Cultural Resource Management Studies

CULTURAL RESOURCES EVALUATION OF THE NORTHERN GULF OF MEXICO CONTINENTAL SHELF

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ABSTRACT

A study of the occurrence of shipwrecks and related artifacts was conducted for the continental shelf area, northern Gulf of Mexico, from the Rio Grande River to the Florida Keys. The period of consideration extended from 1500 A.D. through 1945 A.D. Published and unpublished reports of losses and locations of known wrecks were utilized along with charts and maps. From this data, a listing of 1,904 reported losses and/or known wrecks was compiled, with a basic data sheet for each wreck. It is estimated that the total number of significant wrecks in the study area is between 2,500 and 3,000.

The nature of shipping, the character of the vessels, sailing practices in use, and routes were considered chronologically, with discussion and presentation being grouped into four periods as follows: 1) 1500-1699 A.D.; 2) 1700-1819 A.D.; 3) 1820-1865 A.D., and 4) 1865-1945 A.D.

Of the total shipwreck population, approximately 70 percent date from the 19th and 20th centuries. The remaining 30 percent, the wrecks from the 16th, 17th, and some from the 18th century, offer data which, unlike the information from more recent wrecks, may be unavailable from any other source.

It is estimated that approximately two-thirds of the total number of wrecks in the northern Gulf are within 1.5 kilometers of the coast. Another 500 wrecks probably lie between the 1.5-kilometer and 10-kilometer line. For the most part, wrecks are associated with approaches to seaports, straits, shoals, or reefs and along well established sailing routes.

In addition to shipwrecks, there are a number of danger zones on the continental shelf where hazardous materials such as bombs, missiles, and other ordnance are known to occur. Other areas have been used for waste dumping and may have concentrations of modern artifacts.

Current techniques employed in subaqueous cultural resource surveys are discussed and evaluated. These include remote-sensing tools such as magnetometers, side-scan sonars, and sub-bottom profilers. Recommendations for intensity of survey effort in the study area are made in a companion map volume. Zones are identified based on probability of culture resource occurrence, and intensity of survey effort is related to the various zones.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Since shortly after the discovery of the New World, when the first vessels of the Spanish explorers entered its blue-green waters from the south, the Gulf of Mexico has served western man not only as a highway along which he could travel and transport the goods and merchandise of commerce, but also as a surface over which the exchange of ideas has continually taken place. Since 1520, the year of the earliest shipwreck known in the Gulf, vessels of various types and nationalities and their cargoes have been lost to storms, other marine hazards, and hostilities in and along the shores. These losses steadily rose as commerce in the Gulf increased through the periods of colonization, expansion, and industrialization, until the period in the late nineteenth and early twentieth centuries when the tonnage of mechanically-powered vessels surpassed the tonnage of sailing vessels, and improved aids to navigation and broadcast storm warnings reversed the trend (Clausen and Arnold, 1974).

Due primarily to incomplete and often inaccurate historical records, the exact number of wrecks which have occurred in the Gulf of Mexico over these four and a half centuries will never be known. We do know, however, that the number of missing vessels is in the thousands, as Volume IV of this report testifies. More important than any attempt to quantify the number of wrecks is the growing realization that the shipwreck population constitutes an important cultural resource deserving of protection.

As targets for archeological research, shipwrecks have an important advantage over the majority of sites on land. This advantage, often referred to as "the time capsule effect," stems from the following two factors. First, the generally violent circumstances surrounding the demise of most

vessels insure that a broad cross-sectional sample of material culture of the period will be isolated at the wreck site. Secondly, through stylistic analysis of the artifacts or use of other evidence to determine the nationality and period of the wreck, followed by thorough, primarily archival historical research, this cultural sample can often be temporally placed to the day, occasionally the exact hour, that the sample was isolated (Clausen, 1967). By contrast, sites on land typically exist for periods of from several years to, in some cases, hundreds of years, often with considerable selection of the surviving artifactual sample through re-use. Habitation sites, particularly towns, have a tendency to drift spatially, often through such simple and relatively unpredictable mechanisms. Consequently, the longer sites have existed, the more difficult it becomes to closely date materials or other features associated with them, and the less valuable they are as indicators of change (Clausen and Arnold, 1974).

The investigation of shipwreck sites by underwater archeologists is analogous in some respects to the Federal Aviation Administration's investigations of airline crashes. Although FAA inspectors usually limit their efforts to determining why and how an airliner was lost, the same care is taken in gathering and recording the location of each piece of evidence from the site (because of the information an analysis of the inter-relationship of the parts to the whole might reveal) during both types of investigations. To go a step further, the reader can appreciate the depth of knowledge of our own culture, technology, and history that could be gleaned by an in-depth analysis of a modern aircraft, its equipment and instrumentation, including the electronics and the personal remains and possessions of the

passengers and crew by, for example, a hypothetical future archeologist or interested visitor from elsewhere in the galaxy. The analogy here is, of course, that the wreck of an ancient ship is related to its culture and time in much the same way a crashed modern airliner is to ours. Both had a broad purpose of communication and trade. Both transported passengers and required a somewhat specialized crew to operate the craft. Both contain a significant, although admittedly somewhat biased, sample of the material culture of their respective periods.

Although survival of materials in underwater wreck sites is selective in favor of non-organic, relatively dense substances, surprising instances of preservation have occurred. For example, pages of a book with legible print survived more than three centuries in a wreck off the eastern Florida coast (Harnett, 1965). From the Vasa, an early 17th century Swedish vessel, the hull of which was raised largely intact from the bottom of Stockholm Harbor, were recovered sea chests containing such perishable items of apparel as hats, sweaters, trousers and shoes, and even identifiable foodstuffs (Franzen, 1966). Moreover, those artifacts which do survive are often in a condition unequalled at coeval archeological sites on land, since they are taken from the hands of man unbroken or before their useful life has ended. Occasionally, materials are present which, because of their mundane character, are passed over entirely in the literature and collections of the period (Clausen, 1967). As examples of all of the above, archeologists have found hafted tools -- hammers and hatchets -- with large portions of their handles remaining, intact spirit bottles, and wooden packing chests for lead shot and silver coins recovered from a 250-year-old Spanish flagship off the Florida coast. More recently, a chest from a Spanish wreck lost in 1733 containing individual packets of perfectly preserved awls and sail makers' needles was found (Clausen, 1975).

This time-capsule effect and the condition of artifacts from wreck sites described above, in conjunction with the substantial number of vessels lost from the period of discovery through the present, create a continuous series of tightly dated sites covering, in the case of the Gulf, over four and a half centuries through which many aspects of the cultural development of the western world can be traced. For this reason, the shipwreck population in the Gulf of Mexico constitutes a valuable, although finite and non-regenerative, resource for the study and comprehension of the development of our present culture (Clausen, Saltus and others, 1974).

Statement of the Problem

This section of the cultural resources survey of the northern Gulf of Mexico discusses the spatial and temporal distribution of historic vessels, missile, and other artifacts in the study area. Although emphasis has been on the location and identification of shipwrecks on the continental shelf, such areas as gunnery ranges, missile impact areas, dumping grounds, and safety fairways have also been identified. These latter areas are the only recognized zones which concentrate artifacts or which contain known dangerous objects which are hazardous for recovery. A map has been devised which shows bands of shipwreck probability. The hazardous areas appear on current Coast and Geodetic Survey charts.

Survey Design

During the design phase of this project, it was decided that a compilation of shipwreck information based primarily upon secondary sources would be sufficient in terms of site distribution and density to adequately identify the theoretical boundaries between zones of relatively high and relatively low occurrence of historical-period shipwreck sites within the

Gulf of Mexico. On the basis of this judgement, the cultural resources atlas (Volume III) of this report was compiled; as planned, the distributional data from it was utilized to justify the delineations made and to reach certain other conclusions relative to the shipwreck population in the Gulf which are presented in this report.

To simplify the collection of data on shipwrecks, the survey was restricted to the predetermined region of the coastal zone and the adjacent waters of the northern Gulf of Mexico from the Mexican border to Key West, Florida (Figure 1). Within this area, shipwreck references and sites encountered in the course of the survey were included or excluded on the basis of the following general criteria.

1) Known and referenced sites within the survey area in the Gulf and along its shore were naturally included.
2) Included on the basis of probability were vessels leaving Gulf ports above latitude 26°00'00" North for ports on the east coast of the United States, Nassau, Caribbean ports, or Europe and reported "lost in the Gulf," even though in some portion of these, especially in the case of English vessels, this reference may have been to the Gulf of Florida (Straits of Florida) rather than the Gulf of Mexico.
3) Vessels bound out of these same ports and reported in the reference as simply "lost in the Florida Keys" were included on the basis that the general route followed by these craft lay toward the Dry Tortugas or the Marquesas and then along the balance of the Florida Keys eastward to longitude 80°30'00" West, the eastern boundary of the survey area. A relatively large, though at present unknown, quantity of these losses would have occurred within the survey area.

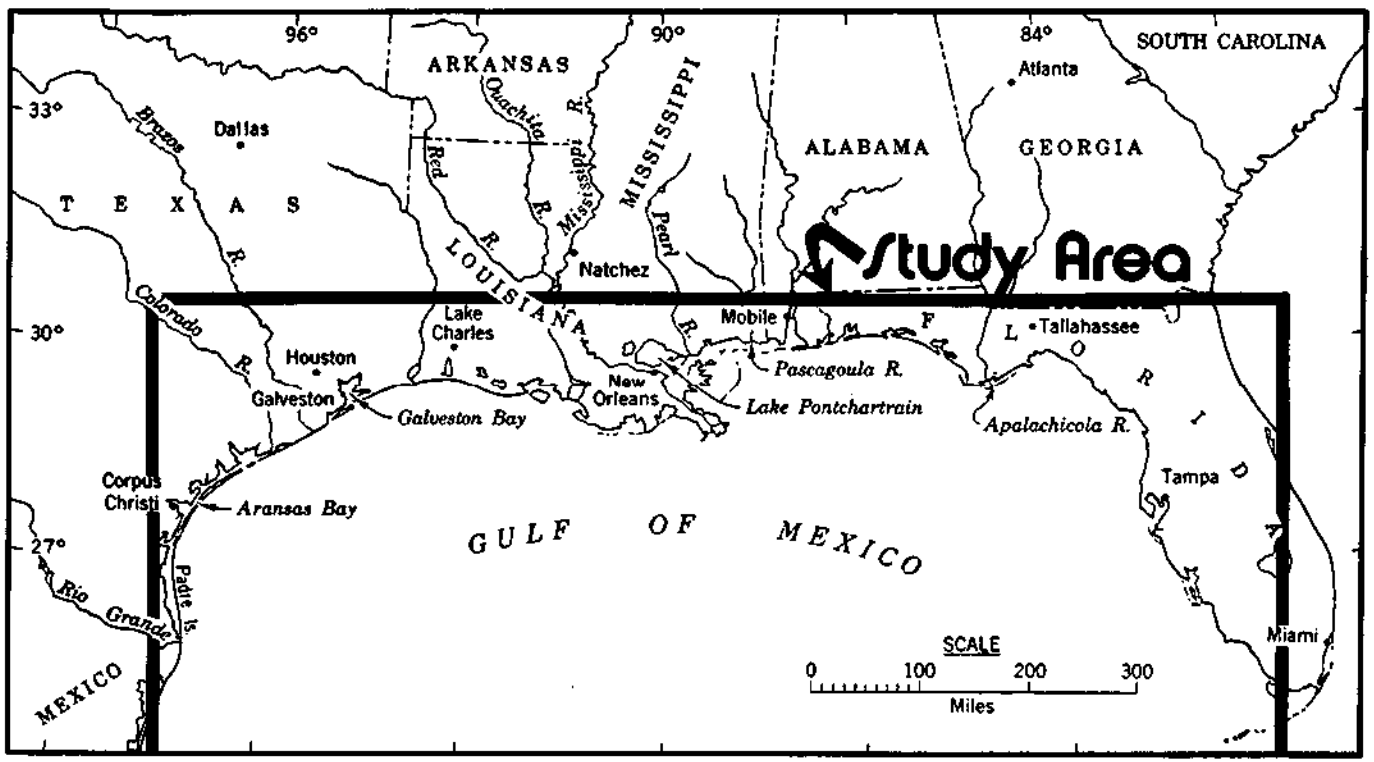

Figure 1. Study area for shipwreck site compilation.

4) English vessels bound from Jamaica or Honduras to ports on the eastern seaboard, England, and elsewhere in Europe were included if the reference simply indicated the area of loss as "the Florida Keys." A very high percentage of these vessels, after rounding Cabo San Antonio on the west end of Cuba, did not follow the Cuban coast eastward (a virtually impossible task during certain periods of the year due to the northeast trade winds) past Havana and thence past Cay Sal or Double Headed Shot Keys to the Bahama side of the straits. Many turned north, hoping to do one of three things: 1) sight the Tortugas, 2) come on soundings west of those islands, or 3) more dangerously, come on soundings between the Tortugas and the Marquesas Keys, and then proceed either up the Florida east coast or tack between that coast and the Bahamas. A relatively high proportion of the losses of vessels following this course can be expected to lie in the lower or western Keys, which were included in the survey area.

5) In dealing with the more-or-less fragmentary secondary references (some of their shortcomings will be commented on later) and some primary sources relating to the loss of Spanish ships, vessels were considered lost in the Gulf if they were en route from Vera Cruz and Campeche to La Havana or from New Orleans, Pensacola,or other Gulf ports to La Havana, and the source indicated that they had simply been lost "on the coast of Florida" or "in the Florida Keys." The general course for these vessels lay along much of the Gulf coast of that state, and their passage out of the Gulf into the Straits of Florida toward La Havana seldom deviated too far from one side or the other of the Dry Tortugas, an area of proved hazard to shipping.

6) On the other hand, without more specific information than the reference "lost in the Florida Keys," English, Spanish, and American vessels bound out of Havana for these same ports in North America and Europe were normally excluded from the survey. In the case of the English and American ships, they most often attempted to come within sight of the Florida Keys at a much higher latitude (in the vicinity of the Cape Florida - Cayo Tabona, now Tavernier Key, area). Romans (1775) states in the 1770's that nine out of ten vessels bound from Cuba (north) up the Gulf of Florida heave in sight of the Cape Florida area, and because of this, nine of ten that are lost coming on that course are lost here. The Spanish vessels leaving Cuba attempted to heave in also, although perhaps at a somewhat lower latitude. The vast majority of these losses in either case could be expected to fall east of longitude 80°30'00" West, the eastern boundary of the survey area.

Survey Limitations

Both the data assembled here and the conclusions reached in this effort are presently untested; in terms of project goals, the results define the probability zones of shipwreck occurrence and, thus, appear satisfactory. It would be indefensible to present this information without pointing out some of its principal shortcomings and some of the problems that were encountered in amassing it.

References to shipwrecks, specifically to locations, have a tendency to be characterized by a certain vagueness. This is primarily attributable to the essentially featureless medium which the sea presents. Man has only recently, with the invention, development, and general adoption of electronic

aids to navigation, such as radar and various radio-positioning equipment such as Loran, come to grips with the problem of knowing with accuracy the location of a vessel at sea under virtually any conditions. Prior to the advent of these devices, including radio, and before the introduction of chronometers, navigation was carried out through what might be described as "latitude and check-point-oriented dead reckoning."

Man has for centuries been able to determine latitude with instruments such as the astrolabe, quadrant, and sextant with reasonable accuracy. Anyone even reasonably adept with a sextant can, with some experience, determine latitude -- usually to within a minute (1/60 of a degree = 1 nautical mile) under reasonable conditions. Such was not the case, however, with longitude; naturally, both sets of coordinates are necessary to locate oneself with any degree of accuracy on the open sea.

The possibility that longitude might be determined at sea through the use of some form of timekeeper was first advanced by a Flemish astronomer in a work on navigation published in the first half of the 16th century. There was no means, however, in that day, and really for centuries after, by which a sufficiently accurate marine timekeeper could be constructed. The technology simply was not available. It was not until after 1750 that anything approaching an accurate mechanism was developed by the British, and really not until the 1780's that serviceable chronometers appeared on most large vessels at sea.

The inability to determine one's position with any great accuracy on an east/west axis, which prevailed for several centuries after the discovery of the New World, is the principal reason behind the strange shapes of the land forms found on early charts and maps of this hemisphere. The latitudes of cities, headlands, and other points important to mariners could easily be determined, but their location east to west could not. As a consequence, there

are maps of Florida, for example (which now practically any junior-high student in that state can draw a reasonable profile of), which show the peninsula as a triangle, very pointed at its lower (south) end and very broad where it joins the mainland.

Also, since latitude to mariners was easily and accurately determined, most of the early shipping routes equated with certain latitudes or latitude ranges. For example, the most favorable winds on which to return to Europe from the Western Hemisphere are the prevailing westerlies, which generally lie, depending on the season, between 30° and 50° North. Consequently, when a commander of a fleet or the captain of a single ship wished to cross the Atlantic, he simply moved north or south along the Atlantic Coast until he found the winds fair within this latitude range. He then turned east following that latitude through observation, until he began to encounter what mariners refer to as "land signs," moving more cautiously until land was actually sighted. When, through identification of some landmark, his position was established, he simply turned either north or south along the European coast and proceeded to his destination.

Most vessels, however, were lost under less than ideal conditions. During storms it may not have been possible for many hours, several days, or even a week or more, to make the necessary observations to determine one's latitude. Add to this the fact that it was entirely feasible, even without a great deal of luck, to sail from continent to continent without once determining one's longitude, and that many captains for centuries did just that, and one may begin to appreciate the vagueness in the reports of certain references to losses.

It was not customary or feasible to maintain one's position at sea with any great accuracy on merchant ships even as late as the Second World War.

Thus, even the longitudes and latitudes of vessels torpedoed and sunk in the Gulf, unless determined or confirmed by sonar contact after the loss, do not reflect their true position, but the last reference that the navigator was able to give the radio operator of the stricken ship, which, in at least one instance we know of, was off by at least an hour.

Even under the best of conditions, the survivors of a shipwreck, even the officers, may not have been aware of exactly where their vessel was lost, especially if the loss took place some distance from land. For this reason, and because the data assembled for this phase of the survey was amassed primarily from secondary sources, some of which we shall offer comment on below, the reader is cautioned to view these locations (with the possible exception of some of the wreck site references) as possibly accurate within .25 to perhaps 10 kilometers.

Of course, the principal weakness in this compilation of data on shipwrecks in the Gulf of Mexico is the fact that it was done primarily from secondary sources and, thus, suffers from several drawbacks of information of this nature. In particular, the data on Spanish losses in the Gulf (followed closely by those of the French) are open to criticism on this point. Much of the data on Spanish losses were assembled from popular compendiums containing sections on shipwreck sites in the Western Hemisphere. An increase in books of this type followed publication of the first edition of John S. Potter's The Treasure Diver's Guide (1960). One of the most recent entries is Bruce D. Berman's Encyclopedia of American Shipwrecks (1972). Berman's book dispenses with the combination of treasure hunting and underwater amateur archeological lore which characterizes many of the other entries in this field. While some authors, like Potter, go to extremes to verify entries, there is a tendency among the popular writers (in their efforts to thoroughly cover the field) to

include references from previous secondary sources. This process insures that any errors or prejudices of earlier writers, some of whom published in the 1940's and 1950's,are perpetuated.

An example of this problem is the inclusion in many of these works of what Potter has dubbed "ghost galleons," a typically Spanish vessel with an extremely rich cargo which usually sank in an unidentified deepwater location. The Santa Rosa, which many treasure hunters still believe exists, supposedly sank in the 1520's somewhere in the Key West area with millions in Aztec treasure aboard. This ship epitomizes the "ghost galleon" syndrome. The story usually goes that a Navy diver found the wreck in 200 feet of water in 1939 and recovered a chest of gold from the captain's cabin. Unfortunately, these stories have somewhat of a self-improving effect. That is, although a story of this nature may have been unrealistic at its beginning, it improves as it is unconsciously embellished or as illogical sections are deleted by the divers. The end product is a plausible story, even to an expert. In the case of the Santa Rosa, Potter, who went to immense trouble to track down the origin of the story, discovered that the tale had sprung not from the loss of a 16th century ship, but from a press agent's efforts to generate some interest in a 1930's movie about sunken treasure (Potter, 1972).

Another example of such a "ghost galleon," but one which has a grain of truth behind it, is the Santa Margarita. This galleon, purportedly carrying many millions of dollars worth of valuables, reportedly went down in 1595. Coffman (1957) reports that this vessel, worth $7,000,000, sank in or off Biscayne Bay, Florida, or Sebastian Inlet, Florida. The latter reference is apparently included as a result of materials which were then being recovered from a wreck (or wrecks) of one of the 1715 fleet vessels found in that area by Captain Steadman Parker (Wagner, 1966). Lonsdale and Kaplan have the Santa Margarita located off Palm

Beach, Florida, in 180 feet of water and reportedly carrying $3,000,000 in silver and gold (1964). Berman also reports the Santa Margarita as having a $7,000,000 worth, indicating that it was lost off Biscayne, Florida, or Merritt Island, Florida (1972). With this type of confusion concerning just one ship, one can begin to appreciate the danger of working with these sources.

Except for Berman, who states in his introduction that he has "excluded" references to vessels of less than 50 gross tons, we know little of the criteria used by these writers for including or excluding wrecks. It is entirely possible to find references to wrecks actually lost in Texas and in the Carolinas in some works devoted to Florida wrecks. Part of this problem is attributable to the Spanish use of the term La Florida to refer to that huge area now encompassing some ten to fourteen southwestern and southeastern states. Other problems are changes in place names, similarities, and discontinuations which have occurred in the intervening centuries. As examples, we find Cabo Romano, formerly very likely La Punta de Nueva Espana, and now Cape Romano, on the lower Florida west coast at approximately 25°52.2' North and 81°41.5' West, and a Cape Romain on the South Carolina coast north of Charleston. Another example of a change is the Bahia de San Bernardo, now Matagorda Bay in Texas (although one English source shows Galveston Bay as St. Bernard's Bay). Many small towns simply no longer exist. Prime examples of this are the relatively large numbers of small river towns which were dependent on steamboat traffic on the waterway, which became superfluous when railroads replaced river vessels as prime freight carriers.

Much of the problem, however, stems from incomplete or otherwise poor translations of minimum documentation, coupled with a simple lack of training in or understanding of Spanish Colonial -- and later -- history. Together, the results of some or all of their shortcomings can be disastrous. In one work, purporting to deal with shipwrecks in Florida, we find five consecutive

entries which have nothing at all to do with wrecks in the waters of the present state of Florida. Two wrecks are attributed to Florida waters which were actually lost on the Texas coast. One entry, with a date of 1554, reports the loss of a vessel purportedly of the fleet of Bartholome Carreno at a time when Carreno was safely in Spain. A third reference reports the loss of the same two vessels mentioned above. The fourth error indicates the loss of a vessel belonging to "Farfan" near Ais, when the vessel in question was probably the Capitana of the fleet of Cosme Rodrigues Farfan lost in the Bahama Channel (probably on the Bahamas side) in late 1554. A fifth entry indicates that several vessels of Farfans's fleet were lost in the Bahama Channel in 1555 and never heard from again, when in fact the vessels were separated from Farfan's fleet during his second attempt to reach Spain late in 1554. Damaged and unseaworthy, they turned back to the Caribbean ports. Finally, there is an entry mentioning the loss in 1559 of a number of vessels of the fleet of Don Tristan de Luna y Arellano in a tempest. These vessels were probably lost further up the Atlantic Coast in what is now South Carolina (Marx, 1969). The fact is that not one of the vessels lost in these six entries lies in the waters of the present state of Florida.

Another aspect of the problem which we hesitantly touch upon is that some individuals who have done research in various archives and who have contributed heavily to these compendiums actually derive personal income from the sale of information on the locations of potentially valuable wrecks to treasure hunters. Thus, in some instances it is not surprising that entries dealing with wrecks which may be valuable are not only brief, but specific information or clues relating to the actual locations of these wrecks are omitted or even possibly misrepresented.

In the case of a significant number of vessels, the loss is given at a port city such as Brownsville, Tampa, Key West, or, very often, New Orleans.

However, in many instances the loss did not actually occur there, but was reported at that city as the first port of call reached by an officer or the survivor of the lost ship or the captain of the vessel encountering the wreck. If the actual site of the loss could not be determined from the secondary records, the reference was still included in the survey. In a few instances, the loss of vessels reported, for example, in New Orleans may actually have occurred out of the survey area. Care should be taken in accepting such entries as wrecks lost at that location. The microfilms of newspapers from these port cities (if the cities still exist) are often a substantial aid in acquiring more exact information on many of the wrecks contained in this report.

It was discovered very early that some confusion existed in the minds of the researchers as to whether vessels wrecked in or just upstream of the mouths of major navigable waterways entering either bays or the Gulf, or those wrecks in bays, should be included. The initial effort to establish boundaries for the survey via setting forth limits using longitude and latitude undoubtedly contributed to the confusion since the lower reaches of many rivers, and, of course, all bays, were included in the boundaries. This prompted the addition of some vessels in these areas, although they do not by definition actually fall in the area of the Gulf proper.

It is expected that our own decision-making process in this case has resulted in the inclusion of a limited number of sites which may not actually fall within the boundaries as they have been described. Also, although primary sources were used when possible, the use of secondary sources, mainly in the case of Spanish wrecks, has resulted in the inclusion of some wrecked vessels which may not lie in the survey area and possibly, in one or two instances, do not, in fact, exist.

Another problem stems from the British custom of referring to the Straits of Florida and even portions of the coastal waters of the lower

Florida east coast as the "Gulf of Florida." It is evident that the boundary between the "Gulf of Mexico" and the "Gulf of Florida" is not clear in the minds of many mariners, especially during the 18th century, just as the boundary between the Gulf of Mexico and the Atlantic Ocean, or the Straits of Florida, has been a matter of some legal debate in recent years. Consequently, in a number of cases, ships indicated as lost in the Gulf of Florida were included in the survey when an examination of the reference or other evidence suggested that the wreck or loss might have been expected to fall within the area established for study.

One possible distortion of the survey is the omission of many American vessels, particularly small, coasting vessels, lost in the Gulf of Mexico during the middle to late nineteenth century. This situation could be alleviated only by primary research in the various 19th century newspapers, many of which have been microfilmed. This search would not only need to include the port cities on the Gulf, like Pensacola, Tampa, and Brownsville, and those on major rivers leading to the Gulf, such as New Orleans, but also the principal maritime cities along the Atlantic coast, such as Jacksonville, Charleston, Miami, and New York. While this coverage would be expected to be spotty, because preservation of newspapers is by no means complete, certain periods are well represented; data gleaned from these could be projected to fill the gaps, thus correcting this deficiency to a degree.

Because the shipwreck research included in this study was originally divided among three or more individuals, some duplication of effort can be expected. However, every effort has been made during the synthesis of the data to weed out duplicate sites or references to losses.

Rationale for Determination of the Four Maps

The decision to divide the time period 1500-1945 into four intervals, and thus four maps, was based upon significant changes in either technology or history relative to Gulf of Mexico seafaring.

The period 1500-1699 was established as a unit since it was deemed to be the period of major Spanish activity in the northern Gulf. Although the Spanish were not the only sailors in the area during this time period, they were at the height of their colonization and exploration, and the vast majority of shipwrecks of this time are Spanish.

The period 1700-1819 is marked by a sharp decline in Spanish activity, an increase in British and French interests in the northern Gulf, and at the close of the period, the first use of steam-powered vessels. This period is also probably the most unstable in that three major powers (Spain, England, and France) were continually vying for naval supremacy and for the strongest foothold in the Gulf. Towards the end of the period, the young United States merchantman navy also ventured into the northern Gulf waters and became involved in the turmoil.

By 1820, the northern Gulf had quieted down a good deal, and newer and faster ships entered the picture. These ships were at first a combination of both sail and steam, with steam-powered vessels equalling sailing ships in number by about 1870. From 1870 until 1899, the demise in sloops, barks, schooners, etc., occurred rapidly. Virtually all of these ships finally gave way, by about 1900, to vessels powered by gas, steam, oil, and electricity. Of course, schooners and the like were still being built in the early 1900's, but they were far outnumbered by the self-powered vessels. Thus, 1900 became one of the points at which to divide the northern Gulf history.

From 1900-1945, the Gulf saw a great increase in the use of vessels which, except for size and speed, were basically no different than those still

plying the coasts today. The end of World War II (1945) was designated as the cut-off point between modern vessels and those of "historic interest."

In summary then, the maps can be characterized as follows:

1500-1699: Spanish domination of the Gulf.

1700-1819: Decline of Spanish, rise of British, French, and American naval interests, and a period of political instability.

1820-1899: Rise and parity of steam-powered and other self-powered vessels with sailing ships.

1900-1945: Development of present-day ships and almost complete decline of sailing vessels.

Rationale for Determination of Sailing Routes

Another area concerning the maps which needs explanation is that of the logic used in determining the various sailing routes appearing on each map.

The map of 1500-1699 depicts sailing routes which were determined through a review of Spanish naval archives and other literary sources to represent the most common tracts employed by the large Spanish flotas of the period and various coastal exploratory parties. The presence of the French and British in the northern Gulf and the establishment of French bases at Ship Island and Mobile towards the end of this period warranted the inclusion of sailing routes leading in and out of these ports. This would also hold true for St. Marks and Pensacola, two Spanish bases in use during the latter half of this time period. Excerpts taken from sailing directions for Spanish flotas heading from Vera Cruz to Havana can be found in Appendix A of this report. Similarly, sailing directions for Spanish ships coasting south along the western coast of Florida to either Las Matires (The Keys) or Las Tortugas (Dry Tortugas) and on to Cuba are included.

For the period 1700-1819, a greater quantity of documents which provide sailing directions were available upon which to base our map routes. As can be seen in Appendix A, Bernard Romans, a British traveler and chronicler of sailing directions, has given us a wealth of valuable information. In the 1700-1819 map, most of the routes are taken from Romans. There were some, however, which come from the Spanish Archives in Seville, and they have also been included in the appendix.

Coastal routes have been included to illustrate the routes of inter-Gulf commerce during this time. For instance, the Baton Rouge - Pensacola trade route, used by the British in the late 1700's, involved travel through Lakes Pontchartrain and Maurepas and up the Amite and Iberville (Bayou Manchac) Rivers into the Mississippi. This route is shown on the map.

From 1820 until 1899, the Gulf witnessed the zenith of maritime commerce. The routes shown on this map reflect only the major routes between highly active ports. Since steamships played a major part in this maritime growth, and since their tracks were largely independent of wind direction, most of the routes on this map are straight lines connecting important ports. However, since sailing vessels were still in use, their routes must also be considered. Because these routes did not change significantly from the previous period, and their inclusion would hopelessly clutter the map, the authors refer the reader to the 1700-1819 map for sailing-ship routes.

On the final map, 1900-1945, the shipping lanes are derived by connecting each of the fifteen (15) major Gulf ports dealing in foreign trade during the first half of the 20th century with two primary points. These points are the Yucatan channel and an area south of the Dry Tortugas. Upon leaving port, ships would sail directly for one of these two points, and after reaching their chosen point, they would then head either eastward into the Atlantic or southwest

toward the Panama Canal. Of course, areas around shoals and obstructions were avoided. This information was obtained from personal communication with captains of Lykes Brothers Steamship Co., Inc.

Since the routes shown on this map only lead the mariner out of (or into) the Gulf and do not represent in-Gulf commerce, the reader is directed to the preceding period map of 1820-1899. During that period, Gulf trading routes were not a great deal different from the local routes followed in the most recent period.

Outline of the Sections

The shipwreck volume of the report is divided into five sections. The first section discusses the exploration, settlement, and commercial development of the northern Gulf of Mexico. The second section describes the deterioration of shipwrecks and the dispersal of cargoes and ship fragments across the sea bottom. Section three lists sites and other manmade obstructions which may be found on the continental shelf. The latest electronic techniques which can be used to locate and define these are discussed in the fourth section. The final section summarizes the previous sections and presents recommendations for managing archeological resources found on the continental shelf.

EXPLORATION, SETTLEMENT, AND COMMERCIAL DEVELOPMENT OF THE NORTHERN GULF OF MEXICO: A SYNOPSIS

Period 1500-1699 A.D.

Coastal Exploration

Based upon the accepted geographic definition of the southern boundary of the Gulf of Mexico, which is formed by the partly submerged ridge extending eastward from the Yucatan peninsula on which the island of Cuba is situated, the first Spanish explorer to see and sail upon the waters of the Gulf was probably Sebastian De Ocampo, who circumnavigated Cuba in 1508 (Worchester and Shaeffer, 1956). The Spanish governor of Puerto Rico, Ponce de Leon, however, has traditionally received credit as the first European to sail into the northern Gulf of Mexico. After his discovery of Florida in late March 1513 and his landing on the Florida east coast and consequent claiming of the area for the Spanish king on April 8 of that year, Ponce de Leon sailed southward, rounded the southern end of the peninsula, and entered the Gulf of Mexico. It is thought that on this first voyage to Florida, he sailed northward along the Florida west coast to at least latitude 27°30' North and that he may have ranged up to that point where the coast begins to trend westward (Lawson, 1946).

In the years that followed, the large island of Cuba, discovered on Columbus' first voyage and conquered by Diego Velazquez in 1511, was settled and became a jumping-off point for further exploration and expansion. By 1515, settlements had been established at Santiago de Cuba and the original site of Havana, the city which was destined within a few years to become the focus of Spanish overseas trade in the New World, and at some five other locations on the island, including the original landing point, Baracoa.

From Cuba sailed the vessels of the expeditions which discovered Yucatan (Francisco Hernandez de Cordoba - 1517) and first explored the Mexican coast (Juan de Grijalva - 1518). The island was also the point of departure for perhaps the most famous Spanish expedition in history, that of Hernando Cortez, which landed in Mexico at Vera Cruz in 1519 and, after suffering reverses and weathering difficulties, succeeded in conquering what was to become one of Spain's richest possessions in the New World.

During this period, however, Cuba was not the only source in the Indies of ambitious Spaniards seeking their fortunes through exploration and conquest. At the time Cortez was engaging the Indians in central Mexico, a Spanish exploratory expedition sent by Francisco de Garay, governor of Jamaica, under the command of Alonso Alvarez de Pineda, entered the Gulf of Mexico. Their stated purpose was to seek a strait to India and to explore new lands. Stopping briefly at Vera Cruz, Pineda could not be dissuaded by the pleas and threats of Cortez's representatives to abandon his intention to explore further north along the coast, an action which potentially might cloud Cortez's claims to Mexico. Unimpressed, Pineda sailed on, examining in some detail the shores, bays, and rivers he encountered, especially those in the northwestern Gulf, now comprising the shorelines of northeastern Mexico and the state of Texas. Apparently, he ranged as far eastward as Apalachee Bay in present-day Florida. He drew or had prepared the first map of that area, stretching from Florida to Tampico on the Mexican coast, christening the land mass bordering the northern Gulf "Amichel." Returning to Jamaica, the expedition brought back reports of winds and currents in these higher latitudes favorable to vessels bound eastward toward the newly established ports in Cuba, Hispaniola, and what is now the island of Puerto Rico. This information was particularly welcome since it was soon discovered that contrary

currents and the dangerous shoal areas north of the Yucatan peninsula, coupled with the northeast trade winds which prevail especially over the lower, and often the middle, Gulf from sometime in March to late August or September, made sailing eastward from Vera Cruz directly to the ports in Cuba and Hispaniola almost an impossibility during the summer and extremely dangerous during the winter.

Evidently, Pineda thought the area where the Panuco River flows into the Gulf, near present-day Tampico, suitable for settlement, for a second group of Spaniards from Jamaica lead by Diego de Camargo attempted a colony there in 1521. Unfortunately, for a variety of reasons, Camargo's colonization effort failed, but a Spanish settlement on the Panuco River, San Esteban, was realized in 1522, when Cortez, who by this time had central Mexico within his control, arrived at the head of an army of 40,000 Indian auxiliaries to expel the Jamaican colonists. The following year, Garay himself led another party of Spaniards to the same region, but this effort was thwarted by Cortez, and Garay was sent to Mexico City where he soon died (Webb, 1952). The settlement on that river was destined to mark the actual limit of Spanish expansion in northeast Mexico for more than 100 years.

Across the Gulf, a similarly unsuccessful attempt at colonization was made in 1521 by Juan Ponce de Leon, the explorer who had earlier discovered Florida. Holding a royal appointment as governor of the land he had claimed for Spain, Ponce de Leon returned to Florida at the head of an expedition to conquer and colonize the "island," as it was then thought to be. Evidently, the expedition was less prepared to conquer than to colonize, for they never got off the beach. In a brief engagement with, it is thought, the Calusa Indians, Ponce de Leon received a mortal wound, and his landing force was driven to the safety of their ships. The small fleet returned to Cuba where

their leader died the same year (Lawson, 1946). Historians have pointed to the hostile reception received by the Spanish on this occasion as evidence of previous "informal" Spanish expeditions to that coast to secure slaves for their mining and agricultural efforts in Cuba and Hispaniola. However unsuccessful the attempt, Juan Ponce de Leon must receive credit for trying to establish the first European settlement on the northern Gulf coast.

The conquest of the Aztecs and their allies was virtually complete by 1521. From the central valley and surrounding provinces of the new land, which would be called Nueva Espana, up and over the ridges, through the high passes of the Sierra Madre Oriental, and down toward the coast through Jalapa to Vera Cruz came long caravans of Indians, and later mules, loaded with the spoils and the produce of the land which had passed by right of conquest to the Spanish. At Vera Cruz, these treasures, which would shortly make the Spanish king's dominion of Nueva Espana the envy of Europe, were lightered south down the coast a few leagues to a rocky key, San Juan de Ulua (the site of the present modern city of Vera Cruz), which provided a small lee shore on this exposed coast, where they were loaded onto waiting vessels for the trip back to Spain. With the vessels loaded and the way known, the purpose the Gulf was to serve for the Spanish for almost three centuries was set.

Early Spanish Sailing Routes in the Gulf

The course the vessels from New Spain customarily followed was north-northeast or northeast, depending on the season and hence the winds, along the low coast. As they moved northward, they needed to come within sight of land only occasionally during the day to determine how much running room they might have to the west, if needed. At night, they kept well offshore, moving in tighter formation under reduced sail, diligently following the

signal lights on the stern of the lead ship. Every hour or half-hour, their deep-sea-level lead lines would bring them assurance that they were maintaining their distance from the coast.

Between latitude 25° North and 27°30' North (depending on their instructions from the Royal officials or, on occasion, their own judgment), they would turn due east, sailing directly for the Florida coast. When their lead lines again began to find bottom, they would advance cautiously until samples of sand, shell, or mud or a familiar landmark on the coast, or both, gave them their position. After turning south, they felt their way along, bringing up the coast occasionally on their most eastward tacks, but staying within soundings. During the day, they moved briskly, but at night caution, as always, prevailed. However, as their latitude decreased, their use of sounding lines and their concern increased, for ahead of them, directly in their path, lay the only serious obstacle in their safe passage to Havana, the vicious reefs surrounding the islands of the Dry Tortugas and to the east, the long sandy shoal which extends many leagues westward from the Marquesas Keys. The size and draft of the vessels and the experience of the commander and his pilots determined where they would try to break through the barrier to the safety of the deep, almost royal blue, waters of the Straits of Florida beyond.

Ever mindful of the depth and the nature of the bottom, the Spanish commander approaching this area might drag his feet a little or even mark time, having the vessels of the flota "stand off and on" for a few hours if necessary, even in this exposed area, in order to avoid running this gauntlet at night or during periods of poor visibility. Most of the time, they would try to pass just east of the Tortugas, but occasionally, if the winds were fitful or the fleet a large one, the general or admiral in charge

might lead them around the deeper western side. Once over and into the straits, Havana, with good weather, was less than a day's sailing away, with 95 percent of the route over deep water with the landmarks on the Cuban coast visible from far offshore.

Spanish Exploration of the Interior

The Spanish made two other attempts to explore and conquer the area of the northern Gulf before the middle of the 16th century. These were the expeditions of Panphilo de Narvaez in 1528 and that of Hernando de Soto in 1539.

The exploration of the southwest United States, including portions of what are now the states of New Mexico, western and northern Texas, and perhaps Oklahoma and Kansas, by the Spanish under Francisco Vazquez de Coronado which, in part, took place during the same period (1540-1542) that the de Soto expedition was in Arkansas and east Texas, will not be discussed here. Although the Coronado expedition was important from a geographical point of view (in combination with the journey of de Soto, it provided the Spanish with considerable insight concerning the vast interior of the continent, forming the basis of the cartography of the area for decades, perhaps centuries), it was at all times greatly distant from the Gulf of Mexico and even the northern coastal regions bordering the Gulf (Hodge, 1907).

De Narvaez, authorized and commanded by the crown "... to conquer and govern the provinces of the main extending from the River Palmas (Rio Grande) to the Cape of Florida," landed his force at a point some five leagues north of the entrance of Tampa Bay (Hodge, 1907). Undaunted, he set about his task, marching off (against the advice of some of his officers) at the head of some 300 men with only 15 days rations into what would have been total oblivion had it not been for four survivors, among them the famous Alvar Nunez Cabeza de Vaca, who appeared eight years later in western Mexico near the Rio Sinaloa.

Upon his return to Spain, Cabeza de Vaca told of the ordeals he and the others who had gone with de Narvaez had suffered at the hands of the Indians and gave an account of the circumstances of the demise of all but a few unaccounted-for members of that expedition. He also shared his observations of the land with de Soto and gave advice on how to deal with the inhabitants of Florida before the latter left Spain for the New World, a factor that may account for the ability of the de Soto expedition to leave Florida after almost four years in the interior with at least half its force intact.

De Soto apparently also landed in the vicinity of Tampa Bay (Hodge 1907), but with a much larger force, numbering some 600, and infinitely better prepared for what lay ahead of them than the ill-led group of de Narvaez. Marching north into the interior, they wintered the first year (1539-40) in northern Florida. The expedition then pressed onward first to the north and finally west, traversing most of the states now comprising the southeastern United States and "discovering" the Mississippi River, the mouth of which had been found by the remnants of de Narvaez' forces some 13 years earlier as those desperate men sought vainly to reach the settlement at Panuco in five frail barges held together by nails forged from their weapons and armor (Hodge, 1907).

The plight de Soto's army found itself in was grave, but not hopeless. After the untimely death of de Soto and his burial in the Mississippi, or the "Rio Grande" as the expedition referred to it, the army fell to the command of Luys Moscoso de Alvarado. In council, they, as had the survivors of the de Narvaez expedition, elected to try to reach the safety of the most northerly Spanish settlement in Nueva Espana. Some have held that they proceeded as far westward as east Texas before the sheer immensity of the land

they had set forth to traverse overcame them, and they returned eastward to the west bank of the Mississippi. There, during the winter of 1542-43, they constructed seven "brigantines," as they are referred to in the translations, but which probably more closely resembled the type of open vessels the Spanish referred to at this time as chalupas, in which they rowed and sailed down river to the Gulf of Mexico. Leaving the mouth of the Mississippi, the little fleet was alternately driven ashore by storms and by the need for fresh water as they coasted first west and then southwest and finally south along what are now the coasts of western Louisiana and Texas. Some 53 days after leaving the mouth of the Mississippi, they arrived at the mouth of the Panuco River and encountered clothed, Spanish-speaking Indians who told them where they were and that the Spanish settlement of Panuco was but 15 leagues up river (Hodge, 1907). Ingloriously, the expedition of de Soto ended after having traversed the land area bordering the northwestern Gulf from Florida to Mexico.

A different approach was attempted by representatives of the Spanish Church. Fray Luis Cancer de Barbastro, a compatriot of the humanitarian crusader Las Casa, hearing of the royal cedula ordering the repatriation of all Indians taken from Florida to Guatemala, elected to shepherd them back to that land. His instructions were to land on the Gulf coast away from areas that had felt the heavy hand of the earlier Spanish explorers and conquistadores. "In May 1549, through stupidity or ignorance" (as the noted historian Tepaske states), Cancer's pilot brought him to Tampa Bay, precisely the spot which had drawn Ponce de Leon, Narvaez, and de Soto earlier. The Indians seemed friendly, but it was only a ruse. Going ashore after two of his companions had been murdered, Cancer was welcomed by the Indians with open arms, and, when surrounded on the beach, was brutally

beaten down with war clubs in full view of his companions and the crew of the ship on which he had come (Tepaske, 1964).

For the sake of completeness, the expedition of Tristan de Luna y Arellano, who was dispatched by Don Luis de Velasco, viceroy of New Spain, from Vera Cruz with 1500 soldiers, colonists, and priests in 13 ships in 1559 to establish a colony in Florida must be included. It has long been held that the de Luna expedition established a settlement at or near the present locations of either Mobile or Pensacola. As late as 1971, a publication containing the proceedings of a conference attended by noted scholars of Gulf coast history and culture repeatedly indicated that de Luna and his expedition had come to grief as a result of storms, Indian troubles, and shortages of basic supplies on the Florida, Alabama, or Mississippi Gulf coast. This interpretation is questionable since the de Luna expedition may never have disembarked in the northern Gulf, but proceeded straightway to the vicinity of Santa Elena on the Atlantic coast at about latitude 32°, the junction of the present states of Georgia and South Carolina with the shore, where they suffered a disastrous hurricane and the loss of their ships and slowly came to grief. It was probably to this point that the viceroy, hearing of the troubles of this group, eventually dispatched Captain Angel de Villafane to save those he could.

The dismal failure of the expeditions of de Narvaez, de Soto, and others, which had set out to "conquer and subdue" the vast central portion of North America, and the attendant great loss of life, almost 99 percent in the case of the army of Panphilo de Narvaez and almost 50 percent in de Soto's expedition, bore little resemblance in achievement or return to the exciting results of Cortez in Mexico or Pizarro (1531) in Peru. The effort of Fray Cancer was equally disastrous. Spanish interest in the area of

Florida waned. There were fewer swamps, less fever, more tractable Indians, and greater rewards for the Sword and Cross elsewhere. In September, 1561, the Spanish king declared that there should be no further effort made to colonize the inhospitable land of Florida (Priestley, 1928).

Commerce and Settlement Along the Gulf of Mexico

Commerce between Europe and Asia had developed rapidly from the 13th through the 15th centuries via the Near East. The relatively low value of most of the Western exports as compared to the exotic Eastern imports tilted the balance of trade in favor of the East. Consequently, the metals which Europe had secured during the Crusades from Syria and Asia Minor were depleted by trade with Asian markets.

When an economic decline set in between 1350 and 1450, there were attempts to prevent the export of precious metals and a consequent threat to the mercantile class, which played a key role in European economics. The potential of both allies and enemies lay in the location and amount of remaining assets, especially precious metals. For this reason, the sudden influx of substantial quantities of silver from the New World by Portugal and Spain would ultimately prove to be one of the strongest stimuli to change and development that Europe would experience.

It was Cortez's ill luck and ultinately that of his king that one of the vessels which he dispatched directly to Spain from Mexico loaded with samples of the rich treasures fell into the hands of a French corsair cruising between Spain and the Azores. The cargo included gold and silver jewelry, precious and semi-precious stones, jade, and other handicrafts of the Indians as well as produce from the area. Naturally, word of the exotic material and precious metals found in the ship from Mexico soon reached the French king

(Worchester and Schaeffer, 1956). The unfortunate, though predictable, result of the encounter was that French freebooters soon became the bane of the Spanish, especially in the Caribbean, from the 1530's to the 1580's when the dubious distinction of being the front-runner in "bearding the Spanish King" in his overseas dominions passed to the English. The early depredations of the French privateers in raiding Spanish shipping and in taking and sacking the port cities in the New World have a direct bearing on the ferocity, determination, and design of Spain's response to later attempts by the French to settle first in Florida in the 1560's and, later, other areas of the northern Gulf near the end of the 17th century.

Despite their seafaring history, the English were slow to enter the Gulf. Unlike the French, who were neighbors of the Spanish and who soon learned many of the secrets of navigation in the Indies, the English during this period had restricted intercourse with Spain. Some of the first English ships which penetrated the Gulf and sailed along the coast of Florida reported powerful contrary winds and currents which they surprisingly had little experience in coping with. It was said that one ship tried to sail against the Gulf Stream for a week or two tacking back and forth and expending their apparently already dwindling supply of food to a critical level (Voyages and Travels, 1964).

The early English expeditions to the Caribbean, some of which entered the Gulf, were enterprises designed to wrest Spanish silver and gold away primarily through the sale of slaves. It is ironic that the first representatives of England, the nation which the Spanish would find a far more implacable foe in the New World than the French, whom they would ultimately find themselves allied with, first came in the Caribbean and Gulf not to steal, as the latter had done, but to trade. The Spanish had very early

discovered that the New World aborigines, especially those of the islands, were seemingly unable to bear the heavy burden of servitude thrust upon them. By the second decade of the 16th century, tens, perhaps hundreds, of thousands of the enslaved inhabitants died in servitude as a result of a combination of what today we know were crowded conditions, merciless work in the fields and mines, or unreasonable production quotas and disease. Insofar as the Spanish were concerned, the answer was the early importation of Negro slaves from the African coast. Once in the New World, these Negroes carried forward, under the direction of their masters, the back-breaking construction of fortifications, quays and other harbor facilities, roads, and other municipal projects, largely in the coastal cities. When the English tried to enter this market (which had been established by the Spanish in 1517), first visiting the African coast to secure the product and then sailing to the Caribbean ports to sell them, they discovered that the Spanish considered the New World to belong solely to them and that all commerce, in accordance with prevailing mercantilist economic theory, was a crown monopoly. Both the Gulf and Caribbean, especially the latter, had become, in effect, Spanish "lakes" into which the ships of other nations ventured at their own risk.

The English were sometimes able to sell a few slaves, as well as other merchandise, at or near Spanish ports in the New World during relatively peaceful times when the city officials could be induced to break the king's cedulas against such trade "for the well being or perpetuation of the respective city or community" or occasionally simply for personal gain. However, they were generally met with hostility and denied even supplies for their own maintenance. Occasionally, they were the targets of Spanish fleets sent to (or raised in) the New World to hunt down and destroy them.

The experience of the Englishman Sir John Hawkins is fairly typical of the relationship. In 1568, he had the audacity to sail several ships into one of the most vital ports of the Spanish in the New World, San Juan de Ulua, and the bad luck to encounter an armed squadron, the flota fresh from Spain, which arrived there shortly after they did and with whom fighting inevitably erupted (Voyages and Travels, 1964). Classed at best as unwanted intruders, typically as smugglers, and often as pirates, and with their expectations and appetites whetted by riches they had more often heard of than seen, the English soon dropped trade as a viable approach and became raiders, believing one might as well be hung for a wolf as a sheep.

The resolve of the Spanish to avoid dealing with the inhospitable Floridas was short-lived. In 1562, a small French fleet, commanded by Jean Ribault, made a landfall on the Florida east coast about latitude 29°30' North and explored northward. Encountering the present St. Johns River, known to the Spanish as Rio de las Corrientes, Ribault named it "River of May" and took possession of the country in the name of France. On this first voyage, after coasting northward, Ribault erected a small blockhouse, Charlesfort, apparently located on Parris Island near Port Royal in the present state of South Carolina. Here he left some 30 men to maintain the French claim to the vast country and returned to France. This first effort came to grief largely through the delays of the French in returning to reinforce and resupply the garrison (Ribault, 1964). A second, larger French expedition, commanded by Ribault's second in command on the first voyage, Rene Goulaine de Laudonniere, reached the Florida coast in June, 1565, entered the St. Johns River, and began construction of Fort Caroline (Ribault, 1964). The Spanish had recently begun utilizing "The New Bahama Channel" between the Florida east coast and the Bahama Islands to gain their northing after leaving Havana and other

Caribbean ports en route to Spain rather than the older, more dangerous route leading eastward through the lower Bahamas and then turning north. The French presence was what, in modern parlance, would be labeled a "clear and present danger."

The French efforts were authored by the astute French admiral Gaspard de Coligny, a Protestant and an implacable foe of the Spanish. He conceived French settlement of Florida as a means of limiting Spanish expansion in the New World and threatening the safety of the Spanish treasure fleets. Spanish reaction to the infant French settlement in Florida was, however, quick and brutal. The king dispatched Pedro Menendez de Aviles with a fleet of 15 to 25 ships and some 1500 to 2600 men to "exterminate the heretics" (Ribault, 1964). Both Menendez and a third French expedition led again by Ribault arrived off the Florida coast in August 1565. After an ineffectual encounter between elements of the two fleets off the mouth of the St. Johns River, Menendez landed his force further south at what was to become the site of St. Augustine. Ribault, consumed with a desire to destroy Menendez' force, weakened the garrison at Fort Caroline to strengthen the effectiveness of his fleet. Just after confronting the Spaniards at St. Augustine, a hurricane arose which blew the French fleet south to wreck along the coast and shoals north of Cape Canaveral. A few days later, the Spanish army, which had marched overland to Fort Caroline from St. Augustine, took the fort.

The French survivors from some of the larger vessels, some 400 men in two groups, marched north up the beach in an attempt to return to Fort Caroline. They were intercepted by the Spanish at the first inlet south of St. Augustine. All but a handful, who were sent as slaves to the galleys, were put to the sword by the Spanish. The inlet now bears the name Matanzas

in memory of the slaughter which took place there. The immediate French threat was obliterated; Florida had been saved by Menendez, but at a terrible cost in reputation for Spain. Resolved to prevent a recurrence of French influence in the area, the Spanish began construction of a fort to protect Florida, and the first permanent settlement in the continental United States, St. Augustine, became a reality (Ribault, 1964).

Subsequent to the founding of St. Augustine, Menendez may have established temporary outposts in the vicinity of Tampa Bay and Charlotte Harbor on the Florida west coast, but these apparently were short-lived and meant little in the course of the Gulf's history.

The next 120 years following the founding of St. Augustine on the Florida east coast was a period of little change in the pattern of European use of the Gulf of Mexico. The Spanish may have been convinced that, faced with the immensity of the land bordering the Gulf and the generally hostile Indians inhabiting the coastal areas, of whom they had first-hand knowledge, there was little chance of successful intervention by other European powers. They did strengthen St. Augustine, improving the fort there and making the city the seat of Spanish government in Florida, a vast province which, in the minds of the Spaniards, extended north at least to the Virginia capes and westward to the Rio Grande between Texas and Mexico. To establish a source of supply upon which the city could rely and to extend and stabilize this frontier area, as well as spread Catholicism, the Spanish raised missions and military posts, or presidios, which spread in a line northward along the east coast into Georgia and perhaps South Carolina and, most importantly for our study of the Gulf, westward across the fertile savannah country of Alachua in present north-central Florida. To facilitate founding and supplying the missions and presidios further west, the Spanish sought

for and found a suitable location in the shallow northeastern Gulf where two spring-fed rivers joined just before entering the Gulf, affording a small but safe harbor. There, at the confluence of the two streams, presently known as the Wakulla and St. Mark's Rivers, in 1631 they established the small presidio and port facility of San Marcos de Apalachee, the first port area and European settlement in the northern Gulf area.

Supply ships from Havana and St. Augustine visited there, but the stately Spanish ships of the Indies trade, the vessels of the flota of Nueva Espana, only occasionally passed close along the shores of the northern Gulf. They preferred to avoid the shoals of the Mississippi and Cape San Blas area, crossing, unless blown off course to the north, about the latitude of Tampa Bay.

However uneventful this period may have seemed during the first decade of the 17th century, the seeds of change which ultimately would have the greatest effect on the area of the northern Gulf of Mexico had been sown on the northeastern shores of the continent. There, in 1607, English colonists settled Jamestown, Virginia, and further north the French established Quebec in 1608.

From Quebec, the French, displaying their exceptional ability to establish rapport with the aboriginal inhabitants they encountered, pushed relentlessly westward to the Great Lakes, establishing trading centers and forts, outflanking the fledgling English colonies blossoming along the Atlantic Seaboard. By 1673, two French explorers, Louis Joliet and Father Marquette, had come from Lake Michigan by the Fox-Wisconsin River route to the Mississippi and voyaged south to the mouth of the Arkansas. In 1682, Rene Robert Cavelier, Sieur de la Salle, entered the Mississippi by the Illinois route and explored the river southward to its mouth, taking formal

possession of the entire drainage basin of the Mississippi for France, naming it Louisiana in honor of the French king (Langer, 1940). Spain, in her myopic view of the Gulf as simply a pond over which the fruits of her extractive commerce with her colonies could flow, had neglected to press her claim over the key to the Gulf, the Mississippi River.

La Salle's claiming of the entire drainage of the Mississippi, which extended on the east to the west slopes of the Appalachians and on the west to the Rocky Mountains, for France set in motion a series of actions and reactions by the Spanish and English which, in fact, breathed the first real life in over a century into the area of the northern Gulf. La Salle conceived of a settlement in Louisiana as a base, a warm-water port, for connecting Canada and the agricultural potential of the Illinois country with the developing sugar plantation economy on the western end of the island of Santo Domingo, which French pirates had been able to wrest from Spanish control and which, before the end of the century, would be ceded to France by treaty. The French act of developing the area would at once split Spanish Florida from Nueva Espana, give France command of the Gulf, open to attack Mexican fleets carrying Spanish treasure home to the mother country and perhaps even the mining areas in northern New Spain, and provide a buffer against the rapidly expanding English colonies along the Atlantic Coast.

In an attempt to put his plan into action, La Salle left France in 1684 at the head of a small fleet of four vessels loaded with soldiers, settlers, and supplies sufficient to establish the envisioned colony in Louisiana. Unfortunately, in the West Indies one of the smaller vessels was captured by the Spanish, an act which not only deprived the French in Santo Domingo of significant quantities of needed supplies, but more importantly gave the Spanish precise intelligence of French plans for settlement of the Mississippi area.

The La Salle expedition arrived in the northern Gulf and encountered the coast west of the Mississippi delta in 1685. Searching along the shore westward, the fleet came upon the inlet (now Pass Cavallo) connecting Matagorda Bay with the Gulf of Mexico. Apparently, this was for a time mistaken for the mouth of the Mississippi, although later historians believe that La Salle may have purposely taken a course to the mainland west of the delta area in order to establish the colony as close to the Spanish outposts of New Spain as possible (Castaneda, 1936 - 1958). There, beset by difficulties ranging from loss of two of the ships through misjudgement and accident, desertion of the crew of the third ship, who sailed their vessel back to France, and faced with disease and hostile Indians, the colony, in spite of the best efforts of the settlers, including La Salle, failed (Joutel, 1962).

The Spanish were flabbergasted at this French impudence, but late 17th century Spain was not the Spain of a century before. Over-extended and greatly weakened as a national power by governmental mismanagement, an essentially unhealthy economy, and the almost complete lack of leadership manifested by the ailing Carlos II, Spain could not move as decisively as she had almost 120 years before when the French mounted a similar threat in eastern Florida.

To make matters worse, Spain was faced during this period not only with French encroachment on her Caribbean possessions, but British pressure from Jamaica and Barbados as well. Nevertheless, the Spanish set about to strengthen St. Augustine, converting the wooden fort there, Castillo de San Marcos, to stone, and strengthening her alliances with the various Indian tribes in Florida. In addition, a number of Spanish expeditions were dispatched by sea and land to the northern Gulf area to find and destroy La Salle. One of these was, in addition, to make a careful examination of the coast along the northern Gulf with an eye toward determining whether it would be easier to supply and administer further Spanish settlement there from New Spain or

Havana. These actions marked the reawakening of official Spanish interest in the area, especially in the vicinity of the Mississippi.

A Spanish land expedition finally succeeded in locating the abandoned French settlement. In April, 1689, Captain Alonso de Leon, Governor of Coahuila, surveyed the ruins, debris, and corpses, and brought back to Mexico news of the failure of the French effort (Bolton, 1916).

The French would not be discouraged, and in 1698, Pierre Le Moyne d'Iberville and Jean Baptiste de Bienville, commissioned by the French Minister of Marines, Pontchartrain, were dispatched to implement La Salle's original concept of establishing a settlement at the mouth of the Mississippi. Landing first at Dauphin Island near Mobile, the expedition, consisting of four ships and 200 colonists, was forced by the arrival of a strong Spanish force under Arriola, itself sent to settle and fortify Santa Rosa Island at Pensacola, to move to Ship Island near Biloxi. In 1699, Fort Maurepas was built across the bay from the present city of Biloxi, the first permanent French settlement on the Gulf of Mexico. The following year another fort, Fort de la Boulaye, was built on the Mississippi at a point about a third of the distance south of the present location of New Orleans to the mouth of the river (Figure 2) (Gravier, 1899). Due to the lack of response by the viceroy of New Spain, the Count de Moctezuma, Arriola, at Pensacola, was forced to tacitly accept French presence in the Gulf region. This acceptance led to the insistence that French officials have Spanish letters of title. This action thus opened up free trade between Vera Cruz and Havana and the French. The French had thus come to the northern Gulf coast. Their presence there and the first tentative thrusts against Spanish Florida from the English colonies to the north, which had begun in the 1670's, set the stage for the incredible changes which the northern Gulf area would witness in the following 120 years.

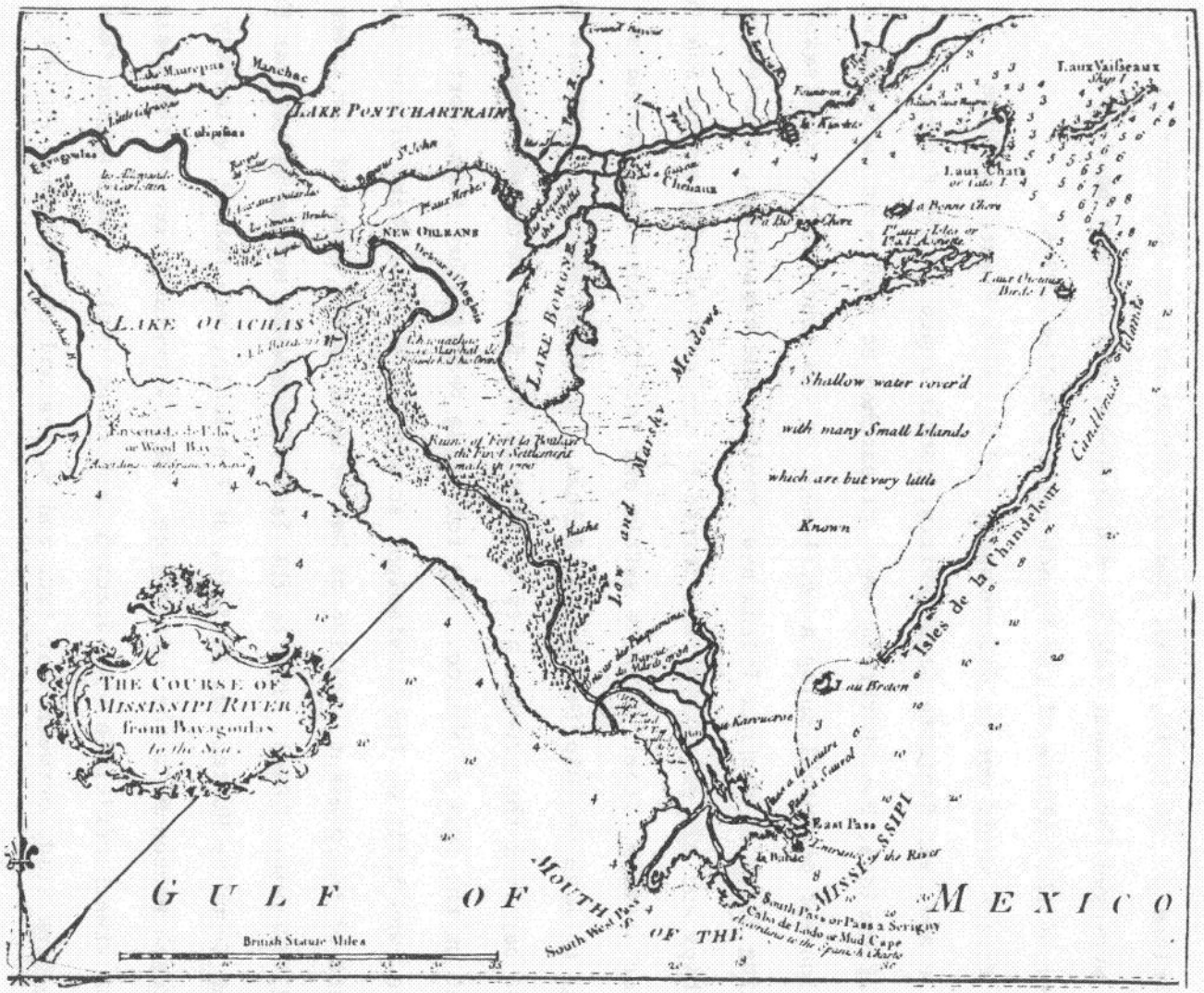

Figure 2. Map of lower Louisiana showing the location of Fort La Boulaye, 1700, the first French fort on the lower Mississippi River.

Technological Changes

In the five centuries of Euro-American maritime activity following the Columbus voyage, there has obviously been a drastic amount of change and innovation in the materials and technologies used in marine architecture. During the sixteenth and seventeenth centuries, change was relatively slow. The first drastic innovations in maritime construction occurred during the Industrial Revolution in the late eighteenth century. As the graph of gross tonnage indicates (Figure 3A), the average size of vessels increased only gradually until the late 1700's,at which time there was a drastic increase.

Changes in shipping technology are discussed in the following paragraphs for the time period 1500-1700.

Shortly after landfall in the New World, the Columbus expedition was met offshore by two canoes containing what seemed to be as many as 100 natives. The canoes were from 40 to 60 feet long and from 7 to 10 feet wide. The spectacle caused Columbus some alarm, since his three vessels carried a combined crew of only 90, and since the largest of his ships, the Santa Maria, was only 82 feet long and 28 feet wide. Like other vessels of that period, his ships were relatively small, with proportionately deep drafts. The latter were necessary to offset high fore and aft castles which were used for small arms firing, since the art of cannonry had not yet been fully developed. The cannons on board were mounted on friction beds rather than on naval trunks. Although awkward to maneuver and difficult to aim, the cannons were used successfully to frighten away the approaching natives.

In the period 1500 to 1700, the size of ships increased gradually, but the basic four-to-one length/beam ratio was retained. Vessels of this period were basically alike in terms of construction; that is, they were built of wood and held together by wooden tree nails and iron fastenings and pins.

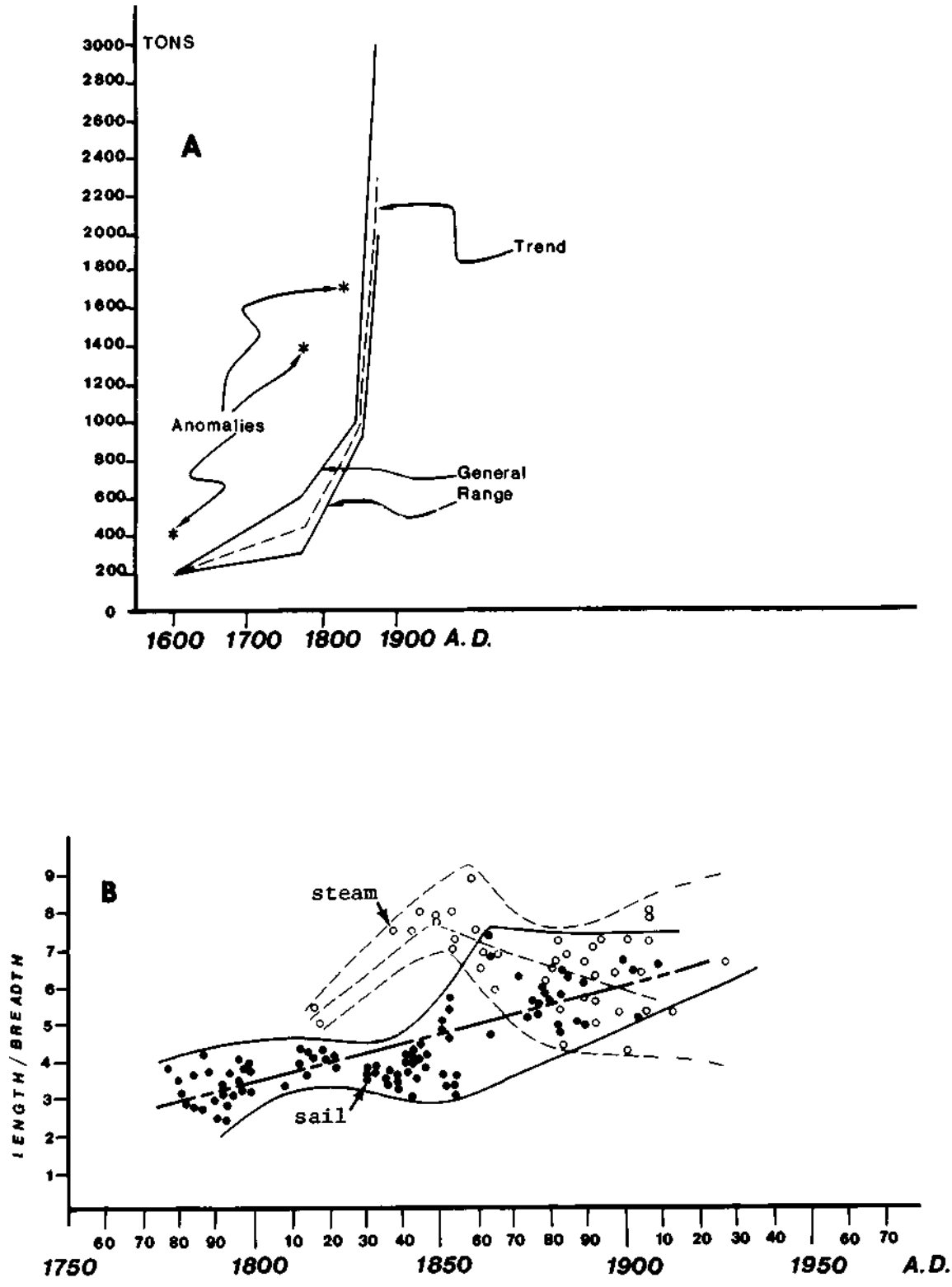

Figure 3. A) Graph of gross tonnage through time. B) Graph of length/breadth ratio through time (From Alan Saltus, personal files).

In addition to the small increases in vessel size, there was a simultaneous increase in the number and size of cannons on board. Conditions of vessels of this period were somewhat less than desirable. According to Masefield (1905) (a contemporary of Lord Nelson, English admiral), "The constant wetting and lapping of the rain on the vessel's frame set up a decay in exposed wood so that many of the ships had become to rot before a plank was placed. Some were as green as grass with mildew and fungus before a single board was fitted." Although this comment was made after the period being discussed here, it would certainly be applicable to the time.

The average life expectancy of vessels constructed during the period ranged from eight to nine years. Few lasted that long, however, without major repairs equaling almost their original cost. The rate of deterioration was greatly increased by the humid, subtropical climate of the southern region of the Caribbean and the Gulf of Mexico. What was not already set up as a deterioration factor in the decay of a vessel prior to planking was accomplished by the marine biotic effects after a vessel had been launched. Especially in the warmer climates of the Gulf of Mexico, Teredo worms, which bore their way into the planking and frames, were a constant menace to ships. Many types of materials were tried as preventatives without much success. These included pitch, animal hide, tar, whitewash, animal hair, and dung composites. One successful way of protecting against the Teredo worm was to place a sacrificial layer of soft wood over the oaken frame and planking. In the interior, between the planking and the hull, some of the composite material was inserted. The Teredo worm fed upon the sacrificial layer, but was repelled by the foul-tasting inner layer, thus leaving the hull proper in one piece. Lead sheathing was also tried, but because of its cost, weight, and deterioration rate, the material proved not to be feasible.

Period 1700 - 1819 A.D.

It was the practice of the Romans to date everything ab urbe condita: from the founding of the city. With respect to the history of the Gulf coast area from 1700 to 1820, such a practice would be especially pertinent, since the history of the area is essentially linked with the exploration, settlement, and growth of the city of New Orleans (Thurston, 1972). Because the two are so closely interrelated, much of the following relates to the history of New Orleans and the Louisiana area.

As indicated in the following discussion, the strategic location of the site of New Orleans attracted the interest of the first explorers in the area, who recognized the commercial and military potential of a post near the mouth of the mighty river flowing from the heart of the continent into the Gulf of Mexico.

French Settlement Patterns (1700-1762)

The Iberville expedition reached Pensacola, Florida, in January 1699, but Spanish soldiers at the fort there refused permission for the French ships to enter the harbor. Iberville sailed westward and established a temporary camp on Ship Island, south of modern Biloxi, from which site he and a small party began to explore the Mississippi. On March 2, 1699, the group rediscovered the mouth of the river and began their journey upstream, arriving at the site of New Orleans on March 5. The party explored the river as far north as the mouth of the Red River, discovering and naming Baton Rouge for a red pole erected there to mark the boundary of the hunting grounds of the Houma and Bayogoula tribes.

Returning to the coast, Iberville selected the present site of Biloxi for his headquarters and ordered the establishment of Fort Maurepas there. (Iberville considered the lower banks of the Mississippi too marshy for

settlement, but he recognized the importance of controlling the mouth of the Mississippi). On May 4, 1699, Iberville sailed back to France to recruit more colonists and raise money. He left Sauvole in command and instructed Bienville to explore the Mississippi River and surrounding territory.

Back in France, Iberville not only obtained further supplies and more colonists, but he also convinced the French government that Spanish claims to Louisiana were not valid and that strong efforts should be made to secure the territory against eventual English encroachments from the Atlantic coast. Upon his return to the Gulf coast, Iberville moved the colonial headquarters from Biloxi to a more strategic point a few miles up the Mobile River, where he built Fort Louis in 1702. In this location, he made plans for a great French empire in the New World, which would be strengthened by commercial and military alliances with Indian tribes as far up the Mississippi River as the site of St. Louis. As part of his plan, be began a series of fortified trading posts along the Mississippi River.

In recognition of French interests in the area, Spain opened the Gulf to trade between the Spanish settlements in Mexico and in Cuba and the French colonies along the Gulf coast. Trade, which previously had been limited to the exchange of Canadian furs and produce, began to increase. By 1704, an average of six ships a year made port at Ship Island, off the coast of Biloxi. There are no reliable records of the volume of local goods and trade passing through Ship Island, but Arriola, in his report to the viceroy of New Spain in 1703 concerning a visit to the French colonies, mentions eggs, fresh meat, bread, milk, and brandy.

In July 1704, the Pelican arrived at the colony from France with soldiers, workers, and 23 women sent to marry colonists. An epidemic of yellow

fever in September of that year, however, caused the deaths of 35 people. This was a serious blow to the struggling colony.

Iberville's grand plan for colonization was interrupted by the War of Spanish Succession (1701-1714) against the English. He took part in the war and died of yellow fever at Havana on July 5, 1706. Because of the war and the lack of support from France, Bienville could not carry out the ambitious project of his older brother, although he was successful in building up trade with the Indians and with encouraging new colonists to move into the area. In 1711, the garrison had a non-Indian population of 400. Development of the colony, however, soon proved to be too slow and too unprofitable to satisfy the French government.

In an effort to decrease expenses of the colony, the government in 1712 granted all trading rights in Louisiana to a French merchant, Antoine Crozat, for a period of 15 years. By the terms of the charter, Crozat was committed to developing the area and transporting new settlers. In return, the French government was to maintain forts and soldiers in the colony for a part of the period. Despite the return of peace in 1714 (with the end of the War of Spanish Succession) and a change of administrators, the colony failed to yield Crozat a profit. The non-Indian population had dwindled to only 100. Crozat objected to suggestions that a post be created on the present site of the city of New Orleans. As a result, there were only a few white people living in what is now Orleans Parish. D'Artaguette reported that there were five to seven inhabitants living between the Mississippi River and Lake Pontchartrain in 1715, and Gayarre states that these people planted an arpent of corn in Gentilly that same year.

Crozat's hopes for a commercial empire based on minerals and increased trade with Spanish colonies in the Gulf area were dashed by the Peace of

Utrecht, in which England forced Spain to close its ports to French vessels. In a desperate attempt to stop the decline of commercial traffic in the Gulf, Crozat imported 500 black slaves to establish a sugar industry in Louisiana. The industry did not generate the commercial boom that Crozat had hoped, but the importation of slave labor established a precedent in the area. On August 23, 1717, Crozat surrendered his rights in Louisiana back to the French government.

A charter for the control of Louisiana was then issued to a corporation called the Compagnie de la Louisiane ou d'Occident (later known as the Compagnie des Indies Occidentales), controlled by a Scotsman named John Law. On October 25, 1717, the company directors, meeting in Paris, formally authorized the founding of New Orleans as the central commercial and military headquarters. The actual establishment did not take place until months later (February 1718), with the arrival of the first public official, a tax collector. According to Baron Marc de Villiers, he "... came ashore among the reeds and the cypresses and the alligators, with his cash-box, his registers and his account book." Bienville selected the site and named it New Orleans in honor of Phillipe d'Orleans, the Regent of France. By June 1718, the town had a total population of 68.

Under John Law's direction, the colony expanded, largely as a result of glowing reports that he had circulated in France and Germany. Concessions of land were made by the company to persons who would agree to colonize and develop them. Many of these grants were made to French nobles, who did not come to Louisiana themselves, but sent stewards instead to manage the property. Agriculture took on importance as the new colonists came to realize that Law's boasted gold mines were imaginary and that they must earn a living in humbler fashion. Among the first successful farmers

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on a very limited scale. Iberville brought a few stalks with him and planted a patch at the mouth of the Mississippi River). Although both crops were later to become vitally inportant to the area's economy, at that time indigo was the principal cash crop in the area near New Orleans, and tobacco was the leading crop upriver at Pointe Coupee. For the most part, the economy of the area during the period was characterized by subsistence agriculture and dependence on fur trade and military establishments. Rice and corn were the principal staple foods. Some land along the river was devoted to gardens and to pasturage for livestock. A hurricane in 1740 destroyed vital crops, which had to be replaced by extensive importations from France, causing the colony to be an even greater drain on the French government and further discouraging efforts for progress. As the population increased, however, a small export trade was developed, involving lumber, indigo, and tobacco, although, for the most part, New Orleans was a receiving port for goods and materials shipped from France and Spain. Ship arrivals were irregular during the period and had little bearing on the commercial development of the area or the Gulf coast. Most waterborne traffic was inland on the Mississippi River and offshore along the coast. Trading also occurred with Cuban and Bahamian fishermen, who utilized the large fishing grounds in the Gulf.

The peaceful development of the colony by France came to an end with the French and Indian War, which locked the British and French empires in struggle from 1755 to 1763. British victory in the war resulted in the Treaty of Paris in 1763, which gave to Great Britain the following holdings in the New World: Canada, the Louisiana colony east of the Mississippi, and the Spanish colony of Florida. As compensation for Spanish aid against England during the war, France ceded to Spain the Island of New Orleans and the Louisiana Territory west of the Mississippi.

Although France lost its holdings in the area, the French influence endured, especially in lower Louisiana (below Pointe Coupee). This influence was and continues to be reflected in land use and settlement patterns, local place names, language, religion, music, architecture, and cuisine. The French introduced a mode of land division that distinguishes all their settlement areas from others in America. Because French settlement began at a time when waterways constituted the only means of travel, the French adopted the method of land division used along streams in northwestern France and in Flanders. Under this method, the stream served as the survey base, and surveys for grants extended out from the stream at right angles, resulting in many pie-shaped landholdings caused by the curvature of the river banks. Each landowner was required to build a landing on the river and to maintain a road along the top of the natural levee. This linear settlement pattern was occasionally broken by a complex of religious, civil, and professional buildings. The original land grants usually measured 8,000 feet deep, with 12,000 to 16,000 feet of frontage. With the passage of time, however, these large plots were divided and subdivided lengthwise among the male heirs in equal parts to allow each one access to the river. Eventually, the plots became so small that owners sold the land.

Spanish and British Domination (1763-1801)

Throughout the period that France was consolidating its power in the Gulf coast region, Spanish officials repeatedly urged development of the economic potential they recognized in Florida. It was not the Spanish policy to colonize Florida, however, and without active colonization, production and commerce were not possible. When a cargo of naval stores was produced in St. Augustine and shipped to Vera Cruz in 1756, it created great consternation among officials there, who could find no precedent to guide

them in deciding what to do with such an unheard-of thing as a product of Florida.

The British occupation of Florida in 1763 brought an increase in economic activity to that area and precipitated the emergence of a maritime commerce. The colonial government in West Florida was seated at Pensacola, but economic activity was focused farther to the west around the Mobile and Iberville Rivers. For several years, settlers from Barbados, the Bahamas, and the northern colonies migrated to Florida, along with their slaves and household goods, but these immigrants soon left because of the continued absence of marketable exports. By 1770, indigo had become a basic export commodity, along with small quantities of naval stores and lumber. After the American Revolution, British loyalists emigrated in large numbers to Florida, providing additional impetus to economic growth.

The transfer of the Island of New Orleans and the Louisiana Territory west of the Mississippi to Spain was kept secret from officials and the people of Louisiana until the middle of 1764. When announced, it proved highly unpopular among the local population, who petitioned Louis XV to undo the cession. Louis XV refused, and on March 5, 1766, Antonio de Ulloa arrived to govern in the name of the Spanish king.

Ulloa was coldly received and almost ignored. He was not a forceful man, and matters were made even worse by his timid method of governing indirectly through the last of the French governors who remained in the colony after cession to Spain. During his administration, he built Fort Real Catalica opposite to La Ballise, a fort opposite the mouth of Bayou Manchac, and a fort at Vidalia opposite Natchez. He also tried to enforce Spanish mercantilist decrees, but his poor diplomacy, the British free-trade policy,

economic difficulties, and the general displeasure with Spanish control were causal factors in an armed rebellion against Spanish authority, led by several prominent Creole businessmen in 1768.

Ulloa sailed away to Cuba immediately, but local hopes of independence were dashed ten months later when Count Alexander O'Reilley arrived in Louisiana with 2,000 soldiers to reestablish Spanish control and prestige. A man of action, O'Reilley executed five of the leaders of the rebellion which ousted Ulloa, substituted Spanish law for French, the Spanish language for French as the official tongue, and enforced Spanish commercial regulations which, based on the prevailing mercantile theories of the day, limited Louisiana trade to Spain and Cuba.

During the Spanish rule, an important addition was made to the Louisiana population -- the Acadian migration. The Acadians, who refused to swear allegiance to the King of England, began arriving in Louisiana from Nova Scotia after 1760. The colony was a suitable refuge for them because they shared with the local population a common French descent and religion. By 1790, more than 4,000 Acadians had come to Louisiana, settling in the southern part of the state, along the banks of the Mississippi, and farther west in the Bayou LaFourche, Opelousas, and Attakapas districts. Still another migration to Louisiana occurred in 1791, when a slave revolt in Santo Domingo drove out the whites, many of whom came to Louisiana.

During the American Revolution, the Spanish government of Louisiana provided aid to the American colonies, not so much to help the Americans as to humble England. Munitions were shipped through New Orleans to American forces fighting the British in the Ohio Valley, and the Spanish governor, Galvez, allowed Americans to use New Orleans as a base for operations against the loyalists and British in West Florida.

When Spain declared war on England on June 16, 1779, Galvez set out to occupy for Spain East and West Florida, which were controlled by the British. In addition to establishing commercial ventures in Florida in 1763, the British had also established control of the east bank of the Mississippi River. Land grants were offered along the Mississippi River, and thousands of immigrants had flocked to the area. As a result, the town of Natchez was reborn, Baton Rouge developed rapidly, and a new town was established at the mouth of Bayou Manchac. Plantations lined the river banks from Manchac to Baton Rouge. Galvez succeeded in capturing the British outposts at Bayou Manchac and Baton Rouge, and then marched to Natchez and captured Fort Panmure. He later seized Pensacola and Mobile. These acts were a severe blow to the British interests in America.

American Influence and Control (1803-1819)

Trade between American settlers in the Ohio Valley and Louisiana, although illegal under Spanish law, had become prevalent in the period prior to the American Revolution. After the war, the volume of trade increased dramatically as a result of the increased migration of Americans to the Ohio country. It readily became apparent, therefore, that control of or free access to the Mississippi River and its mouth was essential to western citizens of the United States. When Spain began to forbid American commerce at New Orleans and occasionally seized boats and cargoes sent there from Tennessee and Kentucky, the tension became great. The problem was temporarily resolved by the Treaty of 1795 between Spain and the United States, in which Spain recognized the Mississippi as the western boundary of the United States. For a three-year period which was later extended, American commerce was allowed free use of the river and the right to deposit and export goods at New Orleans.

Andrew Ellicot, appointed by Washington to survey the 31st parallel, the boundary between Spanish Florida and the U.S. Territory, fomented a popular rebellion against Spanish rule in Natchez, forcing the Spanish to evacuate that town in March 1798. In 1800, Spain secretly retroceded the Louisiana Territory to France in return for a large section of Italy. Napoleon, envisioning the reestablishment of a French New World Empire, planned to send an army to garrison Louisiana, but the army was wiped out before it ever arrived by the combined disasters of a native uprising and yellow fever in the French colony of Santo Domingo. In addition to this setback, Napoleon became engaged in war with England in 1803. Because of his need for additional money, his fear of England's taking Louisiana from him, and the impossibility of sending another expedition to occupy and defend it, Napoleon decided to offer to sell all of Louisiana to the United States.

On April 30, 1803, the Americans, amazed at the French offer to sell, consummated the bargain by which the United States more than doubled its size and gained more than 80,000 inhabitants. On December 20, 1803, Pierre de Laussat, who had represented the French republic in Louisiana, handed the territory over to the United States, represented by W.C.C. Claiborne, the new territorial governor, and Gen. James Wilkinson. The United States now controlled the most important waterway in America, the Mississippi River, and the most important port on the Gulf coast, New Orleans.

The value of this acquisition was greatly enhanced in 1791 by a fortuitous turn of events in the Caribbean. A slave revolt in Santo Domingo forced many sugar planters, mill masters, and coopers to flee that country. Many came to New Orleans. In 1794, a French plantation owner, Etienne de Bore, set up the first successful commercial sugar operation in the Gulf coast region. He undertook the endeavor because of the declining market

for his indigo crops and because of the stories of sugar prosperity carried by the newcomers from Santo Domingo. So successful was de Bore's operation that by 1800 the Spanish government had lifted its ban on the import of slaves in order to foster the growth of the industry. By 1801, New Orleans had become the center of the sugar industry, exporting 200,000 gallons of rum, 250,000 gallons of molasses, and five million pounds of sugar (Carter, 1942).

With the division of Spanish territory into Florida and Louisiana by the retrocession of Louisiana to France, Florida became Spain's last hold along the Gulf coast. After the purchase of Louisiana by the United States, many Americans migrated to Florida. Among these were the Kemper brothers, Ruben, Nathan, and Sam. As the result of a business disagreement and the belief that they had been slighted by the Spanish government, in 1804 the Kempers led an abortive rebellion against Spanish rule in West Florida. Their army of 35 men was routed by 150 Spanish militiamen. Although the rebellion was unsuccessful, the discontent expressed by the Kempers grew.

By 1809, favoritism and arbitrary fiat -- generally against the interests of America and usually agitated by the large Tory population -- was rampant in Florida. In 1810, news arrived that Napoleon was planning to invade West Florida. As much as Spanish rule was detested, French rule was liked even less. As a result, the rival Tory and American groups grew closer.

On September 22, 1810, a column of 75 West Florida settlers took the fort at Baton Rouge, Spain's last hold on the Mississippi River. On September 26, 1810, the West Floridians proclaimed their independence from Spain and organized themselves into the Republic of West Florida. All land between the Mississippi River and the Pearl River was given to the Louisiana Territory, and the new alcalde of Florida, Fulovar Skipwith, was instructed to seek annexation to the United States. On December 3, 1810, the Spanish

governor of West Florida wrote to U.S. President James Madison requesting the aid of American troops in driving the rebels back to Baton Rouge, and asking that commissioners be sent to Mobile to negotiate the transfer of the province of West Florida to the United States.

On October 27, 1810, however, President Madison proclaimed that West Florida had really belonged to the United States all along as part of the Louisiana Purchase. He then ordered W.C.C. Claiborne, governor of the Louisiana Territory who was in New Orleans, to enter the territory and take possession as far eastward as the Perdido River. By December 1, Claiborne had distributed copies of Madison's proclamation throughout West Florida. The successful rebels were indignant and vowed to defend their independence against the United States itself. While Skipwith was planning to resist, Claiborne proceeded to the town of St. Francisville (capital of the Republic), raised the American flag, and urged the assembled citizens to accept the government of the United States. Angrily and with truth, they answered that "the United States had refused either assistance or protection when it was needed and now when it was unnecessary, sought to force it on us" (Carter, 1942). The claim of the United States, they said, was bad in law and morals, and Madison's proclamation was a virtual declaration of war. They then vowed to defend West Florida with their lives. Claiborne ordered gun boats and reinforcements from New Orleans. Without waiting for them, he marched the few miles from St. Francisville south to Baton Rouge, encountering no opposition. When he raised the American flag over the fort, however, it was torn down. At this point, the reinforcements arrived, and the citizens reluctantly yielded to Claiborne without any blood being shed.

The Census of 1810 reported a population of more than 75,000 residing in the Territory of Orleans. This number was sufficient for statehood, and

a proposal to that effect was made in 1811 by Julien Poydras, the territory's delegate to Congress. In November 1811, a territorial convention met at New Orleans and drew up a constitution patterned after Kentucky's, providing for a governor, a bicameral legislature, and a supreme court. It differed from other state constitutions, however, in retaining the Napoleonic code rather than adopting the Common Law. Louisiana formally became a state on April 30, 1812.

Although Louisiana now ceased to play a part in the intrigue of European diplomacy, its history continued to be eventful. Much activity centered around the control of the mouth of the Mississippi River. The western Gulf of Mexico at this time was controlled by freebooters, privateers, and pirates. To the east, the settlements of Biloxi, Mobile, and Pensacola controlled access to the Mississippi Sound, the major sea channel to New Orleans.

Minor British expeditions to gain entrance to Mobile Harbor during the War of 1812 failed and resulted in the loss of a small frigate, the HMS Hermes. These expeditions were attempts to protect the flanks of the major invasion under Vice Admiral Sir Alexander Cockran and Sir Edward Packenham. Major Nickols of the Royal Marines attempted to arm Indians and to organize a slave revolt to create an army to travel up the Mississippi River to Baton Rouge after the anticipated fall of New Orleans. Reacting to the use of Pensacola as a British stronghold and a possible invasion port, U.S. General Andrew Jackson captured the town of Pensacola on November 7, 1814. The Spanish commander of Fort St. Michael surrendered, opening the way for an assault on the British-held Fort Barrancas, which guarded the entrance to Pensacola Bay. As the Americans approached the fort on November 9, 1814, the British blew it up, embarked on their waiting transports, and rejoined Cockran's main force in Jamaica.

The battle for control of the Gulf coast region culminated at New Orleans on January 8, 1815, when Gen. Andrew Jackson defeated the British at Chalmette in a notable battle, made even more so by the fact that it was fought 15 days after peace had been signed at Ghent between Britain and America. As a result of the battle, however, U.S. dominance along the Gulf coast was recognized.

The town of Apalachicola, on the river of that name in Spanish-held East Florida, had been built by the British during the War of 1812. After the war, the fort and the surrounding countryside, which was occupied by Seminole Indians, became a refuge for runaway slaves and hostile Indians. To eliminate the threat of problems with these individuals, the U.S. government dispatched an expedition which destroyed the fort on July 27, 1816, and touched off armed conflict with Negroes and Indians. A force led by General Edmund T. Gains was instructed to pursue hostile elements across the Florida boundary to the limits of the Spanish posts. On December 26, 1817, command was transferred to General Andrew Jackson, who was given similar orders. Upon receiving the instructions, Jackson wrote to President Monroe,"let it be signified to me through any channel that the possession of the Floridas would be desirable to the United States and in sixty days it will be accomplished" (Morris, 1953). No immediate action on the letter was taken in Washington by President Monroe and Secretary of War Calhoun. Jackson chose to regard their official silence as tantamount to approval of his subsequent course in Florida.

Jackson marched into Florida and seized St. Marks on April 7, 1818, and Pensacola on May 24, 1818, even as Secretary of State Adams was holding discussions with the Spanish minister concerning the problems in Florida. Jackson's raid met with disapproval by all of the cabinet members except

Adams. Because of the popular approval of Jackson's Seminole campaign, which brought all of East Florida under U.S. military control and strengthened the image of the United States in foreign affairs, President Monroe decided not to take punitive actions against Jackson.

Accusing Spain of aiding and abetting hostilities against the United States, Adams declared that the U.S. government had acted in self defense. He defended Jackson's conduct and informed the Spanish government that it faced the alternatives of protecting and controlling Florida or ceding it to the United States. The Spanish posts seized by Andrew Jackson in East Florida were returned to Spain, but Adams' vigorous instructions, coupled with the Spanish colonial difficulties in South America, caused the Madrid government to agree to the U.S. demands. The extended negotiations which Adams had conducted with the Spanish minister resulted in a treaty signed on February 22, 1819, whereby Spain renounced all claims to West Florida and ceded East Florida to the United States. The treaty also defined the western limits of the Louisiana Purchase.

After the United States gained control of Florida, the primary concern shifted to the control of piracy in the Gulf. Congress had authorized war against the pirates in the Gulf on March 3, 1819. At that time, however, the U.S. Navy could spare only a few ships for this purpose. The Linx, with six guns aboard, successfully engaged pirates in the western Gulf in 1819 under the direction of Lt. J.R. Madison. The ship disappeared at sea with its 50-man crew in January 1820. The problem of piracy became even more critical in 1820 and 1821. Further discussion of the problem is included in the historical overview of the period 1820 to 1865.

Technological Changes (1700-1819)

For the first half of this period, the pace of evolution remained at a fairly constant rate. In 1758, however, the Royal British Navy performed

an experiment in which it sheathed the HMS Alarm with copper. The experiment was a success, since the copper not only thwarted the attack of the Teredo worms, but also reduced the build-up of barnacles and algeans on the sides and bottom of the vessel. Without this build-up, the vessel had greater speed through the water. Unfortunately, the Royal Navy did not accept the practice on more than a trial basis until half a century later. Merchants not working through the bureaucratic network, however, were able to implement the practice much sooner. Changes in construction following the experiment with copper sheathing had two important results. The first was a faster vessel; the second was a much more stable, safer, and longer-lasting platform from which to work.

In the century after the experiment, many other innovations were made that changed the appearance, design, and propulsion of vessels. In 1760, Muller, of the English Navy, introduced a smaller cannon which fired the same size shot as the larger conventional cannons. The short cannon, as it was called, reduced the weight of an armament on a vessel while maintaining the same defense power. In 1772, a Scottish inventor, James Watt, created the modern steam engine. Steam-propelled vessels, however, were not in common use in the Gulf of Mexico for another 40 or 50 years. In 1779, the carronade was adopted for use by the British Royal Navy, further reducing the size of the cannon needed to fire a given shot. The carronade could fire shots weighing up to and including a 46-pound ball. Prior to that time, a cannon capable of firing a 46-pound shot was believed by the Admiralty to be too unwieldy for use aboard ship and too hazardous to both the ship and its crew.

In 1783, the use of iron bolts on ships was discontinued. Copper bolts or bolts with copper heads were substituted. The use of copper

reduced the amount of decay-producing water that could get into the middle of the timbers. This seepage was a problem when iron bolts were used because the bolts would deteriorate or corrode through the electrolytic process, allowing the water to enter through the fastening holes.

By the end of the 1700-1819 period, the prospects were bright for even greater advancements and further improvements in maritime vessels. On the whole, however, change was slow during the period, varying not only by country, but also by type of commerce within a country. One of the last important achievements in the period was the production of an anchor chain and a heavier handling gear to raise this chain (1812-1815).

Period 1820-1865 A.D.

The period 1820 to 1865 was characterized by the rapid growth of population, trade, and agriculture in the Gulf coast area. This discussion of events during that period is divided into two parts: the period 1820 to 1860 and the Civil War period (1860-1865).

Antebellum Period (1820-1860)

The history of the Gulf coast area in the four decades preceding the Civil War is closely tied with the organization, economy, political and social development, and military and governmental patterns of the South as a whole. As previously indicated, it was a period of growth and increased stability. From a population of around 75,000 in 1810, the inhabitants of Louisiana increased to more than 150,000 by 1820, 350,000 in 1849, and more than 700,000 in 1860. The population of the city of New Orleans reached 102,000 in 1840, making it the fourth largest city in the Union.

Statistics on sugarcane production illustrate the growth of that crop in the delta area. In 1820, for example, around 25,000 hogshead of sugar

were produced. By 1835, this volume had increased to more than 100,000 hogshead; in 1845, to more than 200,000; and by 1865, the peak year, to more than 450,000 hogshead. This high rate of increase reflects improved agricultural methods and the use of steam equipment after 1830, as well as the growth of population and demand for the product. Commerce, particularly at New Orleans, kept pace with the rapid development of the coastal area in other fields. Figures on freight tonnage brought down the river to New Orleans reflect this growth. In 1815, less than 70,000 tons were shipped through the port. By 1840, the volume had increased to almost 550,000 tons.

The period was marked by a number of significant accomplishments. In 1823, for example, the first gas well in Louisiana was brought in near Natchitoches, but was not thought to be of any value. On April 23, 1831, the first railroad west of the Alleghenies, the Pontchartrain Railroad, opened passenger and freight service between New Orleans and Milneburg. This company continued in operation until absorbed by the Louisville line in 1880. The New Orleans and Carrollton Railroad, one of the first trolley lines in the country, was put into operation between Canal Street and the village of Carrollton. In 1837, Ralph Smith-Smith, a planter, began what is probably the first railroad west of the Mississippi, the Red River line, which ran from Alexandria to Bayou Hauffpauer near Cheneyville for the purpose of transporting cotton and sugar to the Red River steamboats. The invention of the "multiple effect" process by Norbert Rillieu revolutionized the sugar-refining industry in 1846.

Elsewhere along the coast, significant strides were being made toward economic growth and stability. Mississippi, which gained statehood in 1817, was by now a fast-growing frontier region. The state population increased from 40,352 in 1810 to 75,448 in 1820, and the state capital was located

at Jackson in 1822. Two-thirds of the area was still in Indian hands, but gradually the natives ceded their lands to the state and migrated westward.

The Territory of Alabama, which gained statehood in 1819, was rapidly being settled by immigrants from the Atlantic seaboard, who cleared land for farms and built towns in the river valleys. Much of the state was found suitable for the production of cotton, which had become a highly profitable crop throughout the South after the invention of the cotton gin in 1793. Increasingly during the period, farmers began to specialize in the crop, and a plantation economy developed.

The Spanish cession of Florida to the United States in 1821 marked the beginning of sustained development in that state. This was virtually a new phenomenon: for more than three centuries the area had been a pawn of imperial projects, and except for the small towns of St. Augustine and Pensacola, there was only minor evidence of European influence. After a brief period of military government under Jackson, the area was organized into a territory in 1822, and gained statehood in 1845. During the territorial period, much of the area was transformed into plantations and small farms.

Texas, which had been a part of the Spanish colonial empire, became part of the Republic of Mexico in 1821. In 1835, the Republic of Texas was established, and the area became the twenty-eighth state in 1845. A number of port towns along the coast are of historical significance. These include Galveston, Aransas Pass, Matagorda, Velasco, Corpus Christi, Indianola, Port Isabel, Brazos de Santiago, and Sabine Pass.

A new settlement was begun at Galveston in 1834, which served as a naval base for Texas revolutionaries. The town was incorporated in 1839 and flourished as a cotton shipping point and as a port of entry for the

Republic of Texas. Over 120 shipwrecks have been recorded in the Galveston area, including Galveston Island, Trinity Bay, and Bolivar Point (Berman,1972; Lytle, 1952; Shomette,1973; U.S. Navy Department, 1971; Works Progress Administration, 1938b). Most of these occurred during the nineteenth century, beginning in 1841.

The Aransas Pass area was first settled during the 1820's and 1830's by Irish immigrants. Through most of its early history, the area was a fishing port. It is the recorded location of over 30 shipwrecks (Berman,1972; Lytle,1952; Shomette,1973; Works Progress Administration, 1938b), at least 16 of these occurring in the nineteenth century. The earliest of these occurred in 1845.

Matagorda, which was first settled in 1825, was designated a port of entry by the Republic of Mexico in 1831 and remained an important port during the Mexican period. Over 40 shipwrecks have been recorded at Matagorda, the last occurring in 1852 (Berman, 1972; Lytle, 1952).

The town of Velasco was established in the 1830's around the site of a Mexican fort captured by Texas revolutionaries in 1832. The treaty ending the Texas Revolution was signed at this town. Over 20 wrecks are recorded at Velasco/Freeport (Berman,1972; Lytle,1952; U.S. Navy Department,1971), at least 9 of these occurring in the nineteenth century.

Corpus Christi was founded in 1839 as Kinney's Trading Post and received a considerable economic boost with the advent of the Mexican War a few years later. In 1848, the name of the growing town was changed, and settlers were encouraged to locate there. Corpus Christi became an assembly point for prospectors during the Gold Rush of 1849.

Indianola was founded in 1844 as Carlshafen, a port of entry for German colonists. Some years later (1856-1857), the town was a port of

entry for camels which were being imported by Jefferson Davis, then Secretary of War, who hoped to establish an Army Camel Corps in the Southwest. Indianola experienced tremendous commercial activity and immigration for a period of about thirty years. Only one nineteenth century wreck (1868) has been recorded at Indianola (Berman,1972; Lytle, 1952).

Port Isabel was made the site of a government lighthouse in 1853. Neighboring Brazos de Santiago, the entrance to the Rio Grande, was a supply base for Taylor's army during the Mexican War. Eighty-nine wrecks have been recorded in the area of Port Isabel and Brazos de Santiago (Berman,1972; Lytle,1952; Shomette,1973; Works Progress Administration, 1938b), seventy-five of which occurred during the nineteenth century (1846 to 1877).

Sabine Pass was a boom town and center of pirate activity before the Civil War. A well-known Civil War battle fought there in 1863 repelled an attempted Federal landing (Hansen, 1969). References have been found for fifty-one wrecks in the Sabine Pass vicinity (Berman,1972; Lytle,1952; Shomette, 1973; U.S. Navy Department,1971),eleven of these occurring during the nineteenth century.

During this period, the problem of controlling piracy in the Gulf of Mexico became even more critical, especially in view of the unprecedented growth of population, agriculture, and commerce in the area. A decade earlier (in 1813), the governor of Louisiana had issued a proclamation commanding the smugglers at Barataria to disperse, but the pirates, commanded by the Lafitte brothers, ignored the order. By 1821, the problem had reached proportions requiring immediate attention. During that year, the sloop of war Hornet, the brig Enterprise, and the schooner Porpoise had

been actively engaged in the Gulf. These vessels destroyed at least seven pirate vessels and one pirate base on the Cuban shore. The brig Spark and the schooners Scrampas, Shark, and Alligator were also assigned to West Indies waters, and gunboats 158 and 168 patrolled the Georgia and Florida coasts. The need for additional small vessels was apparent, however. As the campaign against the pirates intensified, it became a free-for-all in which it was often difficult at sea to distinguish friend from foe. The naval campaign of 1822 gradually reduced the number of larger pirate vessels and reduced pirate activity to forays by smaller boats from the Cuban shore. In 1823, new classes of small vessels were introduced to combat the kind of maritime guerrilla warfare to which piracy had reverted. In February 1825, a Pensacola newspaper warned mariners that a band of pirates operating some 25 miles east of Havana sometimes displayed a revolving light similar to that at Moreau Castle in order to lure passing vessels within range of attack. The threat of piracy remained serious enough to cause concern in Key West as late as 1829.

Because of its location, the Gulf coast area played an important part in the "Manifest Destiny" chapter of American history, which includes the war with Mexico, the annexation of Texas, and the curious "filibustering" expeditions aimed at fostering revolutions in the Spanish colonies of South America. Many area residents migrated to Texas during the period to help fight that republic's battles against Mexico. Many more served under General Zachary Taylor who, when the United States went to war in 1846, led his armies into Texas from Louisiana territory. In the 1850's, New Orleans was the center of such filibustering acitivity as Naraso Lopez' two futile expeditions against Cuba in 1850 and 1851 and William Walker's temporarily successful rebellion in Nicaragua in 1856.

By 1806, a latently aristocratic and feudal society was beginning to take shape in the more settled communities of the coastal region. The number of slaves in the South had increased from about three-quarters of a million in 1790 to four million by 1860. New Orleans became a major market place for the importation of slaves. As agricultural and commercial activities expanded in the area and in states drained by the Mississippi River, New Orleans became the Queen City of the South. More than 5,000 boats a year traveled down the Mississippi River or across the Mississippi Sound from Mobile, Pensacola, Galveston, and the Sabine River to deposit cotton on the wharves at New Orleans. One proud resident of New Orleans wrote a friend in the Northeast in the year 1858 that New Orleans was probably the principal port in the United States, since it did more day-to-day ship business than the port of New York (Carter, 1942). Wealth poured in from the mid-continental United States and from all over the world. This booming life was soon to feel the impact of the Civil War, as indicated in the following paragraphs.

Civil War Period (1860-1865)

The election of Abraham Lincoln to the presidency in 1860 and the action of South Carolina were quickly followed in 1861 by the dissolution of ties between the coastal states and the Union. In an effort to cut off supplies being imported to equip and sustain the Confederate Army, the Union Navy began to blockade ports along the Gulf coast soon after the war began. From Key West to Pensacola, blockade-runners were engaged in smuggling small amounts of subsistence goods to the inhabitants of the Florida peninsula. From Pensacola east to Mobile, the runners concentrated their activities on running small shipments of goods and supplies along the coastline and into the small rivers that dotted the coast. Since the Union forces were unable to patrol all of the many small swamp ports along the coast, they concentrated activities on the three large ports of Mobile, Galveston, and New Orleans.

Because of the great commercial and strategic importance of New Orleans as the gateway to the Mississippi Valley, that city quickly came under Federal naval attack. Two permanent masonry forts, Jackson and St. Philip, were garrisoned by Confederates about 90 miles downstream from the city. The Federal attacking force consisted of 24 wooden vessels, mounting 200 guns, under the command of Adm. David G. Farragut, and 19 mortar boats, each armed with a 13-inch mortar, under the command of David D. Porter. The attack began on April 18, 1862, with a rain of mortar shells, but after a week of bombardment, it became clear to Federal forces that the mortar boats were ineffective against the forts. On the night of April 24, Farragut ordered his vessels to run past the forts, and by dawn he had achieved his objective. The Union lost one gunboat and a flagship, and another gunboat was damaged. Nine Confederate vessels were sunk or captured. A few days later, on April 29, Farragut walked to the City Hall and demanded the town's surrender. The administration of Maj. Gen. Benjamin F. Butler, the Union commander of occupation who arrived two days later, made him an anathema to the residents of the city.

After the fall of New Orleans, the Union Navy attempted to consolidate its position along the coast by landing at many small towns and rivers where cargoes were still being smuggled ashore by blockade-runners.

To the east, in Florida, most of the coast towns were captured by Federal forces in the first two years of the war. The most important military action in Alabama was the Battle of Mobile Bay, on August 5, 1864, in which a Union fleet, commanded by Adm. David G. Farragut, blockaded the entrance to the bay after successfully engaging the Confederate ram Tennessee, commanded by Adm. Franklin Buchanan. The city itself was not captured until the following year, however.

Although the Union Navy was successful in blockading much of the coast, Confederate cruisers, built or bought in England, caused great loss to

Northern shipping. One of the most important naval conflicts of the war, between the Union Monitor and the Confederate Merrimac, marked the end of wooden battleships. The Monitor, built by John Ericcson, was launched in 1862. Heavily sheathed in iron, the vessel was characterized by revolving turrets carrying two 11-inch guns. The deck was only 18 inches above the water. The Merrimac was a frigate, which was scuttled by the Union, raised by the Confederates, and made into an ironclad, renamed the Virginia. The two ironclads clashed in battle in Hampton Roads on March 9, 1862. The action was indecisive, and no one was killed.

When the war ended at Appomattox Courthouse on April 9, 1865, with the surrender of Lee to Grant, a total of 2,200 battles had been fought between the North and South, comprising more than 6,800 engagements of all kinds on land and sea.

Technological Changes, 1820-1899

Until 1820, most technological changes and improvements, although important, were not very far-reaching. Beginning in the mid-1800's, however, the impact and significance of changes increased dramatically. During this period, the length/beam ratio in sailing ships was increased from 4:1 to as much as 9:1; steam-propulsion challenged the use of sail; and iron for construction was introduced. In another development, the rule joint rudder was replaced by the plug stock or gun stock rudder. The result was a more efficient steering system and a reduction in the size of the large opening needed in the stern for the rudder to swing. (The plug stock needed an opening only the size of the pillar post that came up into the vessel proper).

Various types of ballast were also tried in the late nineteenth century. These included pigiron, sand bags, and even lead, which, at times, replaced the traditional cobble ballast used on earlier vessels. Another type of ballast

has been noted on some of the wrecks from that period. This ballast was lithic in nature, but was quarried, as opposed to stones that were picked up in riverbeds.

As early as the beginning of the 1800's, the vast quantities of good lumber needed to produce a vessel were becoming relatively scarce for many of the major maritime nations. To develop a substitute for this commodity and to produce more durable products, these nations began to experiment with combinations of iron having wooden skins. (The wooden skins were necessary in order to apply copper sheathing). Iron was used first for beams and then for frames. Another procedure was also tried during the early 1800's. This involved triple hull skins in which internal layers of planking were placed diagonally to the water line (rather than parallel), and the outside, or third skin, of planking was placed parallel to the water. This procedure might have replaced the older method of wood construction had it not been for the dwindling supplies of good lumber. Iron was therefore used with increasing frequency, not only because it was a more durable product, but also because it was a more accessible commodity. Iron was harder to work with, however, and required larger machinery. Many of the older shipwrights who took pride in their craft were hesitant to use iron, and some vigorously resisted the change.

During this period, controls were placed on piracy at sea; therefore, it was no longer necessary for vessels to carry a large amount of armament. This development reduced the amount of ferrous material required, decreased the weight of the average vessel, and created additional space for commodities.

During the remainder of the period, most of the innovations related to vessel propulsion. In 1819, the steamship (the Savannah) crossed the Atlantic, although it traveled only partially under steam; in 1829, the first steam warship, the paddlewheeler Sphinx, was launched by the French; in 1834, the

propellor-driven American steamer Midas sailed from New York to China; and in 1836, an Englishman (F.P. Smith) and a Swedish engineer (J. Erickson) obtained patents on a screw propellor. The Izard which was sunk at the mouth of the Withlacoochee River in 1837, may have been the first steam vessel used during war. It was sunk during the second Seminole uprising in Florida. In 1838, the steamship Cirus crossed the Atlantic completely under steam, becoming the first vessel to do so. The first ironclad sailing vessel (the Ironclad) was launched in 1838.

Despite the advances being made with respect to propulsion and iron siding, wooden-hull sailing ships continued to play a prominent role in maritime commerce. The first clipper (the Rainbow) was launched in 1845; the fastest clipper (the Flying Cloud) was launched in 1851; and the largest wooden vessel ever built (the Great Eastern) was removed from its ways in 1853. All of these ships post-dated the advent of steam and iron hulls.

During the Crimean War (1853-1856), however, the advantages of steam warships and armored gun barges were emphatically demonstrated, marking the end of wooden ships of war. The Monitor class vessel, which was used during the Civil War, combined the best characteristics of the armored barge and steam warship. This vessel marked the beginning of a new era in maritime vessels. In 1860, the old hemp standing-rigging gear was replaced by wire rigging.

The aggregate effect of all these changes was to increase the life expectancy of a vessel, its speed, and the safety of the crew.

Period 1865-1945 A.D.

The effects of the Civil War were broad and far-reaching, the greatest being the emancipation of slaves and the resulting economic and social adjustment that followed in the South, particularly in the period of Reconstruction.

Economic and social recovery from the ravages of war was effected more slowly than political recovery. Many of the large landholdings were broken into smaller units, and single-crop family farms (many subsistence) were soon widespread. Lumbering, an adjunct of both plantation and smallholder agriculture since the earliest days of settlement, increasingly became an important industrial activity. Cotton was still the principal cash crop throughout the South, however, although some diversification of agriculture did occur. Tobacco, hides, sugar, and rice were exported in increasing quantities. No real industry, based on production of surplus value, existed during the period. The major "industrial" exports included lumber, cigars, salt, and fish. The coastal area was rich in quantity and variety of saltwater fishes, as well as freshwater varieties. Economically important species included pompano, redfish, Spanish mackerel, menhaden, bluefish, flounder, and grouper. In the shellfish and turtle groups, there were various species of shrimp, terrapins, crabs, and oysters.

Improvements in the important field of transportation were begun after 1870. In that year, a program of levee construction was begun on the Mississippi River. On June 30, 1870, the Robert E. Lee and the Natchez left New Orleans on the most famous steamboat race in history. The Robert E. Lee arrived in St. Louis in three days, 18 hours, and 14 minutes, beating the Natchez by three hours and 44 minutes. In 1873, the first through-train service from Chicago to New Orleans was offered by the Mississippi Central. (The line was reorganized in 1875 as the Chicago, St. Louis, and New Orleans, and this in turn became part of the Illinois Central system in 1877).

The port of New Orleans was greatly benefited in 1879 when Captain James B. Eads succeeded in constructing the first effective jetty system at the mouth of the Mississippi, thus controlling the shifting sandbars, which, by

obstructing the entrance to the river, had always impeded waterborne traffic to the city. In addition to port improvement, by 1883 New Orleans was connected with the rest of the country by five trunk railroad lines and the lines of a series of companies extending to the Pacific Coast. Channel and harbor improvements were made at Galveston, Texas, between 1889 and 1896, which resulted in the city's becoming a major port. The town was severely damaged by a hurricane in 1900, but was quickly rebuilt, retaining its role as a major coastal port. Channel improvements were also made at Port Aransas, Texas, which led to its becoming an active fishing resort. Matagorda, which was an important port during the Mexican period in Texas, faded into insignificance during the second half of the nineteenth century. The town of Velasco, Texas, was absorbed during the early part of the nineteenth century by the town of Freeport. The latter became a major shrimp and sulphur port after the discovery of sulphur in the area in 1913 (Hansen, 1969).

Corpus Christi, which had served as an assembly point for prospectors during the Gold Rush of 1849, became a center for cotton production after the Civil War. From 1875 to 1885, the city was one of the largest wool markets in the world, but sheep production was gradually replaced thereafter by cattle-raising. Today, the town is a center for natural gas production (Hansen, 1969). In spite of the varied economic history of the area, only six shipwrecks have been documented (Berman, 1972). One particular wreck occurred during World War II. It seems likely that others occurred in the area, but simply have not been documented.

The town of Indianola, Texas, which was founded in 1844, was demolished by a storm in 1875. Attempts were made to rebuild the town, but the reconstructed area was demolished in 1886, and the site was abandoned (Hansen, 1969). At Port Isabel, Texas, a supply depot was built in 1866 to serve a possible campaign

(never launched) against Maximilian of Mexico (Hansen, 1969). The town is now a large, modern cargo port, specializing in shrimp.

In 1868, the town of Rockport, Texas, was established by the Morgan Steamship Company as a shipping point for cattle products. Until meat-packing plants were built in the area, hides, tallow, and bone meal were shipped out, and the meat itself was thrown away (Hansen, 1969).

From December 1884 until May 1885, the World's Industrial Cotton Centennial Exposition was held in New Orleans to celebrate a century of progress in cotton production. At the same time, a thriving cottage industry was springing up along the coastline. Tampa, in 1886, was the center of the cigar industry in the United States, and New Orleans had several small potteries. During the period, New Orleans continued to be the largest port in the Gulf coast region. Mobile and Pensacola ranked second and third, respectively (Figure 4). With the discovery of phosphate in south Florida in the 1890's, Tampa and Punta Gorda became major transshipment points for the chemical.

The Spanish-American War had little effect on the Gulf coast, with the exception of Tampa, which became the troops' headquarters for the expeditionary force to Cuba.

The 1890's also marked the beginning of what was to become the major industry in Florida: tourism. First Tampa, then Pensacola and Panama City, began to promote their attractions as resort areas. The Gulf coast towns of Biloxi and Gulfport soon followed suit. By the turn of the century, tourism was a major industry in the Gulf coast area.

After the turn of the twentieth century and until World War II, the Gulf coast area made enormous strides in industry and agriculture. Lumbering became an intensive industrial activity during the period. Steam power in

Figure 4. Part of the busy Pensacola waterfront area in 1855, from an old lithograph.

the form of dredges, pullboats, skidders, tugs, and logging railroads replaced the old method of floating logs out individually at high water, and allowed professional lumbermen to strip thousands of acres of forest in a relatively short time. In most parts of the South, the era ended in the mid-1920's, only 30 years after it began (Figure 5).

Petroleum was discovered near the Louisiana coast in 1901, and for the next several decades, there was a slow, but steady, increase in that sector of the economy. The commercial mining of sulphur was begun at the town of Sulphur in Calcasieu Parish, using the new Frasch system for the first time. Until 1914, this field supplied 75 percent of the nation's sulphur. It was exhausted in 1924.

By 1915, the marine industry had become well established along the Gulf. The shipyards at Mobile, Ocean Springs, Biloxi, Gulfport, New Orleans, and Galveston were among the largest in the nation. Commercial trade in the area tripled in the 1920's as a result of oil production along the Gulf coast.

Sabine Pass, Texas, which was a boom town and center of pirate activity prior to the Civil War, dwindled to a small fishing village during the early twentieth century. The channel has remained active, however, and now serves as an entrance to the modern cities of Port Arthur and Beaumont. The Sabine River itself was accurately mapped for the first time in 1902 (Suarez, 1968).

During World War II, Florida was dotted with the installations of all branches of the armed services, and most of the hotels at Miami Beach were taken over for military personnel. Along the Atlantic coast lurked German submarines, which took their toll of ships, especially tankers. German submarines also sank tankers at the mouth of the Mississippi River, but, undisturbed, the city continued to flourish. Four World War II shipwrecks have been documented at Galveston, Texas.

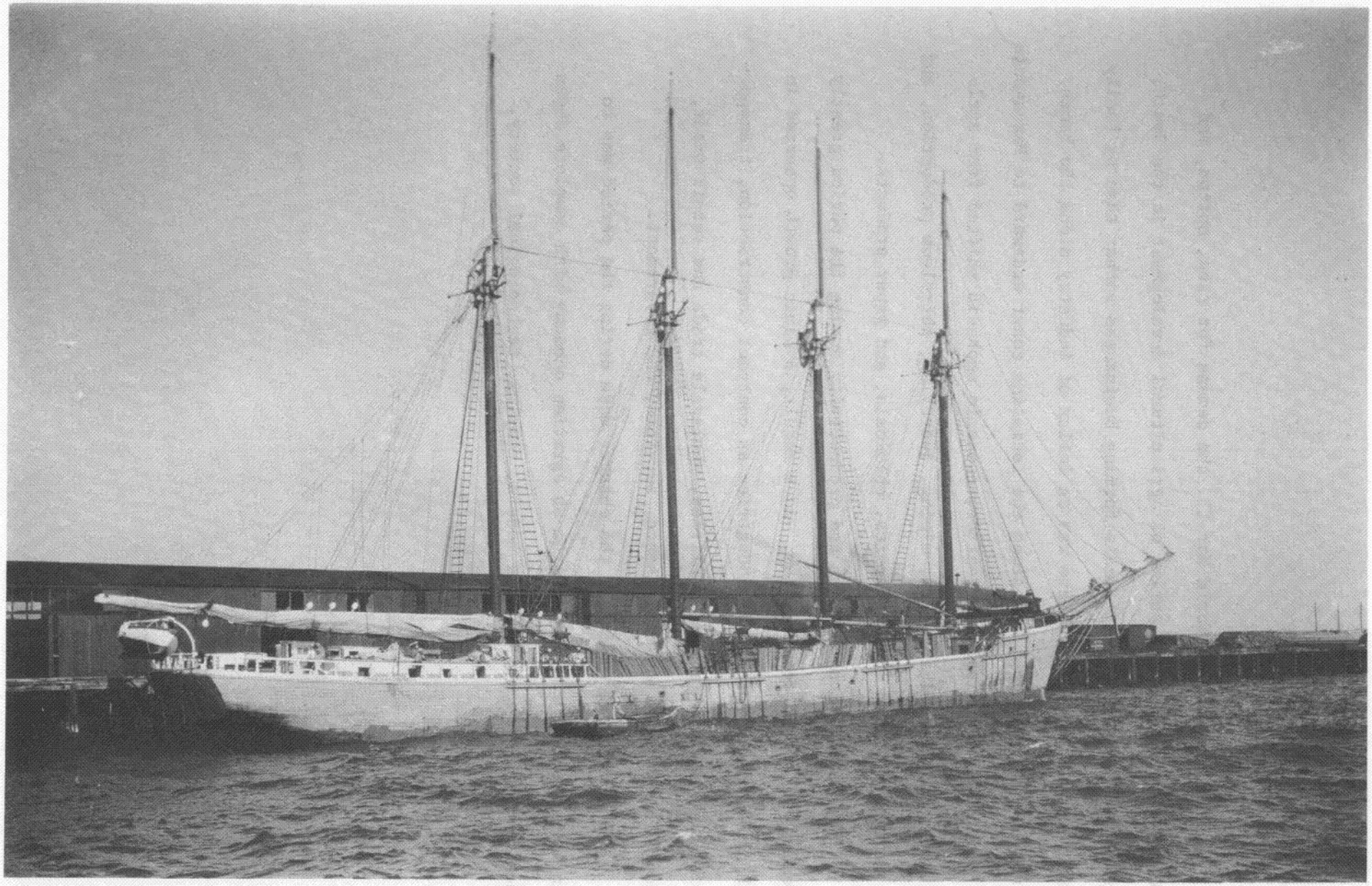

Figure 5. The four-masted schooner Charles H. McDowell with a cargo of lumber in Pensacola in the 1920's. Many sailing ships were still in use in the Gulf coast trade in the early twentieth century.

With the advent of World War II, the demand for rice, cotton, and livestock initiated a new period of agricultural development in the South, carried out largely by large-scale farming businesses rather than by family farms. At the same time, there was an influx of industry along the banks of the Lower Mississippi and along the Louisiana coast eastward to Pascagoula and Mobile. Increasingly thereafter, economic emphasis shifted from agriculture to commercial forestry, mining, quarrying, petroleum production, and the manufacturing of food, textiles, chemicals, and paper products.

Increased economic growth and productivity during the period greatly expanded the demand for services. As a result, dynamic growth occurred in such non-commodity-producing industries as contract construction, transportation, communications and utilities, wholesale trade and retail trade, finance, insurance, and real estate, services, and government.

The cumulative effect of the changes made during the period was to transform the Gulf coast area from an agrarian economy with complete dependence on natural resources to a modern, complex, technological society.

THE SPATIAL AND TEMPORAL DISTRIBUTION OF SHIPWRECKS AND ARTIFACTS

Introduction

Archeologists concerned with the Historical Period ashore typically deal with towns, forts, individual structures, or other types of sites, the identities and geographic locations of which are well known. Occasionally, an entire structure, the walls, or at the least the foundations of a site to be investigated, may be intact. Where structures have fallen into complete ruin, maps or plans may be available which, in conjunction with exposure of foundations or features at selected points, are often all that is needed to unmistakeably identify a specific structure or location. Unfortunately, positive identification of shipwrecks, even relatively late sites such as those in the 19th century, is seldom as straightforward, and on occasion has proved to be a relatively difficult process. Ships, unlike sites ashore, are mobile, and their demise takes place in the more-or-less featureless medium of the marine environment. Moreover, the marine hazard that claims one wreck usually claims others -- in some cases, dozens of others of approximately the same period and nationality as the first. Add to this the somewhat specialized material culture associated with ships and the traditionally conservative attitudes of naval and commercial marine interests toward adoption of new ideas, which, carried to extremes, will see matchlock muskets carried on a Spanish warship in 1715, some 100 years after the invention of the spark lock, and one can begin to appreciate the problem (Clausen, 1975).

The conditions of shipwreck sites vary widely and primarily reflect such factors of the loss as 1) sea state, 2) water depth, 3) type of bottom, 4) nature of adjacent coast, 5) strength and direction of both the prevailing and storm-generated currents and waves in the area, and 6) the size and

type of construction of the vessel. With the very minor exception of some exposed coral reef in the portion of the Florida Keys included in the survey, the bottom in the shallow shelf area of the northern Gulf is composed of or at least mantled with unconsolidated sediments; therefore, it is not necessary to discuss the idiosyncrasies of wreck sites on rocky bottoms. However, a brief comment on the general nature of wrecks on coral reefs is included for the appropriate areas.

Shipwrecks in Shallow Water

In the majority of cases, vessels of wooden construction lost on active, exposed coasts tend to break up and disintegrate under the influence of storm-generated waves and currents. Later, they may also be destroyed by intense attacks of various marine organisms and the effects of succeeding storms, scattering their components, ballast, and cargo over an area much larger than the dimensions of the original ship. As the lighter, less robust portions of the scattered ship and cargo break down and disperse under the conditions described above, the denser surviving elements typically descend through the unconsolidated sand, loose coral, or silts of the bottom until they encounter a more resistant stratum. This stratum, which may be rock, consolidated coral, or even dense clay, effectually forms a horizon on which the surviving elements of the vessel and its cargo come to rest. On the more active coasts, it is not unusual to encounter shipwrecks which cover as much as 100,000 m^2 (Clausen, 1966), although sites 50,000 m^2 are probably more common (Clausen, 1965). Relatively concentrated sites have also been encountered off active coasts. Figure 6 represents a computer-drawn, three-dimensional plot of the magnetic anomalies associated with the wreck of a small, 150-to 250-ton nao or caravel-type Spanish ship lost in April 1554 off the lower Texas coast. This data, obtained in 1972 from a special "close

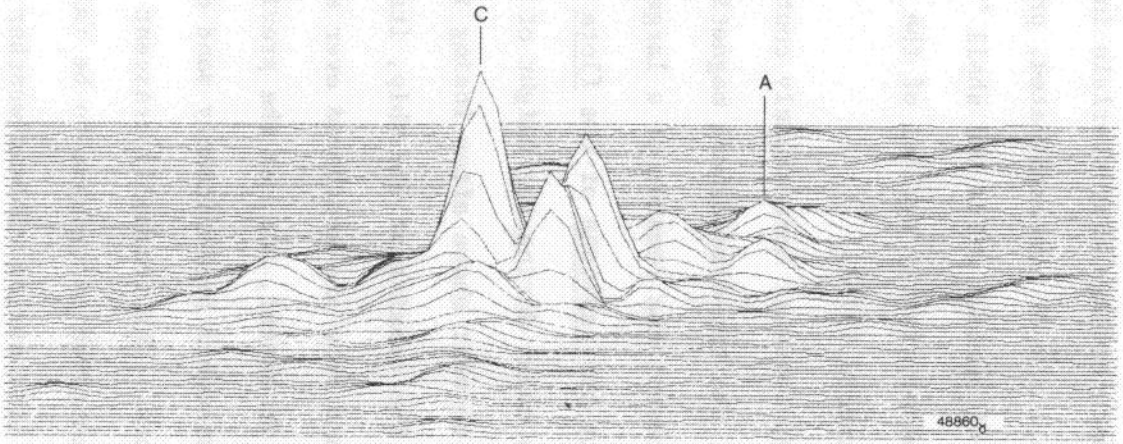

Figure 6. Computer-drawn, three-dimensional view of the magnetic signature of a small mid-16th century Spanish ship lost on the lower Texas coast. The surviving artifactual materials were completely buried in the bottom sediments (From Clausen and Arnold, 1975).

grain" magnetic survey run over an individual site as a prelude to a full-scale archeological investigation, indicates that the ferrous components of this wreck cover an area of approximately 10,000 m^2. The surviving artifactual elements of this wreck were completely buried, scattered atop a dense substratum of medium-gray, Pleistocene-age clay overlain in the immediate area of the wreck by some 1 to 1.5 m of unconsolidated, predominantly sand, overburden containing lenses of various silts and shell "hashes" mixed with sand. This sediment is probably fairly typical of the northern Gulf area (Clausen,1966; Clausen and Arnold,1975).

The results of an earlier (1966), somewhat more crudely controlled magnetic survey are shown in Figure 7, the two-dimensional magnetic signature of a wreck site thought to represent the remains of a larger vessel, a frigate of 40 to 50 guns, very likely the capitana of the flota portion of the Spanish fleet lost off the Florida coast during the height of a violent hurricane in 1715. This vessel broke up near shore after losing its entire bottom, with extensive loss of life. The remains of the ship, its cargo, and the belongings of its passengers and crew are scattered over a remarkably large area perhaps exceeding 16 acres in extent, and, as the previously described site, have migrated downward through a predominantly sand overburden to an underlying stratum of coquina rock. The generally crescent shape of the area over which wreck debris is scattered is thought to be fairly typical for wrecks of larger wooden ships lost during violent weather on active coasts (Clausen, 1966).

The wrecks of vessels of wooden or composite construction lost on shallow,coral reef areas are generally similar to vessels lost on exposed coasts in terms of distribution of the elements of the ship and cargo, although this is dependent to a degree on the ruggedness of the underwater

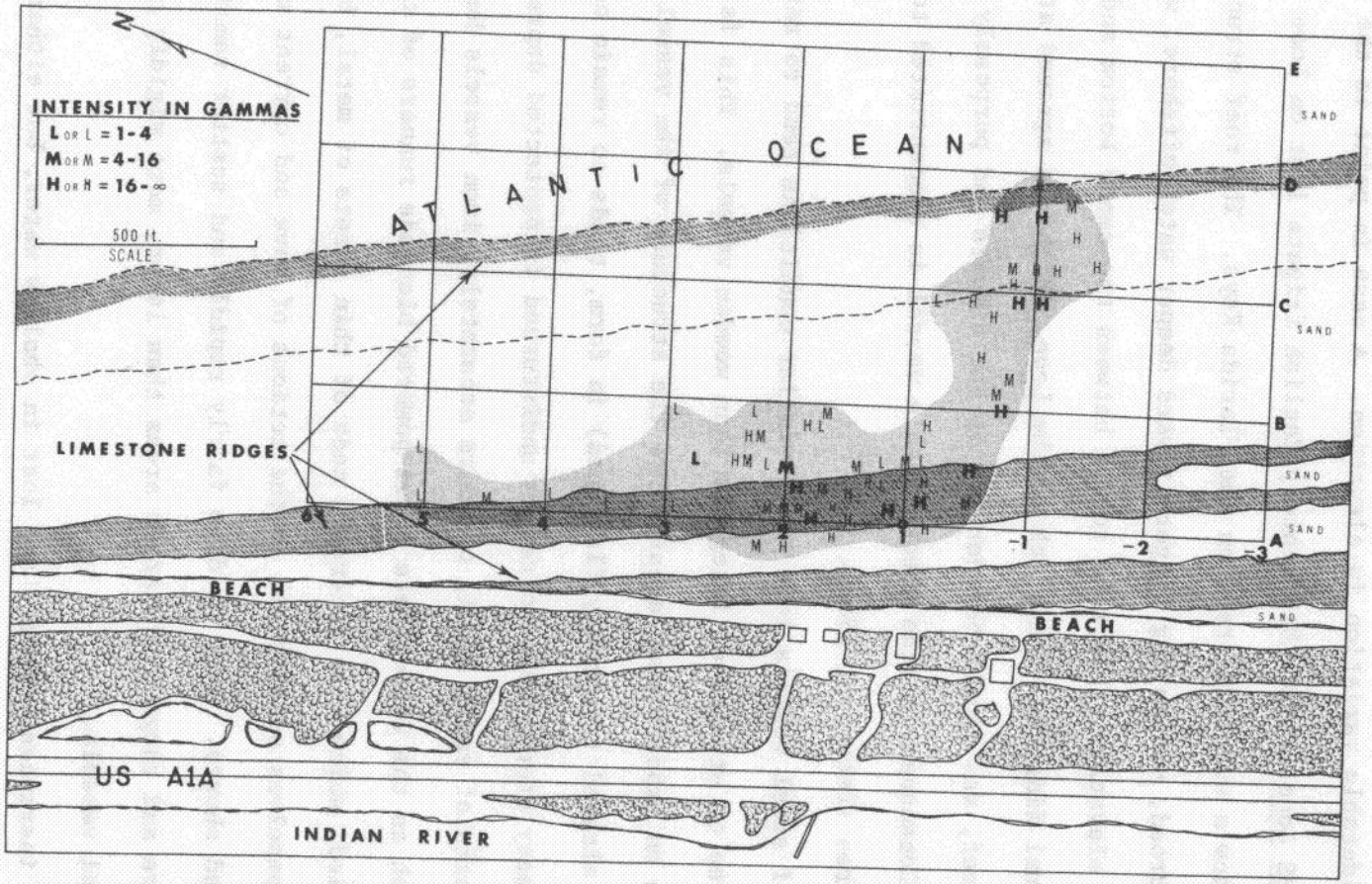

Figure 7. Two-dimensional magnetic signature of the wreck of a 40- to 50-gun Spanish frigate lost off the Florida coast in 1715 (after Clausen, 1966).

terrain. That is, the distribution of wreck remains on broad, flat expanses of reef will generally greatly exceed those of a vessel lost on a reef with considerable variation in elevation. A case in point is the wreck of the HMS Looe, a mid-18th century English frigate lost on Looe Key, which is now a submerged reef on the Florida Keys. The reef structure there runs in broad, undulating fingers toward deeper water offshore, with differences in elevation of up to 5 to 7 m between the sandy bottom and the tops of the coral fingers. The wreck of the Looe, which ran aground at night on the reef, was caught between two of the fingers and purposely burned in place. Consequently, the wreck of this vessel is concentrated to a remarkable degree (Peterson, 1955).

Wrecks of steel vessels lost under similar conditions tend to retain a greater degree of structural integrity than wooden vessels. This is particularly true on exposed reef areas where the structure of the vessel, although vastly altered (typically flattened) in form, tends to remain concentrated because the heavy steel tends to remain undisturbed in protected depressions on the reef. The wrecks of early steel, or, more accurately, iron vessels built in the 1860's,such as the Confederate steam-powered blockade runners of the Civil War period, which were generally made of thin sheets of metal, have also shown themselves susceptible to the actions of wave and current when lost on exposed shores. They go down fairly rapidly and scatter remains of their structure and cargo over larger areas than later, more rigidly constructed, steel vessels.

In some instances, vessels are lost in shallow water, but either in bays or behind barrier reefs, in slow-moving rivers (Arnold, 1974), or otherwise protected to a degree from direct and intense action of the sea during storms. This type of wreck is often characterized by its concentrated

nature. In the case of a vessel of wooden or composite construction, much of the ballast and armament or, in later periods, heavy industrial cargo, may remain in the immediate locale of the hull. As the vessel's structure collapses through biological attacks and later storms or, in some instances, salvage efforts, iron fittings and rigging from the upper bulwarks and masts may be deposited at greater distances from the center line of the vessel than the original limits of the hull. In some cases, if deposited on unconsolidated sediments, the weight of the ballast or cargo may, assisted by the action of the sea, depress the lower portions of the hull below the horizon of the bottom, where, somewhat isolated from the attacks of the more voracious marine organisms and coated or permeated by preservative iron corrosion compounds settling from above, large segments of the original construction of the vessel may survive in an almost pristine state.

Typical of this type of site in a salt-water environment are a number of wrecks of the Spanish flota, lost in 1733 along a broad area of the Florida Keys (Meylach, 1971). Many of the ships of that fleet, which was sailing from Havana for Spain, were driven in over the reef. Some suffered structural damage in passing, to sink or be driven aground (and opened up with the same result) in the calmer waters of Hawk's Channel, as the lagoon area behind the reef line is known. When the Spanish salvage expedition from Havana found the wrecked fleet, many of the vessels actually remained intact (with the exception of their masts, of course, which had been cut down to help them weather the storm), simply full of water and with decks awash. In such cases, there is typically little loss of life. The salvage crews may actually do more damage to the ships in their efforts to open them and retrieve cargo than what was caused by the original storm. In the case of

several of the 1733 vessels, the Spanish salvagers anchored their vessels seaward of the wrecks to break the wave action, waited for low tide, and burned off the superstructures of the vessels. When the tide rose, the debris was washed away, and the soaked decks, an impediment to the Spanish divers, often floated out of the hulls and away to shore like giant rafts. The cargo was then dived or even hooked up out of the great, open, wooden bathtubs the decapitated hulls resembled. Weakened by the removal of superstructure, deck beams, and other cross members, the frames and the sides of the hull slowly relaxed as decay and succeeding storms hastened the process and finally lay horizontally against the bottom to decompose. There is usually some scatter down-current from such sites as smaller segments of the decaying hull break away and drift off, usually along the bottom. Some of these pieces weighted down with spikes and fastenings or rigging may not drift far. Shallow areas in the Gulf where this type of site might occur are extremely limited; the only open, coral reef areas backed by lagoon situations exist in the extreme southeastern portion of the survey area in the western Florida Keys.

Shipwrecks in Deeper Water

Wooden ships which sank as a result of collision, fire, explosion, natural disasters, or hostile action in portions of the Gulf deeper than 20-40 m would probably be protected from the disruptive actions of wave and swell to an even greater degree. Because of distribution and access, we have very little factual knowledge in this hemisphere concerning wrecks of wooden ships lost in waters deeper than 30 m or even 20 m. We anticipate, however, that such wrecks would deteriorate in approximately the same manner as vessels in shallower waters in the lee of protective reefs or islands. The superstructure and upper hull would deteriorate and fall away, while

lighter elements of the cargo and portions of the decomposing structure of the vessel would drift off along the bottom, distributing elements of the wreck and cargo down current, the distance directly dependent upon the velocity of the current and the buoyancy of the debris. Those portions of the vessel remaining, such as the lower hull and heavier cargo or armament, depending on the nature of the bottom, would still probably work their way downward in the sediment. It is quite likely that, except on areas temporarily or permanently swept clear of unconsolidated sediments or where the sediment mantle is quite thin, wrecks of older vessels in the Gulf would be predominantly below the water bottom interface, or that in most cases, only portions of the ballast, armament, or, in later periods, machinery might protrude into the water column.

Later steel wrecks, particularly modern vessels, as numerous side-scan sonar traces examined by us in the course of this study testify, can retain a great deal of their structural integrity, appearing under ideal circumstances almost as if viewed through fog. Figure 8 represents a side-scan trace of a sunken World War II ship lying across a proposed 12-inch pipeline right-of-way in the Ship Shoal area, Block 243 (Latitude 28°26'05.27, Longitude 91°06'01.05).

An example of the preservation of an early vessel of iron construction and, incidentally, a remarkable example of the ability of remote sensing equipment to isolate meaningful data useful to the archeologist from a wreck site over 60 m deep, is furnished by the recent discovery of the famous Civil War ironclad, USS Monitor, off North Carolina. The probable location of the Monitor was narrowed down through the historical research of Gordon Watts, an underwater archeologist with the North Carolina Department of Archives

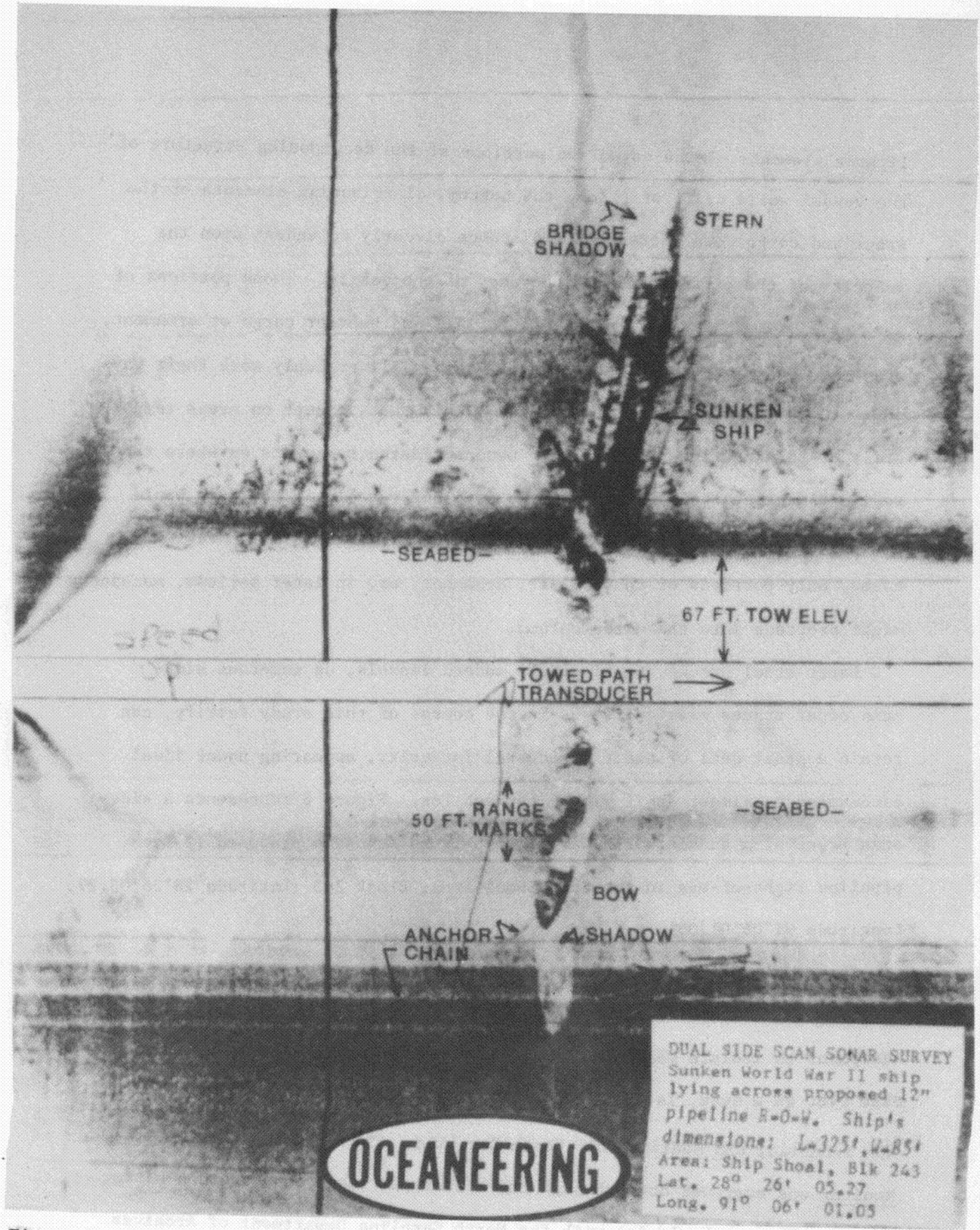

Figure 8. Dual side-scan sonar trace of sunken World War II vessel.

and History. The site, which was found within the area established by Watts, was located through a magnetic and side-scan sonar survey carried out from the Duke University research vessel, RV Eastward. Positional information for the survey tracks was provided by a Del Norte system with transponders located atop aids to navigation in the Cape Hatteras area. Co-participants in this Eastward cruise were Harold Edgerton and R.E. Sheridan.

The USS Monitor was lost south of Cape Hatteras in a winter storm on New Year's Eve during the Civil War in 1862. The vessel was under tow by the steam frigate USS Rhode Island and was proceeding south to participate, with another newly launched monitor, in a planned attack on the Confederate port of Charleston, South Carolina. Figures 9a and 9b represent a photomosaic map of the site and a plan of the wreckage drawn from the photo map. Figure 10 is an underwater photograph taken with a 35 mm oceanographic camera of portions of the surviving structure of the USS Monitor.
Watts theorizes from the historical documentation and the evidence from the site, such as the present attitude of the wreck, that the Monitor, which is located on a hard, sand bottom in water approximately 67 m deep, sank stern first in the following manner. When buoyancy became insufficient in the leaking ironclad to keep her afloat, she settled (because of the heavy propulsion machinery aft) stern first. Once underwater, the presence of the heavy armor belt and turret rapidly caused the sinking hull to rotate along its longitudinal axis 180 degrees until the vessel was going down backward and upside down. The abrupt impact of the stern with the hard bottom damaged the aft portion of the vessel and dislodged the heavy turret containing the two large guns, which dropped away to the bottom. The upside-down hull then settled on the turret, causing further damage to the already-weakened stern

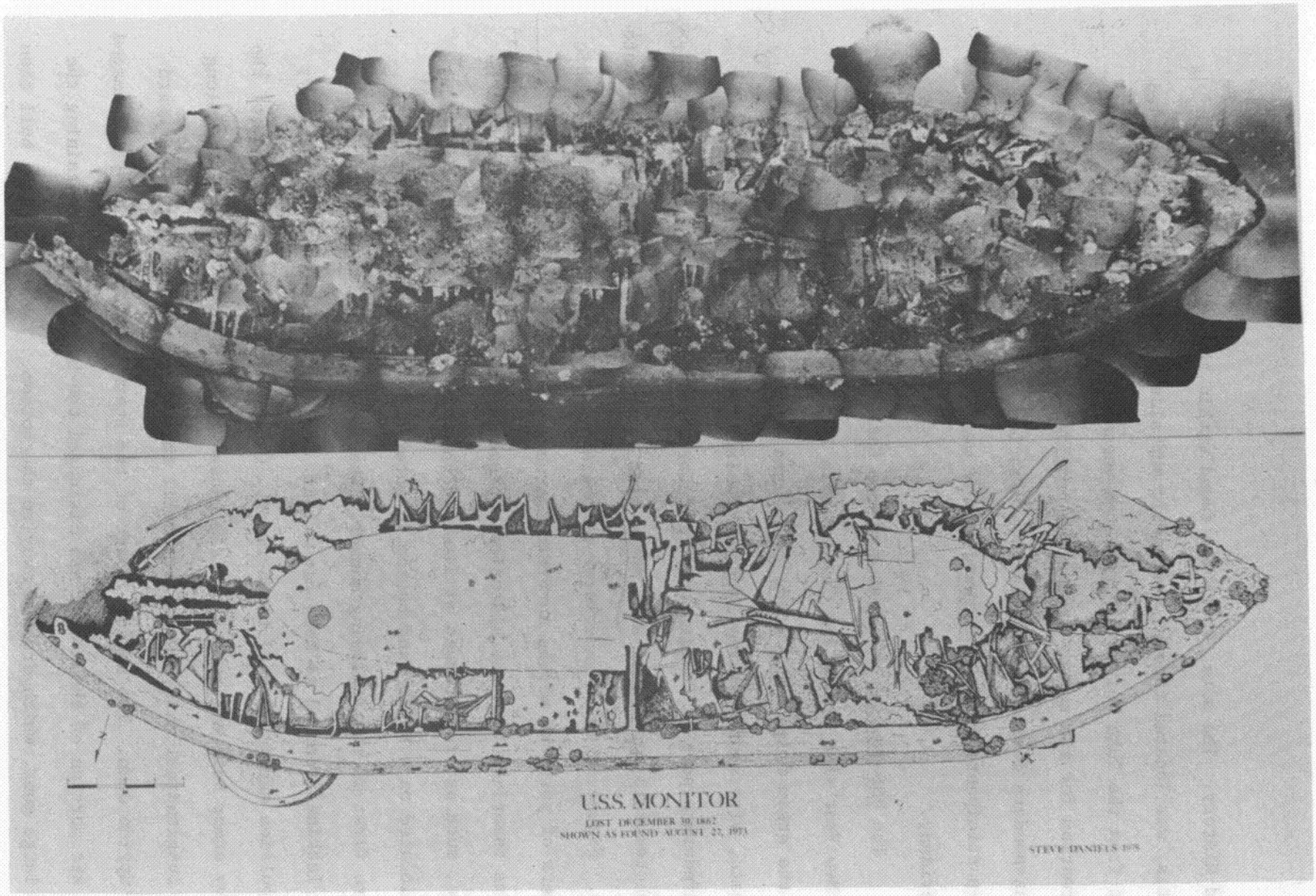

Figure 9a and 9b. Complete photomosaic of the monitor site (No. 22662) prepared by naval photographic experts and a scale drawing of the wreck produced to assist in the evaluation of the photomosaic data.

Figure 10. Overturned turret partially obscured by the port quarter armor belt. The heavy wrought iron transverse support which formed part of the turret suspension appears in the lower right hand quadrant of its base. (From Gordon Watts, N.C. Department of Archives and History, and from an article in press in The Journal of Nautical Methodology). Wreck of the USS Monitor.

portion of the vessel. The more extensive damage to the forward hull portions, visible in Figures 9a and 9b, Watts believes may be attributable to a depth charge attack, or attacks, on the sunken hull, which was probably misidentified by a World War II sonar operator as an enemy submarine resting on the bottom (Watts, 1975: in press, and personal communication).

Not only was the tracking down and discovery of the Monitor a remarkable feat, but the vessel also represents the only target of this age at this depth yet identified. It is surprising that it retains as much integrity as the photographs indicate and is not buried more deeply, although the exact depth and nature of the sediment in the area is presently unknown. Whether a 19th century iron-hulled vessel lost under similar conditions in the Gulf of Mexico would, after this much time, approximate the condition of the Monitor, is presently unknown; however, it is believed that, given similar bottom conditions, it is very likely that it would.

With regard to early wreck sites lying in waters deeper than 100 m, there is little or no factual knowledge concerning their condition. However, it is generally held that the state of preservation of the vessel and other cultural remains should improve as depth increases. This, of course, would be due to decreased chemical, animal, and bacteriological activity related to decreased light levels, lower temperatures, and a much lower dissolved oxygen content than that characterizing surface water, especially near or in a surf zone. There would probably also be minimal dispersion of wreck remains and related material, except in areas of strong current.

It has even been anticipated that the impact of a rapidly descending vessel could bury the hull portion deeply in the silty bottoms often found in deeper water, affording at least the lower structure greater protection. Under these conditions, such an impact might create a temporary sediment cloud which, settling back, might cloak even the upper works in a protective

mantle (Bascom, 1971). In the bottom of the Gulf, however, particularly in the shallower areas where diving archeologists operating under saturated conditions or archeologists in submersible vehicles might feasibly reach shipwrecks, it is thought to be primarily sandy and/or shelly or a combination of sand and shell. In such cases, there are limited areas where unconsolidated silts are found, for example near the Mississippi Delta. Instances of preservation may exist in deep water sites where isolation from the scattering effect of wave action and intense erratic currents, typical of shallow waters, and greatly reduced chemical and biological activity due to the cold and dark are the rule (Bascom, 1971).

It is anticipated that wrecks of steel vessels would very likely also remain intact to a large degree (see Figure 11, a portion of a modern wreck in 97.5 m of water drawn from underwater television tapes). The recent recovery of a portion of a Russian submarine from great depths in the Pacific Ocean will testify, when the findings are released, to the remarkable state of preservation of organic remains, including foodstuffs and even sophisticated electronic equipment, encountered by investigators.

Conclusions

In general, given similar bottom conditions, it appears that the breakdown and deterioration of vessels of wooden and composite construction lost in reasonably calm areas on a bottom composed of silts, sand, or a combination of these materials will be similar whether the water is 10 m or 100 m deep and the wreck 20 or 2,000 years old. Throckmorton (1970) found, during his investigations in Porto Longo Harbor in Greece, that the wooden-hulled wreck of a large, three-masted Greek schooner sunk by German aircraft in 1940 was in virtually the same condition as the wreck of an Austrian brig lost nearby during a storm in 1860. Once the breakdown of a wooden vessel has

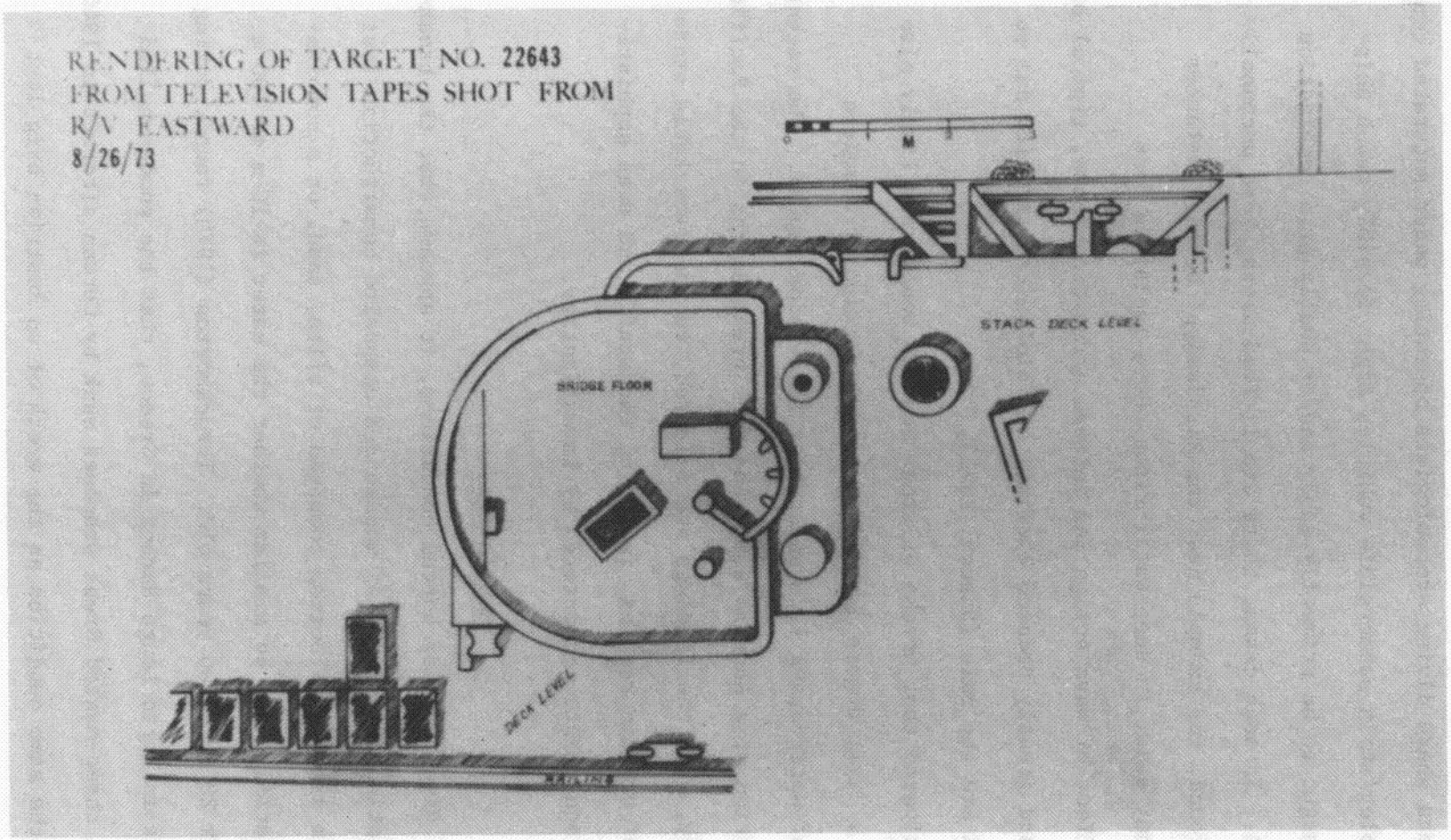

Figure 11. Composite rendering of the vessel at site #22643 illustrating the well-defined superstructure and bridge. Note the modern winch head on the port side of the bridge. (From Gordon Watts, N.C. Department of Archives and History, and from an article in press in Journal of Nautical Archeology.

progressed to the point where the remains have settled into the bottom, a kind of stasis is reached which, carried to extremes, will find pine planking still yellow and well-preserved on a wreck dating from the Roman period (Throckmorton, 1970).

Artifactual materials recovered from salt or brackish water environments do present special problems in handling and preservation, but progress is being made through continued research. Impressive results in the cleaning and preservation of materials more than 400 years old, recovered from an early Spanish shipwreck off the Texas coast, have been achieved by the antiquities conservation facility of the Archeological Research Laboratory, University of Texas at Austin (Hamilton, 1973). That laboratory is probably the most advanced facility for the cleaning and preservation of artifactual materials from the sea presently in operation. Other laboratories specializing or having experience in the cleaning and preservation of shipwreck materials are located at the Division of Archives, History and Records Management, Florida Department of State, Tallahassee; the preservation facility of the North Carolina Department of Archives and History in Fort Fisher, Kure Beach; and the United States National Museum in Washington, D.C. The Canadians also have a viable national underwater archeology program directed by the National and Historic Parks Branch of the Department of Indian Affairs and Northern Development and maintain a conservation laboratory for the preservation of materials recovered under their programs.

One of the conclusions that must be drawn from this study is that exact information concerning the number, character, and distribution of shipwrecks in the Gulf of Mexico is presently limited. However, based primarily upon an analysis of the data assembled to date, in which certain trends are discernible, the following projections for the general character of the shipwreck population in the Gulf of Mexico appear supportable.

It is estimated that the total number of shipwrecks in the Gulf of Mexico amounts to 2,500 to 3,000 sites, all periods combined. The majority of this wreck population, possibly 70 percent or more, dates from the beginning of the 19th century. Of this 70 percent, the wrecks which are associated with important historical events, such as the World Wars and colonization efforts in Texas, would be expected to have more cultural significance. For example, the wreck of the U.S. steamship Izard, lost at the mouth of the Withlacoochee River in Florida during the Second Seminole War, may represent the first steam-powered warship in the world lost during a period of hostility. The USS Tecumseh, a monitor lost by Admiral Farragut during the battle of Mobile Bay in Alabama in 1864 during the Civil War, is another exception. The remaining 30 percent, those wrecks of the various maritime nations which sank during the 16th, 17th, and 18th centuries, are generally of primary archeological and historical importance.

Eighty to 90 percent of these wreck sites are located within 10 kilometers of the present coastline, with 70 to 90 percent of them lying within 1.5 kilometers of the coast. Within the 10 km zone, concentrations of sites were, as expected, associated with areas of intense marine traffic, such as the approaches and entrances to seaports and the mouths of navigable rivers and straits, and with natural marine hazards, such as shoals and reefs. Several areas in deeper water, where shipping lanes have crossed for centuries, were identified during the course of the study. While it is likely that the incidence of wrecks in these areas may be higher than the general open Gulf bottom, it is not believed that these areas warrant special treatment.

The shipwreck population may be expected to fall into a bell-shaped curve reaching its peak somewhere in the period 1880 to 1910. A small

number of sites, primarily commercial fishing boats, but some ocean-going vessels (e.g., the V.A. Fogg) as well, are added to the population each year. Periods of hostilities will be reflected in minor peaks on this curve.

OTHER BOTTOM OBSTRUCTIONS

The emphasis in this report thus far has been on the location and identification of shipwrecks on the Outer Continental Shelf. These, however, are not the only exotic materials which are found on the sea bottom. Many other items are intentionally placed or randomly distributed across the continental shelf of the northern Gulf which are not yet as archeologically important as shipwrecks. For the most part, these items are of very recent origin and contribute little at this point in time to the overall knowledge of the Gulf. However, it is important to know the exact location, or at least the general area, of their existence. By knowing what else occurs in the Gulf, searches for the more valuable artifacts can avoid these sometimes dangerous zones and be concentrated in zones of higher probability of occurrence.

Industry, the military, and commercial shippers have been, and probably will continue to be, the biggest contributors to cultural items on the sea floor. Oil wells number in the thousands on the continental shelf and can be accurately located for future surveys. Pipelines follow known routes to and from oil fields and likewise can be plotted. However, associated with these facilities is the litter from the construction, maintenance, and operation of the activity. Such items as used drilling bits, pipe stems, lost or broken tools, cable, chain, and drums are usually concentrated in the immediate vicinity of the structures. These articles may, however, be scattered throughout the oil field, along the paths ships took to port, or wherever it was most convenient to discharge the waste. Safety fairways, in which no drilling is allowed, are provided through the oil fields (Table 1).

Land-based industries have also used the oceans for discharging chemical and industrial wastes. Drums, cylinders, and canisters are dumped onto

Table 1. Safety Fairways and Anchorages in the Gulf of Mexico.

(1)	Brazos Santiago Safety Fairway. See charts 1117 and 1288.
(2)	Brazos Santiago Anchorages. See charts 1117 and 1288.
(3)	Port Mansfield Safety Fairway. See chart 1117.
(4)	Aransas Pass Safety Fairway. See charts 1117, 1285, and 1286.
(5)	Aransas Pass Anchorage Areas. See charts 1117, 1285, and 1286.
(6)	Matagorda Entrance Safety Fairway. See charts 1117 and 1284.
(7)	Matagorda Entrance Anchorage Areas. See charts 1117 and 1284.
(8)	Freeport Harbor Safety Fairway. See charts 1117 and 1283.
(9)	Freeport Harbor Anchorage Areas. See charts 1117 and 1283.
(10)	Galveston Entrance Safety Fairways. See charts 1116 and 1282.
(11)	Galveston Entrance Anchorage Areas. See charts 1116 and 1282.
(12)	Sabine Pass Safety Fairway. See charts 1116 and 1279.
(13)	Sabine Pass Anchorage Area. See charts 1116 and 1279.
(14)	Coastwise Safety Fairway. (I) Brazos Santiago to Aransas Pass. See charts 1117, 1288, and 1286. (II) Aransas Pass to Calcasieu Pass. See charts 1117, 1116, 1285, 1284, 1282, 1280, and 1279.
(15)	Calcasieu Pass Safety Fairway. See charts 1116, 1278, and 1279.
(16)	Calcasieu Pass Anchorage Area. See charts 1116, 1278, and 1279.
(17)	Mermentau Pass Safety Fairway. See charts 1116 and 1278.
(18)	Freshwater Bayou Safety Fairway. See charts 1116 and 1277.
(19)	Southwest Pass Safety Fairway. See charts 1116 and 1277.
(20)	Atchafalaya Pass Safety Fairway. See charts 1116 and 1276.
(21)	Bayou Grand Caillou Safety Fairway. See charts 1116 and 1275.
(22)	Cat Island Pass Safety Fairway. See charts 1116 and 1274.
(23)	Belle Pass Safety Fairway. See charts 1116 and 1274.
(24)	Barataria Pass Safety Fairway. See charts 1116 and 1273.

Table 1 (continued).

(25) Grand Bayou Pass Safety Fairway. See charts 1116 and 1273.

(26) Empire to the Gulf Safety Fairway. See charts 1116 and 1273.

(27) Gulf Safety Fairway. Aransas Pass Safety Fairway to Southwest Pass Safety Fairway. See charts 1117 and 1116.

(28) Southwest Pass (Mississippi River) Safety Fairway. (I) Southwest Pass (Mississippi River) to Gulf Safety Fairway. See charts 1116 and 1272. (II) Southwest Pass (Mississippi River) to Sea Safety Fairway. See charts 1116, 1115, and 1272. (III) Southwest Pass (Mississippi River) to South Pass (Mississippi River) Safety Fairway. See charts 1115 and 1272.

(29) Southwest Pass (Mississippi River) Anchorage. See charts 1115 and 1272.

(30) South Pass (Mississippi River) Safety Fairways. (I) South Pass to Sea Safety Fairway. See charts 1115 and 1272. (II) South Pass (Mississippi River) to Mississippi River-Gulf Outlet Channel Safety Fairway. See charts 1115 and 1272.

(31) South Pass (Mississippi River) Anchorage. See charts 1115 and 1272.

(32) Mississippi River-Gulf Outlet Safety Fairway (I). See charts 1115 and 1270. (II) Mississippi River-Gulf Outlet Channel to Mobile Ship Channel Safety Fairway. See chart 1115.

(33) Mississippi River-Gulf Outlet Anchorage. See charts 1115 and 1270.

(34) Gulfport Safety Fairway. See charts 1115 and 1267.

(35) Biloxi Safety Fairway. See charts 1115 and 1267.

(36) Ship Island Pass to Horn Island Pass Safety Fairway. See charts 1115 and 1267.

(37) Pascagoula Safety Fairway. See charts 1115 and 1267.

(38) Horn Island Pass to Mobile Ship Channel Safety Fairway. See charts 1115, 1267, and 1266.

(39) Mobile Safety Fairway. (I) Mobile Ship Channel. See charts 1115 and 1266. (II) Mobile Ship Channel to Sea Safety Fairway. See charts 1115 and 1266. (III) Mobile to Pensacola Safety Fairway. See charts 1115, 1116, and 1265.

(40) Mobile Anchorage. See chart 1115.

(41) Pensacola Safety Fairway. See charts 1115 and 1265.

Table 1 (continued).

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(42) Pensacola Anchorage. See charts 1115 and 1265.

(43) Panama City Safety Fairway. See charts 1115 and 1263.

(44) Port St. Joe Safety Fairway. See charts 1115 and 1263.

(45) Tampa Safety Fairways. See chart 1114; also partially shown on charts 1113, 1256, and 1257. (FR-10/25/68; FR-11/7/68; FR-11/21/68; FR-2/16/68).

(46) Charlotte Safety Fairway. See charts 1113 and 1255. (FR-10/25/68).

the shelf. Dumping grounds are found along the entire length of the Gulf shoreline (Table 2). These areas are concentrations of debris and dredge spoil, both of which will interfere with any survey work.

The military is a prime contributor to sea floor litter. Selected areas have been designated as impact areas for missiles and as target areas for naval gunfire and aircraft bombing (Table 3). Debris of this nature can be assumed to be concentrated in these areas, and any soundings which are plotted should be surveyed very carefully. No known distribution patterns exist.

Commercial mariners are a third source of continental-shelf litter. Freighters, fishermen, tugs, and other vessels periodically throw junk, such as pieces of chain or cable, doors, broken rigging, or unneeded equipment, into the Gulf. A considerable amount of refuse is scattered along the trading lane and in the fishing areas.

Finally, miscellaneous articles just find their way to the Gulf floor. Included in this category are lost aircraft, ordnance expended during hostile action, such as torpedoes, depth charges, projectiles, and bombs, artificial reefs composed of automobile bodies, liberty ships, tires, and concrete forms, and lost oil platforms. The artificial reefs and lost platforms should be easy to locate. The other items will most likely be located only by chance.

Summary

No attempt has been made to show the distribution of oil wells, pipelines, and target ranges since maps of such features are readily available elsewhere. The other materials are randomly scattered and are extremely difficult to plot. Bottom surveys in military target areas clearly call for special precautions because of the possible occurrence of live ordnance. Surveys in the dredge spoil disposal areas require special techniques

because of disturbance and burial. Surveys should avoid the safety fairways except where pipelines cross them since no permanent structures are allowed in them. Finally, the other dumping grounds may be sampled, but archeological materials are likely to be masked by modern garbage.

Table 2. Dumping grounds in the Gulf of Mexico. Dumping grounds 1 through 8 are to be used for dumping suitable nonfloatable materials which are not easily transported by currents. The prohibited dumping grounds are more restricted in dumping practices. Contact nearest Engineers District Office for details. Descriptions of areas are transcribed verbatum in order to avoid confusion and provide the most accurate data available.

Dumping Grounds

(1) The waters of the Straits of Florida south of Key West Harbor, Florida, within a circle having a radius of five miles with its center at latitude 23°54' 00", longitude 81°37'00".

(2) The waters of the Gulf of Mexico off the South Pass of the Mississippi River, within a circle having a radius of two nautical miles with its center at latitude 29°03'00", longitude 88°57'18".

(3) The waters of the Gulf of Mexico off the Southwest Pass of the Mississippi River, within a rectangular area described as follows: beginning at latitude 28°52'33", longitude 89°28'58", thence to latitude 28°51'00", longitude 89°31' 54", thence to latitude 28°52"42", longitude 89°33'00", thence to latitude 28° 54'18", longitude 89°30'12", thence to the point of beginning.

(4) The waters of the Gulf of Mexico off Calcasieu Pass, Louisiana, within the following areas:

(i) Area A. Beginning at West Jetty at latitude 29°44'59", longitude 93°20'36"; thence to latitude 29°44'51", longitude 93°21'33"; thence to latitude 29°45'38", longitude 93°21'41"; thence along the mean high tide shore line to West Jetty; thence along West Jetty to point of beginning.

(ii) Area B. Beginning at East Jetty at latitude 29°45'00", longitude 93°20'25"; thence along East Jetty to the mean high tide shore line; thence along the mean high tide shore line to latitude 29°46'02", longitude 93°19'37"; thence to latitude 29°45'07", longitude 93°19'28"; thence to point of beginning.

(iii) Area C. Beginning at latitude 29°39'47", longitude 93°19'44"; thence to latitude 29°39'39", longitude 93°20'44"; thence to latitude 29°44'22", longitude 93°21'31"; thence to latitude 29°44'30", longitude 93°20'32"; thence to point of beginning.

(iv) Area D. Beginning at latitude 29°34'08", longitude 93°16'19"; thence to latitude 29°33'06", longitude 93°16'38"; thence to latitude 29°37'21", longitude 93°20'22"; thence to latitude 29°37'45", longitude 93°20'26"; thence to latitude 29°37'52", longitude 93°19'25"; thence to latitude 29°37'29", longitude 93°19'23"; thence to point of beginning.

(5) The waters of the Gulf of Mexico off Sabine Pass, Texas,within the following areas:

(i) Area A. Beginning at latitude 29°38'09", longitude 93°49'23"; thence to latitude 29°35'53", longitude 93°48'18"; thence to latitude 29°35'06", longitude 93°50'24"; thence to latitude 29°36'37", longitude 93°51'09"; thence to latitude 29°37'00", longitude 93°50'06"; thence to latitude 29°37'46", longitude 93°50'26"; thence to point of beginning.

(ii) Area B. Beginning at latitude 29°38'13", longitude 93°49'13"; thence to latitude 29°38'36", longitude 93°48'09"; thence to latitude 29°36'20", longitude 93°47'04"; thence to latitude 29°35'57", longitude 93°48'07"; thence to point of beginning.

(6) The waters of the Gulf of Mexico off Sabine Pass, Texas,bounded by the mean high tide shore line, Sabine Pass West Jetty, the 12-foot depth contour and a line 1-1/2 nautical miles westerly from and parallel to Sabine Pass West Jetty.

(7) The waters of the Gulf of Mexico off Galveston Entrance, Texas,within the following areas:

(i) Area A. Beginning at latitude 29°20'02", longitude 94°40'46"; thence to latitude 29°18'56", longitude 94°38'40"; thence to latitude 29°18'04", longitude 94°39'15"; thence to latitude 29°19'11", longitude 94°41'21"; thence to point of beginning.

(ii) Area B. Beginning at latitude 29°20'11", longitude 94°40'40"; thence to latitude 29°21'02", longitude 94°40'05"; thence to latitude 29°19'56", longitude 94°37'59"; thence to latitude 29°19'04", longitude 94°38'34"; thence to point of beginning.

(iii) Area C. Beginning at latitude 29°16'54", longitude 94°41'30"; thence to latitude 29°14'24", longitude 94°38'42"; thence to latitude 29°15'54", longitude 94°37'06"; thence to latitude 29°18'00", longitude 94°39'30"; thence to point of beginning.

(8) The waters of the Gulf of Mexico off Galveston Entrance, Texas,bounded by the mean high tide shore line,Galveston North Jetty, and the following lines: beginning at Galveston North Jetty at latitude 29°20'44", longitude 94°40'44"; thence to latitude 29°23'24", longitude 94°42'30"; thence to latitude 29°25'18", longitude 94°40'00"; thence along longitude 94°40'00" to shore.

Note: The areas prescribed in subparagraphs (4), (5), and (7) of this paragraph are reserved for the dumping of spoil removed from Federal project channels by government dredges. The areas prescribed in subparagraphs (6) and (8) of this paragraph may be used for the disposal of wrecks and similar obstructions.

Prohibited Dumping Grounds

(1) The waters of the Straits of Florida south of Key West Harbor, Florida, within the 30-foot main ship channel and a triangular area including the approaches and entrance to the channel bounded as follows: beginning at latitude 24°28'10.2", longitude 81°48'06", thence to latitude 24°26'00", longitude

Table 2 (continued).

81°46'00"; thence to latitude 24°26'00", longitude 81°50'00"; thence to the point of beginning.

(2) The waters of the Gulf of Mexico at the mouth of the South Pass of the Mississippi River, within an area prescribed by lines bearing 96° true and 159° true from South Pass (Range Rear) Light and extending seaward to the 40-fathom curve.

(3) The waters of the Gulf of Mexico at the mouth of the Southwest Pass of the Mississippi River, within an area prescribed by lines bearing 124° true and 217° true from Southwest Pass East Jetty End Light and extending seaward to the 40-fathom curve.

(4) The waters of the Gulf of Mexico off Louisiana and Texas coasts, except as provided (4) through (8) of this section, bounded by the mean high tide shore line and the following lines: beginning at Galveston Jetty Light at latitude 29°19'39", longitude 94°41'33"; thence to latitude 28°01'12", longitude 94°41'33"; thence along the 40-fathom line to latitude 28°01'18", longitude 94°13'42"; thence to Heald Bank Lighted Whistle Buoy 2 at latitude 29°05'00", longitude 94°13'42"; thence to Sabine Bank Light at latitude 29°28'18", longitude 93°43'24"; thence to Sabine East End Lighted Whistle Buoy 1 at latitude 29°27'00", longitude 93°18'30"; thence 015° (true) to shore.

Table 3. Areas designated as impact areas for missiles and as target areas for naval gunfire and aircraft bombing.

Name	Danger Zone*	Ordnance	Comments
Florida Bay, northeast of Pine Islands, Florida	Bounded on the north by latitude 24°51'08"; on the east by longitude 81°13'52"; on the south by latitude 24°48'52"; and on the west by longitude 81°16'21".	live firing area for strafing	Hull of naval vessel used as target (PE-19). Area closed at all times.
Woman Key and Ballast Key, Straits of Florida	The waters within a rectangular area, approximately 3.0 nautical miles long from east to west and 2.4 nautical miles wide from north to south, with Woman Key at or near the center, bounded on the north by latitude 24°32'37" (approximately one nautical mile north of the north shore of Woman Key); on the east by longitude 81°56'40" (approximately one nautical mile east of the east shore of Ballast Key); on the south by latitude 24°30'12" (approximately one nautical mile south of the short shore of Ballast Key); and on the west by longitude 81°59'53" (approximately one nautical mile west of the west shore of Woman Key).	naval ordnance	Area closed when naval operations are in progress.
Staits of Florida and Florida Bay in vicinity of Key West, Florida	(1) Operational training area. Waters of the Straits of Florida and Gulf of Mexico southwest, west and northwest of Key West bounded as follows: Beginning at latitude 25°45'00", longitude 82°07'00"; thence southeast to latitude 24°49"00", longitude 81°55'00"; thence southwest to latitude 24°37'30", longitude 82°00'30"; thence westerly to latitude 24°37'30", longitude 82°06'00"; thence southerly to latitude 24°28'30", longitude 82°06'00"; thence southerly to latitude 24°25'00", longitude 82°06'30";	aerial gunnery range, bombing and strafing target areas	Navigation prohibited when operations are in practice.

*Note: Because of the extreme hazard which may result from operations in these areas, the geographic descriptions of the danger zones have been copied verbatum from the Coast Pilot in order to avoid confusions.

Table 3 (continued).

Name	Danger Zone*	Ordnance	Comments
	thence easterly to latitude 24°25'00", longitude 81°57'00"; thence southwesterly to latitude 23°30'00", longitude 82°19'00"; thence westerly to latitude 23°30'00", longitude 82°46'00"; thence northwesterly to latitude 23°52'30", longitude 83°11'00"; thence northerly to latitude 24°25'00", longitude 83°11'00"; thence easterly to latitude 24°25'00", longitude 83°08'00"; thence clockwise along the arc of a circle with a radius of 92 miles centered at latitude 24°35'00", longitude 81°41'15"; to latitude 25°45'05", longitude 82°23'30"; thence east to point of beginning. (2) Bombing and strafing target areas. (i) A circular area immediately west of Marquesas Keys with a radius of two nautical miles having its center at latitude 24°33.4' and longitude 82°10.9', not to include land area and area with Marquesas Keys. The target located within the area, a grounded LSIL will be used for bombing and aircraft rocked exercises. (ii) A circular area located directly west of Marquesas with a radius of three statute miles having its center at latitude 24°35.6' and longitude 82°11.6', not to include land area within Marquesas Keys. The targets located within this area, pile-mounted platforms, will be used as high altitude horizontal bombing range utilizing live ordnance up to and including 1,800 pounds of high explosives. In general, these explosives will be of an air-burst type, above 1,500 feet.		

*Note: Because of the extreme hazard which may result from operations in these areas, the geographic descriptions of the danger zones have been copied verbatum from the Coast Pilot in order to avoid confusions.

Table 3 (continued).

Name	Danger Zones*	Ordnance	Comments
	(iii) A circular area located west of Marquesas Keys with a radius of two nautical miles having its center at latitude 24°34'30", and longitude 82°14'00". (b) The regulations. (1) In advance of scheduled air or surface operations which, in the opinion of the enforcing agency, may be dangerous to watercraft, appropriate warnings will be issued to navigation interests through official government and civilian channels or in such other manner as the District Engineer, Corps of Engineers, Jacksonville, Florida, may direct. Such warnings will specify the location, type, time, and duration of operations, and give such other pertinent information as may be required in the interests of safety.		
Tampa Bay South of MacDill Air Force Base	Shoreward of a line beginning at latitude 27°49'27.38", longitude 82°29'35.83"; thence to latitude 27°49'20.14", longitude 82°29'42.78"; thence to latitude 27°48'44.82", longitude 82°31'10.0"; thence to latitude 27°49'09.35, longitude 82°32'24.56"; thence to latitude 27°49'38.62", longitude 82°33'02.44"; and thence to a point on the shore line of MacDill Air Force Base at latitude 27°50'28.57", longitude 82°32'15.0".	small arms and aircraft jettison	Area closed to navigation at all times.

*Note: Because of the extreme hazard which may result from operations in these areas, the geographic descriptions of the danger zones have been copied verbatum from the Coast Pilot in order to avoid confusions.

Table 3 (continued).

Name	Danger Zone*	Ordnance	Comments
Gulf of Mexico, South of Apalachicola Bay	An area about 45 statute miles wide and 60 statute miles long, approximately parallel to and about 30 miles off the west coast of Florida, south of Apalachee Bay. The area is bounded as follows: beginning at latitude 29°42'30", longitude 84°40'00"; thence east along latitude 29°42'30", to longitude 84° 00'00"; thence southeast to latitude 28°56' 00", longitude 83°31'00"; thence southwest to latitude 28°37'00", longitude 84°11'00"; thence northwest to latitude 29°17'30", longitude 84°40'00"; thence northwest to latitude 29°32'00", longitude 85°00'00"; thence northeast along a line three miles off the meanderings of the shore to the point of beginning.	rocket firing range	Closed during operations.
Gulf of Mexico, South of St. George Island	A fan-shaped area bounded as follows: NW corner-29°35'15" 85°03'12" SW corner-29°31'18" 85°07'31" SE corner-29°30'18" 84°59'18" NE corner-29°35'09" 85°01'53" The seaward end of the area is an arc with a 10,500 meter radius with its center located on the south shore line of St. George Island 1,500 feet east of Cape St. George Light.	test firing range for helicopters	During firings, entire area plus 5 miles beyond boundaries will be patrolled.

*Note: Because of the extreme hazard which may result from operations in these areas, the geographic descriptions of the danger zones have been copied verbatum from the Coast Pilot in order to avoid confusions.

Table 3 (continued).

Name	Danger Zone*	Ordnance	Comments
Gulf of Mexico and Apalachicola Bay South of Apalachicola, Florida	A rectangular area excluding St. George Island with the eastern boundary of the area west of the channel through St. George Island within the following coordinates: beginning at a point designated as the northeast corner latitude 29°38'20" N. longitude 84°58'30" W.; thence southeast to latitude 29°35'23" N. longitude 84°56' 54" W.; thence southwest to latitude 29° 34'15" N. longitude 85°00'35" W.; thence northwest to latitude 29°37'10" N., longitude 85°02'00" W.; thence northeast to point of beginning.	Drone Recovery Area	Closed during testing periods.
Gulf of Mexico, south and west of Apalachicola, San Blas, and St. Joseph Bays, Florida	Beginning at latitude 29°40'00", longitude 85°21'30", in the vicinity of Cape San Blas; thence southeasterly to latitude 29°23'00", longitude 84°39'00"; thence southwesterly to latitude 28°39'00", longitude 84°49'00"; thence northwesterly to latitude 29°43'00", longitude 85°53'00"; thence northeasterly to latitude 29°56'30", longitude 85°38'30"; and thence southeasterly to the point of beginning.	air-to-air firing practice range	
Gulf of Mexico, Southeast of St. Andrew Bay East Entrance	Area No. 1. The waters of the Gulf of Mexico, southeast of St. Andrew Bay East Entrance within a rectangular area beginning at a point on shore at latitude 30°04'32", longitude 85°37' 07"; thence to latitude 30°03'47", longitude 85°37'58"; thence to latitude 30°03'19",	small arms firing range	Closed during periods of firing.

*Note: Because of the extreme hazard which may result from operations in these areas, the geographic descriptions of the danger zones have been copied verbatum from the Coast Pilot in order to avoid confusions.

Table 3 (continued).

Name	Danger Zones*	Ordnance	Comments
	longitude 85°37'00"; thence to a point on shore at latitude 30°04'13", longitude 85° 36'47"; thence along the shoreline to the point of beginning. Area No. 2. The waters of the Gulf of Mexico and St. Andrew Sound within an area described as follows, but excluding Crooked Island; beginning at a point on shore at latitude 30°02' 56", longitude 85°34'35"; thence to latitude 30°02'18", longitude 85°36'18"; thence to latitude 30°01'24", longitude 85°35'40"; thence to latitude 30°00'45", longitude 85°34'41", thence to a point on shore at latitude 30°02'10", longitude 85°33'42"; thence along the shore line to the point of beginning.		
Gulf of Mexico, South of Panama City, Florida	(1) A circular area with a radius of 300 yards around existing research platform No. 1 located at latitude 30°00'34", longitude 85°54'12". (2) A circular area with a radius of 300 yards around existing research platform No. 2 located at latitude 30°07'14", longitude 85°46'30".	underwater experimental areas for the U.S. Navy Mine Defense Laboratory	Closed to navigation at all times.
Choctawhatchee Bay	(1) Aerial gunnery range in west part of Choctawhatchee Bay. The waters of Choctawhatchee Bay within an area described as follows: beginning at a point on the west shore at latitude 30°28' 30", longitude 86°30'00"; thence southeasterly to latitude 30°25'30", longitude 86°21'30"; thence	aerial gunnery range	Closed to navigation at all times.

*Note: Because of the extreme hazard which may result from operations in these areas, the geographic descriptions of the danger zones have been copied verbatum from the Coast Pilot in order to avoid confusions.

Table 3 (continued).

Name	Danger Zone*	Ordnance	Comments
	southwesterly to a point on the south shore at latitude 30°23'30", longitude 86°23'00"; thence northwesterly to a point on the south shore at latitude 30°24'00", longitude 86°25' 00"; and thence northwesterly to the point of beginning; excluding that part of the area included within the aerial gunnery range along the north shore of Choctawhatchee Bay (described in subparagraph (2) of this paragraph). (2) Aerial gunnery range along north shore of Choctawhatchee Bay. The waters of Choctawhatchee Bay within an area described as follows: beginning at a point in the waters of Choctawhatchee Bay at latitude 30°26'00", longitude 86°25'30"; thence north to the shore at longitude 86°25'30"; thence southeasterly and northeasterly along the shore to longitude 86°15'00; thence south to latitude 30°26'29", longitude 86°15'00"; thence southwesterly to latitude 30°26'12", longitude 86°20'35"; thence north to latitude 30°26'57", longitude 86°20'35"; thence southwesterly to the point of beginning.		
The Narrows and Gulf of Mexico Adjacent to Santa Rosa Island, Florida	The waters of the Narrows and the Gulf of Mexico easterly of the periphery of a circular area 5 nautical miles in radius, centered at latitude 30°23'10.074", longitude 86°48'25.433" (USC & GS Station Tuck 3), within the segment of a circle, 3 nautical miles in radius, centered at latitude 30°24'00", longitude 86°41'47".	Air Force proving ground	Closed to navigation during operations.

*Note: Because of the extreme hazard which may result from operations in these areas, the geographic descriptions of the danger zones have been copied verbatum from the Coast Pilot in order to avoid confusions.

Table 3 (continued).

Name	Danger Zone*	Ordnance	Comments
Gulf of Mexico, South of Choctawhatchee Bay, Florida	The waters of the Gulf of Mexico south from Choctawhatchee Bay within an area described as follows: beginning at a point five nautical miles southeasterly from USC & GS Station Tuck 3, at latitude 30°23'10.074", longitude 86°48' 25.433", 3 nautical miles offshore of Santa Rosa Island; thence easterly 3 nautical miles offshore and parallel to shore, to a point south of Apalachicola Bay, Florida, latitude 29°32'00", longitude 85°00'00"; thence southeasterly to latitude 29°17'30", longitude 84°40'00"; thence southwesterly to latitude 28°40'00", longitude 84°49'00"; thence southeasterly to latitude 28°10'00", longitude 84°30"00", thence 270° true to longitude 86° 48'00"; thence due north along longitude 86°48'00" to the intersection of the line with a circle of five nautical miles radius centered on USC & GS Station Tuck 3, at latitude 30°23'10.074", longitude 86°48'25.433", thence northeasterly along the arc of the circle to the point of beginning.	Air Force proving ground	Navigation restricted but area not closed.
Waters of Santa Rosa Sound and Gulf of Mexico Adjacent to Santa Rosa Island, Florida	(1) Prohibited area. Waters of Santa Rosa Sound and Gulf of Mexico within a circle one nautical mile in radius, centered at latitude 30°23'10.074", longitude 86°48'25.433" (USC & GS Station Tuck 3). The portion of the area in Santa Rosa Sound includes the Gulf Intracoastal Waterway between miles 200.6 and 211.4 from Harvey Lock, Louisiana. (2) Restricted area. The waters of Santa Rosa Sound and Gulf of Mexico surrounding the prohibited area	Air Force proving ground	Navigation prohibited during operations and restricted to Gulf Intracoastal Waterway, at all times.

*Note: Because of the extreme hazard which may result from operations in these areas, the geographic descriptions of the danger zones have been copied verbatum from the Coast Pilot in order to avoid confusion.

Table 3 (continued).

Name	Danger Zone*	Ordnance	Comments
	described in subparagraph (1) of this paragraph, within a circle five nautical miles in radius centered at latitude 30°23'10.074", longitude 86°48'25.433" (USC & GS Station Tuck 3). The portion of the area in Santa Rosa Sound includes the Gulf Intracoastal Waterway between miles 204.6 and 216.4 from Harvey Lock, Louisiana. (b) The regulations. (1) Experimental test operations will be conducted by the United States Air Force within the prohibited area on an intermittent basis. Such test operations shall not exceed one hour, and shall not occur more than twice weekly.		
Gulf of Mexico, South of Pensacola Bay, Florida	The U.S. Navy Rifle Range is located on Santa Rosa Island between Fort Pickens and the U.S. Coast Guard Lighthouse. The danger area for the firing range extends 2.6 nautical miles seaward from Santa Rosa Island within the following coordinates: beginning at a point, latitude 30°18'55", longitude 87°15'59"; thence to latitude 30°17'33", longitude 87°13'25"; thence to latitude 30°16'28", longitude 87°16'57"; thence to latitude 30°19'04", longitude 87°16'51".	Naval Firing range	
Gulf of Mexico, South of Pensacola Bay, Florida	(1) The waters on the Gulf of Mexico encompassed by an arc of a circle having a radius of 5 statute miles centered at latitude 28°17', longitude 96°32'.	Gunnery, bombing, and rocket firing range	Closed to navigation without written permission.

*Note: Because of the extreme hazard which may result from operations in these areas, the geographic descriptions of the danger zones have been copied verbatum from the Coast Pilot in order to avoid confusions.

SITE SURVEY TECHNIQUES

Introduction

For the past year and a half, lessees and operators of federal oil and gas leases on the Outer Continental Shelf, Gulf of Mexico, have been required to conduct a minimum geophysical survey designed to locate sites of cultural resource potential. In terms of survey design, this methodology is, at best, adequate for an exploratory investigation locating cultural material or areas that may contain cultural material. It does not, however, necessitate the delineation and evaluation of sites unless it is impossible to redirect a lessee's construction plans outside the area containing the cultural resources. In an in-site survey, appropriate additional requirements are needed to delineate and evaluate possible cultural sites, but these will not be discussed at length here. Only the exploratory survey requirements will be discussed as to their limitations.

There are a variety of limiting factors or disadvantages with the present methodology and equipment as required by the "Notice to Lessees and Operators of Federal Oil and Gas Leases in the Outer Continental Shelf, Gulf of Mexico Area, Minimum Geophysical Survey Requirements to Protect Cultural Resources" (75-3, supersedes No. 74-10), issued by the United States Department of the Interior, Geological Survey, Gulf of Mexico, dated January 20, 1975 (Appendix B). Problems lie in the limitations of the gear used in implementing, deploying, and operating equipment and annotating the print-out from the equipment, as well as in the survey grid itself. All of these factors depend on the targets or types of sites anticipated.

Cultural areas fall into two groups as detected by remote sensing gear -- historic sites and prehistoric sites. Prehistoric sites are relatively free of magnetic components and, thus, are not detectable by the

magnetometer as it is used by present survey methods. The side-scan sonar and sub-bottom profiler may reveal possible areas of former human occupation, including such geological features as riverine and estuary features (Block 98, West Cameron Area, Shell), salt domes (Block 36, 37, or 38, South Timbalier Area, Gulf), escarpments (Block A-362-363, High Island Area, Clark), remaining barrier islands, beach, and/or shoal areas (Block 171, West Cameron Area, Ford, Bacon and Davis), and reef areas (SL-17).

Historic site areas are potentially sensitive to detection by any of the three instruments. Often, however, the magnetometer is the most effective since it can detect sites that are buried and, thus, undetectable by the side-scan sonar, and others that are scattered and undetectable by the profiler.

Historic site areas in the Gulf are somewhat limited to the sites of shipwrecks and related activities such as spill or jettison sites, where the occupants of a ship were deliberately relieving themselves of cargo and equipment in the wake of storms or hostilities.

Both the prehistoric and historic sites are affected by many variables, such as biotic effects and geological effects, which tend to redeposit or mask their locations and sometimes diminish or eliminate their cultural potential. However, other effects can protect and preserve them, depending on the variables involved with each site, or portion of it, such as waves and currents covering the site with sediment, or reefs encapsulating the site and preserving the cultural resource.

Magnetometer

The magnetometer is a relatively precise instrument that measures the total magnetic field intensity of the earth. The units utilized to measure this intensity are gammas. This high-resolution instrument generally displays an ambient field in a five whole-digit readout. It has two inherent universal limitations and several archeological implementation problems.

Limitations

Gradient Limitation

The signal is sharply degraded at the presence of a large magnetic field gradient greater than 200 gammas per foot, or approximately 600 gammas per meter. Large magnetic field gradients are caused by large metal structures (bridges, oil rigs, large-diameter pipelines) and by electrical current from powerlines. The effect of the field gradient is dependent upon distance of the gradient source to the sensor head. For example, a rust flake on the sensor head could render the instrument useless.

Sensor to Target Limitation

The amount of magnetic inflection observed depends on the distance the cultural material target is from the sensor. This distance variable acts geometrically with the distance squared or cubed, depending on the nature and orientation of the target:

$$\text{gamma inflection} = \frac{\text{magnetic moment x mass}}{\text{distance}^{2 \text{ or } 3}}$$

For example, passing directly over a colonial-period anchor that is 6-7 meters below the surface produced a 30-gamma inflection; however, if the same anchor were 25 meters from the survey line with the same sensor height, it would produce only a 5-gamma inflection. At 30 meters from the survey line, it would not be detected at all.

Speed Implementation

The speed of the survey must be kept at a rate such that the target or targets will not be lost within pulse rates. The pulse rate on fluxgate magnetometers is continuous, but these instruments are generally not used for archeological surveys due to difficulties with calibration and deployment. The widely used proton precession magnetometers vary in pulse rate from one every half second to one every two to five seconds. Rapid pulse rate at times cuts down the gamma sensitivity. The Florida Department of State,Division of

Archives, History, and Records Management, and the Texas Antiquities Commission recommend a ± one-gamma sensitivity, which most equipment achieves at a one-second repetition rate. Some manufacturers reportedly have produced equipment with a faster sampling rate, maintaining the ± one-gamma sensitivity. With these options, time distance computations should be worked in order to institute a survey speed slow enough not to introduce magnetic target voids along the survey run, yet fast enough to maintain vessel control in spite of influence by sea state and currents.

Sensor Deployment

The magnetometer sensor must be deployed far enough away from the survey vessel so that the vessel will not be detected. Usually, a cable length two-and-one-half times the survey vessel length is sufficient to place the sensor outside the survey vessel's gradient.

In many cases, additional cable length is needed to deploy the sensor six to seven meters off the bottom. In other cases, the head and cable must be floated in shallow water to keep the sensor off the bottom.

Head oscillation is another deployment problem and can cause noises in the background.

Other Equipment Problems

In installing the magnetometer, several types of extraneous noises need to be analyzed and eliminated; these noises cause false readings or can mask meaningful anomalies of low-gamma inflection. The noise level should not exceed ± 3 gammas over the ambient field readings.

Among other things, erratic readings can be caused by: 1) excessive oscillation of the sensor head, 2) electronic problems, 3) ferrous material on the sensor head creating a gradient, or 4) power cables lying over the sensor cables.

Interpretation

For proper interpretation, traces need to be properly annotated with written comments on information generated by the other remote sensing gear and on visual elements such as buoys, boats, rigs, and boat turns. Inflections of over five gammas, with a period of three or more counts, indicate a possible target. Using one of the three published magnetic contour maps of an historical shipwreck site (Figure 12), done by Arnold and Clausen (1975), it is evident that, using present methodology, the site cannot be detected on more than two lines. To illustrate this, a 150-meter grid was arbitrarily superimposed on the magnetic contour of a 16th century shipwreck, as shown in Figure 12. The "A" pattern detects the site on only two lines with three separate anomalies that have magnetic inflection no greater than five gammas. Moving the entire survey grid to the right 50 meters produces the "B" pattern, which detects three anomalies with a magnetic inflection of 40 gammas and two of five-gamma intensity, and is only observed on one line. The "C" pattern is achieved by moving the grid 50 meters farther to the right and shows one anomaly at 30-gamma inflections with two peaks. The "D" pattern, which occurs when the grid is shifted approximately 45 degrees, detects no anomalies.

Adding to the lane-spacing problem are single objects lost or disposed of, such as shrimp net boards, lengths of chain, cable, pipe, bombs and seismic gear, which yield low-gamma inflections. It has been observed that small, near-surface faulting also produces a 5- or 6-gamma inflection for a period of five to seven counts. Usually, a geological phenomenon is observed as a low gamma inflection of two to five gammas recorded over a long period, whereas the size and nature of cultural material are characterized by larger gamma inflections and shorter time periods.

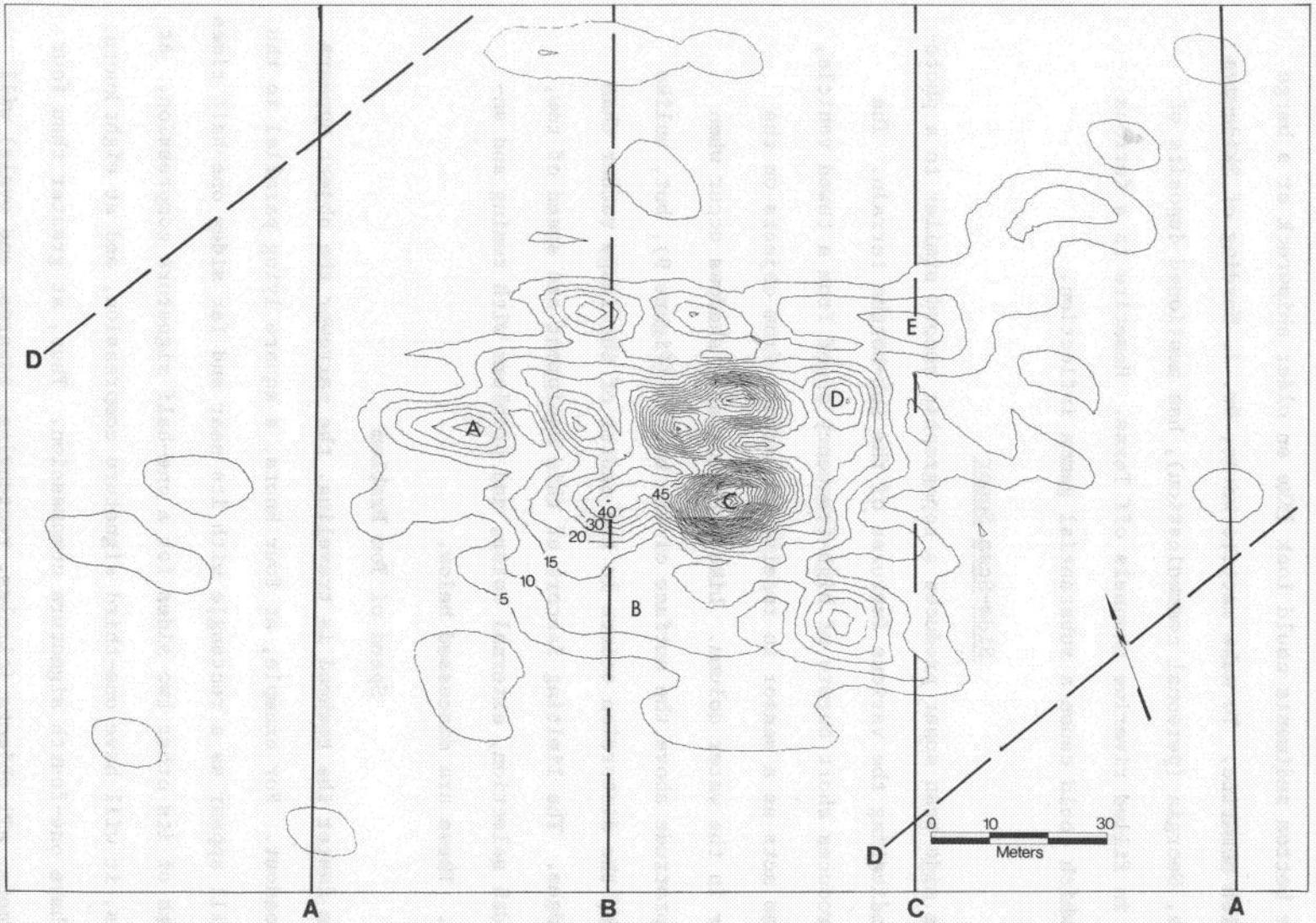

Figure 12. Computer-drawn, two-dimensional map of the magnetic signature of a small, mid-16th century Spanish ship lost on the lower Texas coast. The surviving artifactual materials were completely buried in the bottom sediments (From Clausen and Arnold, 1975).

The magnetometer does not differentiate, to any great degree, old cultural material from new. A modern shipwreck scattered and buried beneath the bottom sediments could look like an older shipwreck or a barge loaded with hematite. To make matters worse, Dr. J. Harding of Skidaways Institute, Georgia (personal communication), has mentioned deposits of hematite in filled riverine channels off Texas. Hematite is a ferrous mineral which could cause a substantial gamma inflection.

Side-Scan Sonar

The side-scan sonar produces a topographic record similar to a photograph, indicating the various features of the sub-bottom terrain. The system produces short bursts of high-frequency sound from a towed vehicle, which also acts as a sensor to receive the echoes from objects on the bottom or in the water column. Like a photograph, shadows occur when objects protrude above the surface of the bottom (Figure 9), but, unlike a picture, the distortion occurs in the center of the image rather than at the edges. The limiting factors of this equipment are speed of tow, scale-width selection, external noise, and problems with tuning and annotating. These are discussed below.

Speed of Tow Problem

The faster the towhead is traveling, the narrower the object appears in the readout. For example, at four knots, a square lying parallel to the sensor will appear as a rectangle with its near and far sides one-half times the length of its other two sides for a one-half signature compression. At six knots, it will have one-third signature compression, and at eight knots, it will have one-fourth signature compression. Thus, at greater than four to six knots, all objects (circles, rectangles, squares, and ovals) will appear similar, which negates shape as a criterion for evaluation. Small objects can also go undetected.

Scale Width Selection

The shorter the width of area displayed on the traces, the higher the resolution; i.e., the equipment will display a better resolution at a 75-meter scale width than at a 150-meter scale width. Because the signal travels only half as far, it allows the equipment to send and receive a stronger signal at a faster rate.

External Noise

External noise can be introduced by many sources -- screws of the vessel, wave action, electronic interference from boat equipment or other seismic gear, and internal side-scan sonar tuning and related malfunctions. As the EG&G side-scan sonar operators' manual states, the system allows the human eye to distinguish between records produced by continuous, coherent echoes from an object and those produced by random noise. There is, however, a point at which noise such as wave effects in shallow water or external electronic noise, could mask small amounts of cultural material lying on or protruding above the surface of the bottom.

Operating, Tuning, and Annotating

The traces without complete annotation, such as those which omit line numbers or length of tow cable, could render the data useless. Cross annotations for anomalies are useful. Operators' observations of material on the surface of the water are sometimes mandatory in evaluating the data due to the possibility of surface objects like boats, rigs, buoys, or sub-surface schools of fish,to be interpreted as bottom features.

The tuning of the equipment can result in the acceptance or rejection of the data. Too much or too little initial gain, slope, or time-variable gain could produce a printout too dark, too light, or both on the same trace.

Sub-Bottom Profiler

The sub-bottom profiler is an instrument similar to the side-scan sonar that emits an acoustical impulse, but of low frequency, which reflects off the bottom sediments at different rates of time. The "echoes," or reflections, from the various strata are intercepted by a receiver and written in a permanent record and/or recorded on tape. The production of the emitted acoustical impulse varies. Pingers (crystal electronically stimulated acoustical emissions), boomers (mechanical acoustical emissions), and sparkers (electronic spark acoustical emissions) are usually used for archeological implementation, with the latter two producing the deeper penetration. The limitations as described by Palmer (1965) are subdivided into three groups: external limitations, vessel problems, and instrument limitations.

External Limitations

The quality of the record diminishes proportionally to the ocean's wave turbulence (sea state). Generally, data obtained in a sea state with wave heights greater than two to four feet produce an unacceptable record.

The source of the acousticalemitting system depends on the depth of the water and the composition of the bottom sediment. In shallow water, a sparker can cause excess noise and multiple echoes, but penetrates through dense sediments, such as shell and the Beaumont clays. Pingers are good for bathymetric data, but often do not have sufficient force to penetrate deep enough to give the required 15 meters of high-resolution trace. In some situations, it is impossible to penetrate underlying strata, such as in the case of gas encapsulative plant organisms.

Vessel Problems

Electronic or mechanical interference between the ship's equipment and seismic instruments can cause extraneous noise. Another noise problem

can be caused by "screw beat," where the vessel's screws are turning slightly out of phase, causing dark lines on the printout.

Equipment Limitations

The greatest disadvantage to the sub-bottom profiler is its ability to sense only a limited area directly under the sensor. The system must pass directly over an object before it can be detected; therefore, at best, the survey area can only be tested to indicate possible cultural resources. As the depth of water increases, the equipment senses a greater area within the fixed angle of coverage, reporting an average condition over the sea floor rather than a specific profile directly below the boat, as in shallower water.

An additional problem is caused by vessel speed. As with the magnetometer and side-scan sonar, vessel speed can be such that small cultural targets, such as small shell deposits, could fall into pulse voids and go undetected. This situation reflects that the instruments design is basically geologically rather than archeologically oriented.

Survey Specifications Limitations

The archeological survey specifications published by the Department of the Interior, Bureau of Land Management (Appendix B), constitute a step forward in affording protection to the cultural resources lying on the Outer Continental Shelf of the Gulf of Mexico. There are, however, definite limitations to the present survey practices which also must be noted, along with the equipment limitations, in order to achieve a more complete evaluation of the survey procedure as it is now being implemented. These limitations fall into four groups: lane spacing of geophysical grid, vessel speed, data acceptability and interpretation, and annotation of printouts from instrumentation.

Lane Spacing

As discussed previously in the hypothetical test using Clausen and Arnold's (1975) magnetometer contour map of a 16th century shipwreck, it is evident that the present 150-meter lane spacing is not sufficient to detect the portion of the material being searched for. Not only is it difficult or impossible to observe on the magnetometer, but also on the side-scan sonar. Using the BLM standard lane spacing of 150 meters, the shipwreck in Figure 12 could have easily gone unobserved (Pattern D), resulting in low gamma readings (A) or in a large anomaly on a single line (Patterns C and D). These observations suggest that any significant anomaly could represent a colonial-period shipwreck.

One of the specific recommendations for survey intensity presented in Volume 3 of this report is to narrow lane spacing to 50 meters from the usual 150-meter runs. Not all areas, however, require the intense investigation of a tighter grid pattern of 50 meters because of the lesser probability of shipwreck occurrence.

Little mention has been made of lane spacing for proposed pipelines. There are two areas of concern: the placement of offset lanes and the coverage of the center line. The offsets are supposed to identify sites that might be damaged by the anchors of the pipe-laying barge. When this anchor zone has to be increased due to increased water depth, the offset lanes need to be extended to detect this zone of disturbance. As the present procedures dictate, parallel lines do not coincide with the anchor zones. The proposed pipeline survey usually consists of a center lane and two offset lanes from 500 to 2,500 feet from the center line. When this data is received, any five-gamma inflection with over three-second duration could be considered a shipwreck, yet such deflections also may represent single point sources. Only with additional runs can this be ascertained. Variation from construction plans are costly;

therefore, anomaly checks can save time and additional costs if handled when the survey vessel is in the area. A great number of anomalies that are noted are single point sources of modern cultural origin, but unless further survey work is implemented, they can only be considered as potential areas for cultural resources and protected as present procedure dictates.

Vessel Speed

In order to produce adequate records, the vessel speed must be reduced to four to six knots for all three types of geophysical instrumentation presently in use. With faster speeds, small targets along the survey line are missed. The justification that some vessels cannot maintain a proper course at slow speeds is valid, but these vessels should not be selected for use as survey vessels on archeological investigations of this nature.

Data Acceptability and Interpretation

Due to the nature of the problem of bypassing sites because of instrument limitations, data acceptability in doubtful areas needs to be evaluated by the geophysicists as the Department of the Interior specifications state (Appendix B). Minimum standards of acceptability should be established, with some thresholds of acceptability recommended as follows:

Magnetometer

Any noise level above $\pm$ 3 gammas can mask low inflection, which could indicate a shipwreck. The sensor must be no more than 6 meters from the bottom.

Side-Scan Sonar

If the instrument is improperly tuned, and excessive areas are either blackened or whitened, with no hope of observing topographic features, then the data should be rerun.

Sub-Bottom Profiler

Because of the varying thickness of relatively recent sediment cover on many parts of the shelf, a minimum of 15-meter penetrations should be maintained.

Interpretation of read-outs should include notation of any magnetic anomaly greater than a five-gamma inflection lasting for greater than three counts; i.e., three seconds when implementing the recommended survey speed. Anomalies of less than three seconds are not probable in reality. All cross notations associated with the other pieces of gear should be discussed in the interpretation section of the archeological report to determine if the target is either a possible cultural resource or modern cultural material, such as well heads, cable, pipelines, modern shipwrecks, platforms sunk or intact, etc.

Annotation

All traces should contain the following information: line number, start time, shot points, cross-instrument notations, observation notations (boats, buoys, vessel turns, etc.), end line, sensor orientation from navigation antenna and from boat's stern, operator's initials, survey area, and date. Additional data depend on the settings of each individual instrument, which are described in the following list:

Magnetometer: gamma sensitivity setting, scale factor, sensor depth, repetition rate

Sub-bottom profiler: scale or timing factor, power, if variable

Side-scan Sonar: range setting.

Recommendations

Little variation from what is already implemented would produce a greater degree of safety to the cultural resources on the Outer Continental Shelf of the Gulf of Mexico. Tighter lane spacing in high shipwreck potential areas, slower vessel speeds, better data quality and annotation, and a qualification in interpretation of the printouts from the instrumentation are some suggestions. This, in many ways, could be implemented in three steps: 1) 50-meter lane spacing in zone one, 2) limit vessel speed after a grace period of four to six knots or less, and 3) set up a panel of underwater archeologists to spot check the data and archeological reports turned into the Bureau of Land Management. This last procedure needs to be made known to the geophysical survey companies and archeologists. Once known and implemented, the quality of the data should automatically increase and the pressure on the archeologist, in the form of accepting marginal data or writing off marginal anomalies, would be reduced.

Protection of Sites - The States

There is no question that great strides have been made in this relatively new area of cultural investigation since the first meaningful articles on the subject, Goggin's "Underwater Archeology: Its Nature and Limitations," and Jewell's "Freshwater Archeology," appeared in American Antiquity in 1960 and 1961, respectively.

Acceptable techniques for the scientific recovery of material and data from submerged shipwrecks, ranging from Bronze Age to Roman and later-period sites, have been pioneered by Bass (1967; 1970) in the Mediterranean. In the Western Hemisphere, however, until recently there has been little comparable progress. This has been primarily due to the inhibiting effect of the destructive though colorful activities of the various commercial treasure-hunting groups. By the middle to the late 1960's, the damage these commercial interests were inflicting on this historically and scientifically valuable and non-regenerative cultural resource was prompting legislatures of individual states of this country to pass legislation typically referred to as "antiquities laws." The successes and problems encountered at the state level in protecting and recovering submerged resources from waters under state jurisdiction should provide invaluable case studies for management of similar resources of continental shelf areas falling under federal jurisdiction.

The state of Florida, faced with perhaps the largest and most vociferous groups of both commercial and "hobby" treasure hunters, pioneered the formulation of such legislation in 1965 with the passage of the Florida Antiquities Act (1965 Florida Statutes). The law was incorporated in 1967 in a newer piece of legislation, the Florida Archives and History Act (1967

Florida Statutes). Other states (for example, North Carolina, faced with relic hunters rummaging through sunken Civil War blockade runners, and Texas, suffering damage as a result of treasure-hunters removing sixteenth-century treasure and artifacts from historically important wrecks) have passed similar legislation (1967 N.C. Session Laws; Vernon's Texas Statutes, Article 6145-9).

With the possible exception of Texas, these state laws all permit a continuation of the activities of treasure hunters though limited by contract, permit, or other regulatory devices. Regulatory agencies and specialized supervisory personnel are required to administer such agreements. As a result, until recently the underwater archeological capabilities of states having these laws were mingled with officially sanctioned, or at least regulated, treasure-hunting activities.

Many professional and non-professional concerned individuals find this compromise approach unsatisfactory and point out that the objectives of the treasure hunter and the historian-archeologist are basically opposed. Even with complete examination of all materials recovered in treasure salvage operations, without the time to adequately record the provenance of the material, archeologists estimate that some 70 to 80 percent of the potential scientific value is being lost. There is, also, a bias introduced by the selective salvage techniques of the commercial companies, who characteristically only bring to the surface those objects which might prove commercially valuable. The treasure hunters, on the other hand, are frustrated by the requirements of the archeologist or archeological technician assigned to vessels operating under contract with the state. These contracts specify that accurate, adequate provenience data for the cultural material encountered or recovered be maintained, a factor which slows salvage progress

considerably. It would be difficult to propose a less compatible marriage of endeavors, their only common ground being the employment of vessels and diving and excavating equipment.

The published results of treasure-salvage activities are limited compared to the literary output which generally follows most professionally guided, scientific excavations, especially those conducted in recent years in the Mediterranean. Examples of the type of publications growing out of the association of archeologist and historian with treasure-hunting and curio-hunting divers working under agreements with various states or governments are "A 1715 Spanish Treasure Ship" (Clausen, 1965), "The Acadia --A Civil War Blockade Runner" (Hole, 1974), and "Exploration of a 16th Century Bahamian Shipwreck" (Peterson, 1974).

The state of Texas has recently taken a new direction in dealing with cultural resources on state-controlled water bottoms. There, the State Legislature has elected to fund an underwater archeological research program which is not associated with treasure-hunting activities. Initially, the program was oriented toward research involving three wrecks of a Spanish flota lost on the lower Texas coast in April 1554. During the summers of 1972 and 1973, one of these wrecks was fully excavated, and a report on that research is pending (Clausen, MS).

In recent summers (1974-75), an extensive, remote sensing survey system, developed by Arnold and Clausen (1975) to locate additional targets for underwater research within the prime wreck zone, has been run in the coastal area northward from the Texas - Mexico border to approximately latitude 26°45' North (Arnold, 1974).

The Texas program is also well balanced in that it has allocated substantial sums to both documentary research in European archives and to the

establishment of adequate preservational facilities to properly deal with the recoveries. Such documentary research provides historical perspective to the archeological research effort. Because objects from the marine environment require relatively expensive and specialized handling and preservation before full evaluations can be made, adequate preservational facilities become an important part of the underwater archeology program (Cummings and Lenihan, 1974).

Methodology

As expected, most of our knowledge of underwater sites in this hemisphere comes from vessels lost in quite shallow water near coasts or reefs, primarily as a result of storms. In many instances, conditions at these sites (i.e., shallow, murky, turbulent water with moderate to severe wave and swell activity, coupled with wreck remains which are often buried from 1 to 8 meters below unconsolidated, sterile sediments or blanketed with a a crust of coral growth) often do not permit application of the sophisticated approach first developed by Bass (1967) for working underwater archeological sites in the less active, often astoundingly clear, waters of the Mediterranean on harder bottoms at depths of 20 to almost 40 meters. Substantially different techniques have been developed, for example, in the Texas program for working wrecks on shallow, active coasts; these techniques have the same scientific ends in sight. This is due primarily to the fact that the great depth of overburden commonly concealing typically more scattered wreck remains and the reduced visibility under these conditions do not permit visual or scientific evaluation or quantification of more than a very small portion of the site at any time (Clausen and Arnold, n.d.). These differences are recognized, and currently an interchange of ideas and further development of methods is in progress.

In recent years, rapid advances have been made in this hemisphere in the development of underwater archeological techniques for excavation of prehistoric underwater sites . The degree of data control in such excavations is increasing. Mosaics of underwater photographs of recent, unconsolidated deposits in springs and sinkhole sites containing both prehistoric human and cultural remains in situ have been assembled to convey excavational information and data on position and orientation of artifacts and skeletal remains encountered (Figure 13). Excellent site records have been amassed through the use of advanced, shallow-water diving equipment and both hard-line and open transmission underwater communications systems, which have permitted archeologists operating below to record verbally on magnetic tape the measurements and observations so critical to adequate interpretation of data (Clausen, 1972).

It is clear that as a result of the development both of means of working shipwreck sites and of the newly devised means of working prehistoric sites, we now have at our disposal adequate techniques for the investigation of all types of underwater archeological sites under a wide range of conditions and in ever-increasing water depths.

Depth Versus Efficiency and Feasibility

The present maximum feasible depth limits for effective investigations of this nature, utilizing divers operating from the surface on compressed air, is probably 30 to 50 m. Beyond these depths, more sophisticated techniques must be employed, beginning with the use of suitable gas mixtures and then saturation diving techniques. The deepest archeological work using modern techniques in the Mediterranean so far closely approximates the tentative limit of 50 meters.

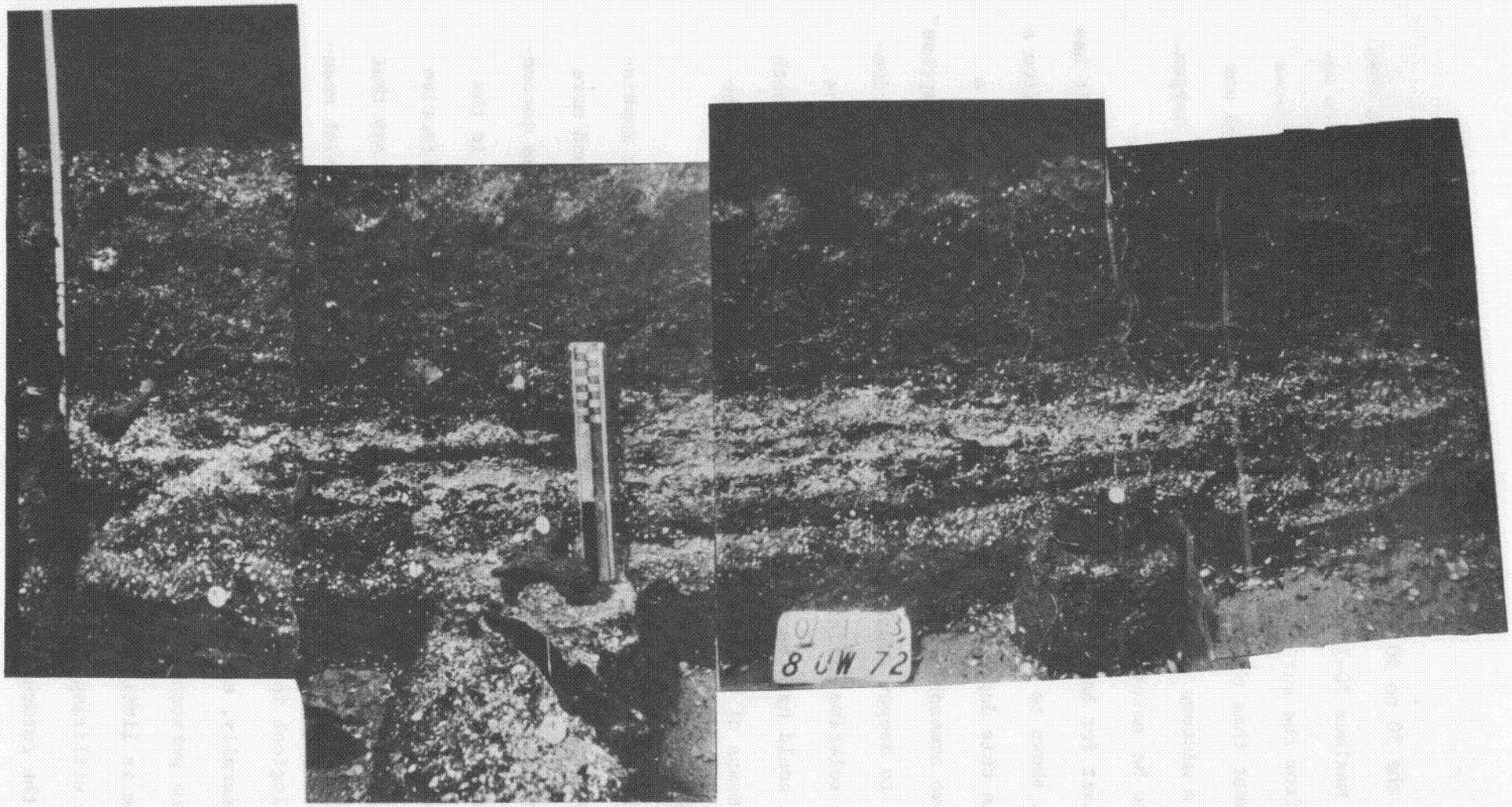

Figure 13. Photo mosaic of exposed strata in underwater excavation at the Little Salt Springs Site in Florida (8 SO 18). Note human bone. Photographs by Carl Clausen.

Beyond the 30 to 50 meter threshhold, there is a zone extending down to perhaps a maximum 70-75 m in which divers might still operate with effectiveness from the surface, but which would require more sophisticated diving equipment than the relatively inexpensive, open circuit SCUBA now utilized and a mixture of air enriched to approximately 40 percent oxygen. It should also be noted at this point that while the maximum known safe depth limit for habitats using air is approximately 30 to 45 m, it has recently been shown to be feasible for saturated personnel operating from a habitat within this depth range to effectively carry out tasks within a zone one to two atmospheres deeper, returning to the habitat to "decompress" from the dive to deeper depths with comparative safety. It is unquestionable that the relative efficiency of these deeper investigations in the Mediterranean could have been improved through utilization of one or both of the above means of extending the diving limits. However, it must be remembered that budgetary limitations are involved.

At the present time, highly trained commercial divers using sophisticated equipment, including Personnel Transfer Capsules (PTCs) and more advanced gas mixtures, operate with comparative safety on problems encountered in the oil and gas industry's offshore drilling operations in the Gulf of Mexico and elsewhere at depths between 120 and 200 m. Effective work at even greater depths has been carried out. It is safe to say that as a result of the efforts of this industry, the threshhold at which meaningful archeological investigations might be undertaken is continually being extended. Naturally, each deeper stage requires more sophisticated equipment (as well as personnel) and the surface support and costs multiply. However, there is little doubt that archeologically oriented investigations on deep sites utilizing these means will be undertaken, at least experimentally, in the future.

Undoubtedly, archeological investigations on sites at greater depths in the Gulf, where conditions may be expected to more closely approximate the clear, relatively still, water conditions found in the Mediterranean, will adopt control techniques more closely related to those developed by Bass, but will probably incorporate the more efficient excavating systems developed in this hemisphere, creating a hybrid of the two approaches. At the present time, new, more advanced photogrammetry, very accurate pressure sensitive, and thus depth-determining, diodes which can be calibrated underwater to any base point, and sonar-distancing equipment, both with digital readouts, are feasible or under development and will greatly increase the efficiency of any future operations.

It is axiomatic that the primary expense involved in underwater investigations of any nature utilizing divers is associated with maintaining the personnel on the bottom who are acquiring the basic data. The sophistication of photogrammetric techniques over the past 10 years has not only increased accuracy, but has also acted to decrease bottom time allotted to mapping and recording provenience. It is considerably less expensive and more efficient to work in a laboratory, perhaps utilizing less skilled or specially trained personnel, than to attempt to duplicate the same effort on the bottom.

Investigation of underwater sites lying deeper than the present physical or theoretical depth limits of scientist-divers using saturation techniques could take place through remotely operated equipment deployed by station-keeping surface vessels. Under these conditions, the scientists' "eyes" will be standard, and possibly image-enhancing, underwater video systems, and his "hands" an array of various size and strength grabs capable of picking up, separating, and lifting both minute and large materials and even taking samples and cores. The principal excavating tool will be a

framework mounting an array of water-powered devices capable in one mode of moving large volumes of water slowly against the target mass or sediment matrix from any angle, delicately whisking into suspension and removing unconsolidated sediments and debris, revealing the sought-for cultural material and its relationships, or spot-jetting away or breaking down more persistent materials. Ultra-high-pressure water jets would be used in wreck sites to cut through and/or dissect the larger conglomerates and hull sections underwater into convenient-sized sections to be placed in containers and/or lifted to the surface, and to cut profiles for examination and recording in the sediment of prehistoric sites. Exact provenance of all artifactual material encountered will be maintained in three-dimensional accuracy by a recording stereo video system. Computer programs will be devised to analyze the video data recorded, providing both the necessary coordinates and elevations for site plans and features; if desired, for interpretive purposes, three-dimensional video line-drawn views or projections from any direction and elevation the viewer desired would be provided. It is even possible, considering the sophisticated surface support required for the operations contemplated above, that entire wrecks might be lifted intact and either carried to shallow, protected waters for investigation or brought up and placed in controlled environments in special vessels, much as was done with the Russian submarine recently recovered from the depths of the Pacific.

Qualified Personnel

Unfortunately, underwater archeology is a somewhat hazardous field of endeavor. It requires professional training in the areas of anthropology/archeology and, in some cases, history, with a degree of proficiency in the specialized techniques of control and recovery of cultural remains from the underwater

environment and, of course, at least an understanding of shallow water diving methods. An appreciable grounding in applicable aspects of certain specialized physical sciences, such as submarine geology, oceanography, and ocean engineering is also necessary. A basic understanding of the geophysical instrumentation necessary for locating cultural resources underwater, knowledge of the proper methods of handling recovered materials, and some experience in vessel handling and navigation have also proved helpful. As expected, in view of the above requirements, the number of professionally qualified underwater archeologists in the United States in quite limited. In 1970, Throckmorton was able to say that there were ". . . not more than five trained marine archeologists in the world" (1970). Today there are probably no more than ten to fifteen trained, capable individuals with adequate experience in this field.

This situation was not a problem until, under the pressure of the developing energy crisis, oil and gas exploration on the Outer Continental Shelf markedly increased, and private companies were faced with new governmental stipulations requiring cultural resource surveys on the leased lands to prevent disruption or destruction of submerged cultural resources. The shortage of qualified archeologists prepared to evaluate the remote sensing data and, if necessary, dive in and evaluate sites discovered was at once appreciated.

Attached to the original archeological Notice to Lessees and Operators (74-10) issued by the U.S. Geological Survey on April 23, 1974, was a preliminary list of professional archeologists recognized as competent to conduct these surveys and to prepare required reports. Recognizing that the preliminary list was not exhaustive and that criteria were not well defined, the National Park Service was asked to assist the Geological

Survey and the Bureau of Land Management to establish criteria for selection of qualified archeologists and to develop a revised list for OCS work. A credentials panel was created, and after considerable discussion and consultation with many individual archeologists as well as with representatives of BLM and the USGS, standards were established (released January 1, 1976).

The concerned agencies agreed that present survey requirements do not require an archeologist of maximum possible skill and experience. Rather, criteria were developed for a Marine Archeological Surveyor (see Appendix B). It was decided further that the term Marine Archeologist should be reserved for the highest level of professional capability. While specific criteria were not established for this category, the panel indicated that it should be reserved for the highest level of professional skill and should identify those individuals capable of designing, directing, and carrying out underwater research or salvage operations of a highly technical nature.

While the panel recognized that some Marine Archeological Surveyors, as defined, might also qualify as Marine Archeologists, it made no attempt to identify individuals in this category. It did, however, re-issue an updated listing of Marine Archeological Surveyors.

Even more recently, the Society of Professional Archeologists (SPA) has undertaken to certify Marine Survey Archeologists as part of its program to certify and list in a directory archeologists qualifying within one or more of a number of specialty areas (see Appendix B). Since the proposed standards for this certification appear to meet the needs of OCS archeology in connection with oil and gas lease evaluations, and the certification procedure has been endorsed by an overwhelming majority of professional archeologists in this country, it is probable that it will replace the interim certification program of the NPS-OCS credentials panel.

It is reasonable to assume that as surveys disclose previously unknown OCS sites, salvage and systematic underwater archeological research will intensify. There will be a corresponding increase in the need for archeologists trained to work under water.

While the number of archeologists sufficiently experienced to investigate sites at depths of 30-to 50-meters is quite limited, the number presently qualified for saturation or mixed gas diving for extended investigation or examination of deeper sites is presently nil. It follows that there is now a need not only for what would be referred to as basic training for underwater archeologists, but also, if deeper sites on the OCS or elsewhere are to be examined, there is a corresponding requirement for advanced diving experience as well. It is recommended as an outgrowth of this work that future habitat experiments involving saturation diving, whether sponsored by private industry, government funds, or a combination of funding, should give consideration to including experiments in underwater archeology in their schedules. Such a program should include selected underwater archeologists in crews to assist in the experiments conducted by other disciplines.

SUMMARY AND CONCLUSIONS

A number of conclusions may be drawn from the research on the occurrence of historic cultural resources on the Outer Continental Shelf of the northern Gulf. Shipwrecks along the coast of the northern Gulf of Mexico are estimated to number between 2,500 and 3,000. A more exact number cannot be determined because of the lack of reliable records. Of these thousands of lost ships, approximately 70 percent date from the 19th century. The remaining 30 percent, the wrecks from the 16th, 17th, and some from the 18th century, are the most important. These sites contain relics that are highly significant historically and often of great commercial value.

It is estimated that approximately two-thirds of the total number of wrecks in the northern Gulf are within 1.5 kilometers of the coast. Another 500 wrecks probably lie between the 1.5 kilometer and 10 kilometer line. For the most part, wrecks are assocated with the approaches to seaports, straits, shoals, or reefs, and along maritime routes used through the centuries. There are a number of dangerous zones on the Outer Continental Shelf which define concentrations of hazardous materials such as bombs, missiles, and other ordnance. Some areas may contain wrecks, but the possibility of locating them is reduced because of the concentrations of modern artifacts, such as discarded junk from the fishing and mineral extraction industries.

Current searches for subaqueous cultural sites utilize a combination remote sensing package consisting of magnetometer, side-scan sonar, and sub-bottom profiler. The magnetometer is most effective in locating historic sites, such as shipwrecks, since it can detect buried metallic objects which are not apparent on side-scan sonar or are difficult to see on the sub-bottom profile. The sub-bottom profiler and side-scan sonar may help verify a shipwreck find through definition of its geometry and attitude.

The sub-bottom profiler and side-scan sonar have additional value in helping to identify and interpret submerged prehistoric habitation sites, such as riverine and estuarine features, remnants of barrier islands, and escarpments.

Finally, there is an apparent need for the training of more marine archeological surveyors and marine archeologists. The increased drilling by the oil and gas industry on the Outer Continental Shelf has brought attention to these cultural resources which may be destroyed if precautions are not taken for identification and investigation.

Sailing Directions

Romans, in 1775, comments on the stories told about the "wreckers" in the Florida Keys creating false lights to lure vessels onto the reefs: "And as for the idle tales which we are told of their making false lights on the shore, I can, from many years experience, assure it to be an untruth. Those fires are occasioned by the hunters and timber-cutters, who burn the woods to clear them of under-wood, and to procure fresh pasture for the deer. Lightning also often sets fire to trees; and I have frequently, in very dry seasons, seen spontaneous fires arise in marshy places. But after all, what business has a mariner (who knows the course he must steer) to follow any light out of that course? And I would just hint to every one who passes along this coast, that on seeing a light to the westward, it behoves (sic) him to look out for breakers if he stands in for that quarter" (p. xxx).

Late 16th Century Spanish Sailing Directions to go from the Mississippi River (Rio Del Espiritu Santu) to La Habana

"To go down from El Rio del Espiritu Santu (the Mississippi) south to La Bahia del Espiritu Santu (Tampa Bay -- author) it is 25 (sic) leagues. You will find La Bahia del Espiritu Santu to be a large bay with its low parts extending one league out into the sea with one or two small cayos. From there to La Punta de Carlos which is called La Isla de Santa Maria (Sanibel Island -- author) is another 25 leagues. Along here you will find two rivers which you could safely enter. One called Rio de Canoas and the other Rio de Caymones*.

*We do not know here whether the Spanish refer to perhaps the Manatee River and the small river in the vicinity of Venice or to major inlets between the islands which parallel this section of the coast which Spanish mariners commonly refer to as "rivers." It seems possible that they might even be referring to the Myakka and Peace Rivers, which flow into Charlotte Harbor, but this is doubtful. Nevertheless, this information is interesting for the geographical information it provides which may some day assist scholars in determining where the Spanish explorers Ponce de Leon and Hernando de Soto made their landings, which is in question, and for the location of "Carlos" which appears from this description to have been in the vicinity of the present Fort Myers Beach-Bonita Springs area, probably closer to the former.

Further south of the Punta de Santa Maria there is no land at all because from there to Carlos the coast runs east and west for 6 leagues. Along these 6 leagues is a river called Rio de los Ostiones (perhaps the Caloosahatchee -- authors). From this river it is a distance of two leagues to Carlos which is on the north to south coastline. From there you come south to the La Punta de Nueva Espana (apparently Cape Romano -- author), a distance of 12 leagues. Two leagues before you arrive at this point you will encounter a river (?) which extends some of its shoals about a league into the sea. From this point southward you will no longer see any land because the land turns from the east-southeast (maybe "turns from the south-southeast." The Florida coast south of Cape Romano does trend away to the southeast for some distance. It is somewhat of a mystery why there is no reference to Cape Sable in this description,but perhaps it was too far east and in too shallow water, to be a viable landmark -- author). To go from here to La Habana change course to the south and to the southwest. As soon as you see Los Martires (Florida Keys -- author), immediately follow the western turn maintaining seven or eight brazos. If you are in a large ship approach Las Tortugas instead of Los Martires because Los Martires has a long reef extending 6 leagues (apparently here the Spanish are warning mariners away from the long shoal extending westward from the Marquesas at the western tip of the main chain of islands comprising the Florida Keys, an area shown on modern navigational charts as "The Quicksands" -- author). Therefore you arrive at Las Tortugas and you can proceed through 20 brazos and 16 brazos and when you can no longer find the bottom you will know that you are in the canal (Straits of Florida)" (British Museum 28, 189).

Early 18th Century Spanish Sailing Directions From La Vera Cruz Through the Gulf to La Habana

"From San Juan de Ulua for La Habana you shall steer to the northeast or the north-northeast (depending upon) where the wind strikes you. About

27 and one-half degrees you shall rotate to (the east) to take your crossing looking for soundings on the coast of Florida above the Bahia del Espiritu Santu. Finding soundings on this side you will be some 25 leagues from Cabo de Apalache to the west of you (sic) shall tack southeast or southwest (again depending upon) where the wind strikes you and you shall go on until you lose the sounding and when you do you will tack back toward the land side until you reach 20 brazos and then you shall tack away again. In this manner turning from side to side you shall go (south) along the coast until 25 and one-half degrees you will find a depth of 15 brazos. If you find 8 or 10 brazos you will see very low land (with some trees which give the appearance of having been planted next to the water) at this latitude you should take 50 brazos depth and you shall continue your way in search of La Sonda de la Tortuga which is in 25 degrees and when you take a sounding of 30 to 40 brazos you shall steer south taking a sounding from time to time. If your depth diminishes you shall rotate to the southwest to find more water and when you begin to lose your sounding again turn south until you lose it entirely (cross over into the Straits of Florida) from whence you shall steer to the south-southeast (?) in search of La Habana where you will see El Morro which from out at sea looks like a ship at sail."

Author's note: The above directions are abstracted from a rough translation of a portion of the orders prepared by the King's chief pilot for an aviso sailing alone during war time (Archivos Generales de las Indias, Ct 4895). There are some apparent inconsistencies in the text, including a reference to a latitude in the Gulf of 28°30' N. We have not been able to determine at this time whether this reference constitutes an optional latitude on which to cross the Gulf from the Texas side or whether because it is war time, the pilot is electing to have the advice boat, which normally carries important dispatches including orders of the King, intelligence on the location or intentions of the enemy

(in this case the Dutch and English were the principal foes), and notices on the movements of Spanish armadas including flotas, sail across the Gulf on an east-northeast course, rather than the standard easterly course, perhaps to avoid any interference by English (or less likely, Dutch) vessels which might be lying in wait along the customary routes. It should be noted that the route of the vessel avoids all of the Florida Keys, apparently passing west of the Tortugas. This might be another effort to avoid observation for, as Bernard Romans states in the 1770's, one of the logical places for a cruiser (English warship) to lie in wait for Spanish vessels from Campeche and Vera Cruz bound for Havana is around the Key West area (Romans, 1775: xi,xii).

Spanish Routes Through the Gulf, in 1770's

In reference to the course through the Gulf used by the Spanish ships coming from La Vera Cruz, Romans makes two comments in the appendix of his book: "It was communicated to me by a gentlemen whose name was Don Manuel Hidalgo, a very experienced commander, who assured me that the Spanish galloons (sic) from La Vera Cruz in order to make the Bay of Tampe (sic), from which they shape their course so as here to disembogue (sic) out of the Gulf of Mexico into that of Florida, passing a little east of the Key Marques. I have seen two of these ships on the coast of West-Florida, not far south of Cape Blas; which circumstance and that of three galleons being cast away near the bay of St. Bernard, seem to confirm that gentleman's information" (p. xi). "This place lies right in the way of the Spanish ships, from the westward; on account that these ships in coming from the western part of the Mexican gulph (sic), chuse (sic) to run out of the way of the eastern or trade wind, and for that reason must go as far north as the coast of West-Florida will allow them; thus they are forced on an attempt to make the Tortugas; which often leads them further east, and then the currents

generally render it difficult for them to get out, unless they know Boca Grande passage: for this reason a vessel in the proper season, cruising to the north of this key, and those that lay to the westward of it, can hardly fail of meeting them ..." (pp. xi-xii).

Mid-18th Century Directions for Sailing from the Mississippi River Through the Florida Straits

"If you are bound out of the Mississippi eastward, to go through the gulf of Florida, you ought to endeavor to make the Tortugas, in order for this steer ESE from the Balize, run that course till you come on the edge of soundings, between latitude 26°: and 27° N., by this means you will not be plagued with the trade wind, in the way of which you would fall too soon, before you get your easting. I remember a vessel bound from Pensacola to Carolina, who was drove as far to leeward as Cape Catoche, and after being a long while (I think 4 or 5 weeks) out, was obliged to return to recruit her stock of provisions; this was doubtless occasioned by not getting her easting while she was out of the way of the trade. After you are on this edge of soundings, direct your course more southward, you will find very regular gradations of the depth, such as my map lays them down, you may depend on them. It frequently happens that vessels fall too far to the westward, as was the case with one from North-Carolina some four or five years ago, who was either lost or taken near the bay of St. Bernard and the people underwent numberless hardships, as well among Spaniards as savages."

English Routes in the Eastern Gulf, 1770's

Directions for Going to and from the Mississippi

"If you are bound into this river keep the NW course till you are in latitude 29° 10 N., then run down for the river on a W course; if you

happen to fall in to the northward of the mouth, come no nearer than 15 fathom,when you will have coarse, brown sand; then run S, or S half W, keeping your lead going, till you come on soundings so soft that the lead will bring none of the mud up, unless it be woolded (sic) with canvass; if then the wind be free, run the above course or rather more westerly; but by all means take care you are not to the southward of the last mentioned latitude when you are down on a W course, for fear of falling in to the south of the river: When you approach the rivers (sic) mouth, which you will by running about 4 miles on the above soft soundings, you will see the color of the water alter, and it will appear like a shoal; this is occasioned by the current of the river mixing with the sea; but you need apprehend no danger, for there is from 25 to 30 fathom water, therefore run boldly in till you have about 8 fathom, the bank is pretty steep; when you are in this depth, you will see some mud islands about as large as a vessel of 150 or 200 tons; from among which you will perceive the river's mouth; the opening between these islands is about 100 fathoms wide: there are some Spanish pilots kept at Fort Balize, who give a very indifferent attendance; but if you see a launch coming out, you may depend on its being them, and your best way is to run directly for them, keeping off and on when you think yourself too near.

"If no launch come out, and the weather fine, come to an anchor, there is little or no danger; and if need the current will always carry you out again, provided you keep opposite the channel.

"In going up the river it is necessary to keep within about 20 feet of the land, or of the drift wood that lies along it, except when you find it lodged on points or banks, in such places give it a reasonable birth.

"Observe also where you see the timber of a dwarfy and shrubby growth, or where willows grow, on the points in such places the water is shoal, and it is requisite to give the land a birth of about 100 feet.

"There are however no shoals of any consequence, till you are about 10 miles past the Detour aur Anglois, (Anglice English reach), here one Mr. McCarty has got a plantation on the larboard side, where is a point called McCarty's point; from this a shoal runs off near one third of the way over.

"It is almost needless to mention that in this (as in all rivers)* vessels ought to keep on the lee side, for on the other side they would be becalmed.

"Unless in a case of the utmost necessity, (such as fears of seizure at Orleans otherways)* let not go an anchor, for it's a thousand to one but you will loose (sic) it if you do; the appearance of the shore will however tell you whether the logs are numerous or not at the bottom: a buoy will not watch " (pp. lxv, lxvi, lxvii, Romans).

Directions for Vessels who are Bound to Pensacola, and Have Run Down by Jamaica, or on the South Side of Cuba

"After making Cape Anthony, your course for Pensacola, is NW by W 1/2 W, the distance is 178 leagues, go nothing to the westward of this course, and if there be no currents to deceive you, it will carry you about in with the middle of St. Rosa Island; currents are here frequent, and they often change suddenly; in which case you may be carried many leagues either eastward or westward of the cape.

"When you come as far North as the lat. 24°00 N, keep a good look out for the Dry Tortugas, in order to avoid that danger, if you see them not, till you pass the lat. 24° 4 N, I would advise you to keep as far up as NNE or even NE by N if the wind allows, till you get soundings; and depend on it, if you are to the eastward you will strike soundings in about 40 fathom, in lat. 25° 00 N; from hence you may steer NNW: it is a sure sign, that the

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*Parentheses Romans'.

sooner you strike soundings, the more easting you have made; and the longer you run without soundings, the further you are westward.

"If you fall in as far eastward as Cape St. Blas, you will strike soundings above the lat. 29° 00 or 29° 5 N, your first soundings will be in about 90 fathom, on a muddy or oozy bottom, which is the same every where on the edge of the bank; the bank being pretty steep, you will soon be in 60 and 40 fathom, coarse blackish sand, and a few shells in spots: further in your soundings will decrease rather irregularly, on account of some knolls; one of these which lies about 3 leagues south of the cape, has only 18 feet water on it, the depth all around it is about 4 fathom; the pitch of the cape shoal lies in lat. 29° 38 N, about 5 miles out from the land, and the extreme depth of water on it is only 14 or 15 feet: the soundings continue however to the shoal pretty regularly as you go in, till about 4-1/2 or 5 leagues from the pitch of the cape; therefore if you come in upon this part of the land during night, you may run in boldly upon 11 fathom, a hard sandy bottom with broken shells, all the knolls lie within this, they are however only to be dreaded by large ships; this bank is most plentifully stored with fish, especially dolphin for the two-line sport; the pitch of the cape is known by the appearance of a gap in the land about 1-1/2 or 2 leagues to the eastward of it, in which gap stands a very large single live oak tree; about 4 leagues to the NW of the cape is a middling good roadstead, where in case of easterly winds it is safe riding in 4 or 5 fathom, black mud and shells; and about 3 leagues further north is the bar of St. Joseph, the entrance into which harbour will be hereafter described.

"If you fall in still more to the eastward, you will find the water clearer, and even in 12 or 13 fathom, it is of a dark blue like the ocean; the soundings begin in 28° 30, or even sooner, and the bottom is fine sand, mixed with coral, shells, and some spunges (sic).

"In case you fall in with the coast of St. Andrews, you will not strike soundings before you be in lat. 29° 15, or 29° 20 N, same ground as off the cape; but as you advance towards the land you will in many places meet with coarse, muddy grey sand, mixed with black specks, and at some casts the lead will bring up fragments of coral; about the lat. 29.30 N (sic) you will find 18 fathom, sand with small shells; and you may then just see the land of St. Andrews, to the westward of the inlet; which land has a woody flat appearance, with an even white beach, and a bold shore, so as to have 10 or 11 fathom water within a mile, or a mile and a half from the strand; the coast trenches nearly W by N and E by S.

"But if you fall in so far to the eastward as to be right off the entrance of the bay of St. Andrews, or between that and St. Joseph, the coast is not quite so bold, and the depth of 10 or 11 fathom is but just in sight of land, the bottom is sand and small shells.

"The entrance of St. Andrews bay lies in lat. 29° 49 N, and admits only of small vessels.

"If your landfall be any where between the coast and bay of St. Andrews, and the bay and island of St. Rosa, you will strike soundings from lat. 29° 20 to lat. 29° 45; the farther north you run without sounding the farther westward you are; the land here stretches E half N and W half S, all these are marks by which the mariner may know the true place of his vessel on this coast, which is too level to distinguish particulars thereon at a distance: if you strike no soundings till lat. 29° 55 it is a sure mark that you are abreast of some part of St. Rosa island, which is easily known when you come near, being no more than a long and narrow slip of sand-hills, with here and there some groves of pine trees scattered on it; towards the west end the beech is exceeding white, and some of the sand-hills loom like lofty white

buildings, or vessels under sail, especially when not too near; the bottom here is a white sand, with here and there a spot of coral, it shoals very gradually; within the island is a sound which is from 1 to 3 miles wide, narrowest at the east end, so that if you fall in towards that end it is difficult to know it to be an island, though you are within 3 miles of it; the shore is so bold that you may run down along by it at 1-1/2 or two miles off, where there is generally 10 or 11 fathom; to the eastward you can only see the water over the land in spots, though you are at masthead.

"From Cape Blas to St. Rosa bay the course and distance is about NW by W 27 leagues; from that to Pensacola bay is W half S between 16 and 17 leagues; and from that to Mobile bar W between 14 and 15 leagues: Cape St. Blas being so surrounded with rocks and shoals, I would advise by all means to avoid falling in with it, a large ship ought by no means to come nearer than within 6 leagues of it.

"For the better knowing of this coast, I shall make some further remarks, because the coast's running so nearly E & W, and being every where so nearly alike in its level & woody appearance; the most skilful (sic) and experienced pilot may here be deceived, especially as the advantage of observations, which is so great a help on a N & S coast, fail here totally.

"In coming on this coast, if your land-fall be off the island St. Rosa your first soundings will be about 80 fathom (little more or less)* oozy ground, this depth and bottom is about 15 or 16 leagues from the land.

"If you fall in about 10 leagues eastward of St. Rosa bay, you will see the beech (sic) very white, and no sand hills on it, which last circumstance distinguishes it from the land further westward; near the beech is very little growth, besides shrubs, and brushy plants; if you stand pretty well in, you may, from the masthead see that an extensive Savannah (or plain)*

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*Parentheses Romans'.

is situated within this shrubbery; which is an other mark to distinguish it from the land to the westward, which being an island, water is seen over it.

"The bar of St. Rosa only admits craft of 6 foot draught. As you come near this inlet or the east end of St. Rosa island, it is difficult to know that it is an island; the woods grow close to the beach, which is likewise very white, and full of sand-hills, these being contrasted by the dark green of the bushes, are of as dazzling a white as snow: the island as before observed is a narrow slip of sand-hills, with a very few trees scattered over it, mostly towards the west end, and from masthead seems about a cables length over, within appears the sound; the wood-land on the north shore of it is of a middling stout growth, and the trees stand pretty close to the water-side; having run down about two thirds of the length of this island, (in other words)* about 12 leagues or upwards, you will see several of those remarkable sand-hills above mentioned which appear at a distance like buildings or vessels; approaching the bar of Pensacola still nearer, you will see a pretty high bluff point of a redish (sic) colour; about 3 or 3-1/2 miles north of the island, on the main land, this point is called Deer-Point; when you come abreast of this, you will see the vessels (if any there are)* riding at anchor before the town of Pensacola, and a water-house (nick-named a fort)*, on St. Rosa Island. If a guard is kept here, which is commonly the case, you will see a flag hoisted on it if your vessel is a topsail vessel, or a pendant, if she be boomsailed, and a gun fired; which signal is made on account of your approach: if the weather is good, (and the attendance a little better than it was during the time of my residence there)* a canoe or barge will come off with a pilot; if none comes off, you may freely venture with a leading wind to run in by my plans. Off of the Look-out on St. Rosa Island lies a spit, which you must avoid by not bringing

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*Parentheses Romans'.

the watch house more northerly than NNW, till you run off in 5 or 6 fathom water, then by all means keep that depth, until you bring the middlemost or highest red cliff, which opens with the west end of St. Rosa island, to bear N 1/4 E by the compass, and steer directly for it; this course will carry you over the bar in 20 or 21 foot water. The tops of these cliffs are built full of barracks, block-houses, and other military works; so as to appear like a small town. When you are over the bar steer N by W, or NNW, to clear a shoal that stretches near two thirds over from the west end of St. Rosa island, on which is 10 foot water, hence it is called the 10 foot bank. The lat. of this bar is 30°: 19' N.

"If you fall in to the westward of Pensacola, on the Mobilian coast, you will get no soundings till you are near or in lat. 30°:N., the edge of the bank is 80 or 90 fathom deep, on a soft muddy and oozy bottom; but it is steep and shoals suddenly, and by the time you run about 2 leagues, you will not have more than 30 or 40 fathom on a soft bottom of very fine white or grey sand, mixed with mud and shells, and you will be in 8 or 9 fathom when 3 or 4 leagues from the land. The coast runs due E and W; large trees come close down to the water side; the beach is not so white; the sand-hills few, and neither water nor savannah to be seen within land; all which circumstances sufficiently distinguish it from the eastern coast. Observe also that the further you go westward the softer the bottom is.

"West of Mobile the coast is lined with islands, as represented in the map; the bank is steeper, the ground softer, and the land in sight almost as soon as you strike bottom, at least when you are not above 5 or 5 miles on upon soundings. The principal harbour here is between Cat Island and Ship Island. The whole of the navigation in and about those islands, through the Rigolets, and by the lakes to Manchac, is so plainly laid down in my map, that

any wordy elucidation of so minute a matter, chiefly for the use of boats, would be a prolixity in me" (pp. lxvii-lxxiv, Romans).

Instructions to go to Pensacola, on a Route Differing from the Former

"The Dry Tortugas lie in lat. 24°:25' and stretch northward as far as lat. 24°:43'N. The south end lies N 40°:W 31 leagues from the Havana, or N 1/2 W 22 leagues from Bahia Honda, the direct course from the Tortugas to Pensacola is N 34° W, and the distance 142 leagues. But the safest way is to run N 1/2 E 35 leagues, by which means you will make the land in lat. 26° 46 N; where is a large harbour called Charlotte harbor; here, in case of necessity, you may refresh, as it affords excellent water in many places, especially on a high island, whose north end is a broken bluff, and which shows itself very remarkable as soon as you are well shot in; there is likewise plenty of fish, and the islands are stocked with large herds of deer; there are 4 or 5 inlets into this bay; but the one that lies in the above latitude is deepest, it has 15 or 16 feet water on its bar; the southernmost is the next best, and has 14 feet on its bar; this lies in lat. 26° 30, and is remarkable for the coast taking a sudden turn from NNW, to directly west, only for about 9 or 10 miles; when it again resumes its former direction: this nook in the land, forms what the Spaniards call Ensenada de Carlos, i.e., Charles's Bay, the piece of coast that trends E and W, is the beach of an island called Sanybel, this place is further remarkable for a great number of pine-trees without tops standing at the bottom of the bay, there is no place like it, in the whole extent of this coast; the northernmost entrance is likewise remarkable for a singular hommock (sic) of pine-trees, or a grove standing very near the beach, than which there is none like it any where hereabouts; the course and distance from this place to Pensacola is N 49° W 109 leagues; N 36° W about 20 leagues from this place

is the bay of Tampa or Spirito Santo, from whence to Pensacola the course and distance is N 52 W 80 leagues, either of these courses will steer clear of Cape San Blas shoals, and you may in case of currents humour your course so as to have easting enough.

"The navigation in and through the bay of Juan Ponce de Leon, to Punta Largo, or Cape Roman, and as far as Charlotte harbour, being fit only for turtlers, fishermen, and other small craft, I will not say much about it; inspection of my charts, where that part of the coast is very faithfully laid down, will suffice such small fry.

"The fort at Apalache being deserted, the coast very flat, and the bay inconsiderable; I shall omit saying any thing about it, as my maps show with sufficient accuracy what may be expected and done by such small craft, as may have occasion to call there" (pp. lxxiv-lxxvi).

Directions from San Juan de Ulua to La Havana

"From San Juan de Ulua to La Havana, go northeast according to how the wind strikes you as far up as 25°. Turn toward the east. As you approach the area of La Sonda de las Tortugas take soundings. If you find sand you will be east/west of them and if you get conchite (fragmentary old shell?) and guizarrito (?) you will be northeast/southwest of them and if you get black sand you are north/south of them. From there sail toward the southwest all the while looking out for the Pan Cabanas o Mesa de Marien which is to the windward of La Havana about 10 leagues.

"If when you depart from San Juan de Ulua the wind is from the northeast go with it until 27° and a half degrees. Coming down the coast when you find mud or ooze in the soundings you will be in the lower part of the Bahia de Juan Ponce toward the west. If you get sand (at this latitude) you will be southwest of La Bahia de Juan Ponce. From there you may sail to the south until you run out of soundings and then sail southwest in search of La Isla de Cuba.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
GULF OF MEXICO AREA

75-3
(SUPERSEDES No. 74-10)

January 20, 1975

NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL AND GAS LEASES IN THE OUTER CONTINENTAL SHELF, GULF OF MEXICO AREA

MINIMUM GEOPHYSICAL SURVEY REQUIREMENTS TO PROTECT CULTURAL RESOURCES

Recent OCS leases include stipulations concerning archaeological surveys. Should such an archaeological survey be required in the leased area, or area sought for permit, the following minimum requirements must be fulfilled. These requirements will be effective as of the date of this notice and shall apply also to all existing leases that contain archaeological stipulations, including MAFLA leases, where the archaeological surveys have not yet been conducted.

Prior to drilling operations or the installation of any structure or pipeline, the lessee shall conduct a high resolution geophysical survey in the immediate area to determine the possible existence of a cultural resource. The following equipment is required in performing the survey. All equipment shall be representative of the state of technological development.

A. Magnetometer - Total field intensity instruments are needed. The sensor of the magnetometer should be trailed as near as possible to the sea floor; six meters or less is recommended. Knowledge of the sensor depth of tow above the bottom is highly desirable for future analyses.

B. Dual Side Scan Sonar - Coverage of the sea floor at a range width of at least 150 meters per side in the proposed area is needed.

C. Depth Sounder and Sub-bottom Profiler - An analog recorder shall be used for bathymetry and the profiler shall be capable of resolving the upper 50 feet of sediment.

Navigation for the survey shall utilize state-of-the-art positioning systems correlated to annotated geophysical records. Navigation accuracy shall be on the order of $\pm$ 50 feet at 200 miles.

Optional tools could include cameras, underwater TV, divers, and cores. Any engineering soil borings which are obtained shall be made available for the archaeologist's inspection. These data shall be evaluated for indications of aboriginal habitation sites as well as for historic sites.

The track or survey line spacing shall follow the attached illustrated plans.

For a single-drill site or platform location, all geophysical equipment shall run an area approximately one mile square with eleven principal survey lines spaced 150 meters apart with three cross-lines. In addition, two diagonal lines centered on the proposed drill site shall be run. (See attached plan A).

For an entire lease block, or significant portions, a 150 meter x 1000 meter spacing shall be used. (See attached plan B).

For a pipeline installation, three principal survey lines shall be run, one following the exact course of the proposed pipeline with an offset line on either side spaced to coincide with the area which would be disturbed by the barge anchors. The distance of these offset lines from the proposed pipeline route cannot be stated specifically since this is a function of water depth and equipment. (See attached plan C).

A professional underwater archaeologist is not required to be present on all survey activities. A geophysicist must accompany the survey to insure that the equipment is properly tuned and records are accurate and readable. The records shall be inspected by the archaeologist along with the survey geophysicist who shall advise the archaeologist as to record quality and anomaly occurrences. The data will be maintained by the lessee and shall be available to BLM and USGS upon request.

Survey Report Format

The archaeological survey report shall include, as a minimum, the following:

1. Description of tract surveyed to include tract number, OCS number, block number, geographic area, e.g., Mobile South No. 1 Area, and water depth.

2. a) Map (1" = 2,000') of the lease block showing the area surveyed.

   b) Navigation postplot Map (1" = 1,000') of area surveyed showing tract lines and shotpoints with U.T.M. X and Y coordinates and latitude-longitude reference points.

3. Survey personnel and duties.

4. Survey instrumentation, procedures and logs.

5. Sea state.

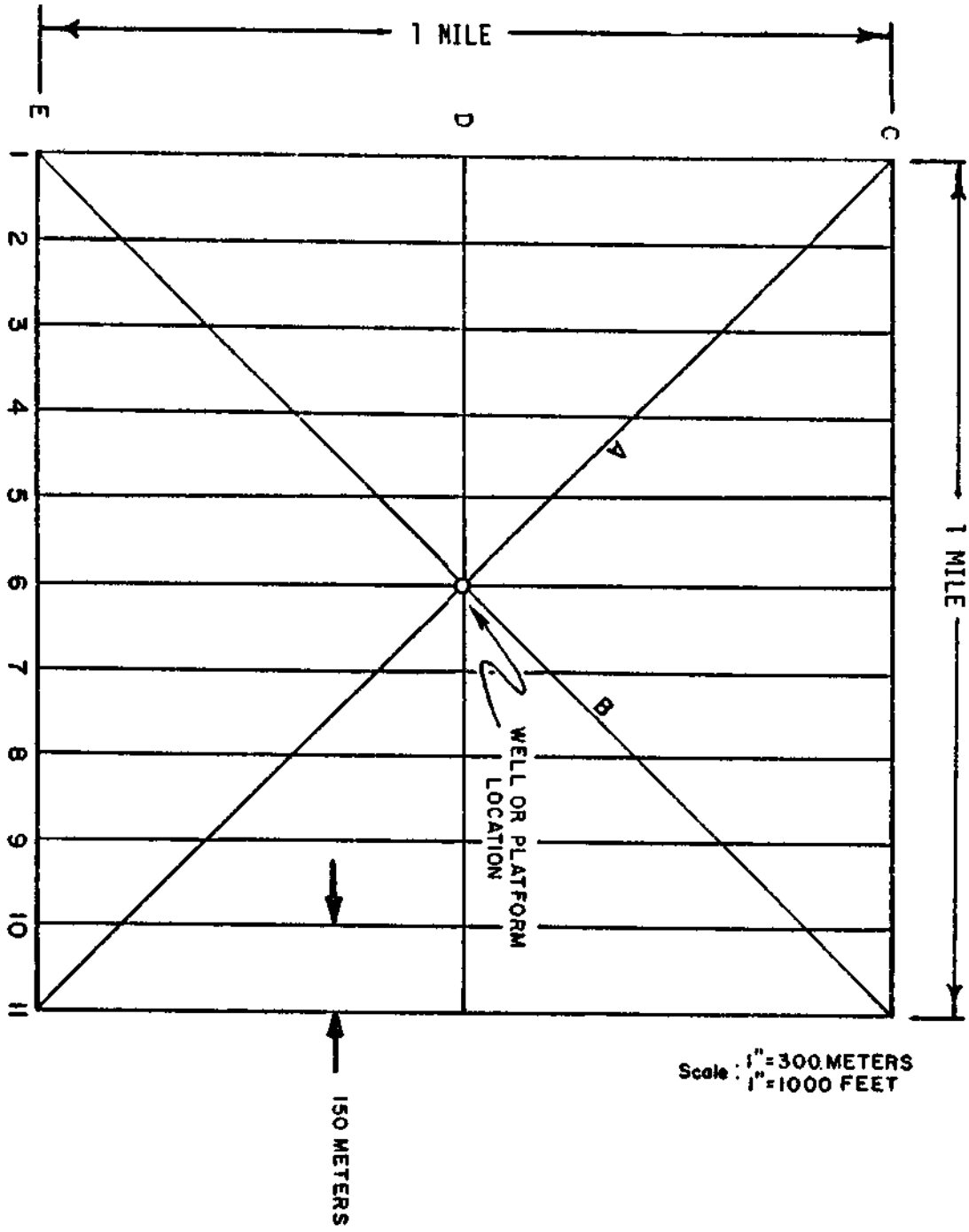
6. The original of a selected line of survey data for each instrument used shall be submitted with each report. In all cases where an anomaly is encountered, the original of all survey data for the line(s) indicating the anomaly shall be submitted.

7. Archaeological assessment, with a signed statement as to the possible existence of a cultural resource.

8. Two copies of the report shall be submitted to this office and also two copies to the New Orleans OCS office, BLM.

D. W. Solanas

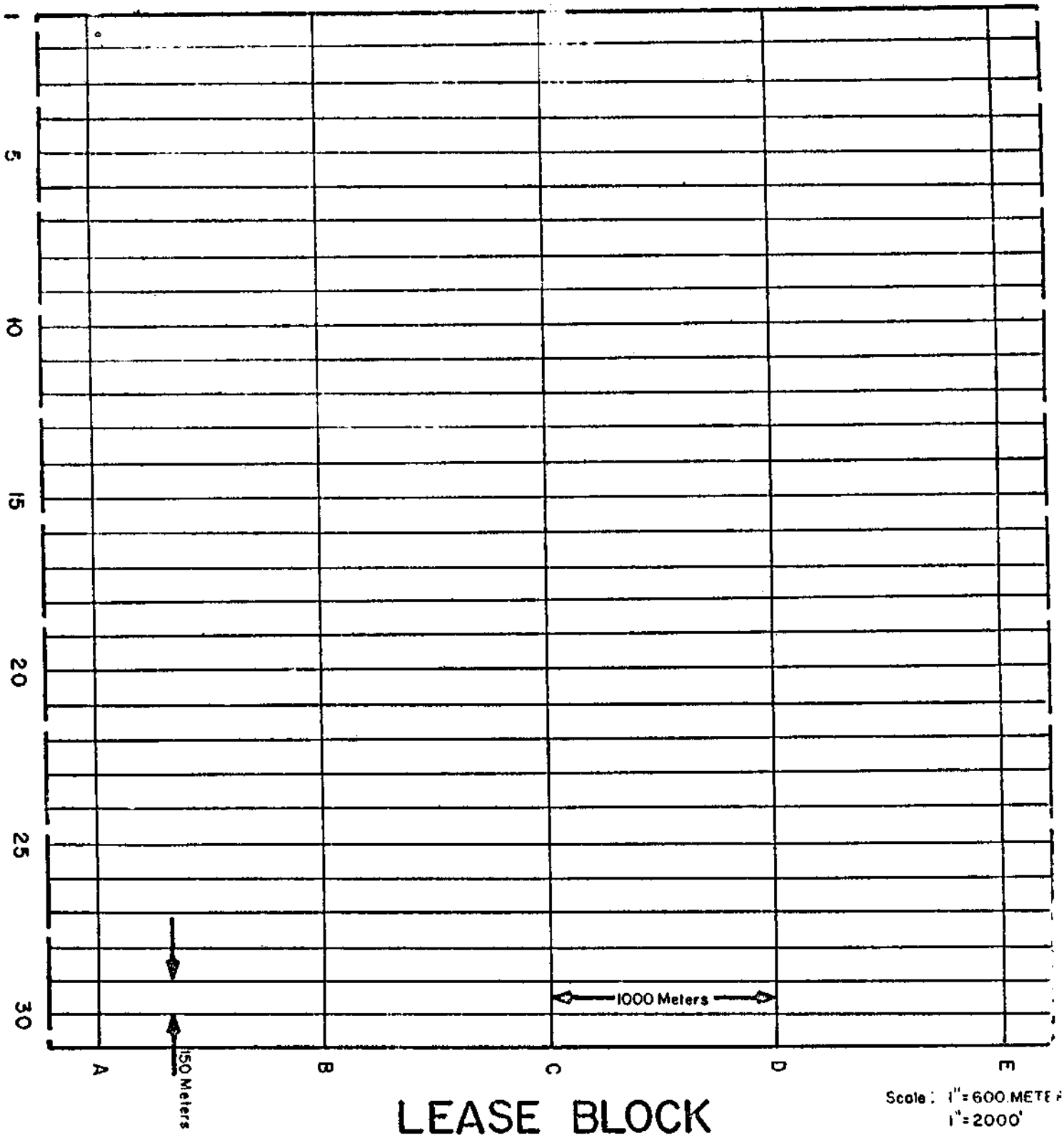
D. W. Solanas
Oil and Gas Supervisor
Field Operations
Gulf of Mexico Area



WELL OR PLATFORM LOCATION

GEOPHYSICAL SURVEY GRID TO DETERMINE THE EXISTENCE OF CULTURAL RESOURCES

PLAN "A"

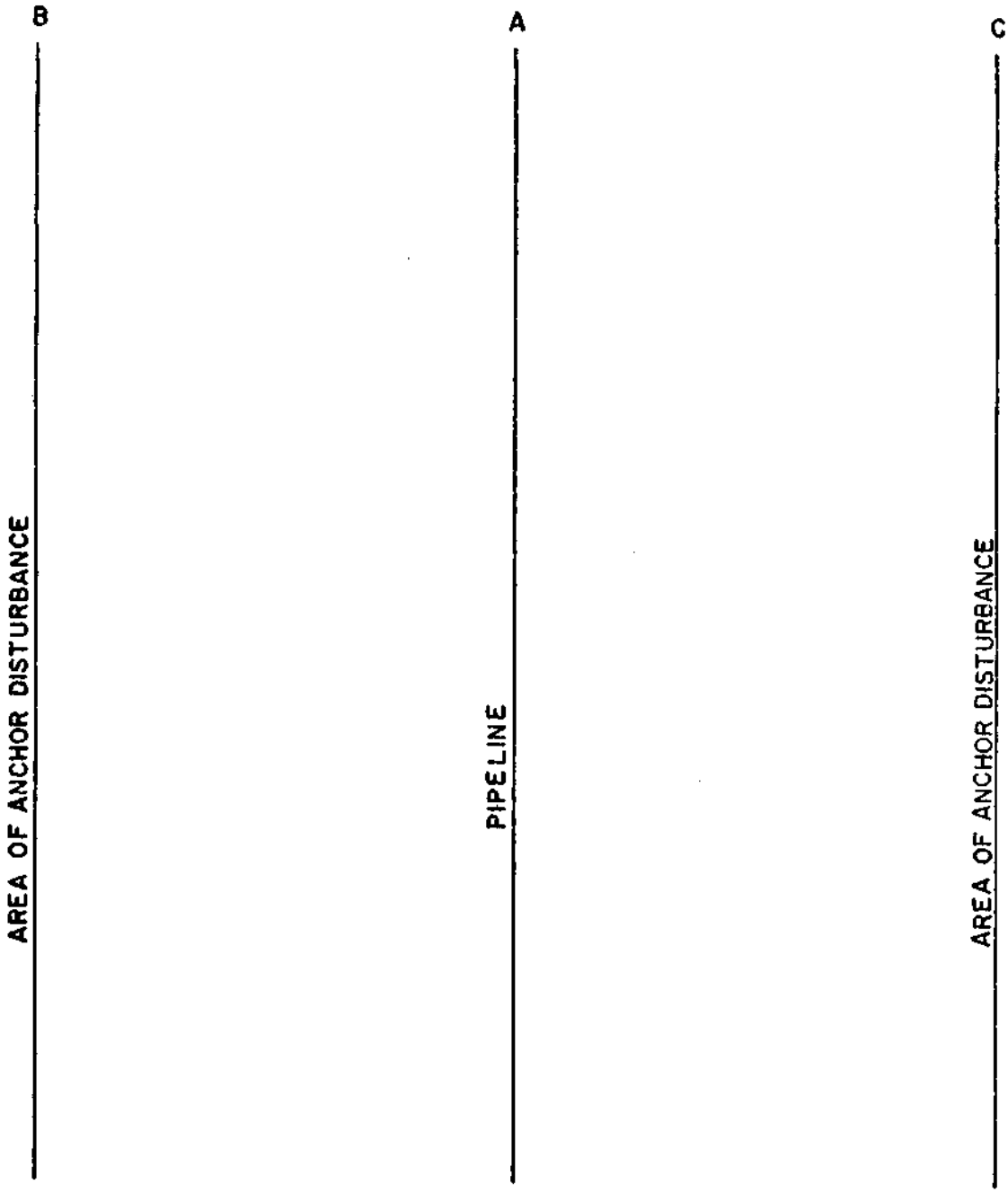


LEASE BLOCK

Scale: 1"=600 METERS
1"=2000'

GEOPHYSICAL SURVEY GRID TO DETERMINE
THE EXISTENCE OF CULTURAL RESOURCES

PLAN "B"



PROPOSED PIPELINE ROUTE

No Scale

GEOPHYSICAL SURVEY GRID TO DETERMINE THE EXISTENCE OF CULTURAL RESOURCES

PLAN "C"

Professional Criteria For Marine Archeological Surveyor as Established by the OCS Credentials Panel of the Archaeology and Historic Preservation Panel

Marine archaeological surveying on the outer continental shelves (OCS) integrates data primarily relating to geophysics and geomorphology with a knowledge of the nature and distribution of historic and prehistoric archaeological remains to make a probability statement about the likelihood that such resources may exist in any given location on the OCS. In consideration of this, the criteria for marine archaeological surveyor are heavily rooted in two areas of training and/or experience: (1) the professional practice of archaeology, and (2) the ability to interpret geophysical and other appropriate data for relevant information.

To meet the specialized needs of offshore cultural resources surveys, the following standard applies for marine archaeological surveyor:

A. The recommended minimum formal qualifications for individuals practicing archaeology as a profession are B.A. or B.Sc. degree from an accredited college or university, followed by two years of graduate study with concentration in anthropology and specialization in archaeology during one of these programs, and at least two summer field schools or their equivalent under the supervision of archaeologists of recognized competence; a Master's thesis or its equivalent in research and publications is highly recommended, as is the Ph.D. degree. Individuals lacking such formal qualifications may present evidence of a publication record and references from archeologists who meet these qualifications.

B. Training and/or experience sufficient for the safe and proficient supervision of appropriate remote sensing survey equipment operation as well as interpretation of survey data for electronic anomalies and geomorphic features that may have some probability of association with submerged aboriginal sites and sunken vessels. Conformance to these criteria should not be construed as qualification to conduct underwater archaeological investigations.

List of Persons Satisfying the Criteria for
Marine Archaeological Surveyor (Revised Jan. 1, 1976)

1. Mr. Alan B. Albright (Historic Sites Only)
   Underwater Archaeologist
   Institute of Archaeology and Anthropology
   University of South Carolina
   Columbia, South Carolina 29208

2. Mr. J. Barto Arnold
   State Marine Archaeologist
   Texas Antiquities Committee
   Box 12276, Captiol Station
   Austin, Texas 78711

3. Mr. W.A. Cockrell
   State Underwater Archaeologist
   Division of Archives, History, and
   Records Management
   Department of State
   Tallahassee, Florida 32304

4. Mr. Carl Clausen
   CCC Enterprises
   Rt. 5, Box 27
   Georgetown, Texas 78626

5. Mr. Roger Desautels
   Scientific Resource Surveys
   149 The Masters Circle
   Costa Mesa, California 92627

6. Mr. Robert J. Floyd
   c/o Department of Anthropology
   Southern Methodist University
   Dallas, Texas 75275

7. Dr. Sherwood M. Gagliano
   Coastal Environments, Inc.
   1260 Main Street
   Baton Rouge, Louisiana 70802

8. Dr. T.R. Hays
   Department of Sociology
   The University of Texas at Austin
   Arlington, Texas 76019

9. Dr. Frank Hole
   Department of Anthropology
   Rice Univeristy
   Houston, Texas 77001

10. Mr. Jack Hudson
    Cultural Resource Services or Suite 820
    P.O. Box 1056 3701 Kirby Drive
    New Iberia, Louisiana 70560 Houston, Texas 77001

11. Mrs. Margie Chaffin Lohse
Department of Anthropology
Rice University
Houston, Texas 77001

12. Dr. Raynold J. Ruppe (Prehistoric Sites Only)
Department of Anthropology
Arizona State University
Tempe, Arizona 85281

13. Dr. Allen R. Saltus, Jr.
Gulf South Research Institute
7700 GSRI Ave.
Baton Rouge, Louisiana 70808

14. Dr. Joel L. Shiner
Department of Anthropology
Southern Methodist University
Dallas, Texas 75275

15. Dr. D. F. Wendorf
Department of Anthropology
Southern Methodist University
Dallas, Texas 75275

Society of Professional Archaeologists
Notice for Marine Survey Archaeologist Candidates

The Society of Professional Archaeologists (SPA) has recently been formed to certify and list in a directory all archaeologists qualifying for work within one or more of a number of specialty areas, including field research, collections, research, theoretical and library research, curatorship, cultural resource management, administration, teaching, and marine archaeological surveying. At the request of the National Park Service, and in response to the urgent need for qualified marine survey archaeologists to work in the evaluation of oil and gas leases on the Outer Continental Shelf, the SPA is expediting its program to certify marine survey archaeologists and experts to publish its first list of certificates in September 1976. Applicants for inclusion in this list should provide applications to SPA on or before August 15, 1976. For application forms, contact:

Office of the President
The Society of Professional Archaeologists
Department of Sociology/Anthropology
Illinois State University
Normal, Illinois 61761

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