su Magestad a sucedido desde el puerto de San Lúcar hasta la isla de Puerto Rico. Archivo General de Indias, Patronato 258, No. 5, Ramo 5. Seville.
1555a January 23. Letter to the Casa de Contratación. Real Academia del la Historia, Colección Muñoz, A/114, folio 303v. Madrid.
1555b February 20. Letter to ——? Real Academia de la Historia, Colección Muñoz, A/114, folio 305v. Madrid.
1555c Relación de la flota de Tierra Firme que vino a cargo de Cosme Rodríguez Farfán. Archivo General de Indias, Indiferente General 737. Sevilla.

Fernández Camillas, Pedro, and Rodrigo Rengel
1557 April 25. Letter to the king. Archivo General de Indias, México 168. Sevilla.

Fernández Duro, Cesario
1895–1903 *Armada Española desde la unión de los reinos de Castilla y de Aragón.* Nine volumes. Madrid: Est. tipografico "Sucesores de Rivadeneyra."

Ferrer, Juan
(n.d.) c. 1552. Letter to the emperor. Real Academia de la Historia, Colección Muñoz, A/113, folio 299r. Madrid.
1553 April 10. Letter to Prince Philip. Archivo General de Indias, México 280. Sevilla.

French, B. F.
1875 *Historical collections of Louisiana and Florida.* 2nd series. New York: Albert Mason.

Fuente, Fernando de la, and Alonso Martínez
1553 February 10. Relación de las naos que fueron en el armada y flota de el cardo del General Bartolomé Carreño para Tierra Firme y Nueva España este año de 1553. *Museo Naval, Colección Navarette* **XXI**, 125, dto. 37. Madrid.

Gastaldi, Giacomo
n.d. *Nova et acurata totius Americae tabula.* Venice: Bertelli and Camoaio. [Late sixteenth century. Humanities Research Center, University of Texas at Austin.]

Gibson, Charles
1966 *Spain in America.* New York: Harper & Row.

Goggin, John M.
1964 *Indian and Spanish selected writings.* Coral Gables: University of Miami Press.

Greener, W. W.
1910 *The gun and its development.* 9th ed. New York: Bonanza Books.

Hakluyt, Richard
1970 *The Tudor Venturers.* Selected from *The Principal Navigations, Voyages, Traffics and Discoveries of the English Nation, Made by Sea or Over Land* and edited by John Hampden. London: The Folio Society.

Hamilton, D. L.
1976 *Conservation of metal objects from underwater sites: A study in methods.* Austin: Texas Memorial Museum, Miscellaneous Papers No. 4, and Texas Antiquities Committee, Publication No. 1.

Hanke, Lewis
1949 *The Spanish struggle for justice in the conquest of America.* Boston: Little, Brown.

Haring, Clarence Henry
1918 *Trade and navigation between Spain and the Indies in the time of the Hapsburgs.* Cambridge: Harvard University Press. [Reprinted, Peter Smith, Gloucester, Massachusetts, 1964.]
1947 *The Spanish empire in America.* First Harbinger Book edition, 1963. New York: Harcourt.

Hays, T. R., and Eugene Herrin
1970 *Padre Island project. Report to the Texas Antiquities Committee.* Dallas: Institute for Underwater Research, Inc.

Henry, Walter K., Dennis M. Driscoll, and J. Patrick McCormack
1975 July. *Hurricanes on the Texas Coast.* Center for Applied Geosciences, College of Geosciences, Texas A&M University, College Station.

Heredia, Pedro de
1553 June 4. Letter to the emperor in the Council. Real Academia de la Historia, Colección Muñoz, A/113, folio 272r. Madrid.

Hogg, O. F. G.
1963 *English artillery 1326–1716.* London: Royal Artillery Institution.

Hoja, Martín de (Bishop of Tlaxcala)
1553 April 8. Letter to the emperor. Real Academia de la Historia, Colección Muñoz, A/113, folio 265r. Madrid.

Horner, Dave
1971 *The treasure galleons: Clues to millions in sunken gold and silver.* New York: Dodd, Mead

Huerto, Francisco del
1551 June. Homebound register of *San Esteban,* Francisco del Huerto, master. Archivo General de Indias, Contratación 2723. Sevilla.
1559 Various documents concerning Francisco del Huerto. Archivo General de Indias, Justicia 849. Sevilla.

Hume, Ivor Noël
1974 *A guide to artifacts of colonial America.* New York: Alfred A. Knopf.

Ingelman-Sundberg, Catharina
1976 Preliminary report on finds from the Jutholmen wreck. *Nautical Archaeology* 5:57–71.

Irving, Washington
1849 *The life and voyages of Christopher Columbus; to which are added those of his companions.* Three volumes. New York: G. P. Putnam.

Jaen, Juan de
1550 June 20. Cuenta que se hizo con Cosme Rodríguez Farfán señor de la nao capitana que fue en la armada de su Magestad de que fue por capitán general Sancho de Biedma. . . . Archivo General de Indias, Contratación 2926. Sevilla.

Johnson, William Weber
1975 *Cortés.* Boston: Little, Brown.

Juana (La Princesa)
1554 September 9. Letter to the Casa de Contratación. Archivo General de Indias, Contratación 5010. Seville.
Kennedy, Don H.
1974 *Ship names: Origins and usages during 45 centuries.* Published for The Mariners Museum, Newport News, Virginia. Charlottesville: University Press of Virginia.
Kenny, Michael
1970 *The romance of the Floridas; the finding and the founding.* Reprinted from the 1934 edition. New York: AMS Press.
Kraus, Antonio Casanova
(n.d.) *Ulúa, último reducto de la dominación española: historia y leyendas.* Veracruz.
Landstrom, Bjorn
1969 *Sailing ships in words and pictures from papyrus boats to full-riggers.* Garden City, New York: Doubleday.
Las Casas, Bartolomé de
1552 October 25. Letter to the Council of the Indias. Real Academia de la Historia, Colección Muñoz, A/113, folio 119v. Madrid.
Laughton, L. G.
1918 Inventory of the *Great Bark,* 1531. *Mariner's Mirror* 5:21–22.
1960 Early Tudor ship-guns. Edited by Michael Lewis. *Mariner's Mirror* 46:242–285.
Ledesma, Pedro de
1636 Description of salvage methods. Museo Naval, Manuscrito 1035, Sección C. Madrid.
León, García de
1556 Tax collected on the treasure salvaged from the three ships lost in "La Florida" in 1554. Archivo General de Indias, Contaduría 292. Sevilla.
León Romano, Luis de
1555 January 31. Letter to the emperor. Archivo General de Indias, Mexico 168. Sevilla.
Lewis, D. B. Wyndham
1931 *Charles of Europe.* New York: Coward-McCann, Inc.
Lovegrove, H.
1964 Remains of two old vessels found at Rye, Sussex. *Mariner's Mirror* 50:115–122.
Lowery, Woodbury
1911 *The Spanish settlements within the present limits of the United States 1513–1561.* New York: G. P. Putnam.
Lyon, Eugene
1976 The trouble with treasure. *National Geographic* 149(6):786–809.
Manuel, Francisco
1583 April 15. Piloto Mayor Francisco Manuel, del derrotero del Padre Urdaneta. British Museum, Additional Manuscript 28, 189, folios 14v–16v, 23r–32v, 56r–62v, 72r–73v.
Manwayring, Henry
1644 *T seaman's dictionary.* No. 328 in a collection of facsimile reprints entitled *English Linguistics 1500–1800,* edited by R. C. Alston. Menston, England: Scholar Press.
Manzera, Valeriano de
1552 October 15. Artillery, munitions, supplies, and other items received by Valeriano de Manzera, master of the ship *Nuestra Señora de la Concepción.* Archivo General de Indias, Contaduria 431. Sevilla.
Martin, Colin
1975 *Full fathom five—Wrecks of the Spanish Armada.* New York: Viking.

Martín, Damián
1552 Relación de las mercaderías y otras cosas que por el registro de la nao nombrado el *Espíritu Santo* maestre Damián Martín que se despachó para la provincia de la Nueva España el año pasado de mil y quinientos y dos años. . . . Archivo General de Indias, Contratación 4338. Sevilla.

Martínez, Vidal Covián
1969 *Cronología Histórica de Tampico, Ciudad Madero y Altamira, Tam. y de la expropiación petrolera (primera parte).* Ediciones Siglo XX. Ciudad Victoria, Tamaulipas, México.

Masters and Pilots, University of
1563 October 9. Meeting of the masters, pilots, and shipowners of Sevilla. Archivo General de Indias, Indiferente General 2005. Sevilla.
1564 El parecer que se trae de la junta que hicieron 40 personas en Sevilla señores maestres y pilotos de navíos. Archivo General de Indias, Indiferente General 2005. Sevilla.

McKee, Alexander
1974 *King Henry VII's Mary Rose.* Briarcliff, New York: Stein and Day.

Mendoza, Antonio de
1550 November 12. Letter to the emperor. México 19. Sevilla.

Menéndez de Avilés, Pedro
1555 August 31. Letter to the emperor. Real Academia de la Historia, Colección Muñoz, A/114, folio 310r. Madrid.

Merriman, Roger Bigelow
1918 The Catholic Kings. *The rise of the Spanish Empire in the Old World and the New,* Vol. II of four. New York: Macmillan.
1925 The Emperor. *The rise of the Spanish Empire in the Old World and the New,* Vol. III of four. New York: Macmillan

Mexía, Francisco
1553 January 28. Letter to the Crown. Real Academia de la Historia, Colección Muñoz, A/113, folio 249r. Madrid.
1555 January 30. Letter to the emperor. Archivo General de Indias, Indiferente General 1561. Sevilla.

Millares Carlo, Agustin
1945 *Indice y extractos de los protocolos del Archivo de notarias de Mexico.* Two volumes. Publicaciones del Centro de estudios historicos. México: El Colegio de México.

Moguer, Andres de
1553 April 8. Letter to "V.A." Real Academia de la Historia, Colección muñoz, A/113, folio 265r. Madrid.

Molina, Juan Vázquez de
1555 February 26. An itemized account of vital requisitions sent by the officials of the Casa de Contratación for the Indies. Archivo General de Simancas, Contadurías Generales 3053. Simancas.

Molina, Lucas de
1554 February. Quenta que se tomó a Lucas de Molina teniente que fue del tesorero Don Fernando de Portugal desde 22 de octubre del año de 1552 hasta fin de febrero de 1554. Archivo General de Indias, Contaduría 876. Sevilla.

Morison, Samuel Eliot
1942 *Admiral of the ocean sea: A life of Christopher Columbus.* Boston: Little, Brown.
1971 *The European discovery of America: The northern voyages,* A.D. *1500–1600.* New York: Oxford University Press.

1974 *The European discovery of America: The southern voyages, 1492–1616.* New York: Oxford University Press.

Muckelroy, Keith

1975 A systematic approach to the investigation of scattered wreck sites. *Nautical Archaeology* 4:173–190.

Munsell Color Company, Inc.

1970 *Munsell book of color.* Neighboring Hues Edition, Matte Finish Collection. Baltimore: Munsell Color Company, Inc.

Museo Naval

1975 Letter to Old Spanish Missions Historical Research Library. San Antonio.

Nance, R. Morton

1955 The ship of the Renaissance—Part II. *Mariner's Mirror* 41:281–298.

Nesmith, Robert I.

1955 *The coinage of the first mint of the Americas at Mexico City. 1536–1572.* Numismatic Notes and Monographs No. 131. New York: The American Numismatic Society.

Newcomb, W. W., Jr.

1961 *The Indians of Texas from prehistoric to modern times.* Austin: University of Texas Press.

Núñez, Beatriz and Mencia

1561 Beatriz y Mencia Núñez . . . con el fiscal de Su Magestad sobre que se les entregue los bienes que quedaron de Francisco Mendez. . . . Archivo General de Indias, Justicia 855. Sevilla.

O'Crouley, Pedro Alonso

1972 *The Kingdom of New Spain, 1774.* Translated and edited by Seán Galvin. San Francisco: John Howell Books.

Ojos, Alonso

1554 Homebound register of the ship *Nuestra Señora Santa Maria de Yciar.* Archivo General de Indias, Contratación 2490 and 1788. Sevilla.

Olds, Dorris L.

1976 *Texas legacy from the Gulf: A report on 16th century shipwreck materials from the Texas tidelands.* Austin: Texas Memorial Museum, Miscellaneous Papers No. 5, and Texas Antiquities Committee, Publication No. 2.

Oppenheim, M.

1961 *A history of the administration of the royal navy and of merchant shipping in relation to the navy from MDIX to MDCLX with an introduction treating of the preceding period.* Ann Arbor: Shoe String Press.

Orbe, Francisco Antonio de

1712 November 22. Derrota que a de llevar el aviso que proximante se despacha con pliegos de S. Mag. para la provincia de Nueva España. Archivo General de Indias, Contratación 4890. Sevilla.

Ordaz, Diego de

1554 Diego de Ordaz con el señor fiscal sobre la encomienda de Tecama. AGI, Justicia 204, No. 2, Ramo. 3. Sevilla.

1556 Diego de Ordás y los hijos de Juan Ponce de León con el fiscal sobre la encomienda del pueblo de Tecama y sus hijos. Archivo General de Indias, Justicia 204, No. 2, Ramo 3. Sevilla.

Ordenanzas Reales

1604 *Ordenanzas Reales para la Casa de la Contratación de Sevilla, y para otras cosas de las*

Indias, y de la navegación dellas. Los herederos de Juan Iñiguez de Lequerica, Vallodolid.

Parry, J. H.
1964 *The age of reconnaissance.* New York: Mentor Books, New American Library, Inc.

Payne-Gallwey, Sir Ralph
1958 *The crossbow: Mediaeval and modern, military and sporting, its construction, history, and management.* London: The Holland Press.

Pejón, Alonso
1553a May 1. Letter to "muy magnífico señor." Archivo General de Indias, Indiferente General 1561. Sevilla.
1553b October 30. Letter to "Muy alto y muy poderoso señor." Archivo General de Indias, Indiferente General 1561. Sevilla.

Pérez, Hernan
1555a February 20. Letter to ———? Real Academia de la Historia, Colección Muñoz, A/114, folio 305v. Madrid.
1555b June 26. Letter to the Council of the Indies. Real Academia de la Historia, Çollección Muñoz, A/114, folio 308v. Madrid.

Perpetuo, Fray (Bishop of Santa Marta)
1553 April 15. Letter to "muy altos y muy poderosos señores." Archivo General de Indias, Patronato 197. Sevilla.

Peterson, Mendel L.
1972 Traders and privateers across the Atlantic: 1492–1733. In *A history of seafaring based on underwater archaeology,* edited by George F. Bass. New York: Walker and Company, Pp. 253–280.
1974 Exploration of a 16th century Bahaman shipwreck. Reprinted from *National Geographic Society research reports, 1967 Projects.* Washington: National Geographic Society.

Philip (as prince regent)
1552a April 5. Letter to the Casa de Contratación. Archivo General de Indias, Contratación 5010. Sevilla.
1552b May 1. Letter to the Casa de Contratación. Archivo General de Indias, Contratación 5010. Sevilla.
1552c Two letters to the Casa de Contratación. Archivo General de Indias, Contratación 5010. Seville.

Philip II (as king)
1556–1557 Royal cédulas on disposition of treasure from the Indies. Archivo General de Simancas, Contaduría General 3053. Simancas.

Pichardo, José Antonio
1931 *Pichardo's Treatise on the Limits of Louisiana and Texas.* Vol. I of four. Translated and edited by Charles Wilson Hackett. Austin: University of Texas Press.

Pontillo, James J.
1975 Nautical Terms in Sixteenth Century American Spanish. Doctoral dissertation, State University of New York at Buffalo. Ann Arbor: University Microfilms International.

Portugal, Fernando de
1560 January 15. Resolución y tiento de cuenta del cargo y dacta de mi el tesorero Don Fernando de Portugal. . . . Archivo General de Indias, México 323. Sevilla.

Pradeau, Albert F.
1938 *Numismatic history of Mexico from the pre-Columbian epoch to 1823.* Whittier, California: Western Printing Company.

Price, Richard, and Keith Muckelroy
1974 The second season of work on the *Kennermerland* site, 1973. An interim report. *Nautical Archaeology* 3:257–268.

Prior and Consuls of Seville
1553a February 10. Letter to the emperor. Archivo General de Indias, Indiferente General 1561. Sevilla.
1553b September 30. Letter to "Muy alto y muy poderoso señor." Archivo General de Indias, Indiferente General 1561. Sevilla.
1553c December 19. Letter to the Prince in the Council. Real Academia de la Historia, Colección Muñoz, A/113, folio 265r.
1554 July 10. Letter to "Muy alto y muy poderoso señor." Archivo General de Indias, Indiferente General 1561. Sevilla.
1555 July 26. Letter to the emperor. Archivo General de Indias, Indiferente General 1561, Sevilla; excerpted in Real Academia de la Historia, Colección Muñoz, A/114, folio 309v, Madrid.

Probert, Alan
1969 Bartolomé de Medina: The patio process and the sixteenth century silver crisis. *Journal of the West,* 8:90–124.

Pulido Rubio, José
1950 *El piloto mayor de la Casa de la Contratación de Sevilla; pilotos mayors, catedráticos de cosmografía y cosmógrafos. Sevilla:* Publicaciones de la Escuela de Estudios Hispano-Americanos de Sevilla.

Quesada, Antonio Rodríguez de
1554 July 15. Letter to "Muy poderoso señor." Archivo General de Indias, Mexico 68. Seville.

Quiñones, Lebón de (Licenciado)
1554 September 12. Letter to "Muy alto y muy poderoso señor." Archivo General de Indias, Guadalajara 51. Sevilla.

Relación
1555 November 27. Relación de las partidas de oro y plata que se hallaron en las arcas de Martín Sánchez maestre que vino de Nuevo España. . . . Archivo General De Simancas, Consejos y Juntas de Hacienda 20. Simancas.
1556 Relación de las partidas de oro y plata que se hallaron en esta Casa en poder de Baltasar Núñez maestre de su nao que vino de Nueva España en este año de 1556 a Sevilla para mercaderes, como de particulares y de la florida. Archivo General de Simancas, Consejos y Juntas de Hacienda 20. Simancas.

Ribero Espinos, Antonio
1554 November 10. Letter to "Muy alto y muy poderoso señor." Archivo General de Indias, Mexico 323. Sevilla.

Robertson, F. L.
1922 A transformation in armament. *Mariner's Mirror* 9:173–179.

Robinson, Gregory
1919 The ancient breech-loading gun—A plea for better designed pigeon-holes. *Mariner's Mirror* 6:10–14.

Roelas, Diego López de las
1549 Medicines consigned to officers of the armada. AGI, Contaduria 292. Sevilla.
Roncière, Charles de la
1899 *Histoire de la Marine Française.* Six volumes. Paris: Librairie Plon E. Plon.
Salazar, Juan Velázquez de, *et al.*
1554 December 31. Letter to the emperor. Archivo General de Indias, Mexico 323. Sevilla.
Salinas, Christóbal de
1554 June 20. Letter to the emperor in the Council. Real Academia de la Historia, Colección Muñoz, A/114, folio 106v. Madrid.
Salisbury, W.
1961 The Woolwich ship. *Mariner's Mirror* 47:81–90.
Salisbury, W., and R. C. Anderson (editors)
1958 *A treatise on shipbuilding and a treatise on rigging written about 1620–1625.* The Society for Nautical Research Occasional Publications No. 6. London: The Society for Nautical Research.
Santo Domingo Officials
1557 September 3. Letter to a merchant in Seville. Real Academia de la Historia, Colección Muñoz, A/114, folio 351. Madrid.
Sauer, Carl Ortwin
1966 *The early Spanish Main.* Berkeley: University of California Press.
Schendel, Gordon
1968 *Medicine in Mexico.* Austin: University of Texas Press.
Sotomayor, Baltasar de, *et al.*
1553 May 15. Letter to the emperor in the Council. Real Academia de la Historia, Colección Muñoz, A/113, folio 287. Madrid.
Stenuit, R.
1974 The *Lastdrager. Nautical Archaeology* 3:229–256.
1976 The wreck of the pink *Evstafi.* A transport of the Imperial Russian Navy, lost off Shetland in 1780. *Nautical Archaeology* 5:221–243.
Stephens, John L.
1969 *Incidents of travel in Central America, Chiapas, and Yucatan.* Two volumes. New York: Dover.
Suárez de Peralta, Juan
1949 Tratado del descubrimiento de las Indias (noticias Históricas de Nueva España). Mexico: Secretaría de Educación Pública.
Tarlton, Kelly
1977 The search for and discovery of anchors lost in 1769 by the French explorer de Surville at Doubtless Bay, New Zealand. *Nautical Archaeology* 6:64–70.
Tinniswood, J. T.
1945 Anchors and accessories, 1340–1640. *Mariner's Mirror* 13:84–105.
Tello, Francisco
1555 April 8. Letter to the emperor. Archivo General de Indias, Indiferente General 2000, folios 253r–254v, Sevilla; excerpted in Real Academia de la Historia, Colección Muñoz, A/114, folio 306v. Madrid.
1556: La Plata de la florida. Archivo General de Indias, Contratación 2926, Ramo 5. Sevilla.
Tello, Francisco, and Diego de Zárate
1555 January 18. Letter to the emperor in the Council. Real Academia de las Historia, Colección Muñoz, A/114, folio 303. Madrid.

Tello, Francisco, *et al.*
1551 June 2. Letter to the emperor. Archivo General de Indias, Indiferente General 2000, folio 38. Seville.
1555 June 11. Letter to the emperor. Archivo General de Indias, Indiferente General 737, folio 130. Sevilla.

Torquemada, Juan de
1723 *Primera parte de los 21 libros rituales a Monarchía Indiana, con el origen y guerras de los Indios occidentales de sus poblaciones descubrimiento, conquista, conversión y otras cosas marvellosas de la misma tierra distribuydos en tres tomas.* Nicolás Rodríguez Franco, Madrid.

Torre, Tomás de la
1973 Traveling in 1544 from Salamanca, Spain, to Ciudad Real, Chiapas, Mexico. Translated and edited by Franz Blom. *Sewanee Review* **81**:429–469.

Traupman, John C.
1966 *The new college Latin and English dictionary.* New York: Bantam Books.

United States Department of the Interior
(n.d.) Padre Island Seashore Master Plan. Washington: National Park Service.

Urrutia, Alonso Ortiz de
1554 Data de la plata y reales imbiados a S.M. de su cargo de lo procedido do derechos y almoxarifazgo y planos de cámera y otras cosas en el año de 1554. Archivo General de Indias, Contaduría 877. Sevilla.

Vázquez, Francisco
1559 Relación de todo que sucedido en la jornada de Amagua y Dorado. Real Academia de la Historia, Colección Muñoz, A/70, folios 5r–69v. Madrid.

Vázquez de Espinosa, Antonio
1942 *Description of the Indies (c. 1620).* Translated by Charles Upton Clark. Smithsonian Institution Press, Washington.

Vega, Garcilaso de la
1966 *Royal Commentaries of the Incas and a General History of Peru.* Translate with an introduction by Harold V. Livermore. Two volumes. Austin: University of Texas Press.

Velasco, Luis de
1554 November 3. Letter to the Casa de Contratación. Real Academia de la Historia, Colección Muñoz, A/114, folio 165. Madrid.

Vigon, Jorge
1947 *Historia de la artillería Española,* Vol. I. Madrid: Instituto Jeronimo Zurita.

Villafañe, Ángel de
1553 October 11. Various notarized documents concerning Ángel de Villafañe. Archivo General de Indias, Mexico 96. Sevilla.
1554 March 30. Letter to the emperor. Archivo General de Indias, Mexico 96. Sevilla.
1562 Various documents concerning Ángel de Villanfañe's exploration of the coast of Florida. Archivo General de Indias, Patronato 19, Ramo 12. Sevilla.

Villiers, Alan
1975 Queen Elozabeth's favorite sea dog Sir Francis Drake. *National Geographic* 147(2):216–253.

Von Gisela Reineking and Von Bock, Bearbeitet
1976 *Kunstgewerbemuseum der stadt koln steinzeug.* Koln: Druckhous Rudolf Muller.

Warren, Eric
1976 April 26–27. Personal interviews with Robert S. Weddle in Austin, Texas.

Waters, David W.
1958 *The art of navigation in England in Elizabethan and early Stuart times.* London: Hollis and Carter.

Wauchope, Robert (General Editor)
1969 Ethnology. *Handbook of Middle American Indians,* Vols. 7 and 8. Evon Z. Vogt, volume editor. Austin: University of Texas Press.

Weddle, Robert S.
1973 *Wilderness manhunt: The Spanish search for la Salle.* Austin: University of Texas Press.

Weddle, Robert S., and Robert H. Thonhoff
1976 *Drama and conflict: The Texas saga of 1776.* Austin: Madrona Press, Inc.

Whistler, Robert G.
1976 April 27. Personal interview with Robert S. Weddle in Corpus Christi, Texas.

Winsor, Justin (General Editor)
1884–1889 *Narrative and critical history of America. Eight volumes.* Boston: Houghton, Mifflin.

Zárate, Diego de, and Juan Gutierrez Tello
1555 February 9. Letter to the emperor. Archivo General de Indias, Indiferente General 2000, folios 230r–231v. Sevilla.

Zárate, Diego de, *et al.*
1553 October 22. Letter to "Muy alto y muy poderoso señor." Archivo General de Indias, Indiferente General 2000, folio 150r and v. Sevilla.

APPENDIXES

Appendix A

SUMMARY OF CARGO REGISTERED ON *SANTA MARIA DE YCIAR* IN VERACRUZ, MARCH AND APRIL, 1554

Presented on the following pages is a summary of a very lengthy document recovered and translated by our researchers from the Archivo General de Indias (Ojos 1554). It is the official register of the cargo loaded in the *Santa María de Yciar* for her ill-fated return voyage from Mexico to Spain. The importance of the information is that both quantitative and qualitative data are presented. Of particular interest are the range of perishable products being shipped. No trace of these items could be expected to survive in the environmental conditions prevailing on the Texas Gulf Coast.

APPENDIX A

SUMMARY OF THE
CARGO REGISTERED ON THE SHIP *SANTA MARIA DE YCIAR* IN
VERACRUZ DURING THE MONTHS OF MARCH AND APRIL, 1554

Entry	Item	Quantity	Duty	Shipped by	Shipped for	Shipped to	Date
1	Wool	?	3 ducats	Antonio de Herrera		Pedro Gomez de Herrera	3/13
2	Silver	100 marks		Hernan Ruiz		Juan de Napoles & Francisco de Santiago	3/13
3	Tepuzque	160 pesos		Bartolome Lopez		Luis de Horozco	3/14
4	Silver	101⅞ marks		Manuel Griego	Melchior de Valdes	Nusio de Colindres	3/13
5	Silver	101½ marks		Manuel Griego	Melchior de Valdes	Geronimo Leon	3/13
6	Silver	158⅞ marks		Manuel Griego	Melchior de Valdes	Andres de Molina	3/13
7	Silver	58¾ marks		Manuel Griego	Melchior de Valdes	Lesmes de Palencia	3/13
8	Silver	76⅝ marks		Manuel Griego	Melchior de Valdes	Lope Garavisto & Hernan Vazquez	3/13
9	Silver	70⅝ marks		Melchior de Valdes		Pedro de Castro & Pedro de la Torre	3/13
10	Silver	83¾ marks		Manuel Griego	Melchior de Valdes	Lope Garavisto	3/13
11	Silver	46⅝ marks		Manuel Griego	Juan Alvarez	Alonso Roman	3/13
12	Cow hides	230	3¼ reales per hide	Rui Perez		Rui Perez	3/13
13	Cochineal, 2 barrels	39 arrobas, 8 pounds	12 ducats per barrel	Juan de Torres	Alonso Sanchez de Cisneros	Diego Sanchez de San Pedro Ortiz	3/28
14	Silver	117¼ marks		Hernan Baez	Pedro Nunez de Montalvan	Hernan Sanchez de la Barrera	3/20
15	Silver	39¼ marks		Manuel Griego	Juan de Castaneda	Alonso Roman	3/30
16	Tepuzque in reales	424 pesos		Christoval Romero		Hernando de Xerez de Baez	3/1
17	Tepuzpue in reales	610 pesos		Christoval Romero		Geronima Cerda	3/21
18	Reales	200 pesos		Christoval Romero		Hernando Osorio	3/19
19	Silver reales	7,076 pesos		Christoval Romero	Doctor Ant° Quesada	Officials of the House of Trade to give to heirs of the deceased	3/20
20	Silver	203½ marks		Christoval Alonso	Andres de Losa	Gonzalo & Gaspar Jorge	3/20
21	Tepuzque in reales of silver 8 reales per peso	2,000 pesos		Christoval Alonso	Andres de Losa	Diego Cavallero	3/20
22	Cochineal, 2 barrels	50.5 arrobas	12 ducats per barrel	Christoval Alonso	Andres de Losa	Gonzalo & Gaspar Jorge	3/20
23	Silver Reales	6 planchas 46 pesos		Christoval Alonso	Juan de Torres de la Sierra	Gonzalo Jorge, Rodrigo Perez & Francisco Bernal	3/20

24	Silver	200½ marks		Christoval Alonso	Juan Garcia Montero	Gaspar Jorge & Juan Garcia	3/20
25	Reales	1,276 pesos		Christoval Alonso	Pio Bazquez de Vergara	Bernardo de Vergara & Luis Grapolido	3/20
26	Silver	209⅜ marks		Andres de Spinosa	Juan Perez de Cordoba	Gaspar Melchior	3/20
27	Silver	202⅝ marks		Andres de Spinosa	Juan Perez de Cordoba	Gaspar Melchior	3/21
28	Silver	202⅛		Andres de Spinosa	Francisco & Hernando Zarfate	Juan & Pedro Zarfate	3/21
29	Silver	73 marks		Andres de Spinosa	Hernan Perez de Cordoba	Martin Hernand de Inquiriana	3/21
30	Silver	57¾ marks		Andres de Spinosa	Hernan Perez de Cordoba	Christova Ruiz	3/21
31	Silver	100¼ marks		Andres de Spinosa	Juan de Mata	Sebastian de la Pazaran	3/21
32	Silver	43⅝ marks		Andres de Spinosa	Juan de Mata	Diego Cavallero	3/21
33	Silver	23½ marks		Andres de Spinosa	Juan de Mata	Diego de Baeza	3/21
34	Tepuzque in reales	340 pesos		Andres de Spinosa	Fran^{co} & Hernando Zarfate	Juan de Xerez de la Isla	3/21
35	Tepuzque in reales in reals	296 pesos		Andres de Spinosa	Hernando de Ribadeniera	Heirs of Hernando de Avila	3/21
36	Silver	62⅜ marks		Andres de Spinosa	Hernando de Ribadeniera	Joan de la Barrera	3/21
37	Silver	108⅝ marks		Andres de Spinosa	Hernando de Ribadeniera	Gaspar de Torres	3/21
38	Silver	201½ marks		Andres de Spinosa	Hernando de Ribadeniera	Alonso Diaz de Leon	3/21
39	Silver	200 marks		Andres de Spinosa	Hernando de Ribadeniera	Gaspar de Torres	3/21
40	Silver	153¾ marks		Andres de Spinosa	Hernando de Ribadeneira	Juan de Espinosa el Romo, et. al.	3/21
41	Silver	109¾ marks		Andres de Spinosa	Hernando de Ribadeneira	Gaspar de Spinosa, et. al.	3/21
42	Silver	69 marks		Andres de Spinosa	Hernando de Ribadeneira	Diego de Avilla	3/21
43	Tepuzque	595 pesos		Geronimo de Cisneros		Miguel de Anis	3/21
44	Silver Tostones 4 pieces of silver: small pot, jar, cup, & drinking vessel. Beds from New Spain & items made of feathers.	50 marks 200 pesos		Alonso de Morales		Alonso Morales	3/21
45	Cochineal, 3 barrels	57 arrobas, 10 pounds	12 ducats per barrel	Manuel Griego	Melchior de Valdes	Lope Garavito	3/23
46	Cochineal, 1 barrel	20 arrobas	12 ducats	Manuel Griego	Melchior de Valdes	Andres de Molina & Alonso Ballesteros	3/24
47	Cochineal, 1 barrel	20 arrobas	12 ducats	Manuel Griego	Melchior de Valdes	Nusio de Colindres	3/23
48	Cochineal, 1 barrel	20 arrobas	12 ducats	Manuel Griego	Melchior de Valdes	Geronimo Leon	3/23

Appendix A. Cargo Registered on the *SANTA MARIA DE YCIAR* — (Cont.)

Entry	Item	Quantity	Duty	Shipped by	Shipped for	Shipped to	Date
49	2 cotten beds Silver pot		3 ducats	Manuel Griego	Pedro de Peralta	Juan de Peralta	3/23
50	Cayetes de tecamahaca	6	2 ducats	Manuel Griego	Melchior de Valdes	Nusio de Colindres	3/23
51	Wool, 15 sacks	5 arrobas per sack	1 ducat per sack	Alexandre Vazquez		Alexandre Vazquez	3/23
52	Silver reales	250 pesos		Alonso Ortiz de Urrutia	Juan Bravo de las Granas	Catalina Gonzalez	3/23
53	Silver	254¼ marks		Alonso Ortiz de Urrutia & Hernando de Vergara	Ortunio de Ibarra	Juan de Orula	3/23
54	White sugar, 13 barrels	50 arrobas	4 ducats	Gonzalo Franquez	Juan Fernandez Caro	Pedro Hurtado	3/20
55	Cochineal, 2 boxes	40 arrobas	22 ducats	Gonzalo Franquez	Christoval Ruiz	Gonzalo Ruiz de Huelva	3/28
56	Silver	155¼ marks		Alonso Onos	Christoval Ruiz de Huelva	Gonzalo Ruiz de Huelva	3/20
57	Silver	109¾ marks		Gonzalo Franquez	Christoval Ruiz de Huelva	Hernando Armenta	3/20
58	Silver	120 marks		Gonzalo Franquez	Christoval Ruiz de Huelva	Gaspar Melchior	3/20
59	Silver	62½ marks		Gonzalo Franquez	Christoval Ruiz de Huelva	Garcia de Armenta	3/20
60	Silver	103⅛ marks		Gonzalo Franquez	Christoval Ruiz de Huelva	Melchior Nunez	3/20
61	Silver	105⅜ marks		Gonzalo Franquez	Christoval Ruiz de Huelva	Gonzalo Ruiz de Huelva	3/20
62	Silver Tostones	188¾ marks 364 pesos		Gonzalo Franquez	Diego Diaz	Diego de Mesa	3/20
63	Silver	61 marks		Gonzalo Franquez	Alonso Gomez Herrera	Diego de Mesa	3/20
64	Silver	122⅛ marks		Gonzalo Franquez	Juan Fernandez Caro	Pedro Hurtado	3/20
65	Silver Tecamacha	67 marks 1 bag		Gonzalo Franquez	Juana Martos	Pedro Xara & Alvaro Garcia	3/20
66	Silver	31 marks		Gonzalo Franquez	Diego de Tarifa	Pedro de Tarifa	3/20
67	Silver	244⅛ marks		Gonzalo Franquez	Diego de Aldava	Hernan Vazquez	3/20
68	Liquidamber, 2 barrels & a box	76 arrobas, 21 pounds	10 ducats	Gonzalo Franquez	Christoval Ruiz de Huelva	Gonzalo Ruiz de Huelva	3/20
69	Silver	87 marks		Gonzalo Franquez	Diego Tellez	Andres Lopez & Hernan Perez	3/20
70	Silver	187¾ marks		Melchoir de Pardinas		Baltasar Pinto	3/22
71	Silver	184⅛ marks		Melchior de Pardinas		Alonso Martinez	3/20
72	Silver	151⅛ marks		Melchior de Pardinas		Alonso Martinez	3/22
73	Silver	165⅜ marks		Melchior de Pardinas		Alonso Martinez	3/22
74	Cochineal, 3 barrels	60 arrobas, 10 pounds	11 ducats per barrel	Pedro Delgado	Pedro Diaz de Aguilar	Martin Campos	3/22
75	Silver	60½		Pedro Delgado	Luis de Mansilla	Hernan Vazquez	3/22
76	Cochineal, 1 barrel	19 arrobas	11½ ducats	Alonso de la Vega & Pedro Delgado	Diego Cortez & Alonso de la Vega	Alonso de la Vega, et. al.	3/22

77	Cochineal, 3 barrels	53 arrobas	11½ ducats per barrel	Pedro Diaz Rageron		Pedro Diaz Rageron	4/3
78	Wool, 2 sacks	7 arrobas, 16 pounds	14 reals per sack	Pedro Diaz Rageron		Pedro Diaz Rageron	4/3
79	Cochineal	4 arrobas	4 ducats	Pedro Delgado	Juan Garzon	Martin de Campos & Pedro Hurtado	3/22
80	Silver	125¼ marks		Manuel Griego	Melchior de Valdez	Lesmes de Palencia	3/24
81	Silver	57 marks		manuel Griego	Francisco de Villalobos	Diego de Najara	3/23
82	Tostones	500 pesos		Hernando de Vergara		Hernando de Castro	3/23
83	Cow hides	88		Andres de Spinosa	Sebastian Garcia	Hernan Vazquez	3/24
84	Cow hides	400	3¼ reals per hide	Andres de Spinosa	Francisco Alvarez de la Parra	Andres Perez	3/24
85	Silver	100⅞ marks		Nicolao de Caziana	Gaspar Perez	Hernan Perez de las Quentas	3/24
86	Silver	97 marks		Nicolao de Caziana	Diego Serrano	Anton Rodriguez de la Madalena	3/24
87	Silver	120⅞ marks		Nicolao de Caziana	Garcia Nunez	Hernan Perez Xarada	3/24
88	Silver	50½ marks		Nicolao de Caziana	Garcia Nunez	Pedro de Sepulveda	3/24
89	Reales	1,000 pesos		Nicolao de Caziana	Pero Nunez	Alonso de Illescas & Rui Diaz de Gibraleon	3/24
90	Reales	800 pesos		Nicolao de Caziana	Pero Nunez	Luis de Mercado	3/24
91	Reales	600 pesos		Nicolao de Caziana	Pero Nunez	Luis de Mercado	3/24
92	Silver	53¾ marks		Nicolao de Caziana	Pero Nunez	Diego de la Torre	3/24
93	Silver	53⅞ marks		Nicolao de Caziana	Pero Nunez	Hernando Cavallero	3/24
94	Silver	113 marks		Nicolao de Caziana	Pedro de Villaribia	Garcia Diaz	3/24
95	Tepuzque in reales	140 pesos		Juan de Segovia		Juan de Segovia	3/24
	Cochineal	2 arrobas					
96	Tepuzque in reales	30 pesos		Juan de Segovia	Juan Ramirez de Alarcon	Teresa Ramirez	3/24
97	Tepuzque in reales	66 pesos		Juan de Segovia	Juan Ramirez de Alarcon	Juana de Leon	3/24
98	Tepuzque in reales	100 pesos		Juan de Segovia	Juan de Sarmiento	Juan de Segovia	3/24
99	Cochineal	4 arrobas		Juan de Segovia	Cosme de Palacios	Juan de Segovia	3/24
100	Cochineal	3½ arrobas		Juan de Segovia	Alonso de Grajeda	Luis de Cordoba	3/24
101	Cochineal	28 arrobas		Juan de Segovia		Juan de Segovia	
102	Reales	1,000 pesos		Anton Delgado		Gonzalo Ruiz de Cordoba	3/24
103	Cochineal	10 arrobas	8 ducats	Fernando de Rebolledo	Alvaro de Caceras	Martin de Campos	3/28
104	Silver	89¾ marks 2 oz. silver		Lieutenants of the Royal Officials of New Spain	Royal Officials of New Spain	Fr. Bartolome de las Casas	3/29
105	Tepuzque in reales	131 pesos		Rui Perez	Juan de Rapain	Juan Ochoa de Rapain	3/28
106	Reales	4,000 pesos		Rui Perez		Rui Perez	3/28
	the mines. Engraved Silver	20 marks					

Appendix A. Cargo Registered on the *SANTA MARIA DE YCIAR* — (Cont.)

Entry	Item	Quantity	Duty	Shipped by	Shipped for	Shipped to	Date
107	Tostones, 8 reales/ peso	750 pesos		Alonso Rodriguez Catalan & Pedro Barahona	Martin Hernandez de Herrera	Hernando de Arauz	3/31
108	Reales	342 pesos		Alonso Rodriguez Catalan & Pedro Barahona	Martin Hernandez de Herrera	Isabel de Herrera & Andres Perez	3/31
109	Silver	149½ marks		Alonso Rodriguez Catalan & Pedro Barahona	Martin Hernandez de Herrera	Officials of the House of Trade to give to heirs of the deceased	3/31
110	Silver	60¼ marks		Alonso Rodriguez Catalan & Pedro Barahona	Martin Hernandez de Herrera	Francisco de Mola & Luis de Cordoba	3/31
111	Reales	730 pesos		Nicolao de Caziana	Pedro Cavallero	Diego Cavallero	4/1
112	Silver	200 marks		Juan Ramirez		Pedro de Spinosa & Gomez Hurtado	4/1
113	Silver	557 marks		Juan Ramirez		Gomez Hurtado & Juan Ramirez	4/1
114	Reales	400 pesos		Juan Ramirez	Hernando Cavallero	Juan Ramirez	4/1
115	Cochineal, 4 boxes	76 arrobas	11 reales per palm per box	Pedro Velasco		Pedro de Velasco	4/1
	Cow hides	100	3¾ reales per hide				
	Anime	3 arrobas	11 reales				
	Sarsaparilla	1 barrel	3 ducats				
116	Silver	400 marks		Gonzalo Lopez		Antonia del Castillo	4/1
117	Tepuzque, 8 reales/ peso	390 pesos		Francisco Sanchez	Pedro Cuadrado	Miguel Toruno Cordonero	4/2
118	Pesos of 8 reales	500		Francisco Sanchez		Juan Diaz de Gibraleon	4/2
119	Pesos of 8 reales	197		Francisco Sanchez		Pedro Galindez	4/2
120	Tepuzque 8 reales/ peso	105 pesos		Francisco Sanchez		Christoval de la Bezera	4/2
121	Silver	64¼ marks		Francisco Sanchez		Alonso Martin	4/2
122	Silver	386⅝ marks		Francisco Mendez Contero		Francisco Mendez Contero	4/2
	Tostones	400 pesos					
123	Silver	64⅞ marks		Inigo de Artiera	Lazaro de Ordas	Francisco de Toro	4/2
124	Silver	47¼ marks		Inigo de Artiera	Lazaro de Ordas	Christoval de Toro	4/2
125	Silver	45⅛ marks		Inigo de Artiera	Lazaro de Ordas	Francisco de Toro	4/2
126	Silver	44½ marks		Inigo de Artiera	Hernando de Cazalla	Francisco de Toro	4/2
127	Reales	266 pesos		Juan Ramirez	Hernando Cavallero, et. al.	Juan Ramirez	4/2
128	Silver	63⅜ marks		Gonzalo Franquez	Juan de Hermosa	Juan de Hermosa	4/2
129	Silver	46⅞ marks					
	Tepuzque in 4 reales	200 pesos		Gonzalo Franquez	Benito de Nero	Hernan Vazquez	4/2

130	Silver	29 marks		Gonzalo Franquez	Diego Rodriguez de Medina	Diego de Baeza	4/2
131	Maravedis	542,960		Miguel de Jauregui	Fernando de Vergara	Antonio de Ysasi	4/2
132	Tepuzque in reales	250 pesos		Melchior de Paredinas		Antonio de Segura	4/2
133	Tepuzque	110 pesos		Micolao de Cazana		Costancia Hernandez de Rojas	4/1
134	Reales	1,000 pesos		Miguel de Jauregui		Miguel de Jauregui & Antonio Rodriguez	4/2
135	Cochineal, 2 barrels	36 arrobas, 12 pounds	12 ducats	Gregorio del Rio		Alonso de Baeza	4/2
136	Silver	52½ marks		Alonso Rodriguez Catalan & Pedro Barahona	Luis de Arauz	Hernando de Arauz	4/2
137	Reales 8 reales/peso	250 pesos		Alonso Rodriguez Catalan & Pedro Barahona	Baltasar Leandre	Ines Texera & Gaspar Miguel	4/2
138	Silver	206½ marks		Alonso de Mansilla	Martin Hernandez de Herrera	Francisco de Molina, et. al.	4/2
139	Tepuzque in tostones	800 pesos		Melchior de Paredinas		Alonso Martinez	4/5
	Silver	27¼ marks					
140	Tepuzque	500 pesos		Melchior de Paredinas		Baltasar Pinto	4/5
141	Silver	27½ marks		Pedro del Algava		Domingo de Azpitia	4/2
142	Silver	47⅛ marks		Pedro del Algava		Rodrigo de Illescas	4/2
143	Silver	201⅝ marks		Pedro del Algava		Rodrigo de Illescas	4/2
144	Silver	70⅜ marks		Pedro del Algava		Bartolome de Vizcarra	4/2
145	Cochineal, 2 barrels	32 arrobas	11 ducats per barrel	Pedro del Algava		Rodrigo de Illescas & Luis Sanchez de Alvo	4/2
146	Reales	312 pesos		Alonso de Villegas	Francisco Ruiz de Ramales	Rui Gomez Adalid	4/2
147	Silver	284 marks		Pedro de Velasco		Pedro de Velasco	4/2
	Tepuzque, 8 reales/peso	500 pesos					
148	Tepuzque, 8 reals/peso	300 pesos		Pedro de Velasco	Hernando de Herrera	Hernando de Salazar	4/2
149	Anime	1 box	1 ducat	Pedro Delgado	Pedro de Velasco	Pedro de Velasco	4/2
150	Cochineal, 1 box	14 arrobas	11 reales per palm	Miguel Blanco		Miguel Blanco	4/3
151	Tepuzque	100 pesos		Francisco Gomez		Pedro Velasco	4/2
152	Tostones of 8 reales	100 pesos		Pedro de Velasco		Geronima de Cervantes	4/2
153	Wool	6 sacks	17 reales per sack	Nicolao de Cazana	Garcia Nunez	Alonso Nunez de Badajoz	4/3
154	Reales	155 pesos		Inigo de Artiera	Alonso Vanegas	Lope Garavito	4/3
155	Tepuzque in reales	107 pesos		Andres de Espinosa	Juan de Mata	Antonio Diaz & Geronimo Herver	4/3
156	Silver	100¾ marks		Andres de Espinosa	Hernando de Ribadeneira	Gaspar de Espinosa	4/3
157	Silver	101 marks		Andres de Espinosa	Alonso de Villaseca	Gaspar & Alonso de Espinosa	4/3
158	Silver	100 marks		Andres de Espinosa	Alonso de Villaseca	Gaspar & Alonso de Espinosa	4/3
159	Silver	40¾ marks		Andres de Espinosa	Alonso de Villaseca	Gaspar & Alonso de Espinosa	4/3

Appendix A. Cargo Registered on the *SANTA MARIA DE YCIAR* — (Cont.)

Entry	Item	Quantity	Duty	Shipped by	Shipped for	Shipped to	Date
160	Silver	23⅞ marks		Andres de Espinosa	Hernando de Ribadeneira	Gaspar de Espinosa	4/3
161	Silver	60⅝ marks		Blas Perez Prado	Juan Rodriguez	Diego de Baeza	4/3
162	Silver	14⅜ marks		Blaz Perez Prado	Amaro Perez	Blas Perez Prado	4/3
163	Silver	51 marks		Andres de Spinosa	Alonso de Villaseca	Gaspar & Alonso de Espinosa	4/3
164	Silver	91⅝ marks		Blaz Perez de Prado		Blas Perez de Prado	4/3
	Tepuzque	1000 pesos		Blas Perez de Prado			
	in reales					Blas Perez de Prado	4/3
165	Silver	199½ marks		Blas Perez de Prado		Blas Perez de Prado	4/3
166	Tepuzque in reales	655 pesos		Blas Perez de Prado		Blas Perez de Prado	
167	Silver	83⅝ marks		Blas Perez de Prado	Alvaro Nieto	Blas Perez de Prado	4/3
168	Maravedis	12,800		Blas Perez de Prado	Francisco de la Pena, deceased	Blas Perez de Prado	4/3
169	Tepuzque in reales	165 pesos		Blas Perez de Prado	Ana de Leon	Domingo de Castaneda	4/3
170	Ducats	50		Blas Perez de Prado	Juan Rodriguez	Alonso Roriguez	4/3
171	Reales	179 pesos		Blas Perez de Prado	Francisco de Penaranda	Diego & Alonso Valdorrey	4/3
172	Maravedis	150,750		Blas Perez de Prado	Herribero de Espinosa	Andres Ribero	4/3
173	Silver	7⅞ marks		Blas Perez de Prado	City council of the city of Mexico	Doctor Sepulveda	4/3
	Reales	245 pesos					
174	Gold, 18 carat	1,148 pesos		Blas Perez de Prado	Juana de Sosa	Gaspar de Espinosa	4/3
175	Silver	73¾ marks		Andres de Espinosa	Francisco & Hern[do] Zarfates	Agustin Francisco	4/3
176	Tepuzque	1,230 pesos		Juan Ramirez		Gomez Hurtado & Juan Ramirez	4/3
	Silver	28⅜ marks					
177	Cow hides	93	3¼ reals per hide	Christoval Alonso		Gonzalo & Gaspar Jorge	4/4
178	Cow hides	253	3¼ reales per hide	Christoval Alonso	Andres de Loya	Gonzalo & Gaspar Jorge	4/4
179	Reals, 8 reales/peso	120 pesos		Alonso Rodriguez Catalan		Beatriz & Ana de la Serda	4/4
180	Silver	5,090½ marks		Lieutenants of the royal officials	Fernando de Portugal	His Majesty	4/4
181	Letters	Large bundle		Alonso Rodriguez,	Juan Velazquez de Salazar	Fernando de Castro	4/5
182	Letters	Bundle		Lieutenants of the royal officials	Royal officials	Officials of the House of Trade; His Majesty	4/5
183	Tepuzque	136 pesos		Pero Diaz Rageron	Francisco Garrido	Ana Diaz	4/5
184	Tepuzque in reales	100 pesos		Andres de Espinosa	Hernando de Ribadeneira	Gaspar de Spinosa	4/6
185	Silver	143 marks		Ruy Lopez		Ruy Lopez	4/6
186	Silver	221⅜ marks		Alonso Rodriguez Catalan & Pedro Barahona	Martin Hernandez de Herrera	Francisco de Molina & Luis de Cordoba	3/24
187	Silver	250½ marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuenca	Juan Rodriguez Cerezo	3/24
188	Silver	134 marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuenca	Alonso de Herrera	3/24

189	Silver	145 marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuenca	Christoval de la Bezerra	3/24
190	Silver	101⅛ marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuenca	Pedro Galindez	3/24
191	Silver	36⅞ marks		Alonso Rodriguez Catalan & Pedro Barahona	Francisco Gonzalez	Pedro Galindez	3/24
192	Silver	221½ marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuenca	Graviel de Balmaseda	3/24
193	Silver	130⅛ marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuenca	Barbola de Burgos	3/24
194	Silver	84½ marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuenca	Andres de Lantadilla	3/24
195	Silver	45 marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuenca	Hospital de la Misericordia of Sevilla	3/24
196	Silver	202⅛		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuenca	Graviel de Balmaseda	3/24
197	Reales, 8 reales/peso	600 pesos		Alonso Rodriguez Catalan & Pedro Barahona	Juan de Limpias	Luis de Corboda	3/24
198	Silver	112⅜ marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan Belmonte	Rodrigo de Palma & Luis Belmonte	3/24
199	Silver Tostones, 8 reales/peso	73¾ marks 503 pesos		Alonso Rodriguez Catalan & Pedro Barahona	Juan Belmonte	Luis Belmonte	3/24
200	Silver	172⅞ marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan Belmonte	Luis Belmonte	3/24
201	Cochineal, 4 boxes	71 arrobas, 21 pounds	37-1/3 ducats	Alonso Rodriguez Catalan & Pedro Barahona	Christoval Quesada	Martin Ortiz	3/24
202	Cochineal, 2 boxes	18 arrobas	14-2/3 ducats	Alonso Rodriguez Catalan & Pedro Barahona	Pedro de la Cruz	Hernando de la Cruz	3/24
203	Cochineal, 2 boxes	20 arrobas	18-2/3 ducats	Alonso Rodriguez Catalan & Pedro Barahona	Martin Hernandez	Francisco de Mo	3/24
204	Silk thread, 2 trunks	143 pounds	8 ducats	Alonso Rodriguez Catalan & Pedro Barahona	Diego Gutierrez	Gaspar Zerfate	3/24
205	Silver	31⅜ marks		Alonso Rodriguez Catalan & Pedro Barahona	Diego Alonso Larios	Alonso Cavallero	3/24
206	Silver Tepuzque in reales	19⅛ marks 52 pesos		Alonso Rodriguez Catalan & Pedro Barahona	Diego Alonso Larios	Diego Cavallero	3/24
207	Silver Tepuzque in reales	40 marks 8 pesos		Alonso Rodriguez Catalan & Pedro Barahona	Diego Alonso Larios	Marcos de Sosa	3/24
208	Silver	23¾ marks		Alonso Rodriguez Catalan &	Diego Alonso Larios	Catalina del Caysa	3/24

Appendix A. Cargo Registered on the *SANTA MARIA DE YCIAR* — (Cont.)

Entry	Item	Quantity	Duty	Shipped by	Shipped for	Shipped to	Date
				Pedro Barahona			
209	Tepuzque in reales	292 pesos		Alonso Rodriguez Catalan & Pedro Barahona	Diego Alonso Larios	Alonso Mexia	3/31
210	Silver	23⅝ marks		Alonso Rodriguez Catalan & Pedro Barahona	Juan Rodriguez	Alonso Mexia	3/24
	Tepuzque in reales	5 pesos					
211	Silver	136⅝ marks		Alonso Rodriguez Catalan & Pedro Barahona	Martin Hernandez de Herrera	Heirs of Juan Garcia de Cibdad	3/24
212	Liquidamber, 45 barrels	258 arrobas, 17 pounds	12 reales per barrel	Alonso Rodriguez Catalan & Pedro Barahona	Francisco & Hernando Zarfates	Pedro Zarfate	3/24
213	Cochineal, 10 boxes	135 arrobas, 5 pounds	73 ducats	Alonso Rodriguez Catalan & Pedro Barahona	Juan de Cuentes	Graviel de Balmaseda	3/24
214	Silver	185⅜ marks		Alonso Rodriguez Catalan & Pedro Barahona	Christoval de Quesada	Martin Ortiz	3/24
215	Letters	Bundle		Alonso Rodriguez	Martin Hernandez	Luis Garcia & Martin de Vaena	3/24
216	Reales, 8 reales/peso	300 pesos		Pedro Barahona		Geronimo de Herrera	4/1
217	Tostones of Tepuzque, 8 reales/peso	772 pesos		Pedro de Velasco	Hernando de Herrera	Pedro de Velasco	3/25
	Silver	41⅝ marks					
218	Silver	12¼ marks		Pedro de Velasco	Pedro Sanchez de la Fuente	Pedro de Velasco	3/25
219	Silver	10⅜ marks		Pedro de Velasco	Rev. Bachiller Puebla	Teresa Alvarez	3/25
220	Silver	90⅛ marks		Andres Lopez de Archuleta		Bartolome de Lasalde	3/26
221	Silver	109¾ marks		Andres Lopez de Archuleta & Juan de Pagalqui		Martin Zavala	3/26
222	Cochineal, 2 sacks	5 arrobas, 18 pounds	5 ducats	Alonso Rodriguez Catalan & Pedro Barahona	Martin Hernandez & Juan Belmonte	Luis Garcia, Pedro Martin de Vaena & Luis Belmonte	4/1
223	Silver	59 marks		Andres de Espinosa	Hernando de Ribadeneira	Gaspar de Espinosa	3/26
224	Silver	203⅞ marks		Andres de Espinosa	Hernando de Ribadeneira	Alonso de Espinosa	3/26
225	Silver	151¾ marks		Andres de Espinosa	Hernando de Ribadeneira	Gaspar de Espinosa	3/26
226	Tepuzque in reales	281 pesos		Andres de Espinosa	Hernando de Ribadeneira	Gaspar de Espinosa	3/26
227	Silver	102 marks		Gonzalo Franquez	Martin de Aranguren	Christoval Perez de Ibarra	3/26
228	Tepuzque	217 pesos		Gonzalo Franquez	Martin de Aranguren	Pedro Abad de Vergara	3/26
229	Tepuzque	311 pesos		Gonzalo Franquez		Andres Perez	4/
230	Cow hides	62	3¼ reales per hide	Gonzalo Franquez	Gonzalo Rodriguez	Francisco Rodriguez	3/26
231	Silver	205⅞ marks		Gonzalo Franquez	Martin de Aranguren	Christoval Perez de Ibarra	3/26
232	Tepuzque in reales	351 pesos		Estate of Antonio de Igonza		Catalina Alos de Amilibia	3/26
233	Silver	111⅝ marks		Gonzalo de Salazar		Martin Valdizar	3/28
234	Ducats	200		Christoval Romero	Gonzalo Salazar	Alonso de Salzedo	3/28

235	Silver	833½ marks	Martin Diaz de Segura	Christoval de Zifontes	Francisco Nunez Perez	4/6
236	Silver	33⅝ marks	Martin Diaz de Segura	Christoval de Zifontes	Bernardo de Ribera	4/6
237	Silver	55 marks	Martin Diaz de Segura	Christoval de Zifontes	Heirs of Juan Aleman	4/6
238	Silver	16 marks	Martin Diaz de Segura	Diego Lopez de Aragon	Pedro de Arbieto	4/6
239	Letters	Bundle	Alonso Manrique		Officials of the House of Trade	
240	Reales	137 pesos	Francisco de Rosales	Juan de Briseno	Rev. Pedro Manuel	4/6
241	Silver	19½ marks	Hernando Rebolledo		Hernando Rebolledo	4/6
242	Tepuzque in reales	146 pesos	Alonso Rodriguez Catalan & Pedro Barahona		Juan Rodriguez Cerezo	4/7
243	Silver	179 marks	Gonzalo Franquez	Pedro Dora	Pedro de Avedano	4/7

TOTALS

Gold in pesos	Silver in pesos	Silver in marks	Ducats	Maravedis
1,148	38,490[a]	20,316[b]	250	706,510

Cochineal	Liquidamber	Wool	Cow hides	White sugar	Miscellaneous	
20,654 lbs.	8,400 lbs.	3,201 lbs[c]	1226	1,250 lbs.	Silk thread	143 lbs.
					Silver vessels	5
					Beds	
					Anime	150 lbs[c]
					Sarsaparilla	1 barrel
					Cayetes de tecahamaca	46
					Items made of feathers	

[a] Fractions of a peso were disregarded.
[b] Fractions of an ounce were disregarded.
[c] Estimate.

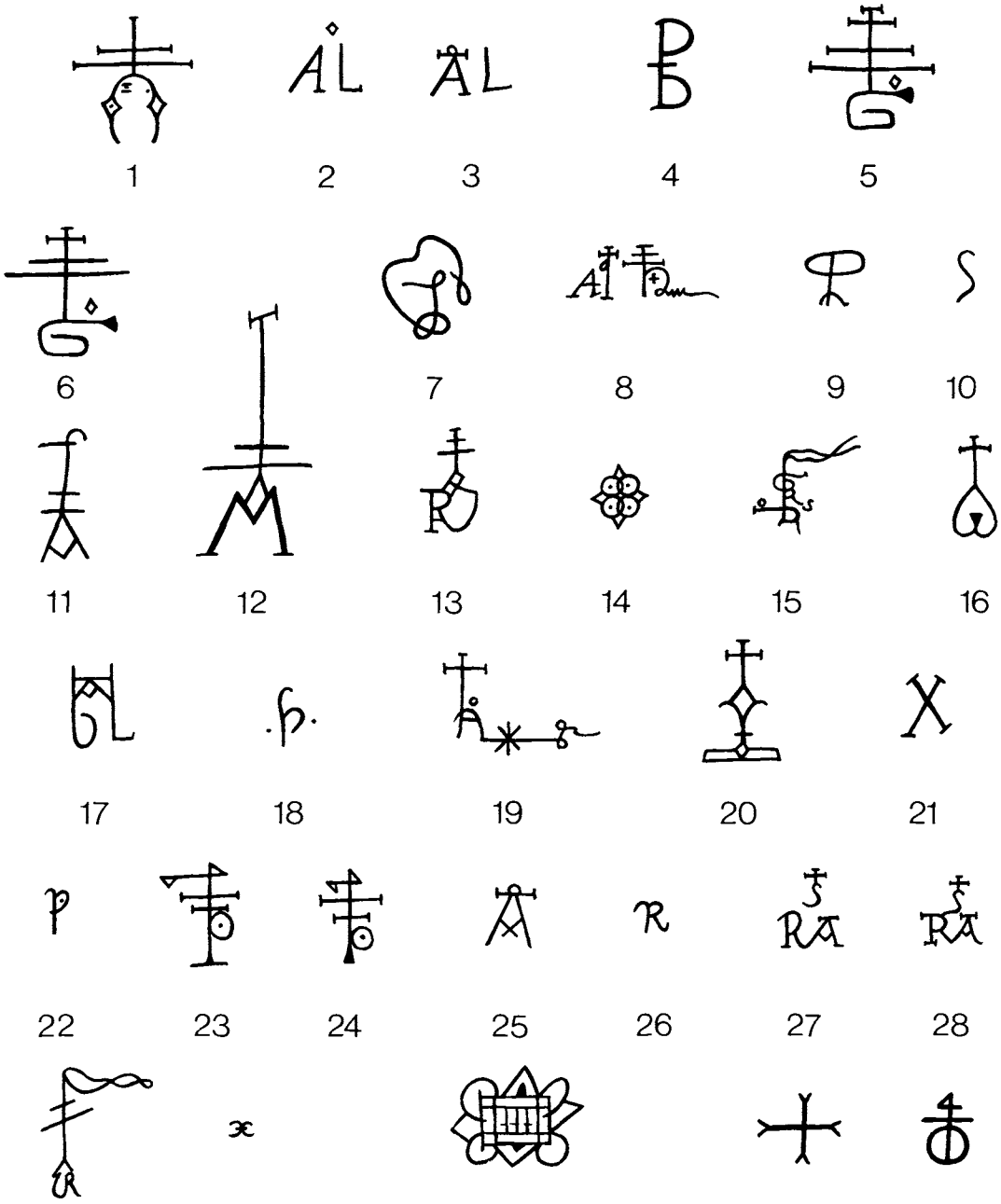

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33

FIGURE A.1. Shipper's marks from cargo register.

1. Antonio Herrera.
2. Andrés De Losa.
3. Andrés De Loya. (Same name as Number 2. Spelling inconsistent in original document.)
4. From Gonzalo Fránquez in the name of Juan Fernández Caro for delivery to Pedro Hurtado.

5,6. From Gonzalo Franquez in the name of Cristóbal Ruiz de Hueva for delivery to Gonzalo Ruiz De Huelva.

7. From Pedro Delgado in name of Pedro Díaz De Aguilar for delivery to Martin De Campos or Pedro Hurtado.
8. From Pedro Delgado in the name of Diego Cortéz and from Alonso De La Vega for himself for delivery to various receivers: Alonso De La Vega, Martin De Campos, Pedro Hurtado. Diego Cortez also sends a share of the cargo in the name of Catalina De Campos.
9. Alejandro Vázquez.
10. Sebastian García.
11. From Andrés De Espinosa in the name of Francisco Álvarez De La Parra for delivery to Andrés Pérez.
12. From Alonso Rodríguez Catalán and Pedro Barahona in the name of Cristóbal Quesada for delivery to Martin Ortiz.
13. From Alonso Rodríquez Catalan and Pedro Barahona in the name of Pedro De La Cruz for delivery to Hernando De La Cruz.
14. From Alonso Rodríguez Catalán and Pedro Barahona in the name of Martín Hernández for delivery to Luis De Cordova.
15. From Alonso Rodríguez Catalán and Pedro Barahona in the name of Diego Gutiérrez for delivery to Gaspar Zarfate.
16. From Alonso Rodríguez Catalán and Pedro Barahona in the name of Francisco and Hernando Zarfate for delivery to Pedro Zarfate.
17. From Alonso Rodríguez Catalán and Pedro Barahona in the name of Juan De Cuenca (for Diego De Balmaseda, deceased) for delivery to the house of Trade and then to Graviel De Balmaseda.
18. Gonzalo Rodriguez.
19. From Juan De Torres in the name of Alonso Sánches De Cisneros for delivery to Diego Sánchez De San Pedro Ortiz.
20. From Fernando De Rebolledo in the name of Alvaro De Caceres for delivery to Martín De Campos.

21,22,23,24. Pedro De Velasco

25. Alonso De Baeza
26. Rodrigo De Illescas and Luis Sánchez De Alvo.

27,28. Díaz Rangerón

29. From Nicolao De Cazana in the name of Garcia Nunez for delivery to Alonso Nunez De Badajoz.
30. From Cristóbal Alonso for delivery to Gonzalo Gorge.
31. Mark of LUIS PÉREZ, Notary.
32. Mark on box of gold recovered from wreck: Owner Unknown.
33. Parcel of Silver Recovered from wreck: Owner, Esteban López.

Appendix B

BENTHIC ORGANISMS FROM THE SURFACE OF ENCRUSTED OBJECTS FROM THE 1554 SHIPWRECK (41 KN 10)

J. S. Holland and Nancy J. Maciolek

Recovered conglomerates were examined for living and/or dead organisms several hours after they arrived in Port Aransas. No errant forms such as crabs, shrimp, isopods, or amphipods were found. Aneomes, probably *Bundostoma* sp., were the predominant living organism. A few live boring bivalves, *Diplothyra smythi* and *Pholas campechiensis* were seen in the solidified sediment on the conglomerates. Several hundred large dead barnacles were seen, but only a few live *Balanus eburneaus* were observed. These were apparently very young, as they were quite small.

The most prevalent dead organism was the oyster, *Ostrea equestris,* which formed the major portion of the encrustations. Some of the valves were attached directly to the metal of the artifact, for example, in conglomerate No. 156. A few dead and apparently very old *Crassostrea virginica* were seen also. Bryozons formed encrusting masses over much of the attached shell. All were dead and not further identified. Serpulid worm tubes were attached over much of the area of several of the artifacts, but none of those checked yielded live polychaetes. Some of the tubes appeared to be fairly recent. A fourth prevalent form, probably a polychaete, formed masses of sand tubes in several areas; but again, no live worms were seen.

Remnants of coral were scattered in a few areas. Several dead bivalves and gastropod shells were collected. These formed part of the encrustations and some of the tiny ones were attached to the polychaete tubes. Those that appeared to be quite old included *Anadara transversa, Crassostrea virginica,* and *Donax* cf. *tumidus*. Others were *Tellina taylori, Terebra dislocata, Crepidula fornicata, Thais haemostoma floridana, Petricola pholadiformes, Retusa canaliculata, Polinices duplicatus,* and *Odostomia laevigata.*

Appendix C

41 KN 10 ARTIFACT INVENTORY

This appendix presents a condensation of the artifact inventory, consisting of the total number of artifacts in the various categories represented in the collection from 41 KN 10, the site thought to correspond with the wreck of the *San Esteban*. This site was the one excavated by the Texas Antiquities Committee in 1972, 1973, and briefly in 1975.

41 KN 10 Artifact Inventory

1. Coins		
(1) 1-real, silver, Carlos and Johanna, Mexico City mint		1
(2) 2-real, silver, Carlos and Johanna, Mexico City mint		114
(3) 4-real, silver, Carlos and Johanna, Mexico City mint		209
(4) Santo Domingo mint		
a. Copper coin — probably 4 maravedís		1
b. 4-real, silver, Carlos and Johanna, F assayer		2
(5) 1-real, silver, Ferdinand and Isabella, Seville mint		1
(6) Unidentified fragments, silver		34
	Total Coins	362
2. Silver Disks (ingots)		
(1) Large		1
(2) Medium		3
(3) Small		15
(4) Irregular pieces and disk fragments		18
		37
3. Gold Bar		1
4. Cannons, Wrought Iron		
(1) Swivel (*verso* type, completely oxidized)		1
(2) Hooped barrel (bombard type)		3
		4
5. Breech Chambers, Wrought Iron		
(1) For swivel (*verso*)		17
(2) For hooped barrel (bombard)		15
		32
6. Associated Parts for Wrought Iron Cannons		
(1) Iron breech wedge (forelock) fragments		2
(2) Wooden plugs for breech chambers		12
(3) Gun powder samples		9
(4) Fiber touch hole plugs		3
(5) Hooped barrel (bombard) carriage		2
(6) Cone-shaped object — possibly a *verso* swivel mount part		1
		29
7. Cannon Balls		
(1) Stone		1
(2) Lead		1
(3) Lead-covered iron		28
(4) Iron		38
		68
8. Small Shot		
(1) Lead		4
(2) Dice of iron or core of lead-covered iron shot		1
		5
Crossbow Part		
(1) Goat's foot lever claw frame		1

41 KN 10 Artifact Inventory — (Cont.)

10.	Miscellaneous Copper Alloy Objects	
	(1) Divider fragments	2
	(2) Set screw (possibly from a cross staff or similar instrument)	1
	(3) Wire link	1
	(4) Scale weight	1
	(5) Straight pins	25
	(6) Sheath for straight pins	1
	(7) Buckle	1
	(8) Ring	1
	(9) Tacks — possibly decorative	3
	(10) Small fragments	4
		40
11.	Pewter Porringers	2
12.	Anchors and Anchor Parts, Wrought Iron	
	(1) Anchors	7
	(2) Anchor Ring Fragments (4 oxidized)	5
	(3) Arm and fluke fragment	1
		13
13.	Rudder Fittings, Wrought Iron	
	(1) Gudgeon	1
	(2) Pintles	2
	(3) Gudgeon or pintle strap fragments	3
		6
14.	Tools	
	(1) Small auger or reemer, wrought iron	1
	(2) Auger, wrought iron	1
	(3) Pincers, wrought iron	1
	(4) Pick adze, wrought iron	1
	(5) Problematical thimble-like object, wrought iron	1
	(6) Awl, bone	1
		6
15.	Miscellaneous Wrought Iron Objects	
	(1) Forelock bolts (4 oxidized)	15
	(2) Spikes, nails, and tacks (many oxidized)	172
	(3) Shear hook	1
	(4) Case knife with brass foil and pin	1
	(5) Clinch rings	8
	(6) Forelock (wedge for forelock bolt)	1
	(7) Chains (standing rigging; 4 oxidized)	5
	(8) Small chain with staple	1
	(9) Miscellaneous chain links (3 oxidized)	7
	(10) Strap hinge	1
	(11) Ring with hinge attachment	1
	(12) Straps or barrel hoops	149
	(13) Bar stock	6
		365

41 KN 10 Artifact Inventory — (Cont.)

16. Lead Objects	
(1) Bar	1
(2) Sounding weights	2
(3) Small weights	6
(4) Straps	54
(5) Scraps, fragments, and slivers	33
	96
17. Organic Material	
(1) Keel section with stern post and gudgeon	1
(2) Beam, plank, and other wood fragments	13
(3) Cargo container fragments	10
(4) Miscellaneous wood fragments	4
(5) Hemp gaskets and caulking	9
(6) Rope	24
(7) Hair samples	2
(8) Resin	1
(9) Cloth fragments	20
(10) Provision remains, including bones, nut shells, horn, seeds, and olive pits	39
(11) Cockroaches	9
	132
18. Ceramics and Glass	
(1) Plain potsherds	110
(2) Glazed potsherds	52
(3) Brick fragments	3
(4) Glass bottle base — possibly intrusive	1
(5) Glass sherds	4
	170
19. Jewelry	
(1) Wooden cross with sheet and wire gold	1
(2) Square quartz bead	1
	2
20. Aboriginal Objects	
(1) Polished pyrite hemisphere	1
(2) Obsidian blades	4
(3) Iron pyrite bead	1
	6
21. Other Objects Recovered	
(1) Fossils — probably not associated with wreck	2
(2) Modern objects	12
(3) Ballast stones — thousands of all sizes	--
	14
22. Encrusted Objects Left Intact	
Includes natural concretions and conglomerates which x-rays showed to contain ballast stones, small sherds, lead scraps, wood impressions, and oxidized iron straps, spikes, and nails.	55
Total Objects in Collection	1446

Appendix D

41 WY 3 ARTIFACT INVENTORY

The total number of artifacts in each category of the collection from 41 WY3, the wreck of the *Espíritu Santo,* is presented in this appendix in a format similar to Appendix C to facilitate comparison. This is the collection recovered by the treasure hunters in 1967. An in depth analysis of this material is available in a monograph by Olds (1976).

41 WY 3 Artifact Inventory

1.	2-real Carlos and Johanna Coins, Mexico City Mint — Late Series	
	(1) Whole, good condition	111
	(2) Whole, poor condition	2
	(3) Fragmentary, good condition	14
	(4) Fragmentary, poor condition	9
		136
2.	Probable 2-real Carlos and Johanna Coins, Mexico City Mint — Late Series	
	(1) Fragmentary, poor condition	2
3.	2-real Carlos and Johanna Coins, Mexico City Mint — Early Series	
	(1) Whole, good condition	6
	(2) Whole, poor condition	1
	(3) Fragmentary, good condition	1
	(4) Fragmentary, poor condition	2
		10
4.	2-real Carlos and Johanna Coin — Series Unknown	
	(1) Partially encrusted, left as is for display	1
5.	3-real Carlos and Johanna Coin, Mexico City Mint — Early Series	
	(1) Whole, good condition	1
6.	4-real Carlos and Johanna Coins, Mexico City Mint — Late Series	
	(1) Whole, good condition	516
	(2) Whole, poor condition	69
	(3) Fragmentary, good condition	12
	(4) Fragmentary, poor condition	95
	(5) Whole, good condition, left partially encrusted on silver disk for display	1
		693
7.	Probable 4-real Carlos and Johanna Coins, Mexico City Mint — Late Series	
	(1) Poor, fragmentary	12
8.	4-real Carlos and Johanna Coins, Mexico City Mint — Early Series	
	(1) Whole, good condition	8
	(2) Fragmentary, good condition	1
		9
9.	4-real Carlos and Johanna Coins — Series Unknown	
	(1) Fragmentary, poor condition	8
10.	Probable 4-real Carlos and Johanna Coins — Series Unknown	
	(1) Fragmentary, poor condition	1
11.	4-real Carlos and Johanna Coin, Santo Domingo Mint	
	(1) Whole, good condition	1
12.	Unidentified Carlos and Johanna Coins — Late Series	
	(1) Fragmentary, poor condition	1

13.	Probable Carlos and Johanna Coins — Denomination and Series Unknown	
	(1) Fragmentary, poor condition	9
14.	4-maravedies Copper Coins	
	(1) Whole, good condition	1
	(2) Whole, poor condition	3
	(3) Fragmentary, poor condition	1
		5
15.	Disintegrated Silver Coins, Converted to Sulphide	
	Most left encrusted as x-ray showed little or no silver remaining. Includes one cluster of 9 coins.	231
16.	Molds of Coins Formed by Encrustation	172
	Total Coins	1292
17.	Silver Disks (ingots)	
	(1) Large	5
	(2) Medium	3
	(3) Small	11
	(4) Small disk with coin adhering, left encrusted for display	1
	(5) Medium disk left encrusted for display	1
	(6) Irregular pieces and disk fragments	31
		53
18.	Probable Silver Thimble	
	Badly corroded and left partially encrusted	1
19.	Objects of Gold	
	(1) Small crucifix	1
	(2) Ingot	1
		2
20.	Cannons, Wrought Iron	
	(1) Swivel (verso type)	5
	(2) Hooped barrel (bombard type)	3
		8
21.	Breech Chambers (various sizes and styles)	
	(1) Iron	29
	(2) Bronze	1
		30
22.	Breech Chamber Parts	
	(1) Handles and fragments	17
	(2) Wooden plugs	10
	(3) Fiber touch hole plugs	3
	(4) Powder samples	12
	(5) Fiber wad	1
		43
23.	Iron Breech Wedges (Forelocks)	8

24.	Cannon Balls	
	(1) Stone (one broken in three pieces)	5
	(2) Lead	10
	(3) Lead-covered iron	27
	(4) Iron (two are fragmentary)	25
		67
25.	Small Round Shot (Musket or Grape Shot?)	
	(1) Lead	2
	(2) Lead-covered iron	1
	(3) Iron	1
		4
26.	Crossbows	
	(1) Bow and most of stock present	1
	(2) Bow and part of stock present	1
	(3) Stock fragment	1
	(4) Bow with no stock	1
		4
27.	Navigational Astrolabes	
	(1) Alidade present but bent	2
	(2) Alidade missing	1
		3
28.	Miscellaneous Copper Alloy Objects	
	(1) Small brad	1
	(2) Possible fitting for astrolabe	2
	(3) Small, hollow, tapered brass cylinders, with heads	2
	(4) Small solid cylinder, with head	1
	(5) Coak	1
	(6) Small fragment chain mail	1
	(7) Fragments of unidentified objects	4
		12
29.	Pewter Plates	2
30.	Miscellaneous Iron Objects	
	(1) Gudgeon bar for rudder	1
	(2) Half an anchor fluke	1
	(3) Sledge hammer head	1
	(4) Incomplete ordinary hammer head	1
	(5) Chains and chain fragments (some with eye-bolts attached)	11
	(6) Spikes, bolts, nails, pins (including fragments)	53
	(7) L-shaped tools (caulking tools)	3
	(8) Small L-shaped wire object	1
	(9) Strap fragments	8
	(10) Small shackles or hoops	2
	(11) Knife or sword blade fragments	2
	(12) Small rings (possibly clinch rings)	2
	(13) Circular piece with pin	1
	(14) Unidentified objects	7
		96

41 WY 3 Artifact Inventory — (Cont.)

31.	Lead Objects	
	(1) Sounding weights	3
	(2) Small weights	10
	(3) Bar with shipping mark	1
	(4) Bars, no marks	2
	(5) Small wedge	1
	(6) Ingots, chunks, irregular pieces	6
	(7) Sheeting or patching scraps (some with square nail holes and fabric impression), small fragments	570
		593
32.	Objects of Other Metal	
	(1) Curved, rod-shaped piece tin alloy	1
	(2) Encrusted fragment of spoon (may be pewter), too fragile to extract from encrustation)	1
	(3) Button fragment,	1
	(4) Fragments of pewter utensil	3
	(5) Small unidentified slivers, left in an encrustation	3
		9
33.	Miscellaneous Stone Objects	
	(1) Ballast	240
	(2) Rock — may be ballast	31
	(3) Slate	10
	(4) Hone	1
		282
34.	Miscellaneous Organic Objects	
	(1) Rope and fiber fragments	22
	(2) Bits of wood and rope from spikes and from around one cannon ball	5
	(3) Miscellaneous wood (includes both modified and unmodified pieces)	18
	(4) Seed	1
	(5) Canvas with possible hair and hide attached	1
	(6) Cloth fragment	1
		48
35.	Encrustations with Molds or Oxidized Metal too Fragile to Extract (some saved for casting and some for display)	421
36.	Bone and Shell	
	(1) Turtle shell fragment	1
	(2) Apparent fossil	3
	(3) Possible domestic animals	5
	(4) Shellfish remains (samples from encrustation)	11
		20
Total Objects in Collection		2994

Appendix E

A RECONSTRUCTION OF THE PADRE ISLAND SHIP

Edwin Doran, Jr. and Michael F. Doran

The task of producing a reconstruction drawing of the Padre Island ship as it was in 1554 is more difficult than might be thought. Not only is this the oldest verified shipwreck to be excavated in the Western Hemisphere, but it is also one of the few European ships of the mid-sixteenth century to have been brought to light by modern archeology. Curiously, more details of marine architecture have been assembled from the evidence of antiquity and from times after the sixteenth century than from the period of the Renaissance in Europe. For a listing of many ancient sites excavated thus far, see Casson (197:214–216). This strange gap in the archeological record is only now beginning to be bridged, through work such as that done on the Texas coast. Although the Padre Island ship has been so destroyed by 400 years of immersion that it provides minimal data, it is possible to produce a generalized impression of its probable characteristics by using evidence from literary and artistic sources to interpret the archeological remains.

SIXTEENTH CENTURY SHIPWRIGHTRY

There are no scale plans extant for European ships before the last decade of the sixteenth century, because the building of ships was regarded and practiced as traditional artisanry until the middle Renaissance. It was

only after literate and interested men recognized that the characteristics of shipping had become regularized through centuries of experimentation and that the "rules of thumb" followed by shipwrights actually could be expressed in mathematical terms, that anyone attempted to codify the process of shipbuilding, The concept of the ship as an elegant and beautiful machine, its parts visualized and assembled with scientific precision, created an intellectual environment out of which came the first treatises on marine architecture.

The first two works on European shipbuilding with scale drawings were published at about the time of the Spanish Armada's sailing in 1588, and, appropriately enough, were contributed by Spain and England, respectively. The earliest book thus far positively dated concerns the construction of Spanish ships, and was written in Mexico in 1587 by Diego Garcia de Palacio (Anderson 1924:53–64). This volume is said to give details of rigging and nautical terminology, and includes plans of the ships known by Garcia de Palacio. The book is rare, however, and could not be consulted for this report. The other treatise is the famous undated manuscript by Matthew Baker concerning Elizabethan ships, now housed in the Pepysian Library at Cambridge (Clowes 1932). Baker's detailed drawings and notes have been a primary source of data in reconstructing the Padre Island ship.

Earlier students of the evolution of European ship design frequently utilized drawings and paintings of the period to compare the ships of the Continent with those of England. Clowes, for example, examined Thomas Pettyt's (1545) drawings of Clais Harbor, Anthony Anthony's sketches of the English fleet in the time of Henry VIII, and the engravings of Pieter Bruegel the Elder (ca. 1550–1569), as the basis for his statement that in the mid-sixteenth century "there were no very marked differences between the largest ships of England and of the Continent [Clowes 1932:67]." This and other subjective appraisals were validated in 1934 when Frederic Chapin Lane published a comparative table of key ship proportions of several nations for the 1500s (Lane 1934a:235). Selected parts of this table, with augmentation from another source, are reproduced here.

Table E.1 does not present actual measured dimensions, but rather proportions based on the ship's beam given a value of 1 with the remainder calculated in relation to the beam. The dimensions of merchantmen are distinguished from those of warships; similar principles of rigging and design were followed for both, but their different functions had by this time produced a noticeable variation in shape. As can be seen from the table, the warships were longer than merchantmen. Keel lengths of warships were a little less than 2.7 times their beam, but the merchantmen's keel lengths were only about 2.2 times beam. The merchant ships were thus decidely rounder in plan, whereas the men-of-war were designed for speed. The important thing to note is that in both categories the ships of England, Venice, and Spain were closely similar in their major dimensions. This gives

TABLE E.1
Significant Ship Proportions in the 16th Century[a]

	Beam	Depth Hold	Length Keel	Length Overall
Merchantmen				
Venetian, 1550[b]	1	0.5	2.2	3.1
English, 1582[b]	1	0.5	2.3	?
Spanish, 1587[b]	1	0.65(?)	2.1	3.2
Warships				
Venetian, 1550[b]	1	0.45	2.7	3.6
English, 1558-61[c]	1	0.48	2.6	3.7
Spanish, 1613[b]	1	0.5	2.7	3.4

[a] Each proportion based on maximum beam as the divisor.
[b] As calculated by Lane, 1934a, p. 235. The Spanish ship of 1613 is actually an Indiaman, but these ships were heavily armed and could be termed warships.
[c] Calculated by the authors from measurements of three ships in Baker, 1948, p. 31. (see fn. 11).

credence to our proposed method of reconstructing a Spanish ship in terms of critical measurement ratios available only from the records of Venetian shipbuilding. According to Glasgow (1964), English warships began to change substantially from their Continental counterparts only after 1570, when ship designers in Britian began both lengthening and deepening their vessels. Probably the English merchant marine did not incorporate these improvements until even later (Clowes 1932:65).

MAJOR PROPORTIONS OF THE PADRE ISLAND SHIP

The major proportions of European ships of about 1550 are known to maritime historians. Thus, once any given measurement of a ship of the period is provided, the others can be found through simple arithmetic. In the case of the Padre Island wreck, it is likely that she was not a galleon, but rather a merchant vessel. This assumption is based on documents referring to the voyage and on the small number of cannon found at the excavation site. If this were the final resting place of a galleon, one would expect that more evidence of armament might have been found. If this deduction is correct, then it is probable that the vessel was a Spanish *nao* (ship) with approximate proportions of: beam = 1, hold depth = .5, keel length = 2.2, and overall length = 3.1. The proportions of the Venetian merchantman of 1550 (Table E.1) are used here because they probably are closer to accuracy than the Spanish ship of nearly 40 years later. In addition, a number of other dimensions are available for the Venetian ship.

Unfortunately, none of the key measurements of the Padre Island ship are available directly. As noted in Figure E.1, only the aftersection of the keel, the base of the stern post, and the stern knee remain. (Several planks also were preserved but are omitted in the drawing as irrelevant to the immediate purpose.) These fragments, however, are sufficient to provide two critical bits of data for a reconstruction: the depth of the keel and the angle of rake of the sternpost.

As shown, line A reconstructs the bottom of the keel, based on a bolt and bit of timber preserved at point C, with the line drawn parallel to the top of the keel. The upper part of the keel is perfectly straight from the bolt forward for about 2.65 m; here it rises about 2 cm in the last 62 cm of the keel fragment. Whether this represents a real rise or a distortion of this weakened end cannot be determined. It is assumed here that the long straight section truly represents the orientation of the top of the keel. The depth of keel then becomes 37 cm. It should be noted that the keel rabbet rises, from 18 cm below top of keel to 7 cm below top, as it progresses forward. This probably is a result of the twisting of the garboard strake from almost vertical to almost horizontal as it reaches forward from the deadwood toward the master couple. Whatever the reason, it seems most logical to reconstruct the bottom of the keel parallel to the long straight section of the top, disregarding the gradual forward rise in the rabbet.

Line B reconstructs the after side of the sternpost tangent to the bolt and timber fragment at point D and to the edge of the fragment at E. Several factors produce considerable confidence in the accuracy of this reconstruction. The resulting rake angle X is 70°, almost the same as the 71° in Lane's reconstruction of a Venetian merchant ship (Lane 1934b:45), and exactly the same as the rake angle in Matthew Baker's drawing of an English ship of about 1586 (Clowes 1932:facing 71). In this reconstruction, the fore and aft thickness of the sternpost at base is almost the same as the depth of keel and there is an appreciable taper upward, both of these factors considered appropriate in the eighteenth century (du Monceau 1758:7) and probably for a long time before.

The depth of the keel is critical in constructing a drawing of the ship, for there was an established builder's rule linking keel depth to keel length. The earliest mention of this rule that we know of was set down in 1670 by Anthony Dean in his *Doctrine of Naval Architecture,* quoted in Baker (1948:73). Writing on ships in general, Dean stated that the depth of a ship's keel should be set at ½ inch per foot of beam. Granted that merchant ship builders tended to be conservative, can we use Dean's doctrine for a ship of a century earlier? One way of checking is to refer to Matthew Baker's scale drawings. Careful measurement from reproductions of his plans gives a ratio of about .45 inches depth of Keel per foot of beam. This is close enough to give confidence in using ½ inch per foot as the basis for estimating the ship's length of keel.

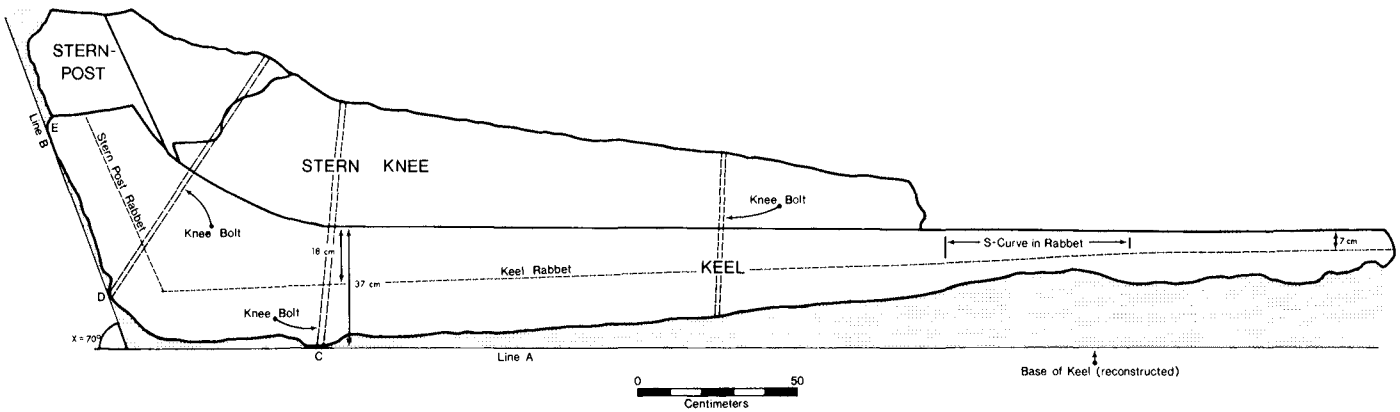


Figure E.1. Keel and sternpost fragment of the Padre Island wreck.

The Padre Island vessel had a keel depth of 37 cm. Using the ratio above from Dean and Baker (and converting from English to metric measurement), for every centimeter of depth there should be a corresponding 24 cm of beam. Simple multiplication, therefore, gives a beam of 8.88 m for the Padre Island ship. Using this as a starting point and converting the detailed dimensions of the 1550 Venetian merchantman as cited by Lane (1934b:48) into ratios and these again into dimensions based on a beam of 8.8 meters, the detailed dimensions of the Padre Island ship are derived (Table E.2).

It should be mentioned that the heavy ballast of the ship on the excavation site covered a maximum length of only 15.5 cm. Although, first, this would seem to suggest a shorter keel length than that found through the computations, the discrepancy can be explained. Ballast might well have been concentrated forward to counter the weight of the large stern-castle, a dominating feature of ships in the Middle Ages and for some time afterward. It is interesting to note that this independent idea of Michael Doran on ballast distribution also is suggested by Martin (1973:443) with regard to the

TABLE E.2
Dimensions of the Padre Island Ship

Dimension or ratio	Dean[a]	Baker[a]	Lane[b]	Padre Island[c] Meters	Padre Island[c] Feet
Keel depth (KD)			?	0.37	1.21
Beam (B)			23	8.88	29.13
Keel length (KL)			50	19.31	63.34
Length overall (LOA)			71.5	27.61	90.56
Hold depth (HD)			11.5	4.44	14.56
Rake, stempost (RS)			15	5.79	18.99
Height, stempost (HS)			18?	6.95?	22.80?
Rake aft (sternpost) (RA)			6.5	2.51	8.23
Ht. aft (sternpost) (HA)			18	6.95	22.80
Rake, sternpost, Degrees		70	71		
B/B		—	1		
B/KD	24	24	—		
KL/B			2.174		
LOA/B			3.109		
HD/B			0.500		
RS/B		0.684	0.652		
HS/B		0.642	±0.783		
RA/B		0.284	0.283		
HA/B		0.789	0.783		

[a] Citations to Dean, 1670, and Baker, 1586, in text; sternpost rake angle for comparison with Lane.
[b] Dimensions of Venetian merchantman of ca. 1550, to top of second deck. Lane, 1934b, p. 48. Dimensions in Venetian feet.
[c] Keel depth from wreck, beam from Dean and Baker ratio, remaining dimensions from Lane ratios.

wreck of an Armada ship, probably the *San Juan de Sicilia,* off Scotland. Instead of contradicting the estimate, the lay of the ballast tends to confirm it, especially in light of the fact that the sternpost/keel segment itself was found several meters aft of the ballast at the excavation site. Current motion certainly played a part in directing the orientation of the keel segment, but the ballast may not have been close in the first place.

The approximate shape of the vessel which foundered off Padre Island in 1554, drawn according to the dimensions just given, is presented in Figure E.2. The sketch shows in black the fragment that remains of the ship's skeleton; the cross-hatched area indicates fairly certain reconstruction. The characteristics of the superstructure are much less easily formulated. Lane's sketch of the Venetian ship (Lane 1934b:45) has been used as a guide, but principal reliance was placed on the etchings of Pieter Bruegel, as reproduced in the H. Arthur Klein volume of the master's works (Klein 1963:57–91). Bruegel's drawings from the mid-sixteenth century are probably the most accurate available for a detailed impression of the shipping he knew, which was mainly Flemish, Dutch, and Spanish. Because the ship at Padre Island was a merchantman, a modest bulkhead and no forecastle are suggested, and similarly the aftercastle is shown in comparatively reduced form.

CONCLUSION

Because of the size of the Padre Island ship, about the same as Columbus' *Santa Maria,* it is assumed that she was not a caravel but rather a full-rigged ship. She probably had four masts and a bowsprit, was square-rigged, and according to her estimated measurements had an approximate displacement of 286 tons (calculated by the standard formula: keel length × .5 beam/94). Bluff lines and extension of the lower part of her transom below the waterline caused drag, which impeeded her speed. Her castles were smaller than those of the previous century, but she still had an aftercastle that today seems enormous, inefficient, and of a weight that compelled the use of a great counterbalance of ballast forward. The Padre Island ship was roughly 30 m (97 feet) in total length, was low-waisted, and had sailing characteristics that were poor but probably average for her time. She was thus a small ship of customary design, and probably in her lifespan of work had a rather uneventful history. Her unique importance comes from the accident of grounding at Padre Island, where her fragments would be located and assembled by the scholars of a later time. Her picture is incomplete and can only be presented in the most general of ways through the techniques described above. We believe, however, that she may well have looked something like the ship drawn by Bruegel, shown in Figure E.3.

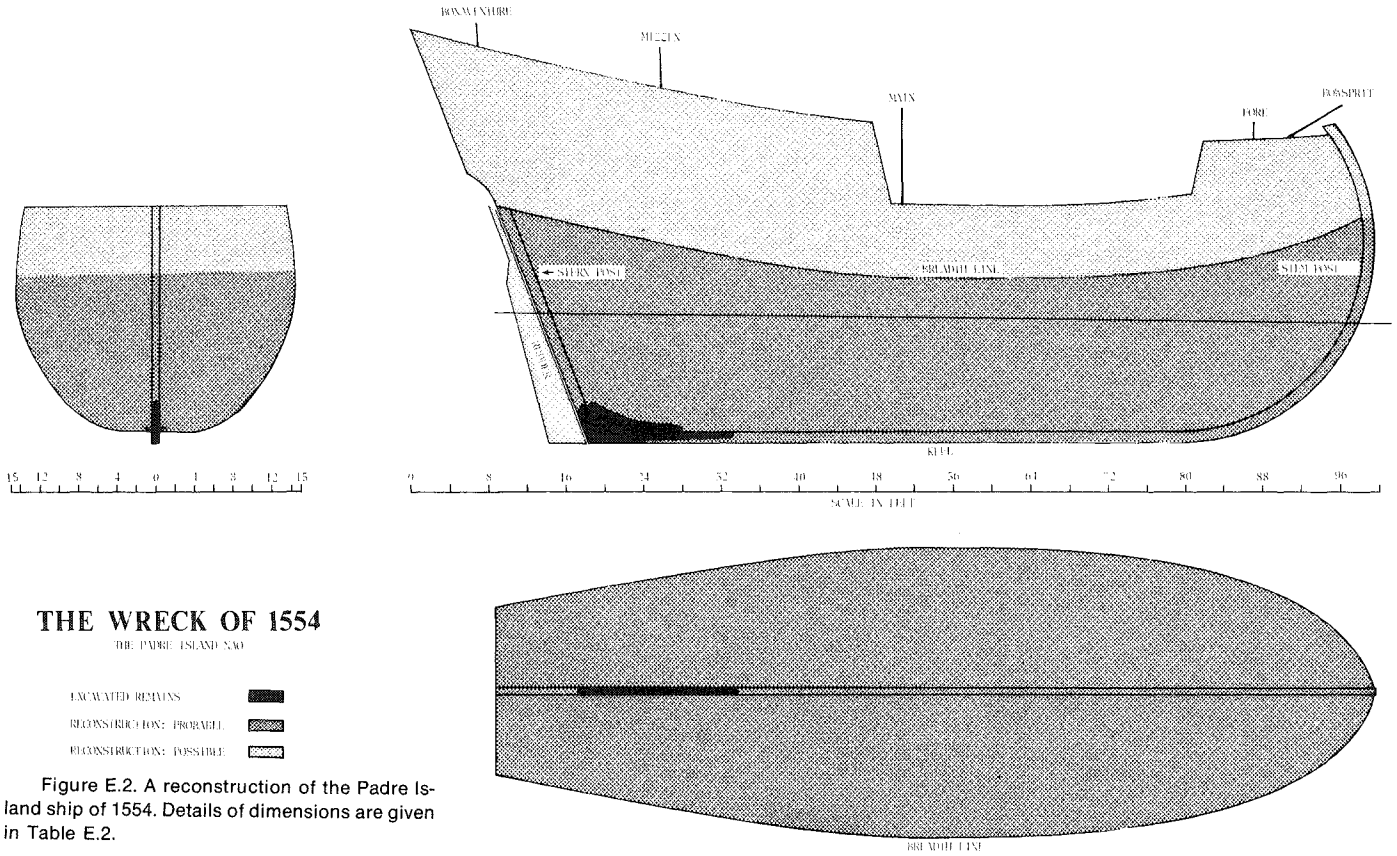


Figure E.2. A reconstruction of the Padre Island ship of 1554. Details of dimensions are given in Table E.2.

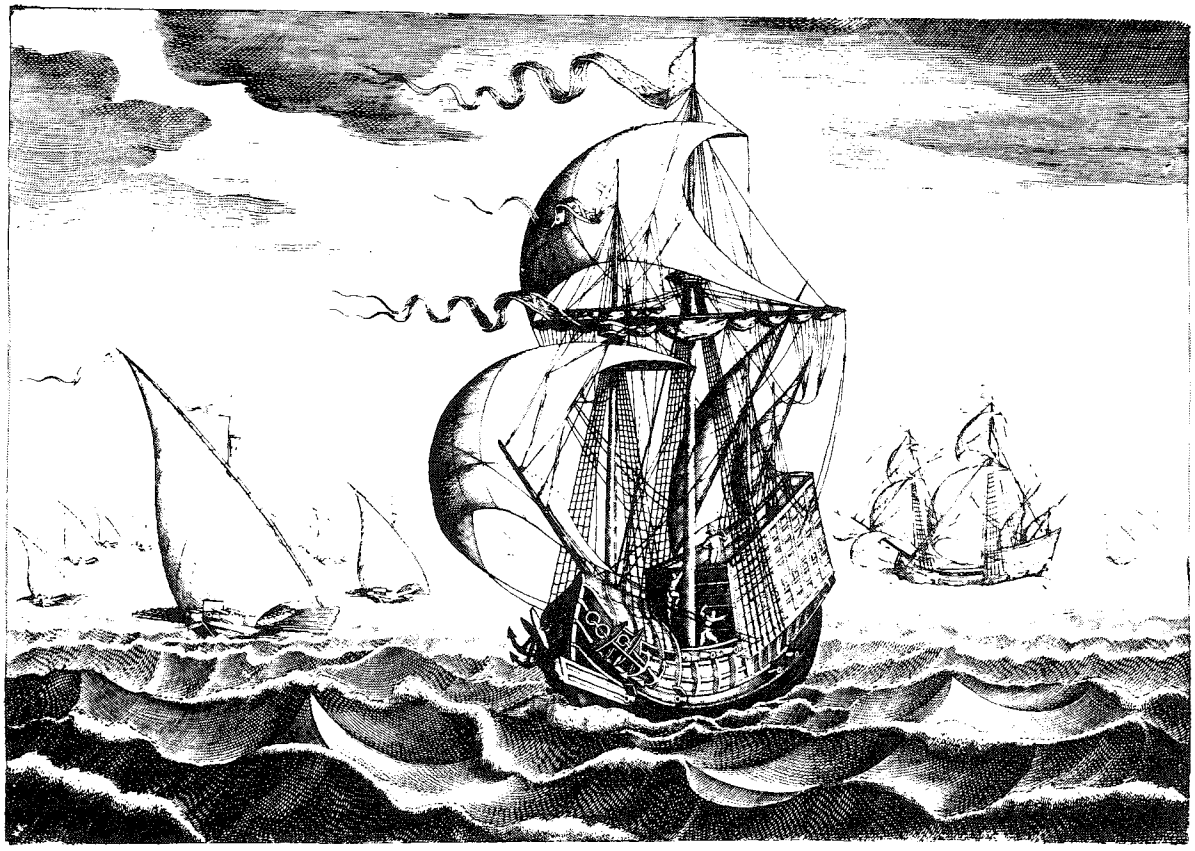


Figure E.3. The Padre Island merchant ship probably resembled this warship engraved by Pieter Breugel.

REFERENCES

Anderson, R. C.
1924 Early books on shipbuilding and rigging. *Mariner's Mirror* **10**: 53–64. [Cites Diego Garcia de Palacio, *Instruction Nauthica. . . . Mexico City, 1587.*]

Baker, G. S.
1948 *The merchant ship: Design past and present.* London: Sigma.

Casson, Lionel
1971 *Ships and seamanship in the ancient world.* Princeton New Jersey: Princeton University Press.

Clowes, G. S. Laird
1932 *Sailing ships. Their history and development.* London: H. M. Stationery Office. [Cites Matthew Baker, "Fragments of Ancient English shipwrightry," Pepysian Library, Magdalene College, Cambridge, England, ca. 1586.]

du Monceau, M. Duhamel
1758 *Elemens de l'architecture navale ou traite pratique de la construction des Vaisseau.* Paris: Charles-Antonine Jombert. [Reprinted in *Editions des 4 seigneurs,* Grenoble, 1970.]

Glasgow, Tom, Jr.
1964 The shape of the ships that defeated the Spanish Armada. *Mariner's Mirror* 50(3):177–187.
Klein, H. Arthur
1963 *Graphic worlds of Pieter Bruegel the Elder.* New York: Dover Publications, Inc.
Lane, Frederic Chapin
1934a *Venetian ships and shipbuilders of the Renaissance.* Baltimore: Johns Hopkins Press.
1934b Venetian naval architecture about 1550. *Mariner's Mirror* 20:24–49.
Martin, Colin J. M.
1973 The Spanish Armada expedition, 1968–70. In *Marine archaeology, Colston papers no. 23,* edited by D. J. Blackman. London: Archon Books. Pp. 439–459.

Appendix F

COMMENTS ON THE PADRE ISLAND SHIP

William A. Baker

The portion of the stern hull structure of the *San Esteban* recovered in 1973 by the Texas Antiquities Committee consists of a piece of the keel, a short section of the stern frame, the stern knee, and some attached planking. Although similar parts of various vessels have been recovered and preserved, these are unusal. The afterend of the keel swells into what is, in effect, an attached knee, and the stern knee proper is cut to suit the curve of the keel's upper surface. The sternpost, instead of having a tenon to fit a mortise in the keel, is scarphed to the keel, the post being to port. The keel, post, and stern knee are bound together with headed iron bolts that are secured on the inside by forelocks driven over washers.

The top of the stern knee has notches port and starboard which received the heels of the after frames. The lower portions of these frames probably were natural-grown Y-shaped timbers notched to fit over the stern knee. The location of the last frame to step on the keel is clearly marked by a hole for its fastening and the keel surface that is comparatively unmarked by marine organisms.

Although drawings and photographs can record this stern structure, nothing can replace the actual item in conveying to viewers the quality of workmanship and an impression of size, Although the recovered wood has been damaged by the teredo it should be preserved as a good detail of sixteenth-century ship construction.

Among the artifacts recovered from this wreck is a rudder pintle with one of its straps intact, which provides a means for roughly estimating the basic dimensions of the vessel. An old rule of Italian shipbuilders gave the length of the rudder as four times its bottom width, and the rudder was to be 61 cm 2 feet) longer than the sternpost. The latter provision probably applied to medium-sized vessels, but obviously could not be a precise figure for all sizes (Anderson 1925). The head of the main piece of the rudder would have to be high enough to allow the proper fitting of a tiller through the helm port above the main transom at the head of the sternpost.

The bottom of the rudder would have been about half the depth of the keel below the top of the keel, in this case, say 12.7 cm (5 inches). For this vessel, then, four times the bottom width of the rudder minus 12.7 cm (5 inches) minus another 61 cm (2 feet) would give the approximate length of the sternpost, a basic figure from which other dimensions can be derived.

It is not known, however, where the pintle recovered from the wreck of the *San Esteban* was located on the rudder. It might have been the bottom pintle, the top pintle, or one of several in between. By assuming that it was either the top or bottom pintle a range of possible dimensions can be established. The length of the strap is 96.8 cm (37¾ inches) from the center of the pintle and as straps often were an inch or two short of the after edge of the rudder the width of the rudder can be assumed to be 101.6 cm (40 inches). Thus if the strap was the lowest on the rudder the minimum length of the rudder would have been 4.06 m (13 feet, 4 inches). Deducting the 12.7 cm the sternpost would have been about long.

By the Italian shipbuilders' rule previously mentioned, the width of the upper part of the rudder was to be one-quarter less than that at the bottom. If the recovered pintle and strap were the uppermost, a reasonable width for the bottom of the rudder would be 1.35 m (4 feet, 5 inches). The corresponding length of the sternpost would have been about 4.65 m (15 feet, 3 inches).

Another fifteenth-century manuscript states that the length of the keel was three times the length of the sternpost (Anderson 1945); similar proportions can be derived from data in other manuscripts and books. Table F.1 lists the possible lengths, breadths, and depths of the *San Esteban* based on information derived from the several references noted which range in date from about 1410 to about 1580. Although Item 5 in Table F.1 is based on an English manuscript, references in it to Greeks, Venetians, Sicilians, and Candians indicate that its contents were influenced by Mediterranean practice.

In general, the derived dimensions and proportions given in the table are those of capacious but relatively slow-sailing merchant vessels. On the basis of proportions alone, Item 3 would be the slowest vessel and Item 4 the fastest. For comparison, a large Portuguese carrack captured by the English in 1592, the *Madre de Dios*, had a keel/breadth ratio of 2.135 (Anderson

TABLE F.1
SAN ESTEBAN. Range of Dimensions.

Source	Length of keel	Rake aft	Rake forward	Length of hull	Breadth	Keel/breadth	Depth
1. Timbotta MS 1445	32.20	1.78	13.32	47.30	12.44		9.77
(Anderson 1425)	44.95	2.48	18.60	66.03	17.35	2.585	13.65
2. Fabricca di galere MS 15th c.	32.76	2.73	11.92	47.41	13.71		7.05
(Anderson 1945)	45.75	3.82	16.25	65.82	19.18	2.385	9.85
3. Pre Todaro MS 1550	28.55	3.71	8.56	40.82	13.12		6.57
(Lane 1934)	39.85	5.19	11.97	57.01	18.35	2.170	9.18
4. Garcia de Palacio 1587	40.60	4.77	8.36	53.73	15.52		9.55
	51.90	6.10	10.68	68.68	19.82	2.615	12.20
5. Fragments of Ancient English	34.85	3.78	9.87	48.50	13.80		7.88
Shipwrightry ca. 1580	48.60	5.28	13.75	67.63	19.25	2.525	11.00
(Baker n.d.)							

1913), while that ratio for a Spanish treasure ship of 1590 was 3.06 (Chatterton 1923).

Other bits of information help to determine which set of dimensions is the more reasonable. From an English table of anchor sizes it is possible to derive a curve of anchor weight versus breadth of ship (Miller 1667). The use of this assumes, however, that Spanish and English practices were similar and that they did not change much for about a century. Both assumptions are reasonable. Two large anchors recovered from the Padre Island wreck weighed 312 and 345 kg (688 and 760 pounds) which indicate ship breadths of about 5 m (16.5 feet) and 5.33 m (17.5 feet), respectively. It is probable, however, that the anchors originally weighed more; hence the breadths should be greater.

The piece of keel recovered seems to have had an original depth of about 25.4 cm (10 inches). The sizes of the main structural members of ships have changed little during the centuries. Today a keel of 28 cm (11 inches) would be suitable for a fishing boat having an overall length of 16 m (53 feet) and a breadth of 5.2 m (17 feet) (Simpson 1951).

As a third bit of information, there are indications that treasure ships sailing from the New World back to Spain during the mid-sixteenth century were relatively small, rarely over 200 tons. Although the English and Spanish tonnage rules differed considerably, a modern study of English and Spanish ships of 1588 showed that the smaller vessels measured about the same under each (Laughton 1958). The English tonnages of the extremes of Item 5 would be 51 and 137.

Considering the anchor weights, the size of the keel, and the range of dimensions in the table the following are reasonable for the *San Esteban.*

1. Length of keel:	14.48 m	(47.5 feet)
2. Length of hull:	20.12 m	(66 feet)
3. Breadth:	5.49 m	(18 feet)
4. Depth:	3.28 m	(10.75 feet)
5. English tonnage:	123	

REFERENCES

Anderson, R. C.

1913 Big ships in history. *Mariner's Mirror,* 3: 44.

1925 Italian naval architecture about 1445. *Mariner's Mirror,* 11: 135–163. [The notebook of Giorgio Timbotta of Modon.]

1945 Jal's "Memoire No. 5" and the manuscript "Fabbrica di Galere," *Mariner's Mirror* 31: 160–167.

Baker, Matthew

(attrib.), *Fragments of ancient English shipwrightry.* Manuscript on file at Pepys' Library 2820, Magdalene College, Cambridge, England.

Chatterton, E. K.
1923 *Sailing ships and their story.* Philadelphia: Lippincott.
Lane, Frederic C.
1934 Venetian naval architecture about 1550. *Mariner's Mirror,* **20**: 24–49.
Laughton, L. G. Carr
1958 English and Spanish tonnage in 1588. *Mariner's Mirror* **44**: 151–154.
Miller, Thomas
1667 *The complete modellist* (3rd edition). London: George Hurlock.
Palacio, Diego Garcia de
1587 *Instruccion Nautica para Navegar.* Mexico.
Simpson, Dwight S.
1951 Small craft, construction and design. *Transactions, the society of Naval Architects and Marine Engineers,* **59**: 554–611.

Appendix G

FIBERS AND FABRICS OF THE 1554 SHIPWRECK (41 KN 10)

James M. Vreeland

Fibrous remains of seven plain weave textiles and seven rope or cable segments were recovered while conglomerates of thickly encrusted metal objects and other artifacts from the wreck were being cleaned by conservation laboratory personnel. Two textile fragments (Sp:43-4 and No. 43-7; see Table G.1) were found adjacent to one of the iron rudder gudgeons and directly under flat lead strips nailed over a joint between two wooden planks at the ship's stern. One fragment (Sp:132-10) was encountered on the surface of a wrought iron breech chamber for a *verso* cannon (No. 132-6),[1] and shows what appears to be a fibrous caulking material on its surface. Two pieces of another fabric (Sp:172-5) were removed from the second hoop, immediately behind the sight of a bombard (No. 172-1). A single fragment (Sp:156-21) was located next to an iron eye-bolt attached to a large chain found near the arm of an anchor (No. 156-2). Four pieces of another textile (Sp:308-1) were found in association with a few bits of wood planking. The remaining textile (Sp:132-29) consists mostly of a clear impression of a coarse fabric and its constituent fibers firmly imbedded on three sides of a

[1]Specimen number designations preceded by the symbol "Sp:" refer to fibrous materials examined and reported here; those preceded by the symbol "No." refer to associated, nonfibrous artifacts.

TABLE G.1
Yarn, Rope, Fabric Structure

Specimen Number	Number of Fragments	Probable Fiber	Dimensions, Centimeters[a]	Yarn Make-up[b]	Twist Angle[c]	Yarn Diameter Millimeters[c]	Yarn Count per Centimeter[a b c]	Remarks
TEXTILES								
43-4	1	sisal or hemp	4.0 x 2.5	Z	15	0.8	8 x 9	
43-7	2	sisal or hemp	4.5 x 2.5 2.0 x 2.0	Z	15	0.6	6 x 9.5	
132-10	1	hemp	7.5 x 4.5	Z	15	0.7	7 x 8	oakum & hair on surface
132-29	1	hemp	4.5 x 6.3[d]	S	30	0.9	4.5 x 3.5	
156-21	1	hemp?[e]	2.5 x 2.0	Z	15	0.3	14 x 15	
172-5	2	hemp	2.0 x 1.5 2.0 x 1.0	Z	15	0.6	7 x 10	
308-1	4	flax or hemp	8.5 x 4.0 5.0 x 3.5 3.0 x 3.0 2.5 x 2.0	Z	15	0.5	6 x 9	one fragment folded in half with hair inside fold
ROPE								
80-3	3	hemp?	14 (total)	Z3S3Z[f]	40	11.0		
81-77	1	hemp?	7	Z?S3Z	40	8.0		
81-109	4	hemp?	7 (total)	Z3S3Z	30	14.0		
156-23	5	hemp?	100 (total)	Z?S3Z	40	20.0		cockroach egg cases under rope segments
162-2	1	hemp?	10	Z?S3Z	30	16.0		
167	1	hemp?	53.3	Z16S3Z	40	22.0		
170-6	1	hemp?	11.9	Z3S3Z	30	13.0		
172-3	7	hemp?	156 (total)	Z?S3Z	30	15.0		
MISCELLANEOUS								
5-107	small fragments of leather-like material with mammalian hairs							
160-18	pine/hemp/hair found in fibrous debris, possibly oakum							
170-4	plug of hemp? Fiber used as a touch hole plug; possibly length of worn out hemp rope.							

[a] No warp and weft sets could be specified. Measurements and counts are made in the same order.
[b] Both sets of elements are nearly identical in all respects and always are identical in make-up.
[c] Mean values.
[d] Dimensions given are those of encrustation matrix around which the textile is formed.
[e] Specimen encased in plastic envelope; fiber examined only partially through envelope.
[f] Construction sequence is read as follows: Three, Z-spun strands are twisted together in the S direction. Three of these identical elements are then plied together in the Z direction to form the final rope.

lump of encrustation products which has no direct association with any other artifacts (Figures G.1, G.2, and G.3).

Seven rope segments were located in the debris of the wreck. Two (Sp:156-23 and 172-3) were encrusted along the top of the bombard gun barrels (Figure G.4). Three others (Sp:170-6, 81-109, and 81-77) were associated with anchor parts, and one (Sp:176) was recovered without any artifactual associations from a troughlike feature of the seabed, where it hac been pressed into the underlying clay.

In addition to the fabric and rope remains, three miscellaneous fibe samples were examined. These include a quantity of unidentified fibrous

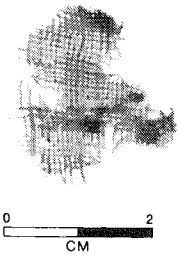


FIGURE G.1. Textile fragment, Sp:156-21.

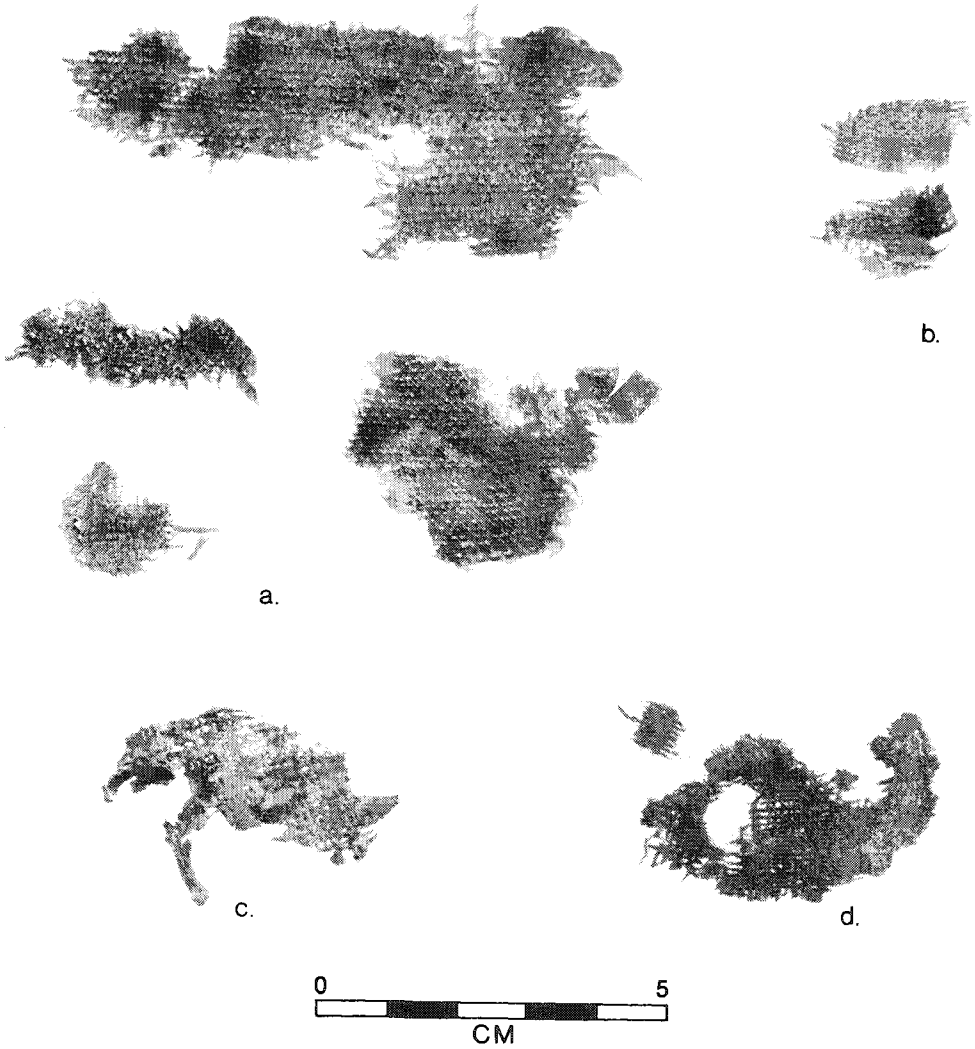


FIGURE G.2. Textile fragments.
a. Spp:308-1; b. 172-5; c. 43-7; d. 43-4.

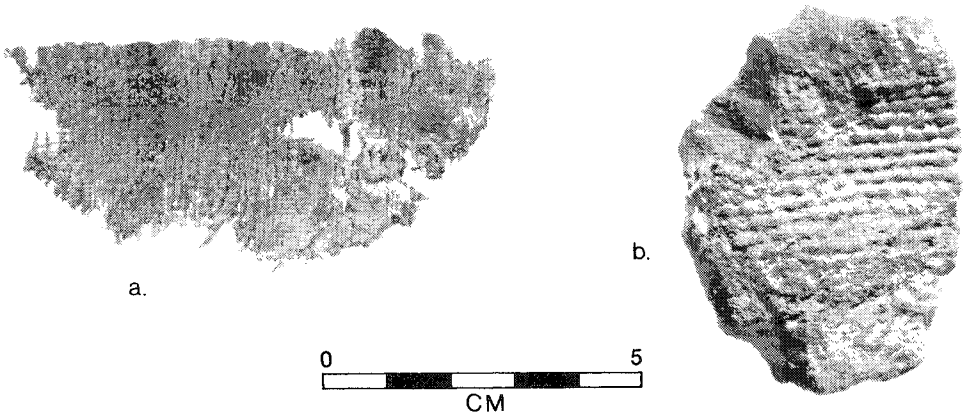


FIGURE G.3. Textile fragments.
a. Sp:132-10;
b. Sp:132-29.

debris (Sp:160-18) that may have served as caulking material aboard the ship, a short section of slightly twisted fiber (possibly a short length of worn out hemp rope) that probably served as a touch hole plug on a bombard breech chamber, and a bit of leather gasketlike material (Sp:5-107) found as a lining inside an iron thimblelike object (No. 5-78).

FIBER IDENTIFICATION

Tentative fiber identifications were made at the optical and electron microscope levels.[2] Series of representative fibers were first teased from the fabric yarns and viewed longitudinally as whole mounts under the compound light microscope, and transversely after thin cross sections were cut from the fiber bundles embedded in a stock plastic medium. Three textile fibers appear to occur in the sample:[3] flax, hemp, and sisal (Figures G.5, G.6, and G.7). Four fabrics appear to consist entirely of hemp yarns, one of either hemp and flax (Figures G.5a and G.6b), and two show evidence of both hemp or sisal. All the rope seems to have been made from the same fiber, which appears to be hemp.

A sample of loose fibrous debris (Sp:160-18) from one conglomerate

[2]Excellent photomicrographs were prepared with the compound microscope in the Southern Regional Research Center (New Orleans) of the USDA by Ines V. de Gruy, Microscopy Division, and Verne W. Tripp, Chief, Composition and Properties Laboratory, whom we thank for the identifications of probable fiber types in six representative specimens. Scanning electron micrographs were prepared by the author.

[3]There is also a possibility that, due to the similarity of cross markings in both hemp and jute fibers, jute occurs as a textile fiber in Sp:308-1. Cross-sectional appearance of the fibers did not suggest jute, however (Tripp, personal communication, 1976).

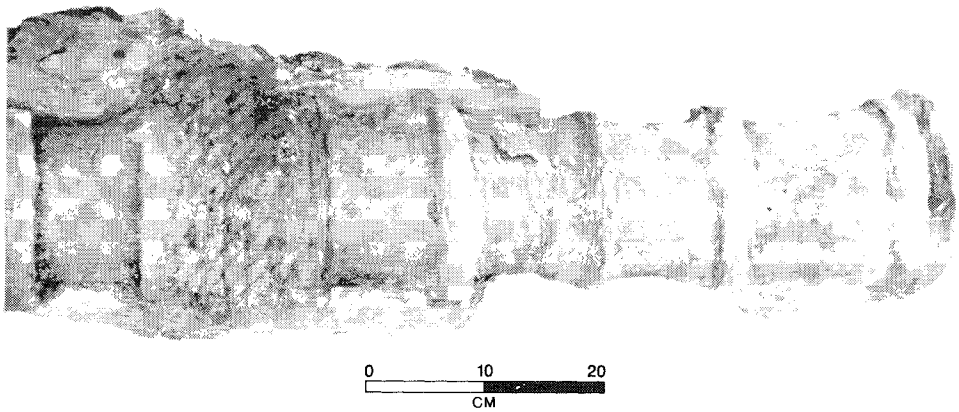


FIGURE G.4. Position of rope binding, Sp:156-23 wrapped around barrel of cannon No. 156.

was also examined and found to be composed of coniferous wood (probably pine;[4] Figure G.8) and some as yet unidentified mammalian hair (Figure G.9). Two hair shafts were examined (Spp:5-107 and 160-18) with the scanning electron microscope after a thin gold-palladium film was vacuum-evaporated over the surface of the hair. One of these (Sp:160-18) appeared to be extremely eroded on the surface (Figure G.10), but the other (Sp:5-107) showed a clearly defined cuticular patterning, classified here (after Wildman 1954:54–59) as an interrupted, regular wave mosaic of medium to shallow depth, and having crennate-rippled margins. Diameter of the shafts varies from 71 to 77 μm and appears to be heavily encrusted with an organic substance (Figures G.11, G.12), possibly a resin-related compound. A combination of pitch and animal hair was used in caulking and this may be an example of that practice.

YARN, ROPE, AND FABRIC STRUCTURE

With one exception, all of the yarns examined are relatively even-spun Z singles, twisted to a mean of about 15° (Table G.1). Specimen 132-29 is composed of coarse-spun S singles twisted to a mean of 30°. Yarn diameters range from about .3 to .9 mm, although the degree to which these measurements have been affected by moisture swelling and erosion cannot be ascertained. Because no heading cords or web selvages have been preserved in this sample, warp and weft sets cannot be indicated. Nevertheless, in five

[4]V. W. Tripp, personal communication, 1976.

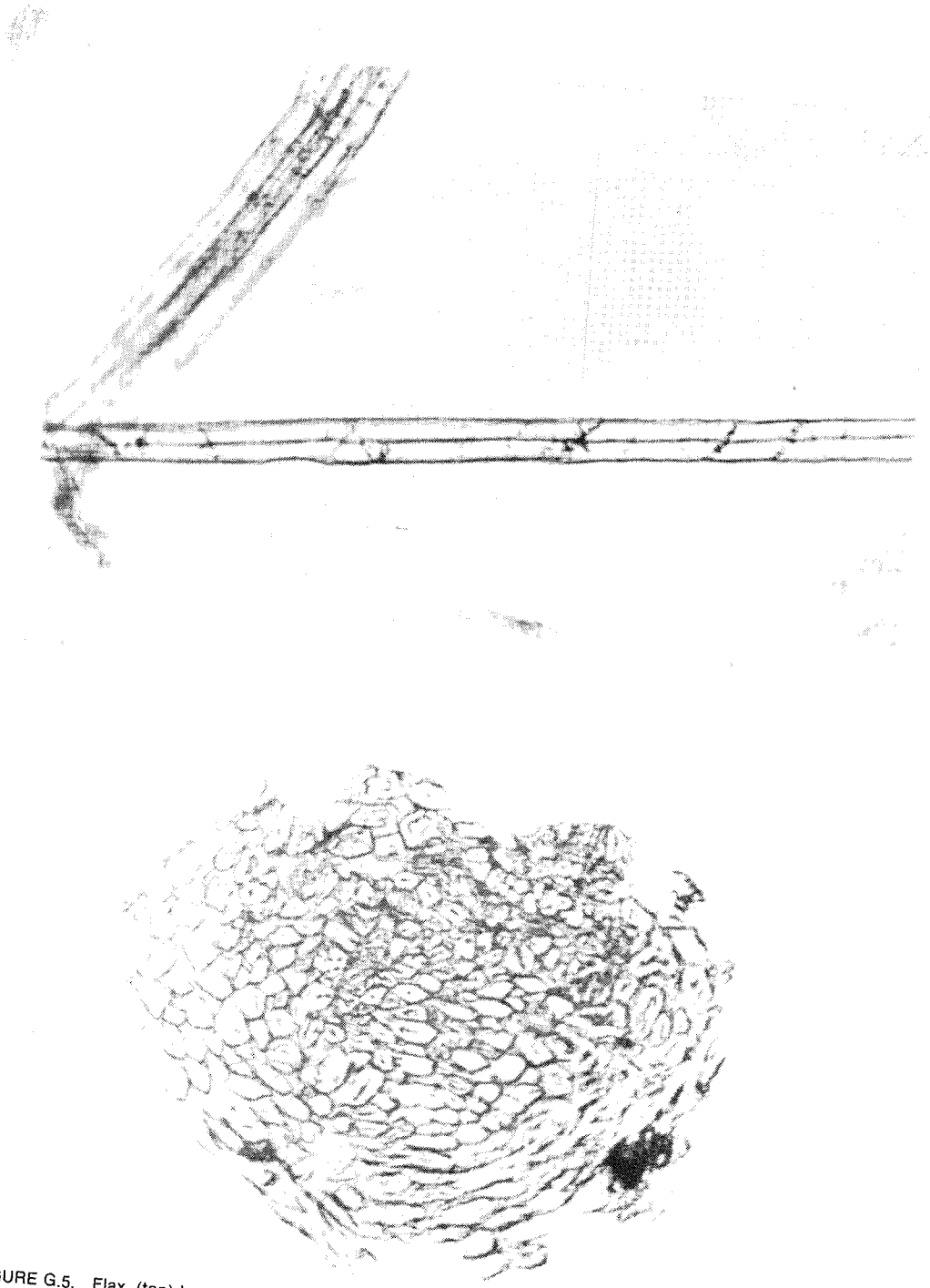


FIGURE G.5. Flax (top) longitudinal (Sp:308-1) and (bottom) cross-sectional (Sp:308-1) views. ×435. Courtesy Southern Regional Research Center, USDA.

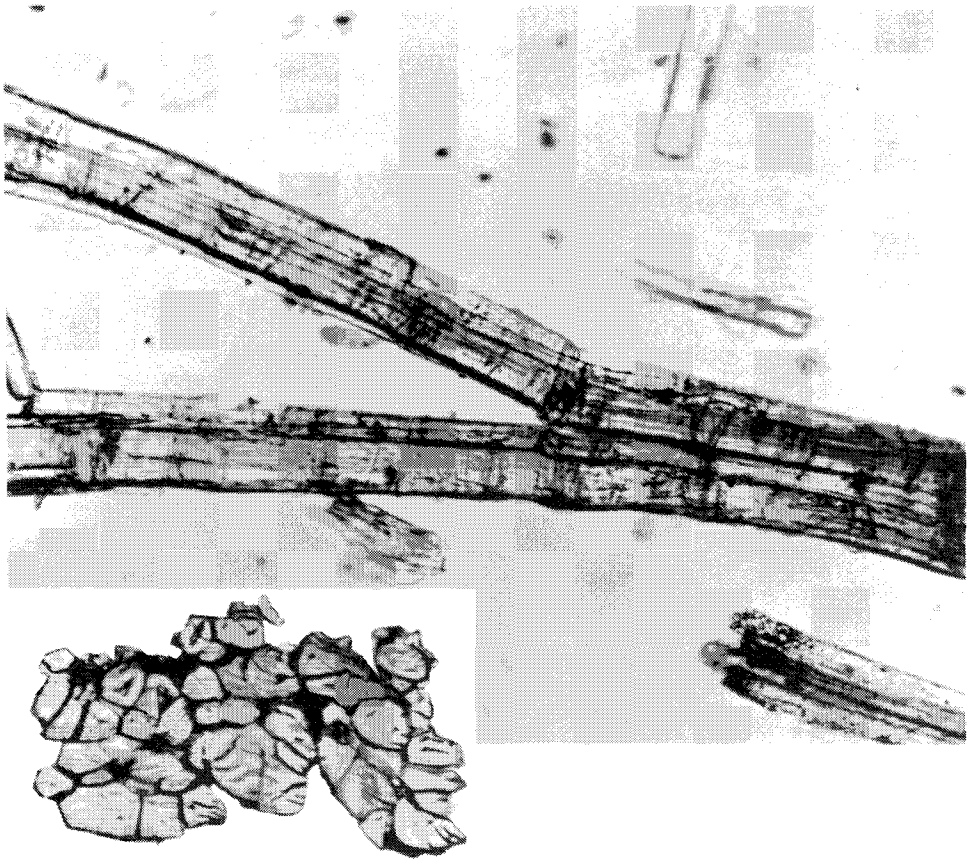


FIGURE G.6. Hemp, longitudinal (Sp:172-5) and (inset) cross-sectional (Sp:308-1) views. ×447. Courtesy Southern Regional Research Center, USDA.

cases it can be seen that warp and weft sets are formed from virtually identical yarns.

The rope segments are uniformly well made, and, like the fabric components, all are nearly homogeneous in make up. In all cases, the final ply of the rope is constructed of three, S-twisted strands twisted together in the Z direction. The number of S-twisted strands could not always be determined, but in every case, these were formed from Z-spun ultimate components that were combined in groups of either 3 or 16 units. It is interesting that all are 3-stage constructions[5] even though diameters of the individual ropes range from a minimum of 8 to a maximum of 22 mm.

[5]A three-stage construction may be represented by the formula ZnSnZ or SnZnS, where Z and S designate the direction of the spin or twist angle, and n refers to the number of

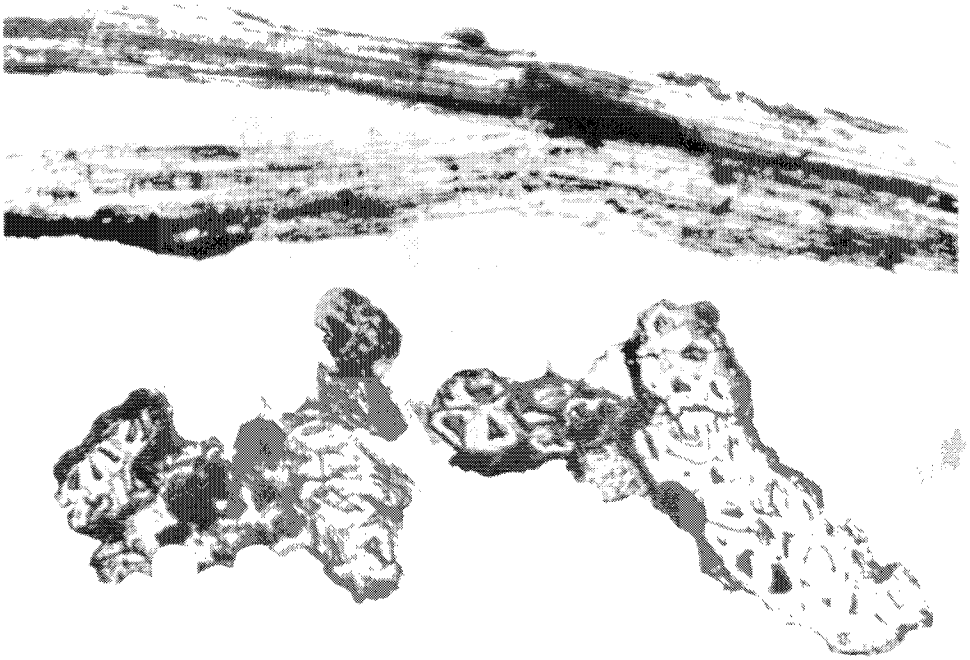


FIGURE G.7. Sisal, (top) longitudinal (Sp:43-7) and (bottom) cross-sectional (Sp:43-7) views. ×423. Courtesy Southern Regional Research Center, USDA.

All of the fabrics recovered are plain woven with a relatively balanced warp–weft texture (Emery 1966). Linear element counts range from about 3.5 × 5.0 yarns per linear centimeter in one fabric to 14.0 × 15.0 yarns per linear centimeter in another, considerably denser, textile.

DISCUSSION

All the fabric specimens recovered from the site are extremely fragmented and small; the largest specimen measures 8.5 × 4.0 cm, and the longest rope segment is just over 53 cm long. The critically small dimensions of the preserved cloth remains afford no clues as to the original dimensions

strands (twisted or spun in the direction indicated by the preceding letter) that are themselves twisted together in the direction indicated by the succeeding letter to form the next stage or component. Zero or no twist can likewise be designated by the letter "I." Commonly the number "2" is deleted from the formulas; if no number follows a letter designation, it is understood that two strands are used to form the next stage. Hence, "ZS" represents an element formed by twisting two Z-spun strands together in the S direction.

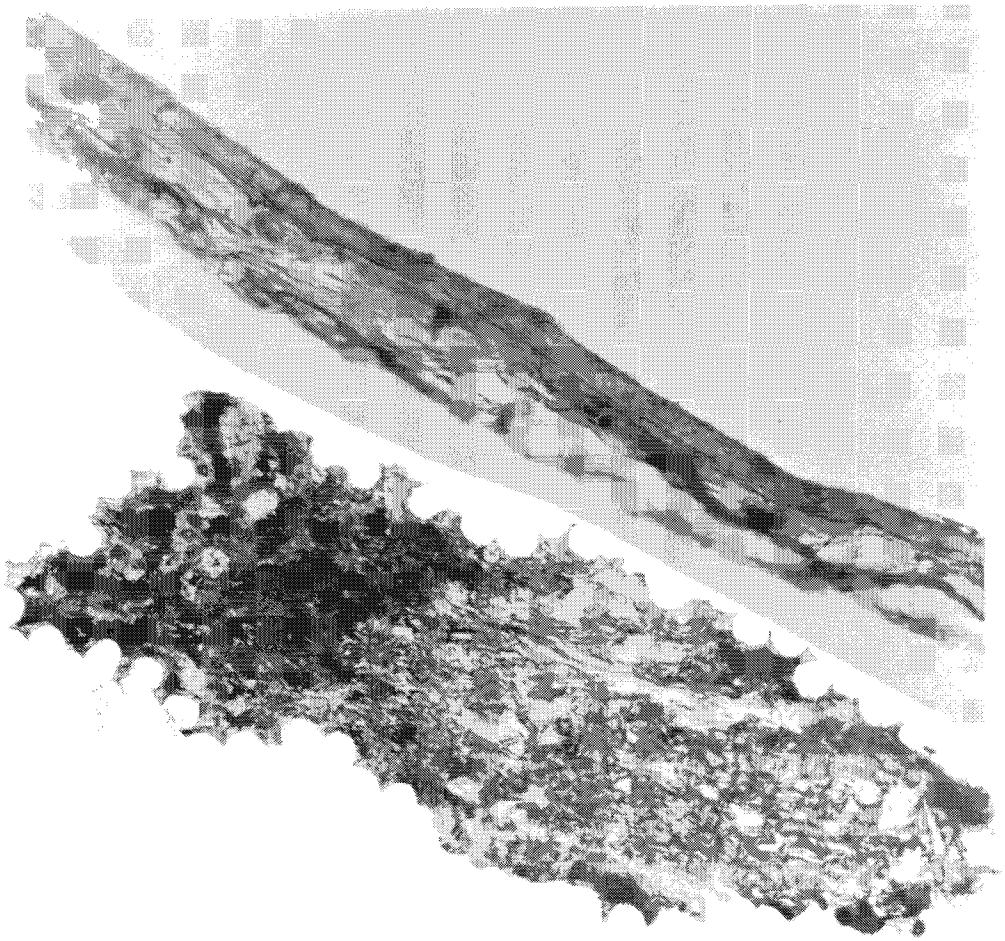


FIGURE G.8. Coniferous wood, probably pine, (top) longitudinal (Sp:160-18) and (bottom) cross-sectional (Sp:160-18) views. ×445. Courtesy Southern Regional Research Center, USDA.

of the loom-woven material. It is evident, however, that individual sections of cloth were sewn together to form larger cloth strips used between wood and metal surfaces (over the fiber-caulked seam, as in the case of Sp:43-4 and 43-7) because such a seam had been identified in an impression found on the underside of a flat lead strip recovered from a different vessel (41 WY 3; Olds, 1976). At least one textile (Sp:132-10) appears to have been cut along one side by a sharp-edged instrument, such as a pair of shears or scissors, that has compressed the individual yarns together in a direction normal to the yarn axis (Hamilton, personal communication, 1976).

The textiles are deeply stained in places by the iron oxide corrosion products that also have reduced or eroded the surfaces of many of the yarns.

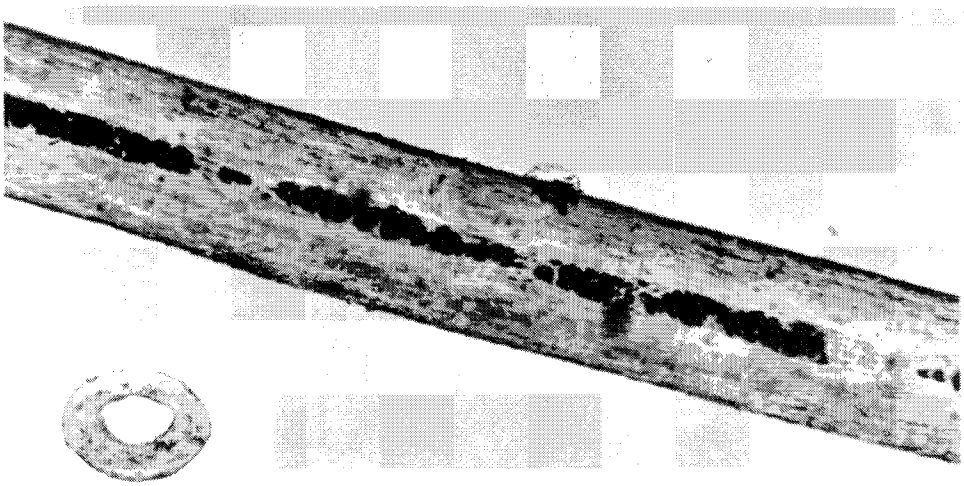


FIGURE G.9. Mammalian hair shaft, longitudinal view shows medulla and a heavily pigmented cortex, found adherent to Sp:132-10 and cross-sectional view (inset) shows large, ovoid medulla, heavily pigmented cortex and thick cuticular sheath. ×440. Courtesy Southern Regional Research Center, USDA.

In several cases, the fabrics had been cleaned and bleached with a 10% solution of HCl and soaked in different concentrations of PVA and acetone as part of a standard conservation treatment. One such fragment (Sp:156-21) had been mounted in a plastic envelope after treatment in PVA, and in order to minimize further deterioration of the material, only gross morphological measurements of the fabric components were made.

Although many of the associations of the preserved fibrous materials with metal artifacts must be considered fortuitous, caused by the sudden grounding and break-up of the ship, at least two occurrences of textiles in direct primary contexts with both metal and wood clearly demonstrate that cloth was used as a caulking or protective interfacing material. Two fragments (Spp.43-4 and 43-7) were each found laid at a right angle at the junction of the ship's wooden stern planks and the upper surface of the starboard and port straps, respectively, of one of the rudder gudgeons. In both cases the cloth was positioned over a layer of shredded fiber caulking material applied to one side of the iron strap and into the seam between two wooden planks. Overlaying all of this and secured with tacks, were specially formed flat lead strips. Whether the cloth interface extended beyond the lateral edges of the lead strips and over the other portions of the hull below the water line cannot be determined.

Two of the seven rope segments recovered are remains of lashings used to bind the bombard cannon barrels into their wooden undercarriages. The ropes were apparently wrapped five and seven times around the barrels (Figure G.4). These heavy lashings served not only as firm and resilient fastenings when the guns were fired, but also as dark, protected nesting areas

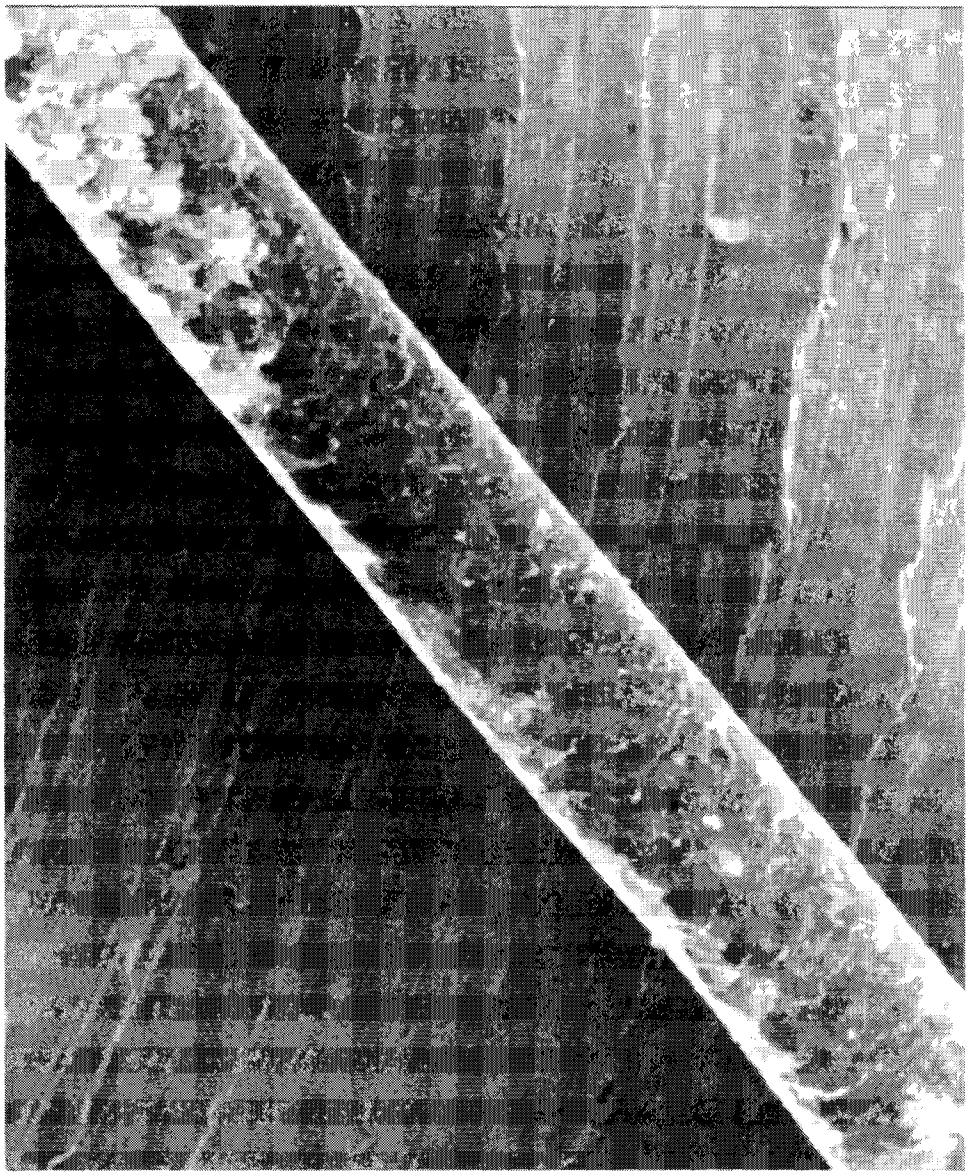


FIGURE G.10. Scanning electron micrograph of surface of mammalian hair (Sp:160-18) similar to that in Figure 12, showing marked surface deterioration of cuticular sheath. AuPd coated. ×127. Width of shaft 79 μm.

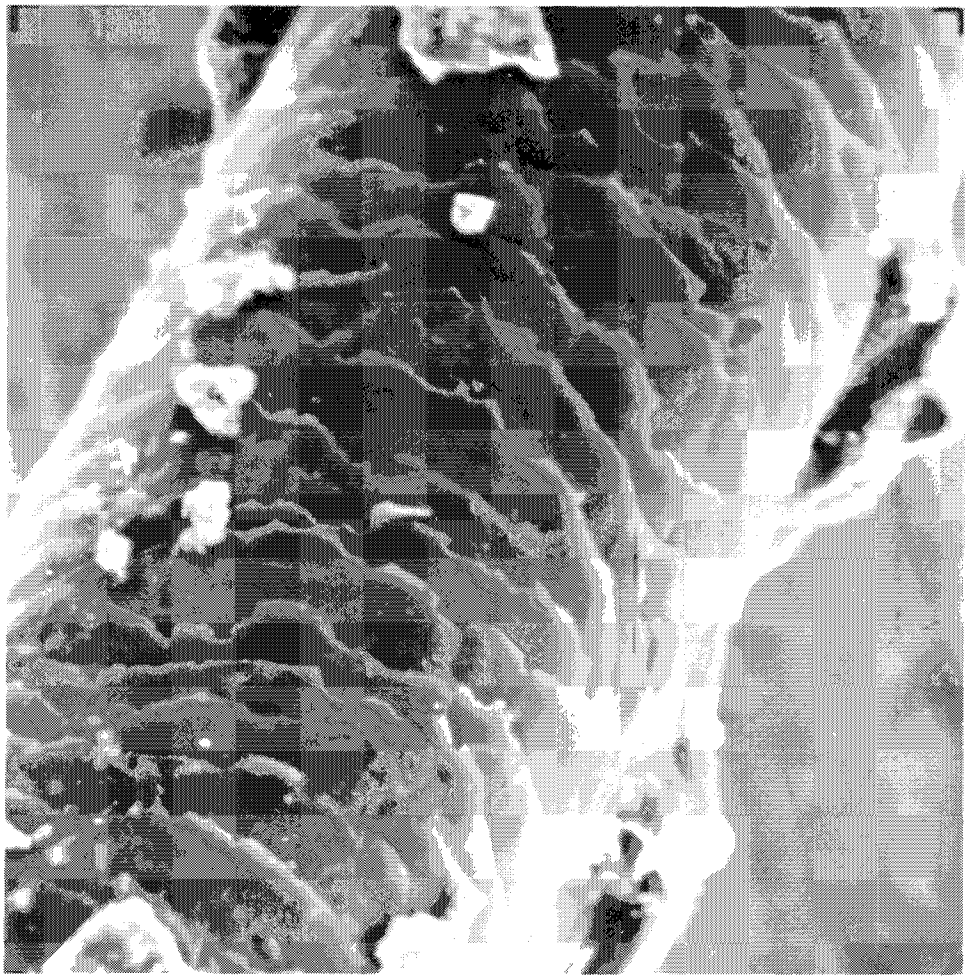


FIGURE G.11. Scanning electron micrograph of mammalian hair (Sp:5-107) showing cuticular patterning and an organic, possibly resinous, substance adherent to its surface. AuPd coated. ×422. Width of shaft 73 μm.

for certain common insect pests when the guns were not in use. Several fossilized cockroach egg cases turned up between the rope lashings at the breech end of one bombard. The mammalian hairs identified in the sample, either in fibrous debris (Sp:160-18; Figure G.9, inset), or adherent to a textile (Sp:132-10 and Figure G.9) probably functioned as part of the caulking materials.

Presumably, both hemp and flax were fibers commonly utilized during the sixteenth century in the ship-building industry in Spain, where both plant fibers were available (Montgomery 1954:283 and Table 16). In the

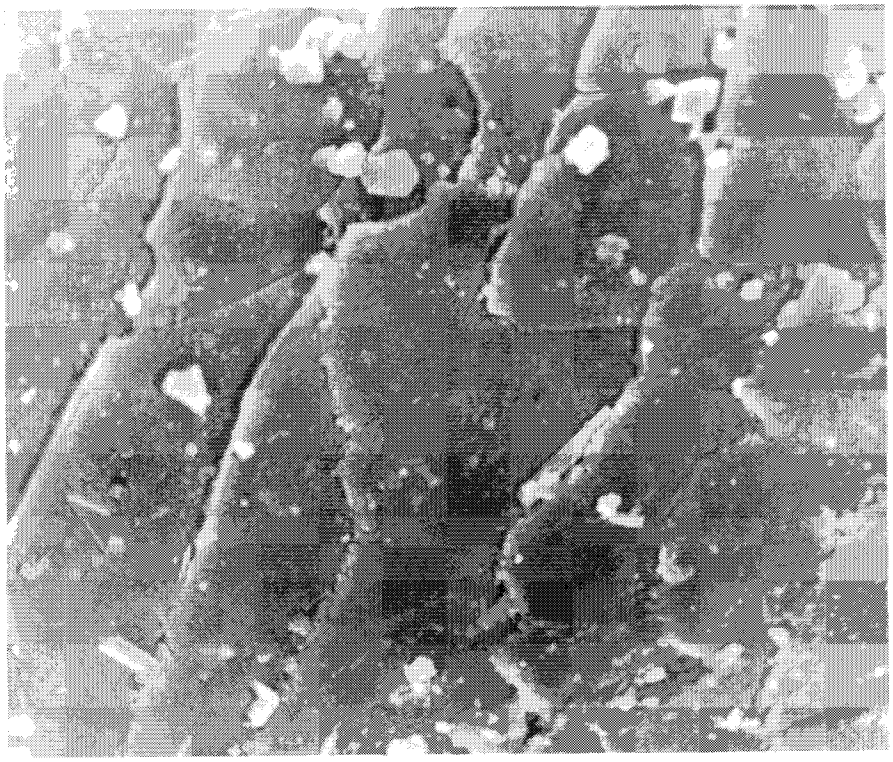


FIGURE G.12. Scanning electron micrograph of surface structure of mammalian hair (Sp:5-107) showing marked chipping of edges of overlapping cuticular plates. AuPd coated. ×1027.

present sample, hemp occurs far more frequently than flax as a constituent of both the fabrics and ropes, and also as the primary form of caulking material, made either from shredded, unspun loose fiber, or from worn and unusable segments of hemp rope. A fibrous composition usually referred to as "oakum" in nautical terminology, consisting of loose hemp, jute, hair, or other fibrous material mixed with asphalt, tar, or creosote, was customarily impacted between the joints and seams of the hulls of wooden ships. Evidence of such a composition and a resinous substance appears on the surface of at least one textile (Sp:132-10; Figure G.3a) and also along the shaft of one mammalian hair (Sp:160-18; Figure G.9b), lending support to the observation that oakum was used on this vessel in joints between wooden planks over which cloth strips were positioned. Furthermore, two special long-handled iron tools, wedge shaped at one end and pointed and recurved at the other, were recovered from the wreckage of one of the other vessels (41 WY 3). Apparently they were used both to pound in the shredded hemp fiber and to remove it when necessary (Olds, 1976).

Probably the most significant aspect of the recovered fibrous remains is the discovery of agave fibers in the ship's textile complement (Sp:43-7 and possibly 43-4). These fibers can be designated as either sisal (*Agave sisiliana*) or as henequen (*Agave fourcroydes*), both of which were restricted to the New World at the time of the Conquest, and which were found in abundance in Mexico at that time (Montgomery 1954, de Mendizábal 1947).

Spain was quick to realize the importance and value of fiber production in her New World dominions, where indigenous developments in the art and technology of fabric making attained a level comparable, if not surpassing, that achieved in Europe during the Middle Ages. By the mid-sixteenth-century, textile production was established as one of the first large-scale industries in both the kingdoms of New Spain and Peru (Haring 1963:243; Silva 1964:7). Because of the inefficient and counterproductive textile trade monopoly controlled by the Spanish *Cortes*, imported textile materials were regularly in short supply in the Colonies (de Mendizábal 1947:360). Thus, the occurrence of agave fiber yarns manufactured in a form nearly identical to those of Spanish origin of the same period can be explained by the strong interest in textile production in Mexico at that time. The fact that certain fabrics from New Spain were employed at least by 1554 on Spanish vessels returning to Europe demonstrates that not only were some repairs and replacements on the ships executed with native American fibers, but also that by the middle of the sixteenth century, textile production had already developed into an industry capable of producing sturdy fabrics morphologically identical to the European materials ostensibly used for the same purposes (Vreeland 1977). It also seems very likely that the repair of the stern area around one of the rudder gudgeons and the recaulking of the joints between the iron straps and the wooden planking were carried out in the New World, possibly at San Juan de Ulúa.

The fibers and fabrics reported here are both the oldest firmly dated archaeologic materials of European origin so far excavated and identified in the New World, and also the earliest documented case for the use of native American fibers for nautical repairs on European vessels.

REFERENCES

de Mendizábal, Miguel Othon
1947 Las artes textiles indigenas y la industria textil Mexicana. *Obras Completas*, Vol. VI. Mexico.

Emery, Irene
1966 *The primary structure of fabrics.* Washington: The Textile Museum.

Haring, C. H.
1963 *The Spanish empire in America.* New York: Harcourt.

Montgomery, Bernice
1954 The bast and the leaf fibers. In *Matthew's textile fibers,* 6th ed., edited by Herbert R. Mauersberger. New York: Wiley.

Olds, Doris
1976 *Texas legacy from the Gulf.* Austin: Texas Memorial Museum, Miscellaneous Papers No. 5, and Texas Antiquities Committee, Publication No. 2.

Silva Santisteban, Fernando
1964 *Los Obrajes en el Virreinato del Peru.* Lima: Publicaciones del Museo Nacional de Historia.

Vreeland, James M.
1977 America's oldest European fabrics: Textiles from a sunken Spanish treasure ship. *Special Publications Series.* Houston: Houston Historical Society.

Wildman, A. B.
1954 *The microscopy of animal textiles and fibres.* Leeds, England: Wool Industries Research Association.

Appendix H

FOSSIL COCKROACHES FROM A 1554 SPANISH SHIPWRECK

Christopher J. Durden

During the conservation of artifacts recovered from site 41 KN 10, preparators discovered the remains of cockroaches (Arnold, personal communication). Fragments of 16 individuals, including 5 egg cases (oöthecae) were found in 8 numbered portions of 5 primary encrusted artifact conglomerates (Nos. 81, 156, 157, 161, and 308). The fossil cockroaches were studied at the Texas Memorial Museum and are deposited with the archaeological materials of site 41 KN 10.

The style of preservation of these fossils is similar to that found in the ironstone concretions at Mazon Creek (Illinois) and Coseley (Staffordshire), but most closely resembles that of the concretions from the Uffington Shale or roof of the Upper Freeport Coal (Ohio and Pennsylvania). All of these ironstones contain fossil cockroaches as well as the occasional marine fossil and abundant plant material. They are of medial Pennsylvanian age (300–305 MY BP). Concretions from the Fox Hills Sandstone of South Dakota contain predominantly marine shell fauna with occasional plant material, beetles, and other insects. These are of late Cretaceous age (70 MY BP). Some of these ancient concretions appear to have formed rather suddenly, associated with the rapid mixing of acid humic waters bearing terrestrial organisms with normal marine waters in situations where marine shales lie directly upon coal beds, with no passage sequence of shoreline facies. Such association of marine and terrestrial fossils with coal has been reviewed by

Mamay and Yochelson (1962). Many ironstone horizons represent rapid inundation of coal swamps by seawater. Just how rapid were these inundations is debatable, but some appear to be associated with basement foundering comparable to the historic formation of Reelfoot Lake during the New Madrid Earthquake of Missouri. Rare terrestrial fossils found in concretions in fully marine strata, far from shore, such as those from the Fox Hills Sandstone or from the late Jurassic of the Las Delicias region in Coahuila, may represent isolated airborn individuals or "shipwreck" of natural rafts swept out to sea from estuaries. In these cases, it appears to be the animals' difference in chemistry from normal seawater that initiated concretion formation. The youngest dated marine concretions, not associated with artifacts, appear to be those reported from Long Island Sound, Connecticut (Waage 1962:30) with a radiocarbon date on shell of 4600 ± 90 years. That concretions, especially ironstone concretions, form rapidly is evident from a study of coal balls where uncompressed stem fossils in the concretion pass along bedding plane into wafer-thin compressions in the shale country rock. Such concretions formed before significant compaction or dewatering occurred in the silts precursor to the shale, probably before silt deposition ceased. A careful study of encrusted shipwreck artifact conglomerates of known age of initiation, and the fossils they enclose would provide valuable information on the rate of concretion formation and on the role of mixing of acid and alkaline waters.

The fossil cockroaches were both live (articulated wings and bodies) and dead (isolated leg, wings, and empty oöthecae) at the time of preservation. They were preserved in crevices between the stone cobbles of the ballast, wood, and sacking in the hold of the ship. The oöthecae were concealed in the coils of the rope lashings of a gun carriage. Two species are represented, both of which are presently cosmopolitan domicilliary in the coastal cities of temperate and tropical regions. One, *Blatta orientalis,* has been spread by man from Asia. The other, *Periplaneta americana,* has been spread by man from Central America.

The ship *San Esteban* with which this wreck has been tentatively identified was part of a Spanish plate fleet bound from Vera Cruz to Havana which sank on the Texas coast in 1554. It was in such early shipping that *B. orientalis* reached America and *P. americana* reached Europe

Family BLATTIDAE Stephens, 1813

Genus *Periplaneta* Burmeister, 1838

This genus (=*Cacerlaca* Saussure) the type species of which is *P. americana* (Linnaeus, 1758), contains numerous species of tropical and subtropical distribution, principally in Asia and Africa, although at least two of the species appear to have been prehistorically indigenous to North and

Central America. The genus is structurally very close to *Blatta* from which its members are distinguished with difficulty by characters of femoral spination and the similarity of sexes in alar development. *Periplaneta japonica* Karny, 1908 is somewhat intermediate between the two genera. *Blatta orientalis* and *Periplaneta americana* are reputed to yield hybrids when hand paired in the laboratory, although they never do this in the wild. It may well be that the genera will be synonymized when the world fauna is revised.

Periplaneta is an ancient genus. *Stantoniella cretacea* Handlirsch, 1906 from the late Cretaceous, Judith River Formation (76 MY BP) of Montana is a *Periplaneta* at present indistinguishable from the *P. fuliginosa* group, indicating a past wider range. *Periplaneta fuliginosa* (Serville, 1839) is now restricted to the North American Gulf Coast, from southern Georgia and northern Florida to central Texas with an unverified record from "South America," and from southern Japan, Formosa, Fukien, Szechwan, Yunnan, and Hong Kong with an unverified record from the Nicobar Islands. Asahina (1961) and others consider the American and Asiatic populations to be conspecific. Hebard (1917) considered these to be closely related yet distinct species, differing in characters of the supra-anal plate and concealed sinistral process of the male genitalia. Variation of these characters in the central Texas population encompasses these differences, supporting the synonymy of the Asiatic *P. emarginata* Karny, 1908 (=*picea* Shiraki, 1906, *nec* Brunner v. Wattenwyl, 1858; =*filchnerae* Karny, 1908) with *P. fuliginosa.* Other species of similar wing shape are *P. ceylonica* Karny, 1908, *P. lata* (Herbst, 1786), *P. robinsoni* Hanitsch, 1915, *P. fallax* Bey Bienko, 1957, and *P. japanna* Asahina, 1969. These are all distinguishable by characters of the supra-anal plate and internal genitalia of the male. This situation of barely separable species is frequent in the genus *Periplaneta* and poses problems of identification for fossil material in which neontological key characters are rarely preserved. Determination of the *San Esteban* fossils was aided considerably by the presence in specimen 156-14-B (Figure H.11) of a supra-anal plate clearly of the *P. americana* configuration.

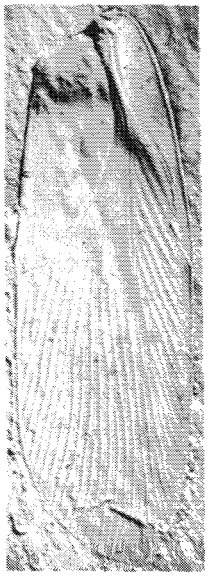
Periplaneta americana (Linnaeus, 1758)

This species (=*kakkerlac* De Geer, =*aurelianensis* Fourcroy, =*siccifolia* Stoll, =*aurantiaca* Stoll, =*stolida* Walker), originally described from Surinam is now cosmopolitan domiciliary, having been dispersed by trade and shipping. Although most species of *Periplaneta* are found in the Old World, this species appears to have originated in Central America and Texas, for here it is most variable and includes a wild (nondomiciliary) race, the probable ancestor of the domestic strain. This wild race was described from Cuernavaca, Morelos, as *P. americana colorata* Rehn, 1901. It occurs together with *P. fuliginosa* (Figures H.1, H.2) and *P. brunnea* Burmeister, 1838 (Figure H.5) (=*truncata* Krauss, =*patens* Walker, =*concolor* Walker) in evergreen woodland habitats along streams as far north as Travis County, Texas.

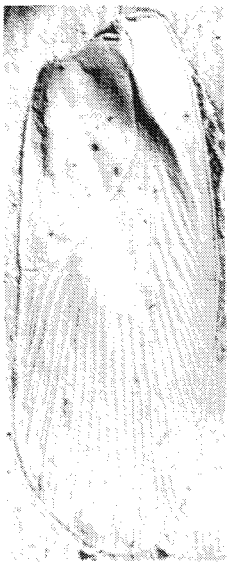
1

2

3



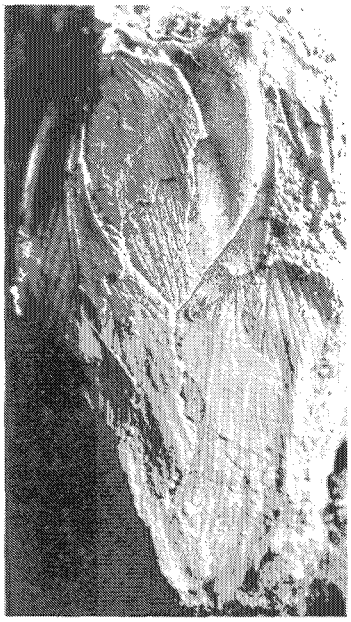
4



5

6

7



8

The origin of *P. brunnea* is obscure, and there is no indication that it was not pantropical in prehistoric times. The domiciliary race *P. a. americana* (Figures H.6, H.7) is rarely found in native habitat, more often along city streets, and most often in dwellings and warehouses. In the latter habitat, it coexists with *P. australasiae* Fabricius, 1775 (=*domingensis* Beauvois, =*zonata* Haan, =*repanda* Walker, =*subcincta* Walker, =*inclusa* Walker, =*emittens* Walker, =*subornata* Walker). *P. australasiae* appears to have originated in the Australian region but has been dispersed throughout the subtropics where it is primarily a coastal species associated with fishing wharves. Although *P. fuliginosa, P. brunnea, P. australasiae,* and *P. americana* are customarily distinguished by color pattern and genitalic characters, these are not usually available in fossils. It is possible to distinguish these species, the only ones of the genus in Central and North America, by wing characters. Size of the wing is not useful, there being frequent stunting and gigantism dependant upon nutrition, especially in the domiciliary species. Females (Figures H.1, H.3, H.5, H.7) have proportionately broader and more rounded wings than do males (Figures H.2, H.4, H.6). Probably this greater bearing area of the forewing is selected to carry the greater body weight of gravid females, although females generally fly less than do males. *P. brunnea* (Figure H.5) may be distinguished by its broad costal field (Durden, 1969) with an openly rounded costal angle. *P. fuliginosa* (Figure H.1, H.2) and *P. australasiae* (Figures H.3, H.4) have costal fields of intermediate width, constricted near the base. They differ in costal field length, which in *P. fuliginosa* females is as much as one-half costal edge length and in *P. australasiae* males is as little as one-third costal edge length.

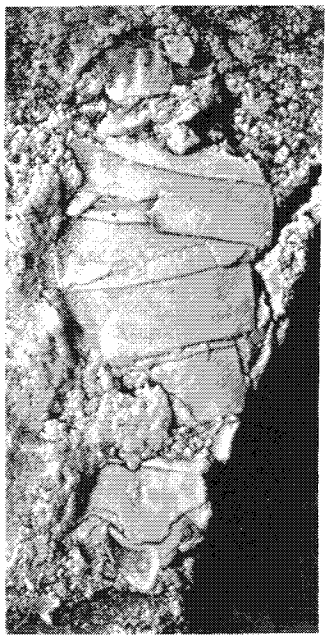
P. americana (Figures H.6, H.7) differs from its congeners in its narrower costal field, which is evenly tapered toward the base. This character may be seen in the fossils 156-20 (Figures H.8, H.9) and 156-14-A (Figures H.16, H.17, H.18). A comparative study of *P. a. americana* and *P. a. colorata* in progress, has not yet yielded reliable structural differences that can be recognized in the fossils. It is presumed, however, that evolution of the domiciliary race preceded European contact by thousands of years and was associated with pre-Columbian urbanization in Mesoamerica.

Material Examined

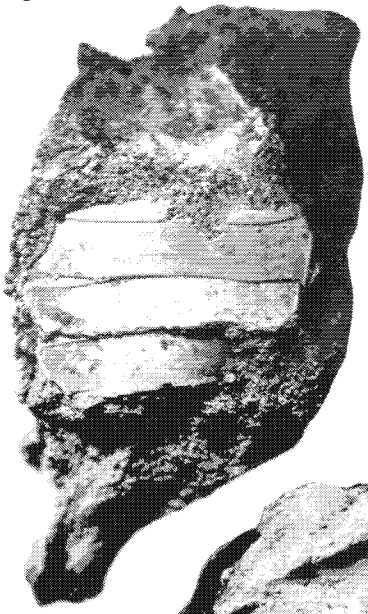
Number 81-117-A major portion of both left and right forewings in closed articulated position, dorsal aspect of dorsal integument on ironstone; adult female. Number 81-117-B basal portion of left forewing, ventral aspect of dorsal integument on ironstone; adult male. Number 156-14-C (Figure H.22) major portion of left forewing and minor portion of base of right forewing in closed articulated position, dorsal aspect of dorsal integument on ironstone; adult, sex not evident. Number 156-14-A (Figure H.16) pronotum, base of costal edge of right forewing and fragments of legs, dorsal

9

10

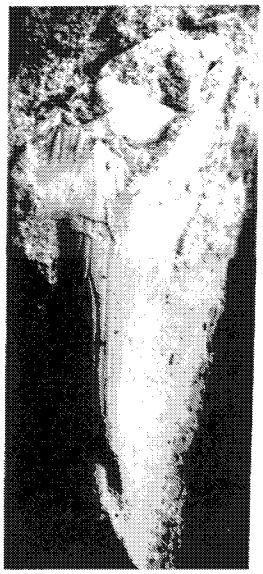


11

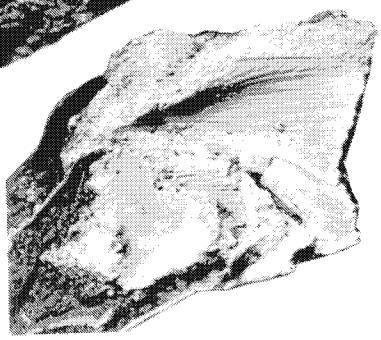


12

13



14



15

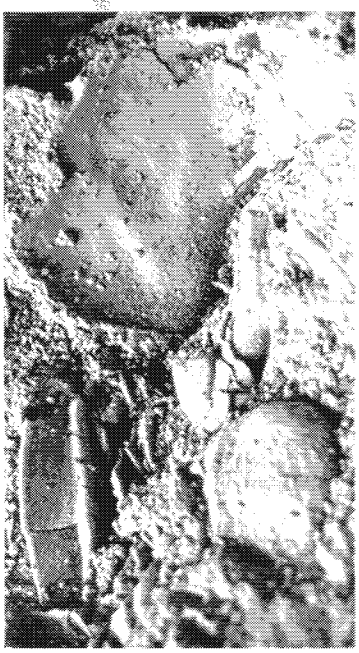
aspect of dorsal integument in ironstone on pebble. Reverse of same (Figures H.17, H.18) in ventral aspect. Number 156-14-B (Figure H.11) six abdominal tergites with supra-anal plate of adult, dorsal aspect of dorsal integument in ironstone; adult male. Number 156-20 (Figures H.8, H.9) major portion of both forewings, dorsal aspect of dorsal integument with some exfoliation exposing ventral integument. Reverse of same (Figure H.10) major portion of right forewing and minor portion of cubital field and edge of left forewing in ventral aspect of dorsal integument in ironstone; adult female. Number 156-25-A (Figures H.25, H.26) oötheca. Number 156-25-B (Figures H.27, H.28) oötheca, broken showing internally the outline of egg chambers. Number 156-25-C (Figures H.23, H.24) oötheca. Number 156-25-D oötheca. Number 157-139-A (Figure H.19) head, pronotum, mesonotum, and portions of metanotum and first abdominal tergite of late instar nymph, dorsal aspect of dorsal integument; juvenile. Number 157-139-B (Figure H.21) right midleg of late instar nymph, dorsal aspect of ventral impression of coxa and base of femora, and dorsal integument of femora and tibia; juvenile. Number 161-31 (Figure H.21) three midabdominal tergites of late instar nymph, dorsal aspect of dorsal integument; juvenile. Number 308-4-A midportions of both left and right forewings in closed articulated position, ventral aspect of dorsal integument on surface of cobble. Reverse of same, midportion of right forewing, dorsal aspect of ventral integument; post discal costa and adjacent radial field of left hindwing, dorsal aspect of dorsal integument in places exfoliated to expose ventral integument, on ironstone; adult male.

Blatta orientalis Linnaeus, 1758

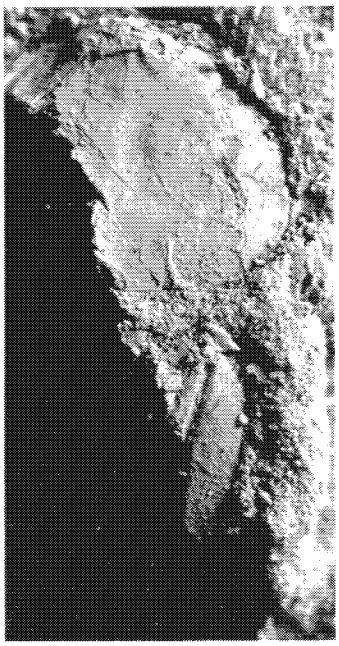
This species (=*culinaris* De Geer, =*ferrugineofusca* Gronov., =*badia* Saussure) originally described from North America and Europe is now cosmopolitan domiciliary, having been dispersed by trade and shipping. Other species of this genus (=*Stylopyga* Fischer) occur in the Old World, principally in southeast Asia. *B. orientalis* appears to have originated in Asia and to have spread with civilization. The shortness and width of the abdominal tergites with their posteriorly actue distal angles suggest *B. orientalis* rather than any of the *Periplaneta* spp. The close association of the fragment of an abbreviated wing renders the determination certain, although not enough of the wing is preserved to indicate the sex of the fossil.

Material Examined

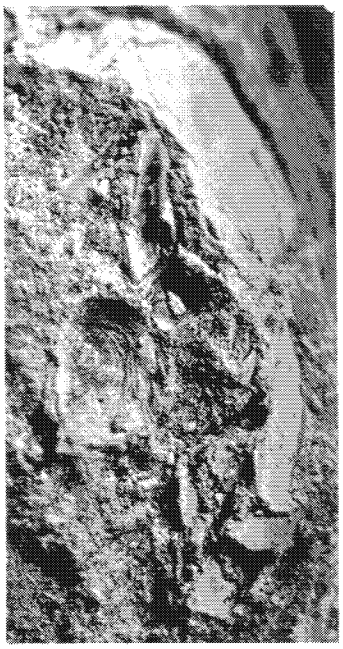
Number 161-61-A (Figure H.20) tergites of the last five abdominal segments and a small portion of the mid-costal region of a right forewing (abbreviated in this species), dorsal aspect of the dorsal integument in ironstone; adult, sex not evident. Reverse of the same wing fragment. Number 156-25-E (Figures H.29, H.30) oötheca.



16

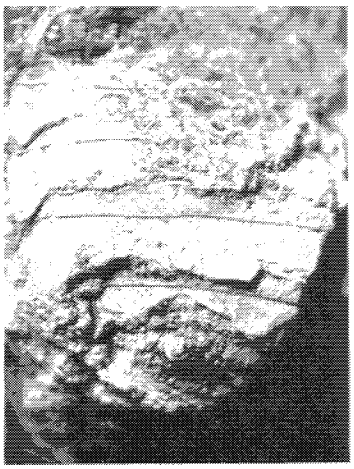


17



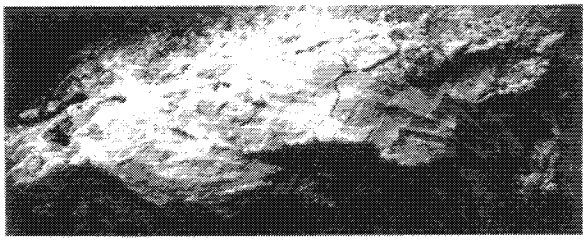
18

19

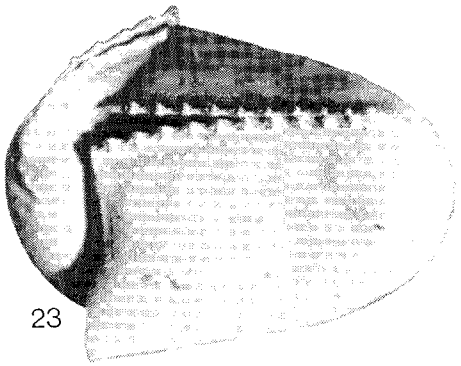


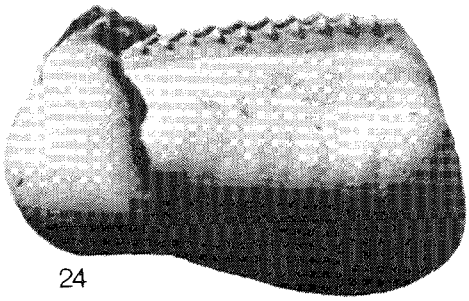
20

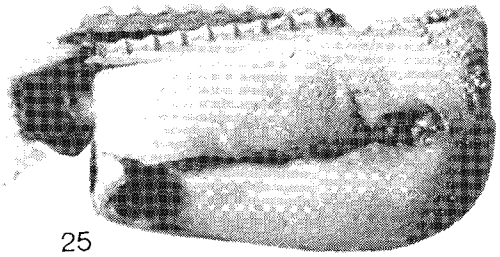
21

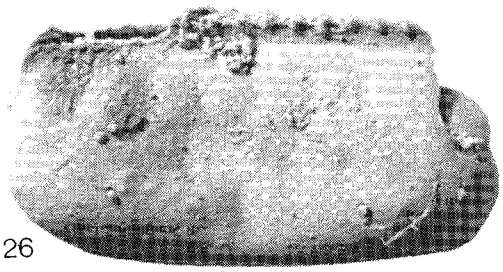


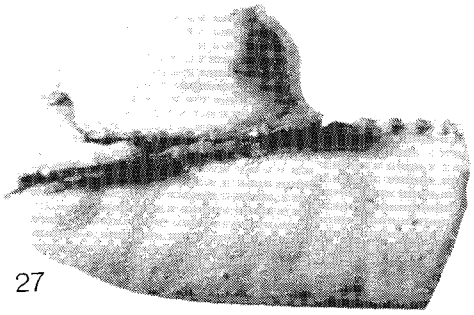
22

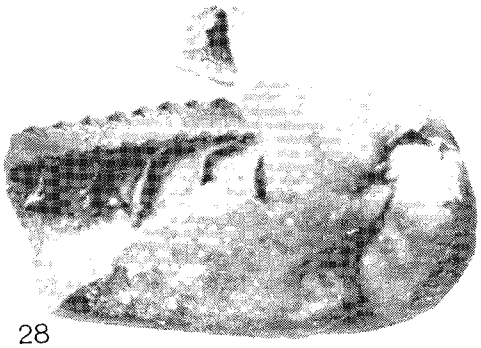

23

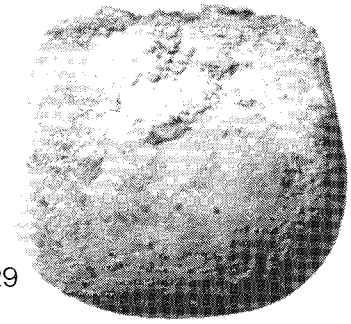

24

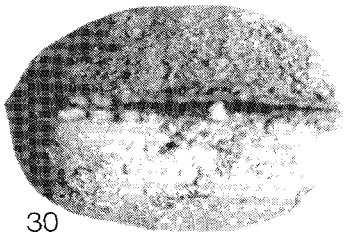

25


26


27


28


29


30

It is most unusual to find both these large species coexisting at the same site. Usually *B. orientalis* is displaced by *P. americana* which tends to form pure colonies in dwellings and mines. *B. orientalis* is slightly more tolerant of lower temperatures and thus tends to form pure colonies in unheated warehouses and cellars, outside the tolerance range of *P. americana.* The *San Esteban* fossil assemblage appears to record a primary infestation of *B. orientalis* from Europe represented by slightly disassociated parts of 161-61-A which were dead and dry at the time of preservation; and a secondary infestation of *P. americana* obtained in America.

The specimens were prepared for photography by coating with sublimate of ammonium chloride to obscure color and diagenetic discoloration. Photographs were made with a Leica camera with 135 mm (Hektor) lens, extension tubes and reflex viewfinder, at f.36 on Eastman Fine Grain Release Positive Film (5302) using an ASA of 7 with an exposure of 25 sec (to average building vibrations) processed for 2 min in Dektol.

REFERENCES

Asahina, S.
1961 A revised list of the Japanese cockroaches of sanitary importance (Insecta, Blattaria). *Japanese Journal of Medical Science & Biology*, 14(3):147–156.
1969 Taxonomic notes on Japanese Blattaria, IV; On a new *Periplaneta* allied to *Periplaneta fuliginosa* (Serville). *Japanese Journal of Sanitary Zoology,* 20(2):63–68.

Durden, C. J.
1969 A simple notation for the naming of segments of complex dendroids in insect wing venation. *Journal of the New York Entomological Society,* **LXXVII**(3):204–207.

Hebard, M.
1917 The Blattidae of North America, north of the Mexican boundary. *American Entomological Society, Memoirs,* No. 2:284, vi, plates I-X.

Mamay, S. H., and E. L. Yochelson
1962 Occurrence and significance of marine animal remains in American coal balls. *United States Geological Survey, Professional Paper* 354-1:193–224, plates 26–34.

Waage, K. M.
1962 Fossils from West Haven. In *Yale Peabody Museum of Natural History, Annual Report* No. 3:29, edited by S. D. Ripley, Cambridge, Massachusetts: Peabody Museum Press.

Appendix I

CONSERVATION PROCEDURES UTILIZED FOR THE SIXTEENTH-CENTURY SPANISH SHIPWRECK MATERIALS

D. L. Hamilton

The Texas Archeological Research Laboratory (TARL) of the University of Texas became involved with the complex problems of processing and preserving material from shipwrecks in the fall of 1969. During the previous year Platoro, Inc., a treasure hunting firm from Gary, Indiana, had been working on at least one of three wrecked ships of the 1554 Spanish Plate fleet located on state-owned tidelands in the Gulf of Mexico off Padre Island in Willacy County. The ship is now tentatively identified as the *Espíritu Santo* and given the site number 41 WY 3. Platoro's operations on this historically significant wreck initiated extended litigation between the company and the State of Texas. Pending the outcome of the case, the 28th Judicial Court of Texas ordered that the recovered material be put in the temporary custody of TARL. The laboratory personnel were authorized to treat and fully analyze the collection. When the collection was received, TARL had no experience in the conservation of shipwreck material, but no time was lost in developing the necessary facilities and expertise to handle the directives of the court.

Largely as a result of the controversy from the Platoro case, the State of Texas enacted in 1969 a very strong antiquities code and established the Texas Antiquities Committee (TAC). The committee hired an underwater archeologist and established an Underwater Archeology Project. Under the auspices of TAC, underwater archeological surveys and excavations were

conducted in 1972, 1973, 1974, and 1975. Most of the excavations have been concentrated in Kenedy County at 41 KN 10, which is the site of another shipwreck of the 1554 Plate fleet and tentatively identified as the *San Esteban.*

By the time the state started its underwater archeological program, TARL had established one of the best underwater archeology conservation facilities in the United States, and the only one in Texas, for treating materials from marine sites. The Texas Antiquities Committee was fully cognizant of the value and the absolute necessity of having a good conservation laboratory arranged beforehand to process all the material recovered from any shipwreck excavation. Accordingly, TAC has contracted with TARL to perform all the required conservation. A comprehensive discussion of TARL's role in TAC's marine archeology program and many of its conservation procedures can be found in *Conservation of Metal Objects from Underwater Sites: A Study in Methods* by D. L. Hamilton (1976). Because of the detailed discussions contained in that report, only a brief coverage of the various conservation procedures will be presented.

To date, TARL has processed a wide variety of artifacts from the sixteenth-century shipwreck excavated by TAC. Included among the metal specimens are a large number of wrought iron objects: anchors, breech-loading guns with their associated breech chambers, breech wedges, and wrought iron cannon balls, as well as many spikes, straps, chains, and assorted tools. In addition to the ferrous materials, there are nearly 400 silver coins and a number of silver disks. The lead artifacts include cannon balls, straps, and weights. Less numerous are specimens of pewter, brass, bronze, and copper. The few cupreous artifacts consist of a few coins, a weight cup, tacks, straight pins, buckles, and miscellaneous small pieces. There are only two gold objects, a gold-bound wooden cross, and an ingot. Occurring throughout the wreck are numerous sherds of olive jars, majolica, and, occasionally, glass. Among the numerous organic specimens in the collections are a large section of the keel, fragments of planks, boxes, barrels, and hooped-barrel gun undercarriages; breech chamber plugs; anchor stocks; pieces of rope, cloth, rawhide, olive pits, almond shells, hazelnuts, animal bones; and even cockroach exoskeletons and egg cases. Most of these objects are intimately associated within sea-encrusted conglomerates.

When artifacts are recovered from the sea, they are commonly encrusted with thick layers of calcium carbonate, magnesium hydroxide, metal corrosion products, sand, clay, and various forms of marine life such as shells, coral, barnacles, and plant llfe. The term "encrustation" is used here to refer to any of the conglomerates that may contain one or more artifacts. Such conglomerates may range from the size of a single coin to masses weighing several thousand pounds containing hundreds of individual objects of many different kinds of materials.

The investigation of encrustations with their concealed contents is

analogous to the excavation of a structure within a site, and the location and orientation of each encrustation needs to be plotted accurately before it is raised from the seabed. The recovery of the encrustation from the site destroys its archeological context, which remains preserved only in the notes, drawings, and photographs made by the archeologist in the field. Unless careful records are kept, the operation is not an archeological excavation but an uncontrolled salvage operation producing simply an inventory of artifacts. The same careful documentation of the provenience of the artifacts within the encrustations is carried out in the conservation laboratory to supplement the field data. It is acknowledged that all associations are not culturally significant, but if one approaches each archeological excavation with the basic assumption that many associations are meaningful and excavates accordingly, additional systematic and intrasite problems can be considered. Because of the data contributed by the conservation lab, it can be emphatically stated without any reservations whatsoever that the excavation of any marine shipwreck without planning for proper conservation is vandalism—pure and simple.

FIELD RECOMMENDATIONS

Proper conservation required that certain procedures be followed in the field, for without proper treatment and storage, specimens from underwater sites will corrode, warp, crack, fall apart, and even completely deteriorate. Also, considerable data represented by molds and impressions in the encrustation can easily be lost; artifacts can be damaged and meaningful associations can be overlooked.

Divers working at 41 KN 10 often bemoaned the fact that all they did was plot, bring up, and attach numbered tags to encrustations; they seldom saw the actual artifacts. One can sympathize with the diver, but the field is not the place to tackle the complex problems presented by encrusted shipwreck material. Field recovery involves one set of archeological techniques and requirements. Conservation involves another set. Once raised, the encrusted material should be kept wet and sent to the conservation laboratory as soon as possible. The conservation laboratory personnel are better qualified and equipped to record the context of each artifact within each encrustation by means of photographic or radiographic procedures and to treat the artifacts as they are removed. These basic archeological data are used to reconstruct remains of the ship and to determine the different activity areas, the functional relationships of the parts of the ship, and the way the ship broke up. The data from the field and the laboratory come together to produce a reconstruction of the past in the best tradition of controlled, scientific archeology.

As a conservator who has worked with considerable shipwreck material, my recommendations concerning procedures in the field are as follows:

1. Make arrangements for conservation before beginning excavation. If conservation cannot be assured, excavation should not be undertaken.
2. Accurately record the precise position and orientation of every object—ship timbers, encrustations, individual artifacts—and number each item, so that there will be no confusion as to how each object lay and what surface was resting on the seabed after the material has been delivered to the laboratory for processing.
3. Do not remove the encrustation from any of the material; it provides a protective, corrosion-preventive layer around the material and preserves associations. Also, considerable data can exist in the form of impressions and molds in the encrustation, data easily lost or overlooked in the field.
4. Keep all material wet at all times, either in sea water or, preferably, in water with the pH adjusted to a reading of 10–12 with sodium hydroxide.

INITIAL DOCUMENTATION

The basic approach to conservation used by TARL is that once an encrustation or any artifact has been delivered to the laboratory for treatment the conservator must (*a*) preserve and stabilize the specimen as well as possible, (*b*) recover useful archeological information, and (*c*) acquire data for conservation research. These are possible only if extensive records are maintained, including detailed descriptions, radiographs, 4 × 5 black-and-white photographs, 35 mm color slides, and notes on the preservation procedures utilized. Since all photographic negatives and prints are kept as a permanent record, they undergo archival processing and are stored in a cool, dry, dark cabinet for maximum protection. All records are placed in an organized filing system so the data are readily accessible. The basic recording system used at TARL is described in what follows.

An Encrustation Record Form (Figure I.1), an $8\frac{1}{2} \times 11$-inch card, is completed as soon as possible after the object reaches the laboratory. On this card, the site number, site name, encrustation identification number, and preliminary descriptive data are recorded. A black-and-white photograph of the encrustation is attached, and a sketch is often drawn on the back of the card. A complete record of photographs and x-rays taken of the encrustation is kept on the card for quick reference. Space is provided for any mechanical or chemical treatment accorded and for a listing of artifacts removed from

TEXAS ARCHEOLOGICAL RESEARCH LABORATORY

[X] ANTIQUITIES CONSERVATION FACILITY

ENCRUSTATION RECORD

Recovery Texas Antiquities Committee, 1973

Preliminary Descriptive Data Encrusted curved strap, broken into three pieces

Circumference of 2.18 m. Would encompass a barrel with a diameter of ca. 69 centimeters

Mechanical/Chemical Treatment

8-16-73 Placed in chromate storage solution ($K_2Cr_2O_7$)

2-5-74 Removed from storage solution for mechanical cleaning

Photographic Record

B&W #321, #524, #525

Color #506

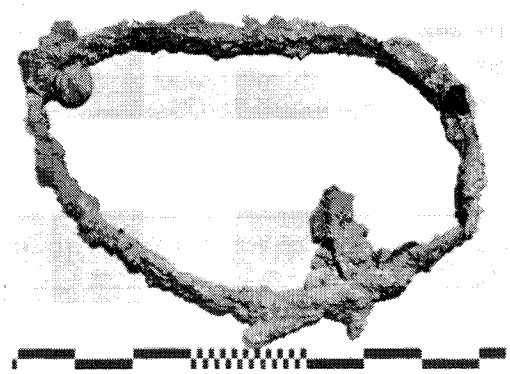
X-Ray #61, four sheets

Reverse Side Large photograph with the associations drawn in place

SITE NO. 41 KN 10 ENCRUSTATION NO. 106

SITE NAME "Edie"

PHOTOGRAPH



Associations

106-1 4 real Carlos-Johanna coin, early series

106-2 Pick-mattock or adze, iron

106-3 Fragments of wood handle for adze

106-4 Planking spike, iron

106-5 Planking spike, iron

106-6 Planking spike, iron

106-7 Barrel hoop, iron

106-8 One small ballast stone

FIGURE I.1. Encrustration Record Form.

the encrustation. Each artifact is given a sequential subnumber of the field accession number, and a Specimen Record Card (Figure I.2), another $8\frac{1}{2} \times 11$-inch card, is completed. More specific artifact identification data are recorded on this card along with a photographic record that lists the number of each color, black-and-white photograph, or radiograph taken of the specimen in its encrusted form, after removal and before treatment, during processing, and after treatment. On the back, a scaled drawing is usually made. It is especially important to have a scaled drawing and a photograph before treatment because the treatment may alter the form or the dimension of the specimen. For badly deteriorated objects the changes may be significant.

On the left side of the Specimen Record Card, space is provided to document major aspects of chemical, electrochemical, or electrolytic reduction treatment. Since a large number of metal artifacts can be expected to

T. A. R. L. ANTIQUITIES CONSERVATION FACILITY

[X] SPECIMEN RECORD

SITE NO. 41 KN 10 SPECIMEN NO. 106-2

SITE NAME "Edie"

RECOVERY TAC, 1973

IDENTIFICATION DATA Small iron pick-mattock

COIN

OB. Assayer _____ Mint _____

REV. _____

Dia. _____ Thick. _____ Wt. Before _____ After _____

Similar to tools called "Cooper's Adzes" for making barrel staves -- a one-handed tool or a carpenter's adze, a two-handed tool. See figures 89 & 90 on pages 95 & 98 in Ancient Carpenter's Tools by H. C. Mercer

ASSOCIATIONS Wood fragments of the handle (106-3) identified as Ash, Fraxinus sp., by R. B. Miller, Botanist, Center for Wood Anatomy, Madison, Wisconsin 53705

PHOTOGRAPHIC RECORD

	Encrust.	Before	Process	After
B&W		538-540		819,820
Color				648-650 878-881
X-Ray				

Reverse Side Scaled drawing with measurements

TREATMENT 2-5-74

Removed from the encrustation with small pneumatic air chisel

Began electrolysis at a very low current density to assure oxide reduction

5-20-74 Removed from electrolysis

Rinse & Chloride Test 5-20-74 to 6-6-74

Alternate boiling/cold rinses in deionized water. Test for Cl^- with $AgNO_3$, negative

Solvent 6-6-74 to 6-11-74 Dehydrated in isopropanol

Preservative 6/10/74 - 6/11/74 immersed in Witco 180M microcrystaline wax at temp. of 175°C. Removed at temp. of 100°C

Results Very good

Disposition Cabinet 5, drawer 12

Sq. Area _____ Electrolyte 2% NaOH

Amps/Sq. cm. .005 Anode Expanded mild steel

	Date	Hr	A/V	So	Cl
1.	2/5		3/6		
2.	2/11			all	1200
3.	2/13				103
4.	2/18			all	191
5.	2/20				113
6.	2/26				189
7.	3/3			all	277
8.	3/12				43
9.	3/18				43
10.	3/25				43
11.	3/26			all	
12.	3/27				32
13.	4/1				44
14.	4/8				44
15.	4/15				32
16.	4/22				32
17.	4/29				32
18.	4/30			all	
19.	5/6				18
20.	5/10				28
21.	5/13				30
22.	5/14				30
23.	5/14			all	
24.	5/15				12
25.	5/20				12
26.	5/20	off electrolysis			
27.		Blank sample of			
28.		electrolyte is			12
29.					
30.					
31.					
32.					
33.					
34.					
35.					
36.					
37.					
38.					
39.					
40.					

FIGURE I.2. Specimen Record Card.

occur in any shipwreck collection, the card is set up to facilitate the recording of electrolytic reduction data, such as surface area of the artifact, current density, electrolyte, and anode material. The length of time in electrolysis, amperage/volts, electrolyte, chloride content in parts per million, and frequency of electrolyte changes are the types of pertinent data that are maintained. In the upper left-hand corner of both the Encrustation and the Specimen Record Cards is a small square. Shorthand symbols, such as an "X" for processing completed or a "D" for specimen discarded, are recorded for quick reference. This eliminates the necessity to refer to the notes to see whether or not the treatment or documentation is completed.

The conservation data records the treatment history of every specimen, thereby accumulating valuable research records on the evaluation of particular conservation techniques. If any specimen needs retreatment in the future, the card provides valuable information on why the original treatment failed and how to reverse the process. Usually accompanying the Encrusta-

tion Record and the Specimen Record are x-ray plates, overlays made from the plates, and observations recorded while mechanically removing the artifacts from the encrustation.

Considerable archeological data exist in the form of associations and provenience of artifacts within each encrustation. This information is recoverable only by *in situ* observation and recording by the conservator. In other words, the conservator is often in a unique position to supply valuable archeological data necessary to reconstruct details of ship life, trade, and commerce.

STORAGE PRIOR TO THE TREATMENT

In order to prevent further corrosion, disintegration, breakdown, or collapse, materials recovered from the sea must be kept wet between recovery and treatment. It is necessary, therefore, to select a storage solution in which all can be safely housed. Since iron artifacts, many quite large, are likely to be the most common, solutions that provide good protection of this metal but do not adversely affect other metals and materials should be selected. Some of the problems can be eliminated by leaving the encrustation intact. The encrustation forms an excellent protective coating which retards corrosion, prevents the chemical conversion of the corrosion products already present, protects the artifacts from additional deterioration, and preserves the associations until they can be adequately documented. Once processing has begun and the different materials are removed, individual artifacts can be placed in a more desirable storage solution pending further conservation.

In general, the encrustations and the iron artifacts recovered from a marine environment are stored in an inhibitive aqueous solution. An inhibitive solution is any solution containing a substance that diminishes or prevents the corrosion of metals placed in it. Alkaline inhibitive solutions of sodium hydroxide or sodium carbonate and inhibitive solutions containing oxidizing agents, such as 1% potassium dichromate or sodium chromate, are commonly used in conservation. For more details on storage prior to treatment see Hamilton (1976:21–25).

ENCRUSTATION REMOVAL

On delivery to the conservation laboratory, the dense and often thick encrustation has to be removed. Removing the artifacts from this mass is analogous to removing objects from inside concrete blocks. Since most of

the objects are hidden from view, radiographs are indispensable for determining the constituent artifacts within an encrustation and for serving as a guide in extracting the artifacts without damage. It is often desirable to make a tracing or overlay from the individual x-ray plates. All the discernible artifacts are traced on the overlay. Any specimens not detectable on the radiographs can be drawn in and their correct provenience located as they are encountered in the encrustation. Useful notations, such as catalogue numbers and condition of specimens, can easily be added to the overlay. See encrustation No. 5 (Figure 78) for an example of this procedure.

After viewing the x-ray plates of an encrustation, it is often determined that no further processing is warranted: cases in which the encrustation contains no artifacts, or artifacts that are largely converted to metal oxides. Such encrustations are left intact for display purposes. For an example of this procedure and the data that can be derived from close analysis of the x-ray plates without mechanically cleaning the piece, see encrustation No. 304 (Figure 91).

For the very large conglomerates—those containing cannons, anchors, breech chambers, wooden planking, and the like—the procedure developed at TARL has been to remove carefully the encrustation from the anchor or cannon in the largest possible sections. The location of each of these fragments is accurately recorded on a photograph. Each section is then x-rayed, an overlay drawing made, and the enclosed artifacts removed. From the assembled overlays a scaled drawing showing all the associations is constructed. Encrustation Nos. 81 and 157 (Figures 70 and 75) were processed in this manner.

Mechanical cleaning is the only feasible alternative for removing the encrustation. To accomplish this, a variety of hammers and chisels are indispensable, especially for the very large pieces. By hammering and chiseling along cleavage lines, the encrustation can be detached from large objects with little or no damage to the artifacts within. For the extraction of smaller specimens, however, pneumatic tools are more efficient and less destructive. Pneumatic weld flux chisels are particularly serviceable for removing large amounts of encrustation and for extracting large, less fragile articles. Smaller, more precisely controlled pneumatic air tools with their more delicate scribes and various chisels, which can be custom made in the laboratory, are ideal for removing the encrustation from small, fragile artifacts and for getting into restricted places. The pneumatic air scribe is much more durable than any comparable electric tool. Combined use of the two types of pneumatic tools, the chisel and the scribe, is often necessary. They have, for example, been very effective in freeing movable parts such as loaded breech chambers and swivels on the verso and lifting rings on the bombard guns.

The encrusted bores of the gun tubes and breech chambers present a special problem. Tube drills are ideal, but each different caliber gun would require a different size tube drill. Since these are quite expensive they may

not be practical for many laboratories. At TARL, as much as possible of the encrustation is removed from the muzzle of the bore with a hammer and chisel, then a sandblaster is employed to cut through the encrustation. Periodically, a steel rod, ground to a chisel-like point, is used to roughen the surface of the encrustation so that the sand will cut more effectively. This technique may sound brutal, but very little, if any, harm is done to the guns. The sandblaster will actually cut a hole through the encrustation without touching the metal. That is, a layer of encrustation is usually left on the surface of the bore. Once a hole is made through the cannon bore, the cannon can be set up in an electrolytic bath with a center auxiliary anode. Hydrogen evolution in the bore will remove the remaining encrustation. Sandblasting works very well on the wrought iron breech-loading bombard or hooped barrel guns because the gun tubes are open at both ends. Muzzle-loading guns and breech chambers can be cleaned the same way, but it is more difficult.

The use of acids to remove the encrustation is generally a slow, ineffective process that is very expensive in both labor and materials. Acids attack the metal oxide as readily as the encrustation and so are too damaging to consider. Even if successful, chemical techniques pose problems in recording associations, observations, and measurements and in making casts from molds of completely oxidized artifacts.

TENETS OF CONSERVATION

Once artifacts are removed from the site or from an encrustation, they must be properly treated to prevent irreversible damage. When treatment is accorded an object, it can include both conservation and restoration. Conservation refers to the process of documentation, analysis, cleaning, and stabilization of an object. The main objectives of the cleaning and stabilization are the protection and prevention of adverse reactions between the object and its environment. Restoration refers to the repair of damaged objects and replacement of missing parts. A specimen may undergo both conservation and restoration, but in all cases the former has priority over the latter.

Conservation should not detract from the natural appearance of the object nor alter any of its scientific attributes since artifacts are a primary unit of study in archeology. The conservator should strive to process specimens so that they retain as much diagnostic data as possible and yet remain chemically stable. For example, every attempt should be made to preserve as much as possible of the original surfaces, form, and dimensions. In addition, all treatments should be reversible. This last requirement recognizes that a conservation treatment may not last indefinitely nor remain superior to all

future techniques. If it is reversible, the option to retreat is always open and the continued preservation of the material is assured.

When objects are treated, the basic attitude and approach should be cautionary and similar to that espoused by Plenderleith and Werner (1971:16–17). Basically they state that the past history of an artifact may impart features of significance pertaining to age and provenience that can validate its authenticity. Therefore, a preliminary examination of the object needs to be made to determine a course of action that will preserve the integrity of the specimen and maintain any significant attributes or any features relating to its manufacture or microstructure. In some cases, a corrosion layer may contain valuable archeological data, in which case it should be preserved and not indiscriminately removed. Only in those instances where the corrosion is unstable, conceals underlying details, or is aesthetically displeasing should it be removed. Above all, one should heed the cautionary advice given by Plenderleith and Werner (1971), "This work calls not only for knowledge, foresight, ingenuity, and dexterity, but for infinite patience. It should never be hurried [p. 17]."

The concern for the recording and preservation of the basic data derived from any given piece is essential and needs to be expressed by all laboratories that process archeological material. In archeological conservation there is often more to consider than just preservation of individual artifacts. One duty of the conservator is to stabilize the artifact so that it retains its form and diagnostic data. When treating archeological material that requires documentation of context, as well as preservation, the documentation demands equal emphasis and first priority.

Conservation is not only an important part of marine archeology because it preserves the cultural material but also because it can contribute significant archeological data. This is possible if the problems of conservation are approached with an archeologically oriented view of material culture. This view contributes a sensitivity to the nature and potential value of the archeological record and the importance of various types of associations. This approach has been invaluable throughout the processing of the material from 41 KN 10, and is a good example of the mutually beneficial relationship that can exist between archeology and conservation.

PRELIMINARY ARTIFACT EVALUATION

After each artifact is removed from an encrustation, it must be rinsed, carefully examined, and its condition evaluated to determine the most appropriate conservation treatment. It is useful to classify the metal specimens into one of three categories analogous to those suggested by Western (1972:83). These are based on weight/size ratio, close visual inspection,

testing the surface with a magnet, probing the corrosion layers with a dental pick, and occasionally using x-rays. The categories include

1. Metal objects with a substantial metal core and a consolidated surface capable of withstanding chemical, electrochemical, or electrolytic reduction without significant changes in the form or dimensions of the artifact. Electrolytic reduction is the preferred treatment in most cases.
2. Metal specimens that are badly corroded, but retain their overall shape. Very little or no metal may remain, and there is little overall supporting strength. Most treatments would alter the original form. The recommended procedure, therefore, is to stabilize the artifact by diffusing the soluble chlorides out in an aqueous solution of sodium sesquicarbonate and to consolidate the artifact with a substance such as microcrystalline wax or other synthetic consolidant.
3. Metal artifacts that are so badly oxidized and fragile they can only be consolidated. Any further treatment will usually completely disintegrate them. Casting the object itself or making a replica from the natural encrustation mold is often the only means of preservation or recovery.

Only after these categorizations have been made should the treatment begin.

CONSERVATION OF RECOVERED MATERIAL

It is not possible to detail all the conservation alternatives required to process the many metallic, siliceous, and organic objects recovered from 41 KN 10 in the space allotted here. Objects of the same material may be treated by a number of different methods, depending on their condition, diagnostic characteristics, and eventual deposition. All of these must be taken into consideration when the treatment is being considered. Only the more routine or most common TARL laboratory procedures are presented.

METAL ARTIFACTS

All aspects of the conservation of metal artifacts recovered from the 1554 Spanish shipwrecks and any underwater site in general are thoroughly discussed in an earlier TAC publication, *Conservation of Metal Articles from Underwater Sites: A Study in Methods* (Hamilton 1976). The interested reader is referred to that source. Additional information can be found in Plenderleith and Werner (1971), Pearson (1972a,b), and Patoharju (1964, 1975).

Iron

The conservation of iron from salt water environments presents the conservator with some of the most complicated problems. A generalized flow chart of the standard conservation alternatives for treating iron is shown in Figure I.3. At TARL if the iron (cast or wrought) has a substantial metallic core, it is cleaned by electrolytic reduction. The artifacts are set for electrolysis in one of the set-ups shown in Figure I.4. A 2% sodium hydroxide electrolyte, expanded steel anodes, and a current density that ranges from .005 amp/cm^2 for metal reduction to .1 amp/cm^2 for mechanical cleaning from the vigorous evolution of hydrogen are used. The iron objects are left in electrolysis until all the corrosive chlorides are removed; this requires about 2 months for a small spike and often up to 12 months for a hooped barrel gun. Throughout the electrolytic cleaning, the build up in the level of chlorides in parts per million is monitored in each change of the electrolyte as a guide to determine when the treatment is completed. At times, the electrolytic reduction is concluded in a 5% sodium carbonate electrolyte which is easier to remove than sodium hydroxide in the subsequent rinse in several different baths of boiling deionized water. After rinsing, the iron is dehydrated in 99% isopropanol. The surfaces of the metal are then sealed from the atmosphere to retard corrosion by submerging in molten microcrystalline wax.

Significant iron objects so badly corroded that they cannot withstand electrolytic reduction cleaning are cleaned by the very slow process of water diffusion. At TARL, the objects are placed in a stainless steel sterilizer that contains a 5% solution of sodium sesquicarbonate or sodium carbonate. The solution is heated to 50°C and is charged frequently until no further buildup of chloride is measured in the solution. The articles are then dehydrated in alcohol and immersed in microcrystalline wax. For some pieces a consolidating epoxy, polymethyl methacrylate or polyurethane, is required.

In other examples the only alternative is to make a cast of the object or of a natural mold of it formed by its encrustation. In these cases compounds of polysulfide rubber or silicon rubber are used. If desired, rigid casts are made of epoxy or polyester resin from the rubber molds or casts. For details on TARL's procedure for casting, see Hamilton (1976:72–85).

Silver

The silver objects recovered from 41 KN 10 consist entirely of coins, silver disks, and small fragments of disks. The silver objects are mechanically removed from the encrustation; but in some instances, 10–20% formic acid is used to remove any residual encrustation close to the surface of the metal. All the coins with substantial metal remaining are cleaned by electrolytic reduction using 5% formic acid as the electrolyte and platinized

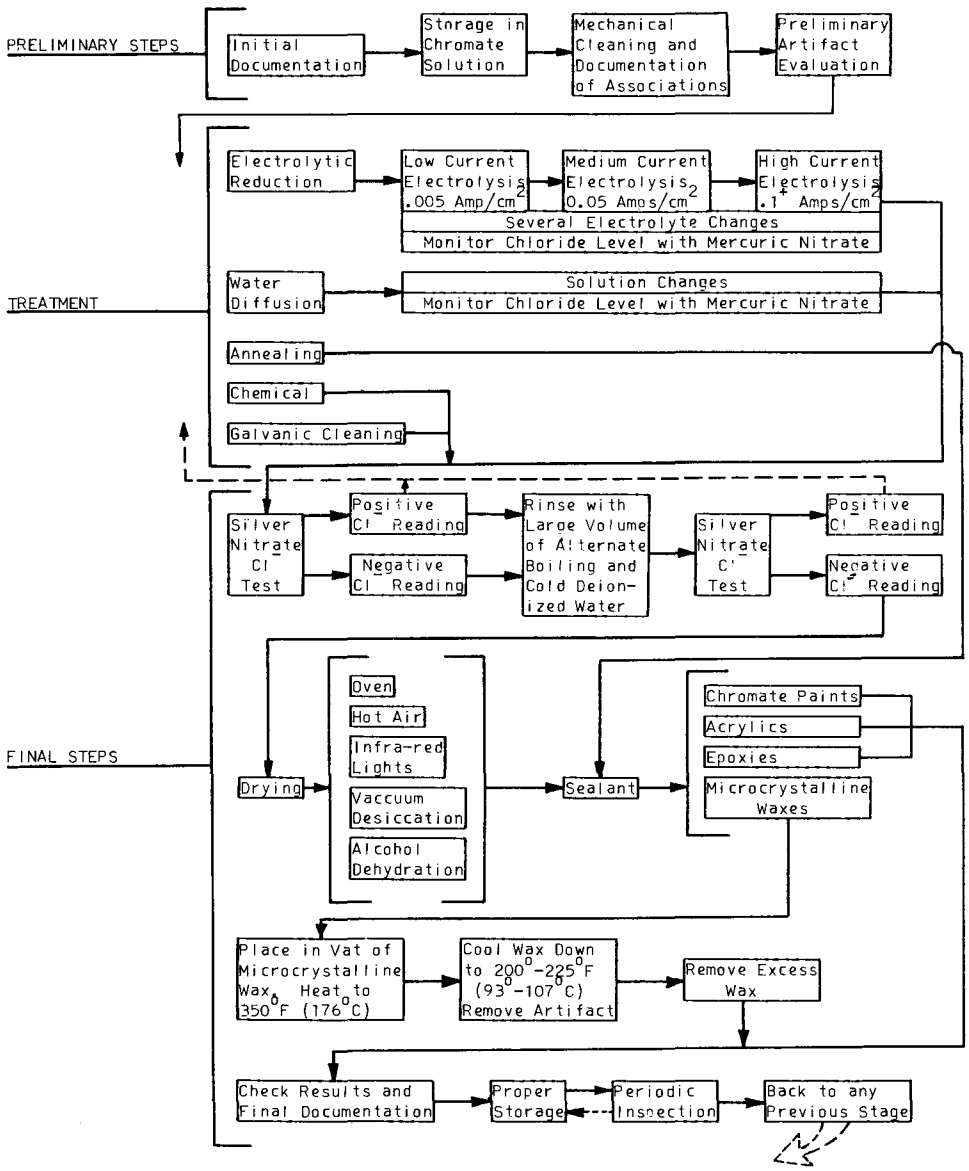


FIGURE I.3. Alternatives for treating iron.

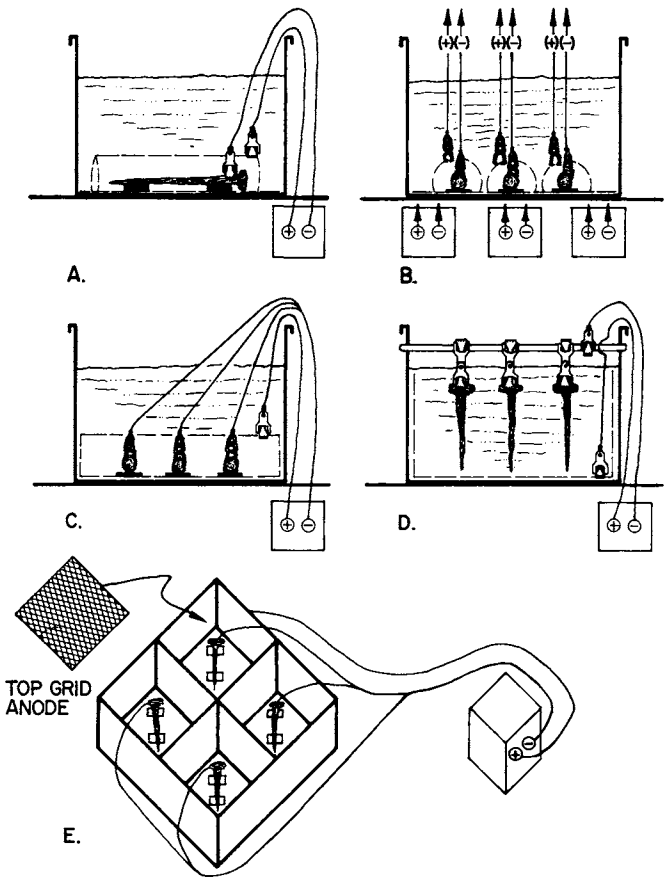


FIGURE I.4. Five alternative electrolysis set-ups.

titanium as the anode. The coins are placed on a copper screen with the anode suspended above them (Figure I.5). Periodically the coins are removed from electrolysis to turn the coin over and to brush off the reduced corrosion products. In the process of cleaning, the surface of the coin is often plated with copper. This is removed by dipping the silver in a .2*N* solution of silver nitrate and brushing. Some of the smaller disks and small fragments were cleaned in the same manner as the coins. The larger disks, however, were also cleaned by electrolysis, but 2% sodium hydroxide is used as the electrolyte with the disks sandwiched between two type-316 stainless steel anodes. See Hamilton (1976:36, 63) for a discussion on the advantage of the different electrolytic set-ups.

Following electrolysis, the silver is rinsed in several changes of boiling deionized water. If a polish is desired on the silver, it is rubbed with a wet paste of sodium bicarbonate after rinsing. The silver is then dried by dipping

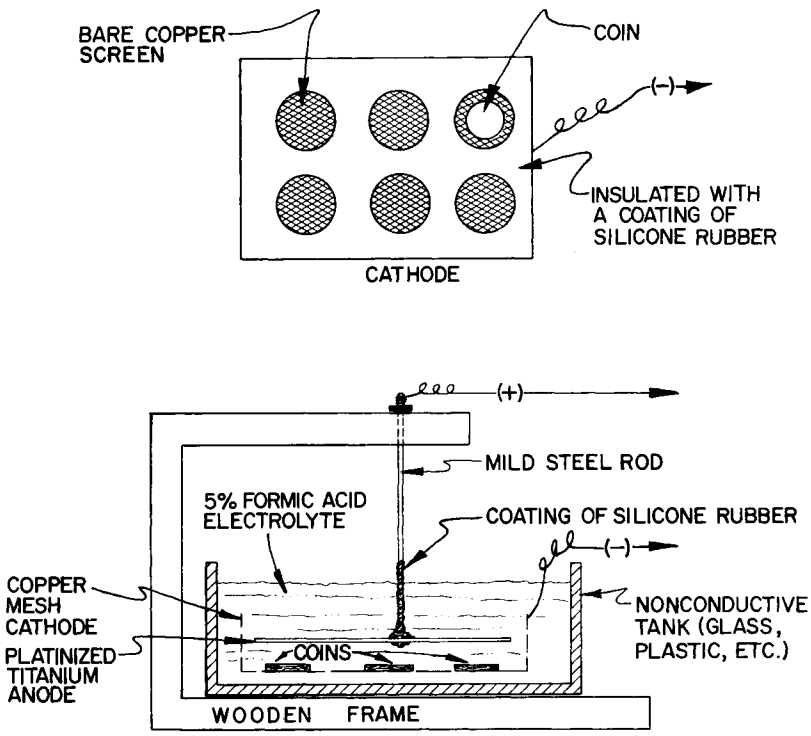


FIGURE I.5. Electrolysis of silver coins.

in acetone and sprayed with clear acrylic lacquer to seal it from the atmosphere.

Frequently coins are encountered in the encrustation that have been completely converted to silver sulfide, forming a cohesive sulfide wafer that retains all the original markings. Sulfide coins are merely rinsed in deionized water, dehydrated in acetone, and thoroughly consolidated with a 5–10% solution of polyvinyl acetate in acetone.

Lead and Pewter

Most of the lead artifacts consist of lead strips and weights. Most of these are cleaned chemically by soaking in 10% hydrochloric acid (Caley 1955) followed by thoroughly rinsing in deionized water and coated with either microcrystalline wax or clear acrylic lacquer.

The pewter utensils are cleaned by electrolytic reduction in 2% sodium hydroxide with expanded mild steel or stainless steel anodes. In order to remove the residual sodium hydroxide electrolyte, electrolysis is followed by rinsing in several baths of very dilute sulfuric acid (15 drops H_2SO_4 per liter of water) until the pH ceases to rise, then the artifact is

rinsed in several changes of cold deionized water until the pH ceases to drop (Penderleith and Werner 1971:269–270). The pewter is then coated with clear acrylic lacquer or microcrystalline wax and stored in a sealed polyethylene bag.

Cupreous Metals

The term cupreous metals is used to refer to any object of copper or an alloy in which copper predominates, such as bronze or brass. Copper artifacts are cleaned by electrolytic reduction in 5% formic acid with platinized titanium anodes or in 5% sodium carbonate with type 316 stainless steel anodes. As with iron, it is imperative that the corrosive chlorides be removed. The objects are then rinsed in deionized water. Alternatively they can be rinsed in ethanol (Pearson 1972:304) to prevent the tarnishing that occurs when rinsed in water. A final sealant of clear acrylic spray is used.

The corrosive chlorides are diffused from very extensively mineralized cupreous articles by extensive, and often long-term, rinsing in changes of 5% sodium sesquicarbonate (Organ 1763b) until the object is chloride free or the bulk of the chlorides are removed. The object is then rinsed in several changes of deionized water, dehydrated in acetone or a water-miscible alcohol, and coated with clear acrylic lacquer or microcrystalline wax. For increased corrosion protection, 3% benzotriazole can be added to the drying alcohol or even to a solution of polyvinyl acetate in ethanol which can be applied to the surface.

Gold

The gold objects from 41 KN 10 consist of one gold ingot and a small wooden cross (Figure 63) partially covered with gold. Only the cross required any treatment. In this case the gold was ignored and the wood treated, since nothing done to the wood would affect the gold.

WOOD CONSERVATION

The Texas Archeological Research Laboratory has not initiated any extensive research to develop new procedures for treating waterlogged wood. We have, however, tried most of the procedures reported in the conservation literature. Of particular value are the conservation techniques reported in Christiansen (1970), Muhlethaler (1973), and Oddy (1975). Only the polyethylene glycol 4000 and the acetone rosin treatments are described briefly in what follows.

POLYETHYLENE GLYCOL

The majority of the waterlogged wooden objects treated by TARL are treated with polyethylene glycol (PEG) 4000 in an alcohol or aqueous solution. The smaller wooden artifacts, such as oak barrel staves, breech chamber plugs, and miscellaneous pieces of wood, are treated in PEG 4000 dissolved in isopropanol, ethanol, or methanol because objects can be treated much quicker in an alcohol solution than in an aqueous solution. At TARL isopropanol is used. Whenever feasible the wood is pretreated with 3.5% hydrochloric acid (1 part HCl/9 parts H_2O) once it is removed from the encrustation or otherwise prepared for treatment in order to remove any remaining encrusting material, along with the calcareous secretions lining teredo worm burrows, and to bleach the wood to a more natural color.

After thoroughly rinsing the acid from the wood, the water in the wood is replaced with isopropanol by placing the wood in a succession of alcohol baths. The first bath is 50% alcohol/50% water, the second 80%/20%, and all additional baths are straight alcohol. Once the wood is completely saturated with alcohol the wood is placed in a container with 10% solution of PEG in isopropanol and heated to 30–40°C. The PEG concentration is slowly increased through evaporation of the alcohol, the addition of more PEG, or a combination of the two until a 100% molten liquid of PEG is reached. The wood is removed, and the excess wax wiped off the surface. The wood is then allowed to dry at room temperature. The duration of the process is dependent upon the size and thickness of the specimen being treated.

The large pieces of wood, such as planks, ribs, and gun carriages, are treated in an aqueous solution of PEG 4000. The cost of treating large pieces of wood in an alcohol solution is prohibitive. In aqueous solutions a fungicide consisting of a 2% mixture of 7 parts boric acid and 3 parts borax (Barkman 1975:82) has been used by TARL; however, in treating the stern section of the keel of white oak, a .1% solution of sodium orthopheny/phenate (Dowicide A) is being used. The percentage of fungicide is based on the weight of PEG in the solution. Smaller objects of wood are pretreated with 3.5% hydrochloric acid. The keel is being treated in a mild steel vat (16 × 4 × 2 feet) coated with epoxy enamel with thermostatically controlled strip heaters on the bottom of the vat. The solution is heated to 50–60°C and continuously circulated with a pump. Initially the keel was placed in a 5% aqueous solution of PEG, which will be slowly decreased to a maximum concentration of 60% PEG over the 2–3 years' estimated duration of the processing. Since the large oak keel has substantial core wood, care has to be taken as the PEG concentration reaches 40–60% to prevent possible shrinkage caused by the PEG drawing out the water in the heartwood where the large molecules of the PEG 4000 have difficulty penetrating (Christiansen

1970:49). During the treatment of large oak pieces with sound heartwood from the *Wasa* it was determined that high concentrations of PEG were both unnecessary and uneconomical; therefore, they did not exceed 75% PEG during the processing and prolonged the treatment time at the lower concentration (Barkman 1975:72, 82).

ACETONE/ROSIN

Several small breech chamber plugs and the gold-bound wooden cross were treated by the acetone/rosin process (McKerrel, Rogers and Varsanyi 1972). The treatment consists of pretreating the wood in 3.5% hydrochloric acid, rinsing out the acid, immersing in three baths of acetone to remove the organic acids and to dehydrate the wood, then placing it in a saturated solution (67%) of rosin (colophony) in acetone for a length of time determined by the thickness of the wood being treated.

The treatment of the cross with acetone/rosin proved successful; however, varying results were obtained with several breech chamber plugs of branches (ca. 5 cm diameter and 3 cm thick), which underwent considerable radial and tangential shrinkage. Other plugs were successfully treated. In comparing the results achieved with acetone/rosin and PEG 4000 in alcohol, consistently better results have been achieved with the PEG, and it is this method that TARL relies on for treating small wooden objects. The cost of using acetone and rosin or PEG in alcohol and the flammability of the solutions make them impractical for treating any large wooden object.

CONSERVATION OF MISCELLANEOUS ORGANIC MATERIAL

A number of miscellaneous organic specimens, other than wood, occur with some regularity in the encrustations. Included under this category are various food remains, textile fragments, and even cockroach exoskeletons and egg cases. The food remains, such as olive pits, almond shells, hazelnuts, and pig bones, generally require only mechanical cleaning. A few require some cleaning with 10% hydrochloric acid, after which they are thoroughly rinsed to remove the acid residue. Regardless of whether or not treatment with acid has been accorded, the specimens are thoroughly rinsed to remove any soluble salts which might crystallize near the surface causing the objects to exfoliate. After rinsing, the specimens are dehydrated in acetone and then consolidated with several applications or immersions in 5–10% PVA dissolved in acetone. The procedure of dehydrating the organic specimens in

acetone and then applying a PVA/acetone solution has been found to consolidate the bone better than applying an aqueous emulsion of PVA to the wet material.

Of considerable interest were the cockroach exoskeletons and even cockroach egg cases (see Appendix H). The chitin of the exoskeleton was revealed as carefully as possible, leaving it *in situ* in the encrustation. They were then thoroughly rinsed, dehydrated in acetone, then a layer of PVA in acetone was brushed over the chitin to add an extra measure of protection. The cockroach egg cases were found in the ropes lashing a bombard gun tube to its wooden undercarriage. The egg cases were removed by immersing the lashings in 10% hydrochloric acid. They were then rinsed and consolidated in 10% polyvinyl alcohol. Polyvinyl alcohol was used because it is water soluble and could be applied directly to the wet egg cases. More importantly, polyvinyl alcohol was selected because it has less gloss, is more transparent, undergoes much less shrinkage, and therefore exerts less contractible forces on the egg cases which are very thin, fragile, and easily distorted.

TEXTILES

Most of the encrusted organic specimens could be removed entirely by mechanical means without resorting to chemicals. It is extremely difficult, however, to mechanically remove textile and rope fragments without damaging them. Once detected in a conglomerate, as much of the encrustation is removed from around the specimen as possible without damaging the fibers. The remaining encrustation is removed by immersing in 10% hydrochloric acid. The hydrochloric acid also removes iron stains; however, this can be accomplished more safely with 10% oxalic acid. For some textile fragments, 1% hydrofluoric acid is required to remove very difficult iron stains. Immersion in 5% hydrogen peroxide bleaches textiles and removes sulfide stains which are very common.

After the textiles or rope fragments are removed from the surrounding encrustation, and the stains removed, it is necessary to rinse the pieces thoroughly in water and then dehydrate in acetone. They are then consolidated in 10% PVA (Bakelite AYAA) dissolved in acetone. Alternatively they can be consolidated with 10% polyvinyl alcohol after they are rinsed and still wet. The polyvinyl alcohol can be applied directly to wet specimens and is a more flexible consolidant that has less tendency to distort the fibers through shrinkage. At times the cloth has to be consolidated *in situ* in the encrustation, and there are several examples in which the cloth or rope exist only as an impression in the encrustation. In the latter cases the surface of the textile impression in the encrustation is consolidated with PVA after thoroughly rinsing. Then latex peels or rubber casts can be made.

CERAMICS

The successful cleaning of encrusted pottery from marine sites presents some still unsolved problems. The pottery from 41 KN 10 consists of numerous earthenware olive jar and majolica sherds, along with a few sherds of Cologne stoneware. The initial problem is to remove them from the encrustation, which is achieved primarily by mechanical cleaning with a pneumatic scribe. In most cases mechanical cleaning is all that is required. Residual calcareous material that may remain can be removed by immersing in 5–10% hydrochloric acid, but considerable monitoring is required if this is done to prevent damage to the paste and especially the various metallic glazes and enamels on some of the pottery. Spot application of 10% nitric acid is sometimes used to remove iron oxide stains that are present on many of the sherds. The danger in using any of these acids is that they can weaken the pottery by dissolving the iron oxides from the body paste and can alter the colors of the glazes and paints. When large numbers of encrusted sherds have to be processed, few feasible alternatives to acid treatment are presently available. Key specimens are selected for more meticulous hand cleaning.

After any chemical cleaning is used on ceramics, they are thoroughly rinsed to remove all the chemical residue, but more importantly they are rinsed to remove all the soluble salts in the pottery that would crystallize and damage the surface of the sherds. Regardless of the treatment, it is imperative that the soluble salts be removed before the treatment is completed. Until these salts are removed, the sherds must be kept wet.

Olive and Pearson (1975) discuss the danger of using acids to clean pottery and recommend the use of a 10% solution of tetra-sodium salts of ethylendiaminetetra-acetic acid (EDTA) to remove calcareous concretion. This procedure is effective and has minimal effect on the iron content of the ceramics, but it is often very slow. When iron sulfide, an especially common corrosion product, or organic stains obscure the glazed and painted surfaces of the pottery, they can be removed by submerging in 20–25% hydrogen peroxide. After rinsing, the sherds are dried by immersing in a series of acetone baths. The first bath is 50% acetone/50% water; the last bath is straight acetone.

Regardless of the treatment, if the sherds are friable or the glaze or the paints on the majolica have a tenuous bond with the body of the sherd, the pottery needs to be consolidated with a thin solution of polyvinyl acetate (PVA) dissolved in acetone or a PVA emulsion. At TARL, immersion or painting with several coats of a 5–10% solution of PVA (Bakelite AYAA or AYAF) dissolved in acetone is generally used.

Once dried and consolidated, if necessary, the different sherds are glued together with a variety of commercial PVA or cellulose nitrate products (Mibach 1975:55–61). Similar preparations are easily mixed in the labora-

tory (Dowman 1970:71–72). To date, no restorable ceramic vessels have been recovered from 41 KN 10.

CONSERVATION CONSIDERATIONS

Clearly, detailed information can be lost if an attempt is made to process marine encrustations in the field. Many of the specimens are completely converted to corrosion compounds. Although these specimens are not even recoverable in the lab, their proveniences can be recorded, measurements taken *in situ,* and locations shown in all drawings. Their presence is just as important as the artifacts which survive intact. Additional information is recovered by casting the natural molds and impressions from obliterated silver stamps and other disintegrated objects. Occasionally the only possible documentation is in the form of *in situ* photographs and measurements from which reconstructions can be made. At times recorded observations have to suffice.

The expenses involved in conservation force some hard decisions. With continuing increases in the costs of utilities, equipment, chemicals, and labor, it is not economically feasible to treat every artifact from a site. Large objects pose special problems because of the equipment required to process them and the great expense inevitably involved. The decision as to what to treat or not to treat must be worked out with the investigating archeologist. Factors such as budget, facilities, and time are important considerations. In lieu of total conservation, photographs and scaled drawings will sometimes have to suffice for the more common specimens and even for some of the less ordinary pieces.

Much more is contributed by the conservation laboratory than simply individual objects which have been stabilized. In consultation with the archeologist directing, TARL documents the associations, documents and photographs the artifacts, makes scaled drawings, makes preliminary identifications, arranges or conducts various analytical tests, has wood samples, bones, and other faunal material identified, and makes casts of artifacts in addition to cleaning and stabilizing the material. The conservator also often makes suggestions as to what items should be left for display, occasionally leaving pieces untouched or only partially exposed. For example, from encrustation No. 304 the articulated pig's foot (Figure 89) was exposed and left *in situ* in the encrustation for display purposes.

The role of the conservation laboratory is usually considered to be completed after the initial preservation is performed. It remains, however, for a trained conservator, who knows what the telltale signs of corrosion or deterioration are, to insure their continued stability. Any artifact evidencing signs of deterioration must be reprocessed. No conservation process can be

assumed to last indefinitely and, depending on storage or display environment, some will have to be retreated at some time in the future. The objective of any conservation technique is to delay this reprocessing as long as possible and to make any necessary retreatment brief.

INTERACTION OF CONSERVATION AND ARCHEOLOGY

Archeology and conservation have a symbiotic relationship. Conservation provides archeology with archeological data, and archeology contributes material to be processed which also can be used for research and experimentation in conservation. Treating of archeological specimens makes it possible for the conservation laboratory to contribute valuable information to the technology of conservation. In addition to utilizing established preservation techniques, new procedures can be tried on unimportant or numerously represented objects, and the more successful ones can then be applied to museum and art collections. The detailed records on treatment maintained on specimen record cards make it possible to evaluate the treatment of each object over a long period of time.

Nevertheless, conservation cannot be considered an independent discipline; there must be continuous interaction between it and archeology. The operations of the conservation laboratory should be included in the research design and the budgeting of archeological excavation projects. Scheduling also is important. The conservation laboratory has to have time to process the material to coincide with the report schedule. From the time the processing begins the laboratory has a continuous input, providing data to be incorporated in the report. There is a continuing interplay of ideas between the conservator and the archeologist throughout the processing, lasting until the final report is published. Cooperation between the Texas Antiquities Committee's underwater archeology program and the Texas Archeological Research Laboratory of The University of Texas at Austin has been highly productive of archeological data and conservation technology and has been mutually beneficial to both organizations.

REFERENCES

Barkman, L.
1975 The preservation of the warship WASA. In *Problems of the conservation of waterlogged wood,* edited by W. A. Oddy. National Maritime Monographs and Reports No. 16:65–105.

Caley, Earle R.
1955 Coatings and incrustations on lead objects from the Agora and the method used for their removal. *Studies in Conservation,* 2(2):49–54.
Christensen, B. Brorson
1970 The conservation of waterlogged wood in the National Museum of Denmark. In *Studies in museum technology,* No. 1. Copenhagen: The National Museum of Denmark.
Dowman, Elizabeth A.
1970 *Conservation in field archaeology.* London: Methuen.
Hamilton, D. L.
1976 *Conservation of metal objects from underwater sites: A study in methods.* Austin: Texas Memorial Museum, Miscellaneous Papers No. 4, Texas Antiquities Committee, Publication No. 1.
McKerrell, H., E. Rogers, and A. Varsanyi
1972 The acetone/rosin method for conservation of waterlogged wood. *Studies in Conservation* 17(3):111–125.
Mibach, E. T. G.
1975 The restoration of coarse archaeological ceramics. In *Conservation in archaeology and the applied arts.* London: The International Institute for Conservation of Historic and Artistic Works. Pp. 55–61.
Muhlethaler, Bruno
1973 *Conservation of waterlogged wood and wet leather.* Travaux et Publications XI. Paris: Editions Eyrolles.
Oddy, W. A. (Ed.)
1975 *Problems of the conservation of waterlogged wood.* Maritime Monographs and Reports No. 16. London: National Maritime Museum.
Organ, R. M.
1963 The examination and treatment of bronze antiquities. In *Recent advances in conservation*, edited by G. Thomason. Washington: Butterworth. Pp. 104–110.
Olive, J., and C. Pearson
1975 The conservation of ceramics from marine archaeological sites. In *Conservation in archaeology and the applied arts.* London: International Institute for Conservation of Historic and Artistic Works. Pp. 63–68.
Pathoharju, Ora
1964 Corrosion problems in marine archaeology. In *Current corrosion research in Scandinavia*, edited by Jon Larinkan. Pp. 316–323.
1975 Conservation of cannon recovered from the Brackish Sea. In *Conservation in archaeology and the applied arts.* London: The International Institute for Conservation of Historic and Artistic Works. Pp. 183–187.
Plenderleith, H. J., and A. E. A. Werner
1971 *The conservation of antiquities and works of art.* New York: Oxford University Press.
Pearson, Colin
1972a The preservation of iron cannon after 200 years under the sea. *Studies in Conservation,* 17(3):91–110.
1972b *Restoration of cannon and other relics from H.M.B. "Endeavor."* Report 508. Maribyrnong, Victoria: Department of Supply, Australian Defense Scientific Service, Defense Scientific Service, Defense Standards Laboratories.
Western, A.C.
1972 The conservation of excavated iron objects. *Studies in Conservation,* 16(2):83.

Appendix J

ARTIFACT MEASUREMENTS

TABLE J.1
Anchor Analysis

Site & specimen number	Length of fluke (f) relative to length of arm (a)		Length of shank measured in ½ arm lengths	Shank length (excluding ring) in meters	Angle (fluke to crown to shank)		Diameter of ring (r.d.) relative to length of fluke (f)	Weight in kilograms (pounds)
	arm 1	arm 2			arm 1	arm 2		
41 KN 10								
80-1	f < a/2	f < a/2	6 2/3	3.51	54°	56°	r.d. < f	342 (760)
81-1	f > a/2	missing	6 9/10	4.17	53°	missing	r.d. < f	310 (688)
156-1	f < a/2	f < a/2	7 2/5	3.54	62°	62°	r.d. > f	202 (450)
156-2	f = a/2	f = a/2	6¾	3.64	60°	58°	r.d. > f	279 (620)
157-1	f < a/2	f > a/2	6¾	3.25	56°	58°	r.d. < f(L)[a] r.d. = f(S)	156 (346)
159	f = a/2	f < a/2	6 2/5	3.81	57°	57°	r.d. > f	428 (950)
161-1	f < a/2	missing	6¼	3.34	64°	missing	r.d. ≃ f	104 (232)
41 KN 16								
310	f = a/2	f < a/2	6 3/5	4.31	56°	56°	r.d. > f	450+ (1000+)
Jetties Anchor	f < a/2	f < a/2	5½	3.59	54°	55°	r.d. > f	450+ (1000+)
Raymondville Anchor	f < a/2	f > a/2	6 4/5	3.47	53°	57°	r.d. < f	251 (570)
$\bar{X}$				3.66	56.9°	57.4°		298 (662)
σ				0.36	3.7°	1.1°		115 (256)
n				10	10	8		10

[a]#157-1 has drastically different fluke lengths so a comparison was made on the basis of both the longer f(L) and the shorter f(S) fluke.

TABLE J.2
Wrought Iron Nails and Spikes

The t-tests of each of the groups of spikes and nails confirmed a significant difference in the mean lengths of each group with the exception of the large and medium iron spikes.

TABLE J.2.1
Large Wrought Iron Spikes

Shank cross sections begin circular at head and become square as shank tapers to point. Measurements in centimeters.

Specimen Number	Length	Shank Diameter or Width	Head Diameter or Width	Remarks
5-26	19.4	1.4	3.7	oakum under head
5-29	20.7	1.5	3.8	oakum under head
5-90	22.0	1.4	4.3	oakum under head
102-3	18.8	1.7	3.8	length incomplete
221-8	19.0	1.2	2.6	
221-22	13.4	1.3	2.5	
$\bar{X}$	18.0	1.4	3.4	
n	6	6	6	
σ	2.95	0.17	0.73	

TABLE J.2.2
Medium Square Wrought Iron Spikes

Measurements in centimeters

Specimen Number	Length	Shank Width	Head Diameter or Width	Remarks
5-28	18.1	1.2	2.3	
5-32	17.5	1.2	2.3	Oakum under head
5-52	17.1	1.4	3.2	Oakum under head; length incomplete; tip missing
5-62	17.5	1.2	2.8	
5-64	16.3	1.4	2.9	Length incomplete
5-71	16.9	1.7	2.2	Head & length incomplete; tip missing
79-53	16.3	1.3	3.0	
102-8	17.0	1.4	2.7	
106-4	17.1	1.2	—	Spatulate tip; head badly oxidized
182-5	17.1	0.9	2.6	
183-2	16.4	1.1	2.0	Oakum under head; length incomplete
221-5	17.8	1.2	—	Head badly oxidized
221-14	16.9	1.1	2.8	
221-18	16.5	1.1	3.1	
221-20	16.7	1.1	2.8	Oakum under head
$\bar{X}$	17.0	1.2	2.7	
n	15	15	13	
σ	0.54	0.19	0.37	

TABLE J.2.3
Small Square Wrought Iron Planking Spikes

Measurements in centimeters

Specimen Number	Length	Shank Width	Head Diameter or Width	Remarks
5-14	15.6	1.0	2.5	
5-24	15.8	1.3	2.4	Oakum under head
5-33	16.0	1.2	2.8	Oakum under head
5-54	13.1	1.2	2.4	Oakum under head; length incomplete; tip missing
5-56	15.2	1.2	2.4	Length incomplete
5-70	15.2	1.1	2.6	Length incomplete
5-81	12.7	1.4	1.9	Length incomplete; tip missing
5-83	14.8	1.0	1.9	Length incomplete; tip missing
102-4	17.2	1.4	2.5	Oakum under head; length incomplete
102-5	15.9	1.2	2.1	
183-3	15.6	1.2	2.0	Oakum under head
201-2	15.9	1.2	2.0	
221-7	15.1	1.2	2.4	
221-9	12.9	1.0	1.8	Length incomplete
221-10	15.2	1.1	2.8	
221-11	15.9	1.2	—	Head badly oxidized
221-13	15.1	1.3	2.8	
221-15	15.0	0.8	2.1	Oakum under head
221-16	15.5	1.2	2.5	
221-24	15.1	1.2	2.4	Oakum under head
221-25	14.4	1.3	3.0	Oakum under head
81-98	13.6	1.1	3.3	
$\bar{X}$	15.0	1.2	2.4	
n	22	22	21	
σ	1.1	0.1	0.4	

TABLE J.2.4
Large Square Wrought Iron Nails

Measurements in centimeters

Specimen Number	Length	Shank Width	Head Diameter or Width	Remarks
5-45	6.2	1.0	1.9	Oakum under head; head badly oxidized; length incomplete
5-72	8.9	1.5	—	Head badly oxidized
5-87	13.5	0.8	2.2	
170-3	10.8	0.8	1.4	
$\bar{X}$	9.8	1.0	1.8	
n	4	4	3	
σ	3.1	0.3	0.4	

TABLE J.2.5
Small Square Wrought Iron Nails

Measurements in centimeters

Specimen Number	Length	Shank Width	Head Diameter or Width	Remarks
5-18	5.6	0.6	1.8	Length incomplete
5-58	5.0	0.9	—	Length incomplete; head badly oxidized
5-89	6.4	0.8	1.4	
5-99	7.7	0.6	1.4	
5-100	4.8	0.7	1.4	Length incomplete; tip missing
5-105	6.6	0.6	—	Head badly oxidized
105-6	8.6	0.6	1.7	
157-26	7.5	0.6	1.4	
$\bar{X}$	6.5	0.7	1.5	
n	8	8	6	
σ	1.4	0.1	0.2	

TABLE J.2.6
Aberrant Wrought Iron Spike

Measurements in centimeters

Specimen Number	Length	Shank Diameter or Width	Shank Cross Section	Head Diameter or Width	Remarks
5-11	23.4	1.3	Square	2.7	Spike; unusual domed head—may be unused form of head which is flattened when driven in

+ 34 unclassifiable broken or badly oxidized fragments

TABLE J.3
Wrought Iron Bolts

Measurements in centimeters

Specimen Number	Length	Shank Diameter	Head Diameter	Head Thickness	Remarks
5-58	—	2.9	5.5	2.5	Bolt; broken
41-1	66.0	3.1	4.7	2.5	Bolt; shank tapers to 2.8 near tip
161-24	41.5	3.8	5.1	2.4	Bolt; badly oxidized
182-4	27.7	2.5	3.9	1.5	Bolt; oakum under head
259-1	45.2	3.2	5.9	2.7	Bolt; length may be incomplete
51-1	49.5	2.9	5.2	2.0	Forelock bolt; shank tapers to 2.5 at tip; forelock slot 1.7 x 0.5, 2.0 from blunt tip; oakum under head
102-2	59.2	3.3	4.4	2.0	Forelock bolt; forelock slot 1.6 x 0.7, 1.4 from blunt tip
103-1	—	3.0	missing	missing	Forelock bolt fragment; forelock slot 1.7 x 0.7, 1.4 from blunt end
116	51.5	3.2	5.6	2.6	Forelock bolt; tapers to 2.5 near end; forelock slot 1.5 x 0.5, 1.9 from tip
182-8	35.0	2.8	5.7	2.7	Forelock bolt; forelock slot 1.2 x 0.6, 1.4 from tip
201-1	59.0	2.9	5.1	2.4	Forelock bolt; forelock slot 1.2 x 0.6, incomplete, 1.6 from tip
214	55.0	3.2	5.5	2.4	Forelock bolt; forelock slot 1.5 x 0.5, 1.5 from tip; oakum under head
156 (no sub-#)	38.0	3.0	—	—	Oxidized eye bolt (forelock) with chain; forelock slot 1.8 x 0.8, 2.0 from end; o.d. 9, i.d. 5
182-13	35.0	3.0	—	—	Eye bolt (forelock) with chain; o.d. 7.4, i.d. 3.1
308 (no sub #)[a]	36.0	2.5	—	—	Eye bolt with chain; completely oxidized
308 (no sub #)[a]	37.0	—	—	—	Eye bolt with chain; completely oxidized
308 (no sub #)[a]	38.0	—	—	—	Eye bolt with chain; completely oxizided
$\bar{X}$	44.9	3.0	5.1	2.3	
n	15	15	11	11	
σ	11.2	0.3	0.6	0.4	

[a] Measurements on oxidized standing rigging in #308 are at best rough approximations due to very poor state of preservation.

TABLE J.4
Wrought Iron Clinch Rings

Measurements in centimeters

Specimen Number	Outer Diameter	Inner Diameter	Thickness
5-7	4.9	2.9	1.1
5-30	5.3	3.0	1.2
107-2	5.6	3.4	1.5
107-10	5.6	2.9	1.4
156-16	5.8	2.9	1.3
208-2	5.6	2.8	1.5
$\bar{X}$	5.5	3.0	1.3
n	6	6	6
σ	0.3	0.2	0.2

One other completely oxidized and not measurable

TABLE J.5
Wrought Iron Breech Chambers for Versos (Swivel Guns)

Measurements in centimeters, weight in kilograms. Size divisions based on length.

Specimen Number	Length	Maximum Diameter of Chamber Bore	Maximum Outside Diameter at Mouth	Handle	Weight	Remarks
Small						
132-3	20.4	3.3	5.7	missing	3.10	Markings present forward of touch hole
132-5	20.0	3.3	5.3	missing	2.7	Markings present forward of touch hole; specimen badly oxidized
145-6	22.4	3.6	6.2	part present	—	Specimen completely oxidized; twisted hemp plug in touch hole
$\bar{X}$	20.9	3.4	5.7		2.9	
n	3	3	3		2	
σ	1.3	0.2	0.5		0.2	
Large						
129-1	24.2	2.3	4.6	missing	—	Completely oxidized
132-2	24.4	2.9	6.1	complete	4.59	Markings present forward of touch hole
132-4	26.1	4.4	7.3	complete	5.30	Markings present forward of touch hole
132-6	24.4	3.8	6.1	complete	5.23	Plugged & loaded
132-7	25.9	3.0	6.2	complete	4.66	Markings present forward of touch hole
132-8	24.4	4.8	6.1	complete	4.59	Markings present forward of touch hole
132-11	25.8	3.9	6.6	missing	3.73	Markings present forward of touch hole
145-7	24.3	2.8	6.6	missing	—	Specimen completely oxidized
145-8	24.4	2.8	6.2	missing	—	Specimen completely oxidized
156-13	24.5	4.2	8.1	missing	3.68	
175-3	25.5	4.3	8.0	part present	4.59	Markings present forward of touch hole
175-2	25.4	3.8	6.6	missing	3.68	Markings present forward of touch hole
175-1	25.5	4.1	7.0	missing	4.22	Plugged & loaded
$\bar{X}$	25.0	3.6	6.6		4.43	
n	13	13	13		10	
σ	1.2	0.8	0.9		0.6	

Note: All constructed from lap welded sheet of iron. Length is probably the critical measurement in achieving a good fit, and it was probably necessary to taylor each breech chamber expecially for its gun. Therefore, these size groupings are more a matter of convenience for description than of functional significance. The verso breech chambers from 41 WY 3 fell into more distinct size groupings by length: $\bar{X}$ = 22.0, σ = 1.4, n = 11 and $\bar{X}$ = 37.2, σ = 2.0, n = 7.

TABLE J.6
Wrought Iron Breech Chambers for Bombards or Built-up Guns

Measurements in centimeters, weights in kilograms (pounds). Size divisions based on length. All with two ring handles except #1650.

Specimen Number	Maximum Length Including Neck	Neck Extension	Neck Diameter	Outside Diameter of Tube	Number of Reinforcing Bands	Diameter of Bore	Weight	Remarks
Small								
72-1	56.0	4.5	9.9	18.4	9	4.4	68 (151)	Rings intact, not plugged or loaded; ring eyes part of reinforcement band
79-3	56.0	4.5	9.9	17.4	9	6.1	64 (144)	Rings oxidized, not plugged or loaded; ring eyes added separately
81-3	57.0	4.5	9.9	17.2	9	6.2	49 (108)	Specimen badly oxidized; bore not cleaned; one ring handle in fragments; one band missing at aft end; rope near ring
156-4	57.5	4.7	9.4	18.5	10	5.0	50 (111)	Specimen badly oxidized; one ring handle intact, not plugged or loaded; missing one (?) band
161-39	56.5	5.0	10.0	17.0	9	6.0	48 (107)	Specimen badly oxidized; ring handles oxidized
165-1	56.1	5.4	9.1	16.6	9	6.1	55 (122)	Specimen badly oxidized; ring handles oxidized, not plugged or loaded
170-1	55.6	4.1	10.0	17.6	9	6.1	72 (160)	Rings intact; loaded & plugged; marked at muzzle end & breech: XX on sleeve (9th band), X on breech (3rd band forward of touch hole)
$\bar{X}$	56.4	4.7	9.7	17.5		5.7	58 (128)	
n	7	7	7	7		7	7	
σ	0.7	0.4	0.4	0.7		0.7	9.9	
Medium								
74-1	64.0	5.0	10.0	18.4	11	6.0	86 (192)	Ring eyes added separately; ring handles intact, not plugged or loaded; marks present

79-1	63.8	5.8	11.7	17.5	10	6.5	77 (171)	Ring handles oxidized; rope fragments found in ring band eyes, not plugged or loaded; ring eyes added separately
79-2	63.1	4.8	11.7	20.2	11	6.7	82 (182)	One ring handle intact, not plugged or loaded; markings on touch hole; ring eye added separately
82-2	63.2	5.3	12.8	18.2	10	8.4	72 (160)	Specimen badly oxidized; rings oxidized; brass band may be a repair—seems to be over seam between reinforcing bands
118-1	67.0	6.8	10.2	17.1	13	5.2	66 (147)	Specimen badly oxidized; ring handles fragmentary; ring eyes added separately
122-1	63.5	4.5	10.5	18.0	11	6.1	69 (154)	Ring eyes added separately; one ring handle intact
150-1	64.0	6.5	9.3	17.5	10	6.4	54 (121)	Specimen badly oxidized; ring handles oxidized, loaded & plugged; ring eyes added separately
145-1	68.9	5.7	11.5	15.7	11	6.6	50 (111)	Specimen badly oxidized; ring handles oxidized
$\bar{X}$	64.7	5.6	11.0	17.8		6.5	69.5 (153)	
n	8	8	8	8		8	8	
σ	2.1	0.8	1.1	1.3		0.9	12.7	
Large 1650[a]	72.5	5.5	11.4	17.5	17	6.8	95 (211)	Only example of four ring breech chamber; ring handles intact; eyes for attaching rings in strips added on top of reinforcement bands; plugged & loaded; unusually small touch hole & only one with touch hole between 2nd & 3rd reinforcing bands

[a]Recovered during test excavations by the Underwater Institute in 1970

Note: For comparison the bombard breech chambers from 41 WY 3 fell into three groupings by length: $\bar{X}$ = 38.4, σ = 1.1, n = 2; $\bar{X}$ = 55.2, σ = .6, n = 3; and $\bar{X}$ = 77.5, σ = 3.8, n = 7. Only one of the largest was a 4-ring handle breech chamber measuring 73.8 centimeters in length, very similar to #1650 listed above. The medium sized breech chambers from 41 WY 3 are also very similar to the small group from 41 KN 10.

TABLE J.7
Ammunition

Measurements in centimeters, weights in grams

Specimen Number	Maximum Diameter	Weight	Remarks
Small Wrought Iron Balls			
81-9	3.4	—	Completely oxidized
81-24	4.0	63.8	Fairly complete but badly oxidized
81-39	3.7	—	Completely oxidized
81-62	3.9	—	Completely oxidized
81-83	3.3	—	Completely oxidized
81-101	3.7	—	Completely oxidized
157-7	3.4	56.0	Complete but badly oxidized
157-8	4.0	97.7	Incomplete
157-24	3.4	—	Completely oxidized
157-25	3.7	47.0	Incomplete
157-31	3.5	71.0	Incomplete
157-36	3.9	54.7	Incomplete
157-37	3.5	72.4	Fairly complete but badly oxidized
157-40[a]	4.0	116.3	Fairly complete
157-41[a]	3.4	88.5	Fairly complete
157-43	3.6	85.1	Incomplete
157-44	3.6	59.3	Incomplete
157-45	4.0	58.1	Complete but badly oxidized
157-50	3.5	—	Completely oxidized
157-51	3.9	55	Incomplete
157-52	3.9	130.7	Fairly complete
157-57[a]	3.7	60.2	Incomplete
157-70[a]	4.2	161.9	Fairly complete
157-72	3.6	53.8	Fairly complete but badly oxidized
157-77	3.6	107.2	Incomplete
157-79	4.0	130.3	Incomplete
$\bar{X}$	3.7	82.6	
n	26	19	
σ	0.2	32.9	
Large Wrought Iron Balls			
157-23	6.5	291.7	Incomplete
157-55	6.5	528.4	Incomplete
157-60	6.4	219.2	Incomplete
157-63	6.5	561.8	Virtually complete
157-78	6.4	478.5	Incomplete
157-168	6.5	—	Completely oxidized
161-4[a]	6.5	612.7	Complete
161-5	7.3	161.5	Incomplete
161-8[a]	6.5	643.6	Complete
161-67	5.9	227.7	Incomplete
$\bar{X}$	6.5	413.9	
n	10	9	
σ	0.3	188.0	

[a] Reasonably well preserved specimens. Original weights would have been somewhat heavier have been reduced by oxidation.

TABLE J.7 — (Cont.)
Ammunition

Measurements in centimeters, weights in grams

Specimen Number	Maximum Diameter	Weight	Remarks
Very Small Cast Lead Balls			
5-4	1.1	7.4	Good condition
5-5	1.6	6.5	Good condition
5-9	1.2	9.0	Good condition
189	1.2	10.0	Good condition
$\bar{X}$	1.3	8.2	
n	4	4	
σ	0.2	1.6	
Lead Balls with Iron Cores			
30	4.2	229.9	Iron core completely oxidized
81-5	4.1	279.5	Complete
81-6	4.3	312.0	Complete
81-8	4.2	345.8	Complete
81-25	3.9	201.8	Complete
81-38	4.0	271.2	Complete
81-76	3.8	217.7	Complete
119	3.7	218.7	Complete
123	4.0	157.0	Iron core completely oxidized
157-27	4.2	292.9	Complete
157-35	4.1	198.1	Complete
157-42	4.2	278.1	Complete
157-47	4.1	318.6	Complete
157-48	4.1	350.7	Complete
157-49	4.3	299.5	Complete
157-53	4.3	359.6	Complete
157-54	4.8	422.6	Complete
157-58	4.2	320.1	Complete
157-59	4.2	286.5	Complete
157-62	4.3	254.6	Complete
157-65	4.0	262.0	Complete
157-66	4.1	289.2	Complete
157-67	4.1	296.6	Complete
157-68	4.2	289.9	Complete
157-69	4.1	287.6	Complete
176	4.3	272.5	Complete
190	4.2	257.5	Complete
291	4.1	180.0	Iron core completely oxidized
$\bar{X}$	4.1	276.8	
n	28	28	
σ	0.2	57.9	
Stone Ball			
81-10	9.9	1147.3	Small fragment missing, but diameter measurements accurate

TABLE J.8
Small Lead Weights

Measurements maximum in centimeters, weight in grams

Specimen Number	Length	Base Size or Diameter	Cross Section of Body	Diameter of Suspension Hole	Weight	Remarks
122-3	8.9	2.5 x 3.1	Rectangular	0.5 x 0.5	508.0	Hammered, not cast; hole punched with square nail
124	5.6	1.7 x 2.5	Ovoid	.5	138.5	Probably hammered, not cast
136	8.5	2.85 x 3.4	Rectangular	0.6 x 0.7	448.2	Hammered, not cast
173	7.1	4.0	Round	.7	551.4	Hammered, not cast
268	9.8	3.6 x 3.7	Rectangular	0.5 x 0.5	713.4	Hammered, not cast; hole in top punched with square nail
$\bar{X}$	8.0	3.3		0.6	471.9	
n	5	5		5	5	
σ	1.6	0.6		0.1	210.7	

TABLE J.9
Silver Bullion

Disks, fragments, lumps, and irregular pieces. Italicized number in parentheses indicates number of times stamp appears on specimen. Dimensions in centimeters, weights in grams.

Specimen Number	Description	Maximum Length & Width or Diameter	Thickness	Weight	Stamps (by letter from Figure 52)
1-1	Medium disk, badly corroded	15.3	1.2	670.5	None discernable
5-10	Small disk	7.9	1.0	75.5	d *(1)*
19	Small disk	9.3	0.6	297.7	d *(1)*
20	Small disk	9.7	0.7	141.2	None discernable
21	Small disk	9.7	0.7	151.8	None discernable
22	Small lump	2.7 x 4.8	0.6	37.4	None discernable
42-1	Medium disk	15.2	0.8	829.2	b *(1)*

52-1	Small disk	9.4	0.8	253.1	d (*1*)
53-1	Medium disk	16.2	0.9	833.2	e (*1*), l (*1*)
81-22	Small disk	9.0	0.7	268.0	d (*1*)
81-58	Scrap	1.4	0.8	2.3	None discernable
81-84	Disk fragment	4.0 x 5.4	1.2	65.0	None discernable
81-103	Small lump	2.1 x 3.2	0.3	8.2	None discernable
84	Medium disk	11.0	0.8	530.0	d (*1*), e (*1*), d (*1*), & one unidentified
87	Medium	12.0	1.1	885.0	d (*1*), e (*1*), k (*1*), o (*1*)
89	Small disk	6.3	0.6	65.8	Faint impression of an unidentified stamp
91	Disk fragment	4.1 x 9.4	0.7	118.7	None discernable
94	Disk fragment	3.1 x 8.3	1.4	135.7	a (*1*)
118-2	Disk fragment	1.4 x 4.0	0.9	27.0	d (*1*), m (*1*), f (*1*)
120	Small disk	8.2	0.5	141.1	d (*1*)
121	Small lump	1.6 x 3.7	0.8	19.0	None discernable
122-2	Small disk	7.5	0.5	123.6	None discernable
141	Small disk	9.5	1.7	736.9	n (*1*) on bottom side
144	Irregular lump	4.0 x 6.5	0.7	86.8	None discernable — possibly a disk fragment
157-22	Scrap	1.1 x 2.5	0.3	4.1	None discernable
157-149	Scrap	1.1	0.8	1.9	None discernable
161-15	Small disk	6.0	0.3	42.5	None discernable
191	Irregular lump	1.6 x 3.0	0.5	11.5	None discernable — possible fragment of disk
193	Small lump, almost completely corroded	3.0	0.4	1.4	None discernable
196	Disk fragment	2.9 x 6.1	0.9	60.0	None discernable
199	Small lump	2.0 x 3.4	0.6	18.9	None discernable
257	Irregular piece	5.0 x 7.0	0.5	64.3	b (*1*)
258	Small disk	7.3	0.4	62.2	d (*1*)
260-1	Large disk	36.7	1.0	4620.0	d (*1*), e (*1*), k (*2*), o (*1*)
290	Disk fragment	10.0	0.5	144.8	Unknown since left encrusted for display purposes — X-ray indicates complete conversion to sulfide
305	Irregular piece	2.7 x 6.4	0.6	47.5	d (*1*)
$\bar{X}$		8.2	0.7	321.7	
n		36	36	36	
σ		6.1	0.3	782.9	

Note: all marks on upper surface except #141.

TABLE J.10.1
Silver Coins, Mexico Mint
Two Reales Coins

Measurements in centimeters, weights in grams. This table includes only those coins sufficiently complete for a valid measurement of each characteristic. Nesmith (1955:44) gives the uncirculated ideal weight of a two reales coin as 6.865 grams.

Specimen Number	Diameter	Thickness	Weight	Assayer	Remarks
5-2	2.8	.15	4.7	L	
5-15	3.4	.10	6.1	L	
81-19	2.7	.10	3.8	L	
81-40	2.6	.20	3.7	L	
81-42	2.7	.15	5.4	L	
81-54	2.8	.20	4.0	L	
81-61	2.7	.20	5.0	L	
81-71	2.9	.25	5.3	L	
98-2	2.7	.20	4.9	L	
105-2	2.8	.20	6.6	L	
122-15	2.7	.15	6.0	L	
142-4	2.6	.10	4.5	L	Poor condition
142-6	2.6	.15	5.9	L	
145-2	2.8	.15	5.7	L	
145-5	2.9	.15	5.0	L	
157-12	2.7	.15	4.3	L	
157-16	2.7	.10	4.5	L	
157-17	2.6	.15	5.1	L	
157-18	2.7	.10	5.6	L	
157-29	2.8	.10	6.0	L	
157-30	2.8	.15	6.6	L	
157-74	2.8	.10	4.5	L	
157-76	3.0	.10	4.5	L	
157-80	2.8	.10	3.4	L	
157-87	2.4	.10	1.9	L	
157-91	2.8	.20	5.5	L	
157-92	2.6	.20	3.4	L	
157-95	2.8	.20	3.4	L	
157-107	2.7	.20	5.8	L	
157-109	2.7	.20	5.7	L	
157-117	2.7	.20	4.6	L	
157-126	2.8	.20	6.4	L	
157-127	2.8	.20	6.1	L	
157-130	2.8	.20	6.1	L	
157-131	2.8	.20	5.2	L	
157-134	2.6	.20	4.9	L	
157-136	2.6	.15	2.8	L	

TABLE J.10.1 — (Cont.)
Silver Coins, Mexico Mint
Two Reales Coins

Measurements in centimeters, weights in grams. This table includes only those coins sufficiently complete for a valid measurement of each characteristic. Nesmith (1955:44) gives the uncirculated ideal weight of a two reales coin as 6.865 grams.

Specimen Number	Diameter	Thickness	Weight	Assayer	Remarks
157-140	2.9	.20	6.4	L	
157-142	2.7	.20	6.5	L	
157-158	2.8	.20	6.3	L	
161-9	2.5	.15	3.0	L	
161-12	2.8	.15	3.4	L	
161-19	2.5	.10	5.1	L	
161-29	2.2	.10	1.9	L	
161-32	2.7	.10	6.5	L	
161-53	2.7	.10	4.9	L	
161-54	2.8	.20	6.6	L	
161-55	2.7	.10	5.4	L	
260-3	2.7	.10	5.0	L	
5-6	2.8	.15	6.3	G	
5-16	3.1	.20	6.0	G	
81-20	2.9	.20	4.8	G	
105-3	2.8	.12	5.2	G	
157-13	2.7	.10	4.8	G	
157-14	2.7	.10	3.9	G	
157-20	2.9	.10	4.2	G	
157-106	2.8	.20	5.0	G	
157-155	2.6	.15	3.9	G	
161-16	2.7	.10	4.2	G	
161-18	2.7	.20	6.5	G	
161-35	2.2	.10	2.0	G	
81-88	2.5	.10	3.0	R	
129-8	2.8	.10	4.3	R	
129-9	2.4	.10	3.5	R (?)	Poor condition
157-105	2.8	.20	5.8	A	
157-116	2.7	.20	4.0	A	
157-128	2.7	.20	6.1	A	
157-146	2.8	.20	5.0	A	
157-159	2.7	.15	4.0	A	Poor condition
157-129	2.7	.20	4.1	S	
157-143	2.8	.20	5.4	R	Early series
$\bar{X}$	2.7	.16	4.8		
n	71	71	71		
σ	0.3	0.04	1.2		

TABLE J.10.2
Silver Coins, Mexico Mint
Four Reales Coins

Measurements in centimeters, weights in grams. This table includes only those coins sufficiently complete for a valid measurement of each characteristic. Nesmith (1955:44) gives the uncirculated ideal weight of a four reales coin as 13.731 grams.

Specimen Number	Diameter	Thickness	Weight	Assayer	Remarks
5-1	3.2	.20	13.3	L	
5-38	2.9	.15	7.0	L	Poor Condition
49-1	3.1	.20	9.6	L	
79-22	3.0	.20	9.7	L	
79-24	3.5	.20	7.4	L (?)	Poor condition
79-26	2.9	.20	4.8	L	Fragment in poor condition
79-30	3.3	.20	5.9	L	Fragment in poor condition
79-48	3.1	.19	8.7	L	Poor condition
81-4	3.3	.15	5.7	L	Poor condition
81-11	3.2	.30	10.2	L	
81-18	3.1	.20	8.4	L	Poor condition
81-34	3.1	.25	6.2	L	Fragment in poor condition
81-35	3.5	.20	10.8	L	
81-45	3.2	.20	8.7	L	
81-47	3.0	.20	7.1	L	
81-65	3.1	.20	12.2	L	
81-66	3.2	.20	12.2	L	
81-74	3.2	.20	11.6	L	
81-75	2.9	.25	4.6	L	
81-80	2.0	.20	6.5	L	Poor condition
81-91	3.1	.20	8.9	L	
81-92	2.8	.10	5.7	L	
81-95	3.1	.20	6.8	L	Fragment in poor condition
81-96	3.2	.20	7.1	L	Poor condition
81-97	2.9	.20	5.0	L	Fragment in poor condition
81-102	3.0	.15	6.8	L	Poor condition
100-1	3.3	.22	12.8	L	
100-2	3.2	.20	12.5	L	
100-3	3.2	.20	12.2	L	
100-5	3.2	.19	9.4	L	
100-6	3.1	.20	13.3	L	
100-7	3.2	.20	11.5	L	
100-8	3.3	.20	13.3	L	
100-9	3.2	.20	12.8	L	
100-10	3.2	.20	9.1	L	
100-11	3.1	.20	12.6	L	
100-12	3.1	.20	10.6	L	
100-13	3.0	.20	11.5	L	
100-14	3.0	.20	10.4	L	
100-15	3.3	.25	12.6	L	
100-16	3.2	.20	11.2	L	

TABLE J.10.2 — (Cont.)
Silver Coins, Mexico Mint
Four Reales Coins

Measurements in centimeters, weights in grams. This table includes only those coins sufficiently complete for a valid measurement of each characteristic. Nesmith (1955:44) gives the uncirculated ideal weight of a four reales coin as 13.731 grams.

Specimen Number	Diameter	Thickness	Weight	Assayer	Remarks
100-17	2.9	.15	6.1	L	Poor condition
100-20	3.1	.20	10.2	L	
100-21	3.1	.20	12.2	L	
100-22	3.2	.20	11.8	L	
100-23	3.1	.18	6.8	L	
100-24	3.0	.20	10.4	L	
100-25	2.8	.20	8.4	L	
100-26	3.0	.20	12.6	L	
100-27	3.3	.20	11.4	L	
100-28	3.2	.20	8.9	L	
100-29	3.2	.20	12.5	L	
100-30	3.2	.20	9.7	L	
100-31	3.2	.20	12.4	L	
100-32	3.1	.20	10.2	L	
100-34	3.2	.20	10.3	L	
100-35	3.2	.20	11.7	L	
100-36	3.2	.20	10.7	L	
100-37	3.2	.20	12.1	L	
100-38	3.3	.10	5.6	L	
100-39	3.2	.20	10.9	L	
100-40	3.2	.20	10.9	L	
100-41	2.9	.10	6.1	L	
100-42	3.2	.20	11.4	L	
100-43	3.1	.20	12.4	L	
100-44	3.1	.20	12.3	L	
100-45	3.3	.20	11.7	L	
100-46	3.4	.20	11.9	L	
100-47	3.1	.20	8.3	L	
100-48	3.0	.20	11.8	L	
100-49	3.3	.20	12.1	L	
100-50	3.3	.20	12.2	L	
100-51	3.2	.20	12.0	L	
100-52	3.1	.10	6.4	L	
100-53	2.9	.20	9.8	L	
100-54	3.3	.20	11.0	L	
100-55	3.3	.20	11.1	L	
100-56	3.0	.20	11.8	L	
100-57	3.0	.20	12.0	L	
100-58	3.2	.20	9.3	L	
100-59	3.1	.20	11.9	L	

TABLE J.10.2 — (Cont.)
Silver Coins, Mexico Mint
Four Reales Coins

Measurements in centimeters, weights in grams. This table includes only those coins sufficiently complete for a valid measurement of each characteristic. Nesmith (1955:44) gives the uncirculated ideal weight of a four reales coin as 13.731 grams.

Specimen Number	Diameter	Thickness	Weight	Assayer	Remarks
100-60	3.2	.20	11.7	L	
100-61	3.2	.20	8.4	L	
100-62	2.9	.20	7.7	L	
100-63	3.4	.20	8.8	L	
100-64	3.2	.20	12.2	L	
100-65	3.1	.20	10.0	L	
100-66	2.6	.20	8.5	L	
100-67	3.2	.20	11.2	L	
100-69	3.1	.20	10.6	L	
100-70	3.3	.20	10.2	L	
100-71	3.2	.20	11.8	L	
100-72	3.1	.20	11.8	L	
100-73	3.1	.20	12.7	L	
101	3.2	.20	11.1	L	
105-1	3.3	.20	13.2	L	
129-7	3.0	.20	11.1	L	
142-3	3.1	.20	11.6	L	
145-3	3.1	.20	13.1	L	
145-4	3.2	.20	13.3	L	
157-3	3.0	.15	8.4	L	
157-10	3.1	.20	11.1	L	
157-11	3.2	.20	9.6	L	
157-39	3.2	.20	11.3	L	
157-61	2.9	.20	9.4	L	
157-71	3.2	.10	6.2	L	
157-73	2.9	.20	7.7	L	
157-75	3.1	.20	7.0	L	
157-89	3.2	.20	11.7	L	
157-90	3.1	.20	9.4	L	
157-93	3.2	.20	11.1	L	
157-94	3.1	.20	12.1	L	
157-97	3.0	.20	9.6	L	
157-98	3.1	.20	11.4	L	
157-102	3.1	.20	10.1	L	
157-104	2.8	.20	7.7	L	
157-108	3.2	.20	12.4	L	
157-110	3.2	.20	11.1	L	
157-111	3.0	.20	10.4	L	
157-123	3.0	.20	9.0	L	
157-124	3.1	.20	7.7	L	

TABLE J.10.2 — (Cont.)
Silver Coins, Mexico Mint
Four Reales Coins

Measurements in centimeters, weights in grams. This table includes only those coins sufficiently complete for a valid measurement of each characteristic. Nesmith (1955:44) gives the uncirculated ideal weight of a four reales coin as 13.731 grams.

Specimen Number	Diameter	Thickness	Weight	Assayer	Remarks
157-132	3.2	.20	9.3	L	
157-135	3.1	.20	9.0	L	
157-137	3.1	.20	9.1	L	
157-144	3.0	.20	5.7	L	
157-145	3.0	.20	7.9	L	
157-156	3.3	.20	9.4	L	
157-161	2.8	.20	6.3	L	
157-164	2.9	.20	7.2	L	
161-2	3.1	.20	9.2	L	
161-3	3.0	.10	7.6	L	
161-11	3.2	.15	4.6	L	
161-13	3.2	.20	10.9	L	
161-20	3.2	.20	11.5	L	
161-21	3.0	.20	7.4	L	
161-34	3.3	.20	10.4	L	
161-41	3.2	.20	9.0	L	
161-44	2.9	.10	5.2	L	
161-45	2.8	.15	7.0	L	
161-52	3.0	.20	8.6	L	
161-57	3.1	.10	5.5	L	
161-60	3.6	.15	7.2	L	
161-62	2.7	.20	6.0	L	
161-64	3.1	.20	13.1	L	
161-66	3.3	.20	11.8	L	
183-1	3.2	.20	11.3	L	
187	3.0	.15	7.0	L	
221-1	3.0	.20	11.0	L	
256	2.9	.20	11.6	L	
260-2	3.1	.20	7.9	L	
100-68	3.2	.20	12.0	G	
122-7	3.0	.20	5.6	G	Fragment in poor condition
161-22	3.3	20	12.7	G	
100-19	3.1	.20	11.2	S	
100-33	3.2	.20	10.5	S	
157-21	3.1	.20	9.7	S	
161-30	2.8	.20	3.9	S	
106-1	3.0	.20	13.5	P	Early series
$\bar{X}$	3.1	.19	9.8		
n	158	158	158		
σ	0.2	0.02	2.4		

TABLE J.11
Silver Coins, Mexico Mint
Means and Standard Deviations by Assayer

			Diameter (cm)		Thickness (cm)		Weight (gm)	
		n =	$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ
2 Reales Coins								
Assayer	L	48	2.7	0.03	0.16	0.06	4.9	1.2
	G	13	2.7	0.2	0.15	0.05	4.9	1.3
	R	4	2.6	0.2	0.13	0.05	4.1	1.0
	A	5	2.8	0.05	0.19	0.02	5.0	1.1
	S	1	2.8	—	0 20	—	6.1	—
Overall		71	2.7	0.3	0.16	0.04	4.8	1.2
4 Reales Coins								
Assayer	L	150	3.1	0.2	0.19	0.02	9.8	2.3
	G	3	3.2	0.2	0.20	0.00	10.1	3.9
	S	4	3.1	0.2	0.20	0.00	8.8	3.3
	P	1	3.0	—	0.20	—	13.5	—
Overall		158	3.1	0.2	0.19	0.02	9.8	2.4

INDEX

Numbers in italics indicate illustrations

A 8
B 9
C 0
D 1
E 2
F 3
G 4
H 5