Raymond Tubby HISTORICAL AND ARCHAEOLOGICAL INVESTIGATION OF THE 1750 SPANISH PLATE FLEET VESSEL *EL SALVADOR*. (Under the direction of Dr. Gordon P. Watts Jr.) Department of History, November 2000.

The purpose of this thesis is an historical and archaeological investigation of the Spanish Plate fleet vessel *El Salvador*. The packetboat was one of four vessels of the 1750 Fleet that was lost in a hurricane which struck the mid-Atlantic region of North America in August 1750. Historical accounts indicate that *El Salvador* was lost in the vicinity of Topsail Inlet, North Carolina. Because the surviving remains were buried by shifting sands in a matter of days salvage operations were negligible and the vessel was quickly forgotten. Over time the exact position of the wreck has become clouded. Historical records provide little information beyond "lost in the vicinity of Topsail Inlet." Historical accounts and geographical coincidence suggest two possible locations for *El Salvador*: Modern New Topsail Inlet and Beaufort Inlet, also known as Topsail during that period. Research and material recovered near New Topsail Inlet in the twentieth century have led the focus of this investigation to that inlet.

Due to the conditions of its wrecking, *El Salvador* may represent one of the few instances in which virtually the entire archaeological record of a Spanish Plate Fleet vessel survives intact. As such, it may provide important clues to eighteenth century ship construction and shipboard life. Prior to initiation of field work a rigorous methodology was developed to guide research in recovering that information.

The methodology employed included developing criteria, based on comparative studies of period shipwrecks and archaeological assemblages,

useful in identifying wreck sites in the archaeological record. A magnetometer and side scan sonar survey was then conducted in a six-mile-square area centered on the inlet. That survey identified two groups of anomalies which may represent shipwreck material. Diver investigation of those sites located the remains of a late nineteenth to early twentieth century sailing vessel. Though *El Salvador* was not located additional research is planned for the future, first concentrating on survey blocks north and south of the current one and should that prove negative considerations will be given to shifting efforts to potential but unlicensed areas in the vicinity of Beaufort Inlet.

HISTORICAL AND ARCHAEOLOGICAL INVESTIGATION OF THE 1750 SPANISH PLATE FLEET VESSEL *EL SALVADOR*

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Chapter 1

Historical Overview of the Fleet System

The discovery of the New World in 1492 ushered in a period of European expansion which culminated in the colonization and exploitation of much of the Western Hemisphere, Asia, and Africa. Spain took a leading role in this expansion and within a generation developed a vast empire spanning North, Central, and South America. The primary goal of that empire was the exploitation of the mineral wealth of the newly conquered lands. A complex system of laws were established to guide the mode of production, trade, and the transportation of this wealth. The resulting Plate Fleets which developed from these policies became one of the largest trans-oceanic trading system in the western world and formed the economic lifeline of Spain. The development of the Indies trade, however, was an irregular process. The prosperity of the trade often coincided with the health of the Spanish state. The trade flourished during the sixteenth century, a period in which Spain was one of the most powerful nations in Europe. As Spanish power and influence declined during the seventeenth century so did its commercial networks. Constant warfare and the economic collapse of Spain brought the fleet system to near dissolution. The reforms initiated by the Bourbon dynasty in the eighteenth century revitalized the trade and yet, instituted policies which eventually led to the dismantlement of the system. For over 200 years the fleet system survived numerous challenges

and provided Spain with the revenues necessary to maintain its standing in Europe.

Development of the Fleet System

The Spanish conquest of the Indies was inspired by the quest for precious metals. Early exploratory ventures in the New World were initially oriented towards locating a passage to the Far East, but when the potential wealth of the Indies was realized efforts quickly shifted toward colonization and exploitation. The Crown originally intended to establish a royal monopoly based on the Portuguese experience in India and the Far East.[1] When it became apparent that the developing trade would become too large to be controlled solely by the Crown the focus changed to private speculation under royal supervision.[2] To regulate this trade the Crown established the Casa de Contratación de las Indias in Seville in 1503.[3]

The Casa regulated the transportation of goods and people to and from the Indies. It received and stored all the materials derived from the Indies trade; collected the *avería* and other duties; and housed all transcripts, receipts, official

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[1]King Manoel of Portugal established a system which restricted trade and communication to India and the Malabar coast to ships traveling under royal charter. A Casa da Indias was established to organize all shipping. Returning cargoes were sold only after being released by the king. Portuguese subjects, as well as some foreign merchants, were allowed limited participation, but all prices for purchasing and selling spices were set by the king. Clarence H. Haring, Trade and Navigation Between Spain and the Indies in the Times of the Habsburgs (Gloucester, MA: Harvard University Press, 1964), 23.

[2]Trade with the Indies was initially a privilege reserved only for residents of Castile. For a brief time during the rule of Charles I the trade was open to all subjects within the empire. This open system was withdrawn after protest from Seville's merchants and did not reopen again until the advent of *comercio libre* in 1765.

communications, and correspondence concerning the trade.[4] The Casa also selected the captains for each ship and ensured that each was adequately provisioned. All ships participating in the trade were required to load and unload at Seville and have their cargoes registered with the Casa.[5] Clerks recorded all merchandise being transported on each ship and the captains of each vessel verified its contents. Similar lists were prepared for vessels returning from the Indies. These lists were sent to the king for inspection once a year. These minutia of regulations affirmed the Crown's desire to maintain a tight control over the trade.

Additional regulations were added periodically. Important rules were issued in 1534, 1536, and 1543. Once the administration of the Casa had been defined these later rules focused on refining the character of shipping materials to the Indies. They dealt with such matters as arming the fleets and manning and provisioning of the ships. In 1552, all the rules and regulations were collated into a single volume, which served as a master document from which future works concerning the laws of the Indies trade were copied.[6]

The volume of trade increased dramatically during the first half of the sixteenth century. The number of ships sailing to and from the Indies grew from

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[3]In 1524, the Crown put the Casa under the control of the Council of the Indies, one of the many advisory committees to the royal court. Its main functions were to provide the king with advice concerning the Indies and pass the king's decrees along to the Casa for enactment.

[4]J. H. Parry, Spanish Seaborne Empire (New York: Alfred A. Knopf, 1974), 56; Clarence H. Haring, The Spanish Empire in America (New York: Oxford University Press, 1947), 318.

[5]Due to the hazardous bar at the mouth of the Guadalquivir ships were allowed after 1508 to load at Cadiz. In 1717, the Bourbons transferred all the major functions of the Casa to Cadiz.

[6]This document covered the entire administrative functions of the Casa de Contratación. It also included the duties and qualifications of merchants, passengers, masters, sailors, bankers, and all other persons and organizations connected with the trade. Haring, Trade and Navigation, 32.

35 vessels in 1504 to 215 by 1550.[7] This expansion was made possible by the rapid colonization of the Americas by Spaniards instilled with a crusading spirit acquired during the reconquest of the Iberian peninsula. During its early years, the Indies trade was operated at a loss for Spain. The small surface deposits of gold on Hispaniola did not offset the costs of sending men, food, animals, and building materials to the island. As the other islands of the Antilles were settled, the balance of trade began to shift as new deposits of gold were located and sugar was introduced as an export commodity. The trade finally became a profitable enterprise after the colonization of the American mainland and the discovery of large silver deposits in Peru (1545) and Mexico (1547).

As the trade grew, the size of the ships participating in it increased. Small caravels and large *naos* were common during the early phases of the trade. In 1522, external threats induced the Crown to pass a decree stating that only ships larger than 80 tons could travel to the Indies.[8] This limit was raised to 200 tons by 1609.[9] By the late sixteenth century galleons, frigates, and *urcas* replaced caravels and *naos*. These vessels carried larger loads and offered better defensive capabilities than their smaller predecessors.

The organization of the Indies trade was shaped by the nearly continuous state of war that existed between Spain and France during the first half of the

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[7]John Lynch, Spain under the Habsburgs, (New York: Oxford University Press, 1964), 1:159.
[8]Mendel Peterson, The Funnel of Gold (Boston: Little, Brown and Company, 1975), 69.
[9]The bar at the mouth of the Guadalquivir limited the size of the ships sailing to Seville to 400 tons. The Casa later eased this restriction to allow vessels as large as 550 tons to make the voyage to the city. Ibid.

sixteenth century.[10] This warfare brought pressure on the maturing trade, forcing it to evolve along the dimensions that would eventually lead to the well-known Plate Fleets. Because French military efforts were directed toward operations on the European continent, the challenge on the seas came mainly from corsair activity. Realizing the value of the Indies trade to Spain and the inadequacy of its own naval forces, France fully supported this private effort. The interception of part of the spoils from the conquest of the Aztec Empire in 1522 underscored the threat posed by these corsairs.

Spain's Indies policy during this period consisted of mainly defensive measures. Initially, a small squadron of ships cruised the waters off Cape St. Vincent at the southwestern tip of Portugal to protect returning vessels as they neared the Spanish mainland. The Crown instituted a new tax, the *avería*, to cover the expenses of maintaining this fleet.[11] Increased corsair activity spurred the Crown in 1526 to order all vessels traveling to the Indies to sail in convoys. When the French shifted their operations to the Caribbean, Spain reacted by sending a warship with the merchant vessels to serve as an escort. Warships provided these services in 1537, 1540, and 1542. In 1543, the Crown made escort duty permanent.

To maximize efficiency, the trade was restricted to vessels 100 tons or larger and fleets were to be comprised of no less than 10 merchantmen under the

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[10]Spain and France fought a series of wars from 1521-1526, 1526-1529, 1536-1538, 1542-1547, and 1551-1556. These conflicts arose out of the rivalry between the nations two rulers. The inheritance of Charles I created the spark for the initiation of the conflict. Charles' inheritance included territories within northern, central, and southern Europe which surrounded France and was perceived by France as a threat to its sovereignty.

[11]This tax was paid from a percentage of the value of the goods derived from the trade.

protection of an escort vessel.[12] In addition, the fleets operated according to a set schedule, with sailings in March and September.[13] Once in the Caribbean the warship sailed to Havana, re-provisioned, and cruised for corsairs. The warship and merchantmen later rendezvoused at Havana for the return voyage to Spain. The *avería* was retained to pay the operating expenses of the escort.

Continued French presence in the Caribbean induced the Crown to initiate further defensive measures.[14] Extensive fortifications were constructed at the main ports of call of the fleets. St. Augustine was establish in northern Florida to discourage foreign colonization and to protect the northern end of the fleet route. In addition, naval patrols, stationed at Santo Domingo and off the southwestern coast of Spain, periodically cruised both sides of the Atlantic to protect shipping as they approached their destinations. Funding constraints, however, hindered efforts to construct further fortifications and establish a permanent Caribbean based naval squadron.

By 1664, a permanent two fleet system had been established with separate squadrons of warships sailing in company with merchant vessels to New Spain and Panama in times of peace as well as war (Figure 1). The New Spain fleet,

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[12]Irregularities, which were typical throughout the existence of the Plate Fleet system, began with the very first sailing. This fleet was reinforced in America by three additional warships which also carried additional ordnance to outfit another two. Ibid., 61; Haring, Trade and Navigation, 201-202.

[13]Ships sailing to Hispaniola and Puerto Rico constituted an exception to the system. These ships could sail without an escort, but only if they sailed in a fleet of 10 ships with the most heavily armed and lightest laden ship serving as the flagship. Peterson, 61.

[14]The brief period of peace prior 1550 persuaded the Crown to abolish both the fleets and the *avería*. Merchant vessels were instead ordered to carry enough armament, provided at the owners expense, to protect themselves while at sea. The Crown quickly re-instituted the fleets when warfare with France erupted again in 1551.

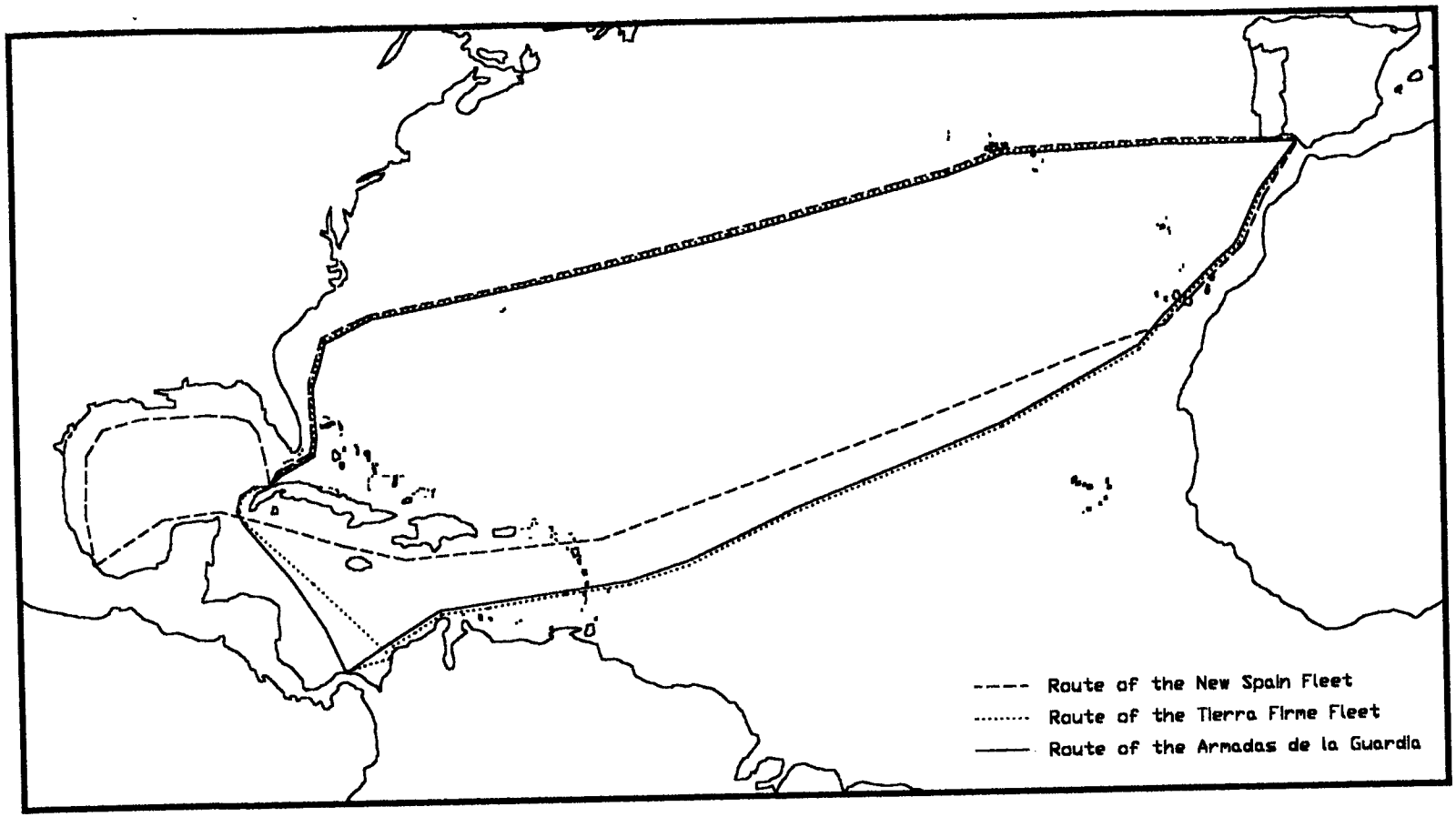

Figure 1. **Routes of the Indies Fleets**

also called the *flota*, sailed in April. Ships bound for Mexico, Honduras, Hispaniola, Puerto Rico, and Cuba accompanied the fleet, which was guarded by three warships. The Tierra Firme fleet, also known as the *galeones*, sailed in August and consisted of ships bound for Panama, Cartagena, and other ports on the Spanish Main. Six vessels provided escorts for the *galeones*. During periods of war, the fleets often sailed as a single unit for mutual protection. During the conflicts of the last quarter of the sixteenth century a squadron of warships, the Armadas de la Guardia de la Carrera de las Indies, accompanied the Tierra Firme fleet to transport the silver mined at Potosí.[15]

Both fleets consisted of a *capitana* (flagship) and an *almiranta* (admirals ship) as well as a number of lesser warships.[16] The *capitana* and *almiranta* were required to be at least 300 tons, carry 8 large brass guns, 4 iron guns, 24 smaller pieces and swivels, and have a complement of 200 men, including crew and soldiers.[17] These warships could not carry any treasure or goods unless they were salvaged from the sea or wrecks.

The fleets typically carried supplies and manufactured goods on their outbound journey and transported bullion and tropical goods back to Spain. When the Armadas de la Guardia de la Carrera de las Indies began sailing it only carried mercury for the mines at Potosí and returned with silver. Sailing times varied. The New Spain fleet took approximately two to four months to reach

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[15]Haring, Spanish Empire, 325; Peterson, 64.

[16]The New Spain fleet also included a *patacha* or dispatch boat while the Tierra Firme fleet was reinforced by a large warship called the *governo*, two smaller ships of 50 guns and an advice frigate of 40 guns. John Campbell, The Spanish Empire in America (London: Printed for M. Cooper in *Pater-noster Row*, 1747), 281-282.

Vera Cruz. The Tierra Firme fleet took four to six weeks to cross the Atlantic making stops at Cartagena to collect gold from Columbia and pearls and other goods along the Spanish Main and at Nombre de Dios (later Porto Bello) on the isthmus to collect silver from Peru. Both fleets wintered in the Indies, the New Spain in Vera Cruz and the Tierra Firme in the protected harbor at Cartagena. The fleets rendezvoused in Havana the following year to obtain fresh supplies and make repairs. From Havana, they traveled along the northern coast of Cuba and exited the Gulf of Mexico through the Florida Straits, following the Gulf Stream up the North American coastline to about the outer banks of North Carolina where they turned east, passing near Bermuda. The fleets were met at the Azores by the Armada of the Ocean Sea to provide an escort for the final leg to Spain.[18]

The periods of warfare with France affected the growth of the trade. Shippers were reluctant to risk cargoes during the periods of instability and the volume of shipping dropped as a result. In 1550, when Spain and France were at peace 133 vessels sailed to the Indies, but four years later, when the two countries were at war, only 23 vessels sailed.[19] Peace in the late 1550s reinvigorated the trade. Between 1576 and 1586 the number of ships sailing to

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[17]These rules, instituted in 1565, first applied only to the *capitana*. The *almiranta* received the same classification the following year. Haring, Trade and Navigation, 209; Peterson, 62.

[18]A flotilla of small ships were sent ahead of the main fleet. These vessels delivered the invoices of the returning vessels so that the amount of tax to be assessed could be prepared. Also, the information provided by these ships was used to determine whether the Armada of the Ocean Sea should be sent out to provide additional protection as the fleet neared Spanish waters. Campbell, 284.

[19]Lynch, Hapsburgs, 1:61.

and from the Indies increased from 114 to 213.[20] This expansion was characterized by an increase in the variety of exports to America: textiles, weapons, household utensils, glass, paper, and books. The galleon became the ship of choice in the trade and Spain's maritime fleet was enlarged by the acquisition of Portugal in 1580.[21] The introduction of the amalgamation process of silver refinement into America in the 1560s further stimulated trade by increasing the amount of silver being mined and remitted to Spain.

Seventeenth Century Decline

The seventeenth century marked a period of crisis for the Spanish monarchy. In the early decades of the century Spain entered a period of decline which greatly impacted it's capacity to conduct and protect its Indies trade. Among the forces fueling this decline, the collapse of the Spanish economy, increased warfare, and a growing independence of the colonies provided the greatest influence in the erosion of trade. However, despite being besieged from every direction, the Plate Fleets survived, often battered, but at a level sufficient to sustain Spain through its century-long period of crisis.

Spain's economic collapse destabilized the fleet system by opening the Indies to foreign competition. This collapse stemmed from social and economic traditions within Spain. Industrial and commercial activities were abhorred by

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[20]Ibid., 163.

[21]Designed by Alvaro de Bazán in the 1550s, galleons usually averaged 100 feet in length and 30 feet in width, contained 3 to 4 decks, and had four masts rigged with a combination of square and lateen sails. They sat high in the water, making them hard to board, but provided excellent platforms for firing down on enemy ships. They had a capacity of 500 - 600 tons and could carry

the higher segments of Spanish society.[22] In addition, Spanish production was based on guilds. Inherently conservative, guilds discouraged the expansion of production and the use of new techniques. Without strong economic foundations and the motive to adapt, Spanish production could not keep up with demands placed upon it by the Indies trade. The government further exasperated the situation by adopting a decree which banned native export and encouraged foreign imports.[23] The resulting outcome squashed any incentive to invest in native production. It allowed foreign merchants, operating through native middlemen, to penetrate the Spanish and Indies markets. As a result of a tradition of neglect and the introduction of cheap, high quality goods from Northern Europe, Spanish goods slowly disappeared from the market place in Spain and the Indies.

Spain's shipbuilding industry also suffered by the economic collapse. The general rise in prices made building materials and labor more expensive in Spain than in other shipbuilding nations. The Baltic region, the source of much of Spain's naval stores, was cut off due to the continuous state of war, which further drove up costs. The construction of small and medium size ships, which were

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200 - 300 men. Timothy R. Walton, The Spanish Treasure Fleets (Sarasota, FL: Pineapple Press, Inc., 1994), 57-58.

[22] For example, in 1530, the Council of the Indies forbade royal officials from taking part in the trade because such trade was "*oficio vil*," a menial occupation which would cause a gentleman to lose caste. Commerce and industry were typically viewed as only being fit for peasants and the ethnic minorities. These trades, however, were often used as a means to obtain wealth, but once achieved they were abandoned for a life of entitlement and aristocracy. As a result, wealth was always re-invested in land while commercial or industrial development stagnated. R. Trevor Davies, The Golden Century of Spain: 1501-1621 (London: Macmillan and Co., 1937), 75.

[23] This decree, adopted in 1548, was viewed as a cure to the rising prices in Spain. The rise in prices was not seen as a result of an over abundance of bullion and declining production, as was the real case, but as the result of over exportation and excessive demand. Lynch, Hapsburgs, 1:120.

crucial to Spain's northern carrying trade, were virtually abandoned as expenses rose. This trade was taken over by foreign-built vessels which were cheaper and better designed. Furthermore, the Spanish government encouraged builders to construct large, ocean-going vessels to service the Indies trade by offering subsidies.[24] When the Indies trade began to contract during the seventeenth century the northern shipbuilding centers underwent a protracted period of decline.

Economic difficulties and the government's practice of seizing Indies vessels for wartime use, often without compensation, dissuaded builders from investing in further vessel construction. Foreign vessels, immune from seizure, took their place. As a result, Spanish-built ships, which comprised approximately 80% of the vessels employed in the Indies trade in the waning decades of the sixteenth century, dropped to less than one third by 1650.[25] The remaining number were either of American or European (Dutch or English) origin.

Excessive taxation took a further toll on the Plate Fleets. Spain's internal tax system hindered industrial growth by taxing goods each time they exchanged hands. The resulting high rates made goods more expensive to produce and sell and deterred merchants from investing in industrial production. Goods moving to the Indies were further taxed with custom duties

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[24]Haring, Trade and Navigation, 269-270; Vives, Jaime Vicens, An Economic History of Spain (Princeton, NJ: Princeton University Press, 1969), 308.

[25]Between 1579-1587 foreign vessels comprised about 5.9% of the ships involved in the trade; by 1590 this number had risen to 21.3%. James Lang, Conquest and Commerce: Spain and England in the Americas (New York: Academic Press, 1975), 50.

and the *avería*. Being based on the volume of goods shipped, the *avería* was very sensitive to the state of the trade. The decline in production produced a corresponding decrease in shipping and royal revenues.[26] The Crown compensated for the loss in revenue by raising the tax. The *avería*, which was normally assessed at 1 to 2%, grew to 35% by the 1630s.[27]

The high tax rate either drove local merchants out of the export trade or induced them into fraudulent practices. A variety of methods were employed to avoid taxes: merchants bribed officials to falsify the registers, merchandise was assessed at a declared value rather than at a verified value, or goods were declared in generalized categories to hide items of higher value.[28] The most popular method of avoiding taxation, however, was non-register of goods. Merchants, captains, and even the crew devised methods to hide merchandise. Gold, silver, and other precious goods were hidden within ships, in false-bottomed containers, and also within the contents of lesser goods. If the escort captains were agreeable, cargoes were loaded on the convoying warships which were prohibited from carrying merchandise and were not subjected to inspection.[29] Silver remittances were likewise subjected to fraud either through evading the payment of the royal *quinto* at the mines or failing to register at

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[26]Foreign merchants operating within the system were subjected to the same level of taxation. Many simply resorted to bribes and loaded their cargoes after the official registers were prepared or transferred their cargoes to the fleets after they put out to sea. Other merchants bypassed Spain and traded directly with the Indies.

[27]Ibid., 52.

[28]John Lynch, Spain under the Habsburgs, (Oxford: Basil Blackwell, 1969), 2:167.

[29]Ibid.

port.[30] The high incidence of fraud only induced the Crown to increase the taxes to recoup the lost revenue.

Spain's economic hardships provided an opportunity for foreign merchants to gain direct access to the Indies through illicit trading. Spain could never adequately supply its colonies with the goods they demanded, and settlements which were off the main trade routes or were too small or poor to provide return goods were ignored by the fleets entirely. The Dutch and English entered the Indies by supplying these marginal areas and once established, expanded their operations into the more populated parts of the New World. The Dutch, English, and later French could bring in the type of goods the colonies demanded at a lower price than Spanish merchants could offer. Smugglers also provided the colonies goods throughout the year, something the fleets could never match.

Expansion of illicit trading was made possible by European colonization of the uninhabited islands of the Caribbean.[31] While possessing no precious metals, these islands produced agricultural goods, which together with manufactures from northern Europe, were used to trade with the Spanish colonies. By 1650, all the islands between Trinidad and the Virgin Islands were settled by other Europeans. Jamaica, captured by the English in 1655, became one of the major centers for illicit trading in the Caribbean. By the end of the

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[30]Similar evasion methods were used in silver fraud as in general merchandise fraud: suborning ships captains, declaring ingots under their real weight, and loading at last minute to avoid close inspection. Ibid.

[31]Colonies were established by the Dutch on St. Vincent in 1627, Eustatius in 1632, and Curacao and Bonaire in 1634. The English settled Barbados in 1627, Nevis in 1628, and Antigua and

seventeenth century the Jamaican trade was worth £200,000 annually.[32] Because Spain was both politically and militarily weak during this period it could offer no resistance to the intrusions into territory it viewed as its sovereign domain.

The *asiento* or slave concession provided another source of illegal trading. The decline of the Native American population during the mid-sixteenth century produced a shortage of labor in the colonies. Unable to supply its colonies with adequate agricultural and manufactured products, Spain was in no position to fulfill demands for the importation of slaves. The only solution was to farm out the trade to foreigners, limiting them to one ship a year.[33] The concession also allowed a limited amount of trade goods to be carried on board. However, unlicensed goods were all too often concealed in among the legal merchandise. The volume of this contraband material was never very great due to the necessities of the *asiento*'s legal cargoes. The *asiento* ships also could not develop the markets to take advantage of the trade like the illicit traders. They sailed only once a year and usually to the same harbors visited by the Plate Fleets. Their goods only added to the glutted market.

As the illicit trade expanded, Spain's own trade network, the Plate Fleets, were unable to compete and as a result, languished. Custom duties and the *avería* made the goods transported on the fleets very expensive. Foreign goods, bypassing the system, did not pay taxes and as a result were sold at costs far

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Montserrat in 1632. The French settled on Martinique and Guadeloupe in 1635. St. Kitts was jointly settled by the English and French in 1624.

[32]Lang, 56-57.

[33]The Portuguese received the first *asiento* after they became part of the Spanish Empire in 1580. They were followed by the Dutch, French, and English, all of whom received the concession as part of the spoils of war.

below those offered by the Spanish. In addition, foreign ships did not sail according to a set schedule like the fleets. They brought goods as needed. Many times the fleets arrived in the Indies only to find the markets already stocked with low cost European goods.

Increased warfare at the end of the sixteenth century further eroded the effectiveness of the trade.[34] During these conflicts, the Plate Fleets frequently became a strategic objective of Spain's adversaries. The fleets suffered their first losses due to enemy action during this period. Even the intervening periods of peace did little to ease the pressure on the trade. As a consequence, fleet sailings became irregular, ruining merchant houses in Spain and putting a strain on the financial resources of the Crown. In addition, Spain's military decline induced its European rivals to increased their pressure in the Indies through territorial acquisition and further illicit trading.

The Treaty of Câteau-Cambrésis (1559), which ended nearly forty years of warfare with France, established a precedent which would govern future European involvement in the Indies. That treaty considered affairs in Europe and the Indies as separate; meaning that peace in Europe did not necessarily imply peace in the Indies.[35] England and the United Provinces subscribed to this principal at the cessation of hostilities with Spain in 1604 and 1609. As a result,

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[34]Between the last quarter of the sixteenth century and the beginning of the eighteenth century Spain was involved in two large scale wars and a number of smaller conflicts. Spain fought protracted conflicts with England, the United Provinces, Sweden, the German provinces, and France between 1566-1609 (Dutch Revolt) and 1618-1648 (Thirty Years War). Minor conflicts arose with England between 1655-1660 and France in 1667-1668, 1672-1678, 1683-1684, 1689-1697.
[35]Walton, 70.

illicit trading and harassment of the Plate Fleets were given tacit approval by foreign governments even during times of peace with Spain.

Spain's enemies typically employed two methods in capturing or destroying Plate Fleet vessels. Squadrons of warships either waited in the vicinity of the Azores as the fleets returned home or cruised in the Caribbean near their port of calls. The success of these tactics were very limited. During the major conflicts which developed out the Dutch Revolt (1566-1609) and the Thirty Years War (1618-1448) only one fleet was captured and one was sunk.[36] Two fleets were also captured or destroyed during the war which followed the capture of Jamaica by the English in 1655.[37] Despite the lack of success, these conflicts put a tremendous strain on the fleet system which often resulted in the cancellation of entire sailings. A cash-strapped Spain resorted to transporting bullion in *zabras* during the earlier conflict and special fleets comprised solely of warships during the second.[38] These vessels carried no consumer goods, they existed only to carry bullion. Few commercial vessels sailed during the wars.

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[36]In 1628, a Dutch fleet of 31 ships under the command of Piet Heyn surprised the New Spain fleet on its approach to Havana. The entire fleet, except for three merchant vessels, was captured as it tried to seek safety in Mantanzas Bay. Over 3 million pesos in silver was captured by the Dutch. In 1639, the returning fleet was diverted to the Netherlands to pay Spanish troops stationed there. After being driven away from the Netherlands by the Dutch, the fleet was pursued and sunk in English waters in the Battle of the Downs.

[37]The Tierra Firme fleet was intercepted at Cadiz by an English squadron under the command of Admiral Blake in 1656. The *capitana* and one merchantman were captured and the *almiranta* and one *urca* were sunk during the action. The following year, Blake destroyed the entire New Spain fleet in the Canaries. The shipment of treasure, however, was safely transported to land prior the English arrival.

[38]*Zabras* were small well-armed vessels which sacrificed everything to speed and were chartered to carry silver when warfare made convoys dangerous. None were ever captured. The fleets of warships that sailed during the Thirty Years War typically carried mercury for the silver mines on the out bound trip.

Spain also created a new squadron of warships, the Windward Squadron or Armada de Barlovento, in 1598 to help protect the Caribbean side of the trade. It was originally composed of six frigates and other smaller craft. The operation of this squadron was irregular. It was periodically diverted to convoy duty or European waters.[39] That, in addition to the diversion of the Armada of the Ocean Seas to other duties, often left the fleets with little or no protection at either end of its journey.

Spain's preoccupation with European concerns lead to neglect of the Plate Fleets despite the fact that its financial security and military capacity were intimately tied to the arrival of the fleets. Tardiness or non arrival of American bullion often stymied or canceled military campaigns in Europe. Shipwrecks cut short the campaigns of 1621 and 1622. Conversely, prompt returns aided military operations. The larger than normal returns in the 1624 fleet provided critical funds during the siege and capture of Breda in 1625.[40] Financial exhaustion from the disruption of its Plate Fleets usually played a conspicuous role in Spain's decisions to end hostilities. The pursuit of peace initiatives with France in 1598 and 1631, England in 1604 and 1630, and the United Provinces in 1648 were all partially influenced by financial crises.

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[39]The squadron was transferred to Europe in 1606. It was re-established in 1640, but was diverted to full-time escort duties in 1643 and later incorporated into the Armada de Mar Océano in 1648. When the Windward Squadron was reactivated in 1665 it was immediately diverted to European activities. Two years later five vessels from the squadron were sent to the Indies, two were diverted to escort duty and the rest were destroyed by Henry Morgan during his attack on Lake Maracaibo in 1668. The squadron was reformed for the last time in 1672 and remained active until the end of the century. Lynch, Habsburgs, 2:177.

[40]Ibid., 72.

Spain's economic woes were further influenced by the growth of independent economies in the American colonies. A thriving inter-colonial trade network developed between Spain's American colonies by the end of the sixteenth century. Lucrative networks developed between Mexico and the South American colonies of Peru and Venezuela.[41] A prosperous tobacco trade, which funneled tobacco directly to Europe through Portuguese, English, and Dutch merchants, also developed in Venezuela and the surrounding coastal region. Much of this trade was conducted by ships constructed in the colonies.[42] The collapse of the fleet system was a catalyst for the growth of these new patterns of trade within the colonies. The growing American economies could no longer look to the infrequent fleets to satisfy their demands for goods and as the danger of sequestration increased during the seventeenth century, American merchants, as well as Spanish, found it more desirable to channel their profits back into the American system.[43]

Spain made every effort to stop this inter-colonial trade. In 1593, it forbade the shipping of Chinese goods to anywhere but Mexico and limited the amount of oriental goods entering that colony. When the trade moved into clandestine channels Spain put restrictions on the intercourse between Mexico and Peru and in 1631, forbade navigation between the two colonies entirely. In

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[41]Mexico's economy was broad-based from its inception. It had a thriving textile, agricultural, pastoral, and manufacturing base. With the fruits of its own production, and the luxury goods derived from the Manila galleons, Mexico could almost supply all the needs of the other colonies.
[42]Guayaquil supplied ships for the Pacific trade, Havana for the Caribbean trade, and even small centers, such as Maracaibo, produced fleets of ships to serve the coastal trades. Lang, 65.
[43]Fleet sailings became more and more irregular as the seventeenth century progressed. Years were often skipped; for example, between 1600 and 1650 only 29 fleets sailed to Tierra Firme. Lynch, Habsburgs, 2:224.

an effort to control the tobacco trade along the Venezuelan coast Spain instituted a state monopoly in 1621, but the trade had become so lucrative that colonial producers refused to trade with anyone but foreigners.

In addition to these colonial trade networks, silver returns began to drop during this period due to a contraction of the mining industry and retention of silver for administrative and defensive functions. The mining industry in Mexico began to falter in the early part of the seventeenth century and fell sharply after 1635.[44] This was mainly due to the exhaustion of the major silver producing mines; new deposits were often poorer in quality and more expensive to work. Peru also experience a similar but less severe decline in its silver production.[45] Mexico's declining production was reflected in its contribution to the overall colonial silver returns to Spain. Mexico's silver exports dropped from 36% of the total returns between 1586-1626 to 21% thereafter.[46] Silver returns were further diminished by retention for governmental use. Administrative and defense costs took much of what was produced in the colonies. In the early part of the seventeenth century Peru shipped 45% of its production and Mexico 50%, by the end of the century Peru sent only 5% and Mexico 25%.[47]

The economic, political, and military decline that gripped Spain during late sixteenth and seventeenth centuries strained the Indies trade to the verge of

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[44]The decimation of the Native Americans by European diseases has been blamed for a major role in the silver declines. However, the Native American population fell sharply prior to the seventeenth century, a period when silver returns were still climbing. It seems more appropriate to conclude that the native decline exasperated the situation when the mines began to fail.

[45]Potosí's production began to fail at the beginning of the eighteenth century. However, new silver strikes in Mexico helped eased the impact of Peru's declining production.

[46]Lynch, Hapsburgs, 2:188-89. To offset the loss of silver, Mexico increased the volume of non-precious exports such as cochineal, hides, indigo, wool, dyes, dyewoods, and medicinal plants.

breakdown. The great expansion that marked the sixteenth century was followed by an equally spectacular decline beginning in the second decade of the seventeenth.[48] American shipping decreased from a maximum number of 200 ships in 1608 to under 40 ships a year after 1650.[49] Royal revenue plunged as shipping fell. Crown receipts, which averaged nearly 11 million pesos at the beginning of the century, fell to 7.4 million pesos by 1615, 4.3 million pesos by 1620, and after 1625, Crown revenues only averaged around one million pesos.[50] In addition, storms and poor navigation played a small but significant role in the decline of royal revenues as shipwrecks often resulted in the loss of entire silver shipments.[51]

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[47]Walton, 138.

[48]During the early years of the trade an average of 15 to 25 ships a year crossed the Atlantic. By the last decade of the sixteenth century an average of 130 ships made the journey each year. This number jumped to approximately 193 vessels a year during the five year period of 1606-1610. Haring, Spanish Empire, 325; Parry, Seaborne Empire, 247; Lang, 54; Lynch, Habsburgs, 2:188-89.

[49]This fall in shipping was a gradual process. While war took a toll on Spanish shipping vessels participating in the Indies trade declined as ships became old and unseaworthy. The deterioration in Spanish ship building meant these vessels were not replaced. This decline was fairly constant. From over a hundred vessels trading in the Indies at the beginning of the century the number fell to an average of 94 vessels between 1632-41 and to an average of 69 in 1639-51. Parry, Seaborne Empire, 249; Lynch, Habsburgs, 2:190.

[50]Lynch, Habsburgs, 2:71, 77, 168.

[51]Pressure for quick turn arounds from the Crown, delays in silver shipments and trading, and the expense of wintering in the Indies often forced captains to fill their crews with unskilled mariners and to sail out of season. The results many times ended with the loss of vessels, crews, and bullion. The following is a brief listing of Plate Fleet vessels lost during the sixteenth and seventeenth centuries:

1554 - 3 ships from New Spain fleet were lost in a storm off Padre Island, about half of 2 million pesos were recovered.
1563 - 7 ships were driven ashore at Nombre de Dios, 15 wrecked in Cadiz harbor, and another 5 lost in Gulf of Campeche.
1567 - 6 ships were wrecked in a storm off Dominica, 3 million pesos lost.
1587 - 6 ships were grounded and broke up on the bar at San Lucar.
1590 - 15 ships were driven ashore at Vera Cruz by a norther.
1591 - 16 ships were wrecked at Terceira.
1601 - 14 ships were lost at Vera Cruz.
1614 - 7 ships were wrecked at Cape Catoche.

The Crown reacted to its falling revenue by debt repudiation, sequestration of private silver returns, and raising taxes.[52] This policy interrupted returns entering Spain on private account.[53] Merchants were either forced to adopt fraudulent practices to survive or, finding the trade increasingly unprofitable, simply abandoned it. Caught in a cycle of declining revenues and higher taxes the Crown was forced to re-evaluate its revenue system. In 1660, the *avería* was abandoned and a fixed quota system instituted.[54] Though bullion shipments remained fairly low revenue stabilized and the fleet system survived, though in a diminished state, until the rise of the Bourbon dynasty in 1700.

1622 - 5 merchantmen and 3 galleons of the Tierra Firme fleet were sunk in a storm near the Florida keys, part of the cargo of two were recovered, and the third, the *Nuestra Señora de Atocha* was never salvaged.

1624 - 2(3) ships from the Tierra Firme fleet with 1 million pesos each were lost at sea.

1631 - Most of the New Spain fleet with more than 3 million pesos were lost north of Vera Cruz (Yucatan). In the same year a galleon loaded with silver sank off Panama City.

1641 - The New Spain fleet was struck by a hurricane in the Bahama channel.

Parry, Seaborne Empire, 179; Walton, 61, 141; Lynch, Habsburgs, 2:174-75.

[52]Whenever Spain declared a suspension of payments it involved a reconversion of the interest rates and not a declaration of bankruptcy. Such declarations occurred in 1557, 1575, 1596, 1607, 1627, 1647, 1652, and 1662. Because Spain constantly defaulted on its debt, foreign lenders would only issue further loans at higher interest rates. To pay these rates and its other expenses the Crown raised taxes, lowered the interest rates it paid on its own *juros*, manipulated the currency, and sequestered more private silver. This only caused further fraud and a drain of silver out of the country. The end results were further suspension of payments. Stanley G. Payne, A History of Spain and Portugal (Madison, WI: The University of Wisconsin Press, 1973), 1:283.

[53]After averaging approximately 20 million pesos a year for the period 1591 to 1620 private returns fell sharply once the government instituted regular sequestration. By 1631-1635 private returns had fallen to 12.3 million pesos a year, by 1646-1650 they declined to 10.1 million pesos and by 1656-1660 they fell to 2.7 million pesos. Lang, 53; Lynch, Habsburgs, 2:71, 77, 190.

[54]The quotas replaced all taxes and custom duties and were instituted to distribute the burden of supporting the convoys more evenly among the regions involved in the trade. The new system was designed to raise 790,000 ducats to be distributed as following: Peru 350,000, New Spain 200,000, New Granada 50,000, Cartagena 40,000, the royal treasury 150,000. Although Andalusia was not assessed it paid for the New Spain quota due to its declining silver production. In 1667, the quotas were recalculated: the royal treasury contributed 150,000 ducats, Peru 350,000,

The Eighteenth Century and the Bourbon Reforms

The installation of the Bourbon dynasty in Spain brought changes to the Indies trade. The Bourbons initiated reforms that were designed to tighten the Crown's monopoly and bring more bullion into Spain. Efforts were made to strengthen Spain militarily, politically, and economically. These reforms, while increasing the overall trade between Spain and its colonies, would eventually make the old system of convoys obsolete.

The War of Spanish Succession (1702-1714) created a threat to Spain's trade from both its enemy and its ally. By the beginning of the eighteenth century Spanish power had declined to a point that it was no longer able to defend itself much less its colonies. France provided the bulk of the forces protecting Spanish interests on the continent as well as the naval forces to keep the trade lines to America open. Even with French warships acting as escorts only five fleets sailed during the coarse of the war in 1702, 1706, 1708, 1710, and 1712.[55] However, since irregularity was already the norm during the preceding century this small number of sailings did not substantially impact Spain. Dispatch boats and single merchantmen provided a measure of normalcy between Spain and its colonies throughout the war. The silver that did get through provided Spain with the funds it needed to survive the war and hold its American possessions.

Andalusia 170,000, New Spain 90,000, Cartagena and New Granada 30,000 still for a total of 790,000. Lynch, Habsburgs, 2:193.

[55]The French began providing escorts for the fleets prior to the initiation of hostilities. The first joint escort was surprised in Vigo by an Anglo-Dutch fleet in 1702. The entire Franco-Spanish fleet was either sunk or captured. Fortunately for Spain most of the treasure had been unloaded prior to the attack. Walton, 153.

The war, especially for England, Holland, and France, was a fight to control and gain further access to Spain's monopoly. Louis XIV saw Philip V's ascension as a means for France to gain direct access to the Indies and, as a consequence, deny it to England and Holland. To further his goals, Louis XIV provided warships to escort the fleets, provided ships to cruise the Caribbean, and sought the *asiento*, received in 1701, as payment for France's aid. France also secretly encouraged its colonists and merchants to carry on their illicit trading with Spanish America. In 1707, Seville merchants complained that since the beginning of the war 30 French ships had traded with Campeche and Vera Cruz, over 80 to Tierra Firme, and at least 15 ships had traveled around Cape Horn to trade in Pacific waters.[56]

Illicit trading from France, Holland, England, and their Caribbean colonies expanded after the Treaty of Utrecht ended the war in 1713. As part of the concessions ending the war England received the *asiento* contract. Besides supplying slaves to the Spanish colonies, the South Seas Company was allowed an "annual" ship of 650 tons to carry general merchandise to Spanish ports in America. As was typical of *asiento* traders, the annual ships carried contraband goods concealed among their legitimate cargoes. The value of the annual ship (to the English) amounted to 2,000,000 pesos.[57] The contraband trade became so

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[56]John Lynch, Bourbon Spain 1700-1808 (Cambridge, MA: Basil Blackwell Inc., 1989), 55.

[57]A study by Jean O. McLachlan revealed that the annual ships were not as profitable as was generally supposed. On any typical voyage, permits had to be obtained prior to sailing and there was always a chance for seizure either due to war or from the *guarda-costas*. In the period 1714 to 1732 the annual ship provided significant returns on only six voyages. Because of such poor performance the *asiento* concession was not renewed in the treaty negotiations at the conclusion of the War of Jenkins Ear. Jean O. McLachlan, Trade and Peace with Old Spain 1667-1750 (London: Cambridge University Press, 1940), 126, 129-131.

heavy that when the fleets arrived they usually found the markets glutted with foreign goods. In addition, the flood of foreign goods caused a drop in market prices. However, this price decrease was only true of Foreign merchandise, Spanish imports remained high.

After the War of Spanish Succession, the new Bourbon rulers sought to reorganize the Indies trade to make it more efficient and help Spain to rebuild. Since much of the trade was already being conducted in Cadiz by the eighteenth century the Crown officially moved the Casa de Contratación to that city in 1717. The fleets were re-instituted in 1720 under their traditional form, but it was quickly realized that illicit trading made transporting goods on the fleets unprofitable and that the colonies were also already largely self-sufficient and did not need goods from Spain. The fleets were transformed into mainly servicing the silver trade, mercury was carried to the colonies and silver transported to Spain.[58] As under the Habsburgs, the pressure of sailing under tight schedules forced out of season departures that resulted in occasional vessel losses.[59] Register ships, under a single contractor, provided regular shipping to

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[58]Between 1715 and 1736, the New Spain fleet sailed on a fairly regular 2 to 3 year schedule. During this same time period only five fleets traveled to Panama. Parry, Seaborne Empire, 286.

[59]The number of losses due to storms and navigation error decreased during the eighteenth century. This was mainly the result of a decline in the number of ships and fleets participating in the trade during this period. The following is a brief listing of vessels lost during the eighteenth century:

1715 - 11 ships of the New Spain fleet and Antonio de Escheverz's register ships servicing Tierra Firme were lost in a storm off Florida.
1730 - The frigate *Nuestra Señora del Carmen* with 3 million pesos was lost in a hurricane south of Jamaica.
1733 - 21 ships of New Spain fleet were lost in a hurricane in Florida keys.
1750 - 4 ships of the New Spain fleet were lost in a hurricane off North Carolina and Virginia.

Walton, 160, 165-166.

compete against the illicit traders.[60] Spain also encouraged the formation of trading companies to trade with those areas of the empire which were not serviced by the fleets.[61] These companies were given a total monopoly over the trade in their respective areas.

The Crown also established the *guarda-costas*, a Caribbean based coast guard, in 1722 to fight the contraband trade. The *guarda-costas* were given the right to stop, search, and arrest any ship thought to be conducting illicit trading.[62] Even the inspection of *asiento* ships was considered part of the duties of the *guarda-costas*. Any ship traveling the regular trade routes through the Indies and carrying goods common throughout the Caribbean basin, such as indigo, cocoa, and logwood were subject to seizure. Even the presence of Spanish money, the medium of exchange in the Americas, was enough to condemn a ship.[63] These broadly defined rules and the method of payment of

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[60]Register ships were privately owned vessels with contracts to conduct trading ventures in the Indies independent of the Plate Fleets. The first register contract was awarded during the closing days of the War of Spanish Succession to Antonio de Escheverz. He was allowed to determine the time and destination of his sailings. His fleet, comprised of six vessels, two of which were French and one Dutch, sailed in 1712. Both his fleet and the New Spain fleet, which also sailed that year, found the markets glutted with foreign goods. Returning to Spain together after an unsuccessful tour of the American ports the fleets were wrecked in a hurricane in the Bahamas Straits. Of 11 vessels, only one, the *Grifon*, a French vessel forced to sail with the fleet, survived the storm. Despite this failure other contracts for private trading were awarded. Unable to compete with the smugglers all of these ventures inevitably lost money. J. H. Parry, Trade and Dominion: The European Overseas Empires in the Eighteenth Century (London: Weidenfeld and Nicolson, 1971), 104.

[61]The success of these trading companies was mixed. The most successful were the Real Compañia Guipuzcoana de Caracas in Venezuela, Real Compañia de San Cristobal in Cuba, the San Fernando Company of Seville to parts of South America not already served by other companies, and the Real Compañia de Barcelona in Santo Domingo, Puerto Rico, and Margarita. Together these companies controlled 20% of the shipping between Spain and America between 1730 and 1778 much to the detriment of the Cadiz monopoly. Lynch, Bourbon Spain, 148.

[62]Fees to support the *guarda-costas* came not from taxes, as would have been typical in the seventeenth century, but from the proceeds of the prizes captured. Parry, Trade and Dominion, 108.

[63]Ibid.

the *guarda-costas* led to many abuses. The increased contraband traffic and the resulting actions of the *guarda-costas* lead to war between England and Spain in 1739.[64]

The War of Jenkins Ear (1739-1748) provided a test for the early reforms. The new fleet schedule was suspended, only four fleets sailed (1741, 1744, 1747, and 1749) all to Mexico. The Tierra Firme fleet was disbanded in 1740 after Puerto Bello was sacked and destroyed. The Peru trade was instead handled by register ships which sailed around Cape Horn, bypassing Panama altogether. The main impact from the war was that register ships, no longer under a single contract, carried on the trade. This break with the fleets provided faster and more frequent service to the colonies. The increased volume of trade it attracted allowed its continuation at the end of the war. Between 1739 and 1754, 753 ships sailed to the colonies, an average of 47 a year.[65] The New Spain fleet was officially re-established in 1754 but it could not compete with the register ships. Prior to 1739, it controlled 46% of the trade, afterward its share fell to 13%.[66]

Further reforms were instituted after Spain's disastrous showing in the French and Indian War (1756-1762). Standing armies were established in the colonies for the first time, communication between Spain and the Indies was facilitated with the introduction of a monthly dispatch service between Coruña and Havana, and San Juan harbor in Puerto Rico, Spain's most easterly possession in the Indies, was turned into a major fortress. Charles III also

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[64]The War of Jenkins Ear was a true colonial war, focusing on issues pertaining to conditions and actions in America (the war would later merge with King George's War in 1740). Ibid., 110.
[65]Prior to the war an average of only 30 ships sailed a year. Lynch, Bourbon Spain, 153.

appointed a royal commission to evaluate the state of the Indies trade. The commission concluded the fleet system was slow, expensive, and could only deliver limited quantities of goods.[67] Furthermore, it noted that the tax structure which supported the fleet system encouraged smuggling. As a result of this report, the Crown abolished the fleet system and opened eight Spanish ports to the American trade in 1765. This system of direct commerce, or *comercio libre*, was eventually expanded to include the rest of the empire. A decree in 1778 formally extended the system to the rest of the Americas except New Spain and Venezuela.[68] The New Spain fleet was officially dissolved in 1789 and the Casa de Contratación was closed in 1790. While there was a relaxing of the policy of trade to include more avenues of commerce the system was still closed, only Spanish subjects were allowed to participate.

Spain's efforts to reform its commercial system began to show positive results by the second half of the eighteenth century. In 1760, prior to *comercio libre*, only six ships were involved in the Cuban trade, by 1778, 200 ships made regular voyages to the island.[69] During the era of *comercio libre*, four fleets sailed to New Spain before its dissolution in 1789. The fleets carried increasingly less of a percentage of the trade and the bulk of its cargo belonged to foreign merchants.[70] Foreigners still dominated the trade during the early phases, but as

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[66]Ibid., 154.
[67]Walton, 177.
[68]Mexico was excluded to prevent its booming economy from drawing trade away from the poorer colonies. Venezuela was excluded due to the influence that the Caracas Company held. Both were incorporated into the system by 1789. Lynch Bourbon Spain, 353.
[69]Lang, 75.
[70]In the 1772 fleet, Spanish products constituted only 12.6% of the cargo. Lynch, Bourbon Spain, 356.

trade increased native production expanded and the proportion of Spanish goods sold to the Indies increased. At the end of the seventeenth century approximately 15% of the cargo shipped to the Indies originated in Spain. By 1798, this number had risen to nearly 50%.[71]

The Spanish Plate Fleet system was among one of the longest enduring trade networks ever developed by the western world. Its rapid expansion was influenced by a religious zeal gained during Spain's centuries long conflict with the Moors. As the Indies trade grew the Crown tightened its control with the establishment of an extensive bureaucracy and numerous regulations. The character of the trade was further refined by the conflicts with France during the first half of the sixteenth century. A system of fleets, or convoys, was established as a means of protection as well as a way for the Crown to maintain strict control of what was sent to and from the Indies. The resilience of the Plate Fleets was tested during the seventeenth century. During this period Spain underwent economic, military, and political stresses that brought the system to near collapse. Despite many setbacks the fleets continued to sail, providing Spain with the revenue necessary to survive the challenges brought before it. The advent of the Bourbon dynasty in the eighteenth century brought fundamental changes in the Plate Fleets. In their efforts to enforce tighter control and make the trade more productive, the Bourbons enacted policies that eventually made the Plate Fleet system obsolete. The two and one half century old system of

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[71]Lang, 75-76.

government controlled fleets finally came to an end as the Crown opened the Indies to free trade in last half of the eighteenth century.

Chapter 2

History of the 1750 Fleet and the *El Salvador*

The ascendancy of the Bourbon dynasty in the early eighteenth century instilled a sense of renewed vigor to the Spanish monarchy. The reforms instituted by the Bourbons had as their goal the re-establishment of Spanish power in Europe. Funding for these reforms came partly from a restructuring of the Indies trade, making it more efficient and productive. However, expansion of illicit trading and the growth of self-sufficiency within the colonies made the fleet system seem more of an antiquated relic than a force to reassert Spanish influence. High priced goods slowly pushed the Plate Fleets out of the general trade. Their place was taken over by register vessels. Though initially failures, register ships came to be reliable carriers and served effectively to supply the colonies during the War of Jenkins Ear (1739-1748). Their activities expanded after the war and with the *comercio libre* policies of the second half of the century the fleet system was phased out entirely.

The 1750 Fleet was representative of this evolution in the Indies trade. Sailing shortly after the war's conclusion the fleet was composed of elements of both systems. Of the seven ships comprising the fleet three sailed in the capacity of regular *flota* ships transporting bullion and commodities from Mexico, two were register vessels carrying general cargo and bullion from South America, and two carried cargoes on behalf of the Crown. Contemporary sources also suggest that these seven were not the only vessels to have sailed from Havana in

August 1750.[1] These other ships were most likely additional register vessels that had joined with the fleet for protection.

The ships of the 1750 Fleet assembled in Havana in June in preparation for the trans-Atlantic journey. The 50-gun frigate, *La Galga*, commanded by Don Daniel Huony, served as the *capitana* of the small fleet. The six merchant vessels under its protection included the frigates *Nuestra Señora de los Godos* and *Nuestra Señora de Guadalupe*, the small frigate or brigantine *Nuestra Señora de la Soledad*, the brigantine *Nuestra Señora de Merced*, the packet ship *El Salvador*, and the Portuguese register ship *San Pedro*. Only one of the non-fleet registered vessels was specifically referred to in the documents. This vessel, the sloop *Mariana*, was mentioned by the captain of the *Godos* in his accounts of the disaster.

La Galga was owned by the Spanish navy and was carrying goods on behalf of the Crown. Its cargo included 419 *tercios* (packages or bundles) of *grana* (cochineal), 265 *tablones* (boards) of mahogany, 31 boxes of cigars, and 628 *tercios*

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[1]Accounts vary as to the precise number of vessels comprising the fleet. While most set the number at seven some indicate eight or nine vessels. The captain's of *La Galga* and the *Godos* mention seven ships in their testimonies and letters. However, both indicated that other ships might have been with the fleet. A letter by Captain Huony of *La Galga* mentions the official seven and "*y interesados*" (other interested vessels). Captain Pumarejo of the *Godos* also lists seven vessels in his account but prior to his arrival at Norfolk his ship was met by another of the fleet and a sloop from Campeche that was sailing for Santo Domingo. Pumarejo's letter implied familiarity with the sloop. This sloop may have been traveling part of the way with the fleet until it reached favorable winds that would have allowed it to re-enter the Caribbean. Pedro de Pumarejo to Don Francisco de Varas y Valedes, 15 October 1750, AGI, Contratación 5157 (Seville, Spain,); Daniel Huony to King of Spain, 13 October 1750, AGS, Marina Legajo 15 (Simancas, Spain).

of powder tobacco.[2] In addition to its general cargo and crew, numbering 120, the ship was transporting 60 English prisoners to Spain.[3]

The two frigates, the *Nuestra Señora de los Godos* and *Nuestra Señora de Guadalupe*, carried enough armament to support the *Galga* in the event of a crisis. The *Godos* carried 30 guns and the *Guadalupe* was armed with at least 15.[4] The *Godos* was commanded by Pedro de Pumarejo and carried a cargo of 613,000 pesos in silver, copper, cochineal, *añil* (indigo), vanilla, cotton, *purga de xalapa* (purgative), Campeche wood, hides, sugar, and other goods.[5] Don Manuel de Bonilla commanded the *Guadalupe*, also known as *La Nympha* and *La Augustta Zeli*.[6] The vessel's cargo consisted of 324,000 pesos of silver, cochineal, indigo, purgatives, cacao, hides, sugar, tobacco, and other merchandise.[7] Like the *Galga*, the *Guadalupe* carried a number of prisoners destined for Spanish prisons.

The four other vessels of the fleet carried cargoes similar to those transported on the larger ships. The *Nuestra Señora de la Soledad*, Don Joseph Renturo de Respaldizar, master, contained a cargo of between 15,000 and 32,000 pesos of silver, cochineal, purgatives, hides, sugar, and other goods.[8] The

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[2]Manuel de Bonilla to Don Francisco de Varas y Valedes, 11 November 1750, AGI, Contratación 5157 (Seville, Spain,).

[3]Daniel Huony to King of Spain, 13 October 1750. Other documents also suggest that there may have been fewer prisoners, around 30, aboard the vessel. Ricardo Wall to Joseph de Carvajal y Lancaster, 3 June 1751, AGS, Estado Legajo 6919 (Simancas, Spain).

[4]None of the documents consulted provided a listing of the armament for the *Guadalupe*. One document did mention that when the crew became mutinous the captain used 15 cannon and personal weapons to protect the treasure. Manuel de Bonilla to Don Francisco de Varas y Valedes 11 November 1750.

[5]Manúel de Bonilla to King of Spain, 18 August 1750, AGI, Contratación 5157 (Seville, Spain).

[6]Register of *Nuestra Señora de Guadalupe*, 15 October 1750, AGI, Contratación 2527 (Seville, Spain); Minutes of the Council of Virginia, 28 September 1750, PRO, CO 5/1327 (Kew Gardens, London).

[7]Manuel de Bonilla to King of Spain, 18 August 1750.

[8]Ibid.; Ricardo Wall to Joseph de Carvajal y Lancaster, 16 December 1750, AGS, Estado Legajo 6917 (Simancas, Spain).

Portuguese register ship *San Pedro*, Captain Don Juan Kelly, carried 150,000 pesos of silver, cacao, and Brasilwood.[9] Don Juan Cruanas commanded the packet boat *El Salvador*.[10] Its cargo consisted of 240,000 pesos of silver, cacao, Brasilwood, and cochineal.[11] The *Nuestra Señora de Merced*, also called the "*Zumaca del Rey*" or the king's sloop, Don Antonio Barroso captain, was listed as carrying a shipment of mahogany for the Spanish Crown.[12]

The sloop *Mariana*, was listed in the documents as transporting a cargo of logwood, hides, and snuff and was commanded by Don Antonio Janasio de Anaya.[13]

After rendezvousing in Havana, the fleet was delayed for another two months to re-provision and take on additional cargo. It did not depart Cuba until 18 August. A week into its voyage the fleet encountered a "bad-looking north wind" which forced the ships to sail only with foresails and mizzens.[14] The fleet continued for another five hours before the wind shifted and increased in intensity and became a hurricane. The ships remained together until the evening of the 26th where they lost contact with each other in the darkness. When the storm broke five days later only four ships survived. Three sailed, battered, into Norfolk, Virginia and another anchored in Ocracoke, North

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[9]Manuel de Bonilla to King of Spain, 18 August 1750.
[10]Many documents simply call the vessel Arizon's packet in reference to the boat's owner, Don Jacinto Arizon of Spain.
[11]Ibid.; Ricardo Wall to Joseph de Carvajal y Lancaster, 16 December 1750.
[12]Manuel de Bonilla to King of Spain, 18 August 1750. Accounts concerning the wreck also indicate that the ship may have been carrying a small amount of tobacco in addition to its main cargo. Minutes of the Council of Virginia, 28 September 1750.
[13]Ibid.
[14]Pedro de Pumarejo to Don Francisco de Varas y Valedes, 15 October 1750.

Carolina. The other four ships were driven ashore along the North Carolina and Virginia shores.

Surviving Ships

Captain Pedro de Pumarejo's letter to the king of Spain provides a detailed account of the hurricane's affect on his ship.[15] The storm severely battered the *Nuestra Señora de los Godos*: its tiller broke twice, the foremast was knocked down, planking and caulking sprang, and the stempost came loose. The captain also noted that at one point 11 $^{1}/_{2}$ feet of water had entered the hold. The crew had worked feverishly to save the ship: throwing everything non-essential overboard to lighten the vessel, manning the pumps, building light rigging and sails to move the vessel during calms, and passing heavers around the hull to prevent the ship from splitting apart. When the storm dissipated on the 31st, the *Godos* still had seven feet of water in its hold and only a small foremast and some light sails to serve as propulsion. The vessel sought safety at an un-named inlet; the captain noted that land was sighted at 36 degrees 38 minutes, near the North Carolina/Virginia border.[16] Local watermen informed the captain that there was no port in the vicinity, the nearest being located in the "Virginia River," some 45 miles to the north.[17] The *Godos* departed the inlet on 2 September and was joined by the *San Pedro* and *Mariana* while enroute to Norfolk. The three ships entered Hampton Roads the next day.

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[15]Ibid.
[16]Ibid.

The damage to the *Mariana* and *San Pedro* were equally extensive. Captain Kelly of the *San Pedro* testified that the storm heavily damaged the *San Pedro*'s stern, carried away his boats, and put six feet of water in the ship's hold.[18] Though no account was found on the *Mariana*'s damage it must have been fairly significant because the vessel's captain petitioned the Virginia government to be allowed to sell some of his cargo to cover the expenses of repairing his ship.[19]

Upon anchoring at Norfolk the captains sent petitions to the governor requesting to unload their cargoes in order make an assessment on the condition of their ships and merchandise.[20] After inspecting the ships papers and weighing their petitions colonial officials gave the captains leave to unload their cargoes and to sell at public auction any damaged goods.[21] The Spanish were also given permission to sell part of their undamaged cargo to defray costs of repairing their vessels.[22]

Each ship was also surveyed to determine whether they were structurally sound enough to continue the journey to Spain. These surveys revealed that besides storm damage the ships were in a state of extreme deterioration.[23] The lower hulls of the ships were rotten and both the *Godos* and *San Pedro* were

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[17]The *Godos*' appearance along this part of the North Carolina border may explain some accounts which state that one of the Spanish vessels was lost near Currituck Inlet.
[18]Minutes of the Council of Virginia 27 September 1750, PRO, CO 5/1327, (Kew Gardens, London).
[19]Ibid.
[20]Under Maritime laws of that period vessels entering a port had to receive clearance from customs officials prior to unloading. This clearance involved inspection of the ship's papers and an assessment of the duty to be charged on the cargo unless an exception was granted.
[21]Ibid.
[22]Ibid.
[23]A Report to the Col. Thomas Lee on Two Spanish Vessels 29, September 1750, PRO, CO 5/1327, (Kew Gardens, London).

condemned as a result. The *Mariana*, however, was in better condition, its captain was allowed to repair his vessel. Since two of the ships were unfit to resume the voyage to Spain the Virginia Council authorized the Spanish to contract local vessels to transport their remaining cargoes and passengers to Cadiz. The *Allerton* and *Dorothy* were retained for that purpose. The ships cleared Norfolk at the end of December and arrived in Cadiz the following February.

The other surviving vessel, the *Nuestra Señora de Guadalupe*, found refuge at the port of Ocracoke in North Carolina. Nearly all the official documentation consulted concerning the *Guadalupe* focused on the theft of a portion of its cargo and the seizure of part of the remaining bullion by colonial officials. One of the few descriptions of the vessel's plight during the storm came from Thomas Wright of South Carolina, who sailed as a passenger on the ship.

Wright noted that the fleet was struck by a severe hurricane on 17 August after three days of stormy weather.[24] While at sea, the *Guadalupe* lost its rudder, mizzenmast, main and fore topmast, and all its sails.[25] On the 20th, the vessel reached the North Carolina coast and anchored off Hatteras Inlet using two cables at either end of the ship.[26] When the ship became endangered of being driven ashore during an intensification of the storm, the captain decided to sail the *Guadalupe* to Ocracoke, the nearest port. Once at Ocracoke, the captain sent

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[24]The discrepancy in the dates given between the Spanish and the English is due to the different calendrical systems used by the two countries. Spain followed the Gregorian Calendar and the English the Julian.

[25]South Carolina Gazette, #860, Monday October 29 to Monday November 5, 1750, 2.

[26]Ibid.

his pilot to Norfolk to arrange for a vessel to transport the *Guadalupe's* cargo there for eventual shipment to Spain.[27]

While at Ocracoke, Captain Bonilla disregarded maritime protocol by not notifying colonial officials of his arrival in port despite being informed by local officials to do so.[28] Furthermore, Bonilla had his cargo unloaded and loaded twice and conducted trade with the locals for necessities and provisions. Despite the flagrant breach of maritime law the governor initially refrained from any direct involvement.[29] However, actions taking by customs officials and word of a possible plot to seize the bullion shipment by local bankers forced Governor Johnston to send an official and a warship to protect the Spanish ship and cargo.[30]

Captain Bonilla's difficulties were not confined to hostile locals. He also had to contend with a crew on the verge of mutiny, incited by the ship's

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[27]The petition to hire a vessel by the *Guadalupe's* pilot was received and acted upon by colonial officials in Virginia during the same proceedings as those in which the ships in Norfolk were heard. Minutes of the Council of Virginia, 27 September 1750.

[28]Governor Johnston suspected that Bonilla may have been influenced by Wright to avoid contact with North Carolina's officials and transport his cargo to Charleston. Governor Johnston to Mr. Abercromby, 18 September 1750, PRO, CO 5/307, (North Carolina State Archives, Raleigh); William L. Saunders, The Colonial Records of North Carolina, (Wilmington, NC: Broadfoot Publishing Company, 1993), IV:1304.

[29]Governor Johnston stated that he chose this course of action because he knew that part of the cargo was being carried on account of English merchants and that he did not want to cause any complications in the relations between England and Spain. Johnston to. Abercromby, 18 September 1750; Saunders, IV:1304, 1308.

[30]Frustrated over the governors refusal to seize the Spanish ship, local customs officials appealed to the Surveyor General of Customs in Virginia for permission to seize the ship. The *Guadalupe* was also threatened by the locals who looked to plundering the ship as revenge for Spanish attacks in the area in 1747 and for the destruction of Brunswick in 1748. Gov. Johnston to Bedford 2 May 1751, PRO, CO 5/13 (North Carolina State Archives, Raleigh); Johnston to. Abercromby, 18 September 1750; A Narrative of the Proceedings in North Carolina in America relating to the Spanish Wrecks in the year 1750, 25 February 1752, CO 5/307 (North Carolina State Archives, Raleigh,); and Saunders, IV:1301, 1306, and 1308-1309.

boatswain, Pedro Roderiquez.[31] At Hatteras, the boatswain attempted to force the vessel ashore by cutting its remaining masts. The captain stayed any attempts to endanger the ship and cargo by offering to pay the crew double wages.[32] To ensure further cooperation Bonilla disbursed 100 silver pesos at Ocracoke, but it wasn't enough to prevent them from breaking into some of the passenger's chests. When the pilot did not return and Bonilla hired two sloops to transport the cargo, Roderiquez forced the captain to load 100 chests of plate and 30 bags of cochineal on the vessels with the claim of going to go to Virginia for supplies.[33] That action was interrupted by the arrival of Colonel Innes, the official dispatched to Ocracoke by Governor Johnston.

Colonel Innes informed the captain that he should make a proper petition to the governor and cautioned him that the two sloops might attempt to run off with the cargo already loaded aboard. The crew, on the verge of full mutiny, would not allow the captain to act on the colonel's offer to seize the sloops and transport them to a safer location. During this potential crisis, the captain chose to leave his ship and to travel to New Bern to meet with the governor. Before leaving he ordered the boatswain to tie up the two sloop's sails and put ten men

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[31]The boatswain's actions are not totally clear. He may have been acting for personal gain or out of concern for the crew. Since the crew was paid once a vessel ended its voyage, whether at its stated destination or some other port, Roderiquez may have been trying to force the captain to declare the ship a wreck and the voyage over so that the crew could receive its wages.

[32]Manuel de Bonilla to Don Francisco de Varas y Valedes, 11 November 1750.

[33]One of the sloops, the *Seaflower*, was owned by Zebulon Wade of Scituate, Massachusetts and the other, the *Mary*, belonged to a Mr. Randall of New York. South Carolina Gazette, 2; New Jersey Council Records, 5 February 1750/1, in Joan Charles, "1750 Spanish Plate Fleet: A Narrative" (Hampton, VA: Unpublished Manuscript, 1997), 38.

on board.[34] This, however, he neglected to do. On 9 October, the two sloops cut their anchors and made an attempt to flee. One of the sloops grounded and was boarded the by the Spanish, but the other escaped with 300,000 dollars (16,500 of which were packed in 55 chests) wrought plate, goods, and 135 bales of cochineal.[35]

The governor immediately fitted out two schooners to pursue the sloop. After the theft, Captain Bonilla requested that the remaining precious cargo be put aboard HMS *Scorpion*, which arrived after the sloop's escape, and to have it transported to Europe. The governor agreed and according to Johnston, Bonilla consented to let him have a reasonable salvage and the captain of the *Scorpion* a freight charge. After the *Scorpion* departed with Captain Bonilla aboard additional help arrived from Norfolk. Manuel de Echanis, first lieutenant of the *Galga*, and a number of troops and sailors were sent to aid the *Guadalupe*'s crew and help prepare the ship to rejoin the rest of the surviving fleet at Norfolk.[36] Since the *Guadalupe* was too damaged to make the journey and Ocracoke lacked the facilities for major repairs, the ship was left behind and its cargo transported to Norfolk instead. The rest of the *Guadalupe*'s cargo was shipped to Spain on a

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[34]Despite being distrustful of the boatswain, the captain put him in charge because he was next in line in the chain of command.

[35]Secretary of State to Governor of North Carolina, re. Wreck off North Carolina Coast, 10 January 1750/1, PRO, CO 324/38 (North Carolina State Archives, Raleigh); South Carolina Gazette, 2.

[36]Declaration of Manuel de Echanis in the trial of Daniel Huony, 12 March 1751, AGS, Marina Legajo 15 (Simancas, Spain).

number of ships hired by Huony in Virginia.[37] For his actions Pedro Roderiquez was arrested and sent to Spain in chains.

The salvage and freight fees enacted on the *Guadalupe*'s cargo by the governor of North Carolina resulted a minor political incident between the Spanish and English governments. The Spanish captain complained that part of his cargo was forcibly removed from the *Scorpion* to pay the salvage and freight fees.[38] The governor responded to the accusation saying that the captain fully agreed to the sum and signed papers, via a translator, attesting to it.[39] A commission formed in England to look into the matter determined that under the circumstances no salvage beyond actual labor and expenses was due.[40] As for the freight charges, the commission ruled that they were justified. They noted that Spanish officials did not complain so much on the rate as to how it was

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[37]Port records for the Port of Hampton indicated that the sloops *Polly*, *Amelia*, *Sekikia*, and [ ]*oray* cleared for Spain at the end of December with cargo from the Spanish vessel at Ocracoke. Though the *Allerton* was also noted as carrying cargo from the *Guadalupe* Spanish records state that it and the *Dorothy* had carried goods from the *Godos* and *San Pedro*. Naval Office Lists 1735-1756, South Potomac and Accomac, James River and Port Hampton, PRO, CO 5/1445-1446, in Richard Cook, An Account of the Spanish Shipwreck "La Galga" and the Loss of the Treasure Fleet of 1750 (Ocean City, MD: Published by author, 1989,) 34.

[38]A total of 16,275 1/2 dollars were taken out of the *Scorpion*. The governor of North Carolina retained a salvage fee of 4 1/2% from the whole lading of the cargo and a fee of 2% was charged to freight the cargo to Europe. A Narrative of the Proceedings in North Carolina in America Relating to the Spanish Wrecks in the Year 1750, 25 February 1752; Bedford to Advocate General, Attorney and Solicitor General, 4 March 1750/1, PRO, CO 44/136 (North Carolina State Archives, Raleigh); Report of Advocate General, Attorney and Solicitor General, re. Spanish wreck, 4 June 1751, PRO, CO 324/38 (North Carolina State Archives, Raleigh); Secretary of State to Governor of North Carolina, re. Wreck off North Carolina Coast, 13 June 1751, PRO, CO 324/38 (North Carolina State Archives, Raleigh); Saunders, IV:1300-03, 1309-10.

[39]A Narrative of the Proceedings in North Carolina in America Relating to the Spanish Wrecks in the Year 1750, 25 February 1752; Saunders, IV:1302-03.

[40]The commission also determined that it was improper for the governor to demand any compensation for his role in the affair. Report of Advocate General, Attorney and Solicitor General, re. Spanish wreck, 4 June 1751; Saunders, IV:1310.

collected.[41] The English government ordered Governor Johnston to repay the fee he charged. Governor Johnston, however, continued to proclaim his innocence, even after the final judgment was rendered. The governor passed away shortly after his last letter in February 1752 and it is unlikely that he ever repaid any of the money.

The sloop that had escaped with part of the cargo was eventually tracked to the Caribbean. It put into Saint Croix briefly before sailing to Norman's Island, in the British Virgin Islands, where most of the silver was buried.[42] Dutch officials later seized the vessel and the remaining treasure after the sloop put into St. Eustatius. By the time English officials became involved the stolen treasure was scattered among many people on a number of small islands. Lieutenant Governor Fleming of Tortola, charged with pursuing the matter, was only able to recover approximately £50,000 of the stolen treasure.[43]

Wrecked Vessels

The four vessels lost during the storm wrecked nearly in pairs along the North Carolina and Virginia/Maryland coasts. The *Nuestra Señora de la Soledad*

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[41]The Spanish complained that they should have been billed for the freight and not had part of the cargo detained for payment. Report of Advocate General, Attorney and Solicitor General, re. Spanish wreck 4 June 1751; Saunders, IV:1310.

[42]The silver on Norman's Island was in turn stolen by the inhabitants of the neighboring island of Tortola. Bedford to Advocate General, Attorney and Solicitor General 4 March 1750/1; Harold T Wilkins, "Pirate Treasure," in Cook, 94-101.

[43]The Duke of Bedford, the official in England handling the affair, noted that the salvage of the treasure from the Caribbean would be more than that exacted in North Carolina and he suspected that the Spanish would lodge protests against that also. Bedford to Advocate General, Attorney and Solicitor General 4 March 1750/1. Fleming charged a 4% salvage fee on what was recovered and also laid an embargo on an additional amount as reprisal for the predations of the *guarda-costas*. The Gentleman's Magazine, February 1750/1, in Charles, 39-40.

and *El Salvador* were said to have been located within 5 leagues of each other in North Carolina while *La Galga* and the *Nuestra Señora de Merced* were recorded 6 leagues apart on the Maryland/Virginia border.[44] Of these wrecks, three grounded with minimal loss in life and a large percentage of their cargoes intact. Only *El Salvador* was a total loss with only four of its crew surviving. An account of each of the vessels, as noted in the historical record, is as follows.

The *capitana* of the fleet, *La Galga*, was reported wrecked 15 leagues north of Cape Charles. One of the foreign prisoners on board, Capt. James Maloney, provided an account of the loss for colonial papers.[45] The storm stripped *La Galga* of its main, foretop, and mizzen masts, and the crew tossed seven of its guns overboard to prevent the ship from floundering at sea.[46] On 24 August, the ship struck Matchapungo Shoals (modern Chincoteague Shoals) losing its rudder. Another 22 cannon were jettisoned as the crew worked the stricken vessel across the shoal and anchored in five fathoms of water.[47] Two days later, the crew ran the ship aground on Chinkateague Island to prevent it from sinking in deep water. They constructed a raft to carry the cargo and themselves ashore after the ship's boats were destroyed while being lowered in the rough seas. Two men and two chests of silver were washed overboard and lost and another two men, who had tied money around their waists, attempted to swim ashore

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[44]The distance between *El Salvador* and *Nuestra Señora de la Soledad* may only be conjecture, as the exact location of the remains of *El Salvador* are unknown.

[45]Because he was familiar with the waters along the coast Captain Maloney was asked by *La Galga*'s captain to pilot the vessel during the storm.

[46]Pennsylvania Gazette, September 6, 1750, 2.

[47]Ibid.

but were drowned.[48] The Spanish traveled overland to Snow Hill on the Pocomoke River where the captain hired two sloops for transport to Norfolk.

The local inhabitants began salvage operations shortly after the Spanish abandoned the wreck. Instead of staying to protect his vessel Captain Huony thought it more prudent to move his men and the silver shipment as quickly as possible to Norfolk because the locals were becoming aware that *La Galga* had carried English prisoners.[49] In a vain attempt at protest, the captain issued a letter to Maryland's Governor Ogle for restitution of everything salvaged from the wreck. The governor dispatched the Worcester County sheriff to take possession of the wreck and seize any of the salvaged goods. Though very little was ever recovered, the sheriff did find much of the ship's heavier equipment in place and part of the non-precious cargo still on board.[50] *La Galga* remained in this condition until October when a storm broke the hull in two, washing the cargo of mahogany ashore and burying everything else too heavy to float. By November, all above surface remains of the vessel had disappeared.

Very little information was found concerning the loss of the remaining vessels. Considering that the crews of the *Merced* and the *Soledad* survived, this fact may seem a little surprising. This may, however, be attributed to the method in which the historical research was conducted. Time and expense limited the

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[48]Maryland Gazette, September 5, 1750.
[49]Daniel Koski-Karell, "Shipwrecks and Treasure - A Tail of Old Assateque." In Cook, 2-3.
[50]Proceedings of the Council of Maryland, 13 September 1750, in Charles, 10-11.

amount of documents that could be consulted in the archives in Spain.[51] As the focus of the thesis was on *El Salvador*, research was directed toward finding information on that particular vessel and any extra time was spent on gathering general information concerning the fleet and the circumstances of its loss during the hurricane. Information on the *Merced* and the *Soledad* may possibly be located in documents not consulted or may even be housed in other depositories in Spain.[52] What has been found concerning the remaining vessels is presented below.

The *Nuestra Señora de Merced* was reported lost approximately six leagues north of Cape Charles. The crew and most of the cargo survived the storm. The *Merced*'s crew joined with *La Galga*'s, traveling with them to Norfolk. The remaining cargo and ship's equipment were salvaged by the local inhabitants whom later burned the surviving superstructure.

The *Nuestra Señora de la Soledad* was driven aground at Drum Inlet. Though the vessel was lost, its entire crew survived. The silver shipment, as well as part of its general cargo, was also saved.[53] The captain hired a vessel to transport the survivors to New England for passage back to Spain.

Much of the information concerning the loss of *El Salvador* is sketchy and conflicting. Since the vessel broke up quickly after grounding, its location is not

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[51]It should also be noted that American colonial documents lack any detailed information on these vessels. They either focus on the surviving vessels or those which were important, such as *La Gálga*.

[52]The *Merced* was noted to be traveling under royal charter and it is possible that documents concerning it lie within collections pertaining to royal affairs.

[53]Minutes of the Council of Virginia, 28 September 1750; Pennsylvania Gazette, 2; South Carolina Gazette, 2. Don Pumarejo reported to the king of Spain that 14 chests of silver were saved from the ship. Pumarejo to Varas y Valedes, 15 October 1750.

reliably known. Various accounts place the ship near Topsail Inlet, near Cape Lookout, 15 leagues South of Ocracoke, and 5 leagues from Drum Inlet.[54]

The records indicate that only four people survived, three sailors and a boy and that a large number of bodies were reported washing ashore on the North Carolina coast. The only witnesses to the plight of *El Salvador* were the crew of the Bermuda sloop *Relief*, owned by Ephraim and Robert Gilbert.[55] The sloop rode out the storm moored to a sand bank in the vicinity of the Spanish ship. The captain of the *Soledad* received information that the sloop had salvaged the sails and rigging of the ship and suspected that it may have also salvaged part of the silver shipment. Captain Respaldizar issued a complaint to the governor of North Carolina who ordered that the sloop and its crew be seized.[56]

El Salvador

El Salvador's service in the Indies trade was very brief, lasting only two years.[57] Originally the English vessel *Henry*, the ship was captured by Spanish

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[54]An Account of the Five Ships of the Spanish Flota put on Shore on the coast of North Carolina by the great Storm August 18, 1750, 15 October 1750, Contratación 5157; A Report given to the Honorable Thomas Lee Esq. President and Commander in Chief of Virginia of the Ships that sailed from Havana under the Convoy of his Catholic Majesty's Ship the *Galga* Don Daniel Huony Commander, 28 September 1750, PRO, CO 5/1327 (North Carolina State Archives, Raleigh); and South Carolina Gazette, 2.

[55]A South Carolinian newspaper reported that the sloop had been driven ashore at Cape Lookout. South Carolina Gazette, 2.

[56]Colonial documents do not indicate whether the *Relief* was ever detained. An Account of Five Ships of the Spanish Flota put on the Shore on the Coast of North Carolina by the Great Storm August 18, 1750, 10 September 1750, CO 5/13 (North Carolina State Archives, Raleigh).

[57]Much of the information concerning the history of *El Salvador* comes from Contratación 1643 and material prepared by Alan R. Riebe during his search for the ship. Riebe claims to have found *El Salvador* near Cape Lookout. Though the material recovered (a number of cannon, a brick stove, and other miscellaneous artifacts) dated to the eighteenth century no bullion or other artifacts have been found which positively identify the vessel as *El Salvador*. Historical research indicates that at least seven vessels dating to the eighteenth century have been lost in the Cape

privateers near Gibraltar in August 1747 during a trading mission between New York and Leghorn, Italy. As Spain was at war with England at the time the ship was seized as a prize and the *Henry* and its cargo sold at auction. Don Salvador de Arizon of Seville purchased the ship under an agent, Don Salvador Font Carbonel, for 3,110 pesos.[58] Arizon renamed the ship *El Salvador* and made applications to sail the vessel to the Indies.

Prior to receiving its Indies license *El Salvador* was given a complete inspection by royal officials. This inspection revealed a number of structural problems with the ship.[59] Repairs were completed in January 1748 but *El Salvador* had to wait another seven months before permission was finally granted for departure. The ship left Cadiz for Cartagena on 23 August 1748 and returned the following June. Its return cargo consisted of 36,233 pesos of gold, 13,933 pesos in gold bars, 21,523 pesos of silver, and another 29,942 pesos of gold on private account.[60]

Shortly after *El Salvador*'s arrival back in Spain, Arizon re-applied for another voyage to the Indies. It was during the inspection for this voyage that much of the information currently known about the ship was found. *El Salvador*'s measurements were 64 feet 3 inches long on the weather deck, 53 feet 3 inches long on the keel, 20 feet 2 inches wide, and 9 feet 3 inches depth of hold.[61]

Lookout area and the wreck located by Riebe may be one of those. Visit aboard Packetboat named *El Salvador*, alias *El Henrique*, 26 August 1749, AGI, Contratación 1643, (Seville, Spain); Alan R. Riebe, Treasure Wrecks Around the Globe 900-1900 A.D., (n.p., 1992), 62-64.

[58]Riebe, 62.

[59]The inspectors recommended that the keel be realigned, new masts and spars be installed, and the sides, deck, and bottom be recaulked. Ibid., 62.

[60]Ibid., 62.

[61]Visit aboard Packetboat named *El Salvador*, alias *El Henrique*, 26 August 1749.

The vessel was rated at 110 tons burden, was rigged with two masts, a fore and a main mast, and was steered by a tiller. The ship was most likely rigged as either a brigantine or snow (Figure 2).

This last inspection also provided a detailed list of the equipment and crew of *El Salvador*. This list included:

3 anchors
2 stream anchors
5 cables
8 axes
12 hand hatchets
2 fitted bilge pumps
2 spare pumps
3 sheets of lead sheathing
a number of nails and tacks of different sizes
6 running lights
4 hand lanterns
1 poop castle lantern with side glasses
80 pounds of wax
and other supplies[62]

The armament for the vessel included:

4 four-pound cannons
4 two-pound cannons, mounted on carriages
12 muskets
12 pair of pistols
12 sabres
12 pikes
240 cannon balls
3 grape shot canisters
3 bar-shot
half a chest of musket and pistol balls
powder[63]

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[62]Ibid.
[63]Ibid.

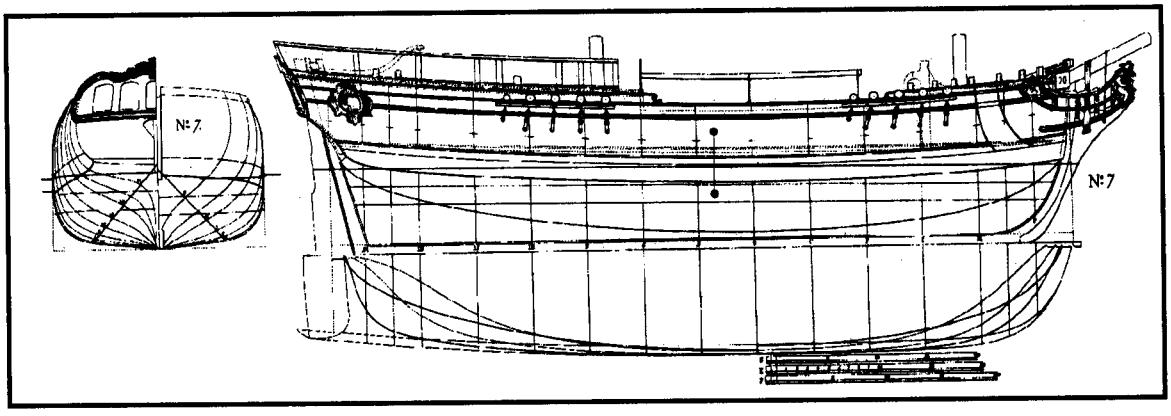

Figure 2. Illustration of a Brigantine (F. H. Chapman, Architectura Navalis Mercatoria 1768, New York: Edward W. Sweetman Company, 1967), XXXIX.

Records show that the ship carried a crew of 30 men and boys, including a pilot, a master/notary, a quartermaster and guardian, a carpenter/caulker, a surgeon/barber, 8 sailors, 12 boys, and 3 pages.[64]

El Salvador sailed from Cadiz on 21 October 1749 in the company of the Portuguese register ship *San Pedro* with a cargo consisting of 250 tons of cloth and fruit.[65] After dispatching its cargo in Cartagena *El Salvador* proceeded to Porto Bello for a shipment of bullion which included 16 large chests of silver and 4 chests of gold.[66] The ship returned to Cartagena where another 30,000 pesos of gold were loaded.[67] *El Salvador* also carried an unknown quantity of bullion and jewels on private account. Fully loaded, the ship proceeded to Havana to join the fleet assembling there for the homeward journey.

El Salvador was the first of the fleet to succumb to the hurricane, which struck shortly after the ships cleared the Bahamas Channel. The vessel grounded

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[64]Ibid.
[65]Riebe, 63.
[66]Each chest carried approximately 3,000 coins. Ibid.

on the coast of North Carolina in the vicinity of Topsail Inlet where it quickly broke up in the heavy surf and became covered in seven to eight feet of sand. Salvage attempts by the Spanish and other individuals were stymied by a lack of visible remains and an accumulation of sand.[68] The circumstances of its loss has allowed *El Salvador* to lay virtually undisturbed for nearly 250 years. The remains of the vessel may hold information which could provide researchers with a rare opportunity to study ship board life and methods of construction which are often undocumented in the historical record. Scientific investigation of *El Salvador* will also allow researchers to obtain data that is often missed or destroyed by salvers during their quest of treasure.

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[67]Ibid.

[68]The Bermudans, Ephraim and Robert Gilbert, whose ship grounded near *El Salvador* conducted salvage operations on the wreck until 1754. The success of these efforts is unknown, though research by Alan Riebe indicates that the salvage attempts were not profitable for the Gilberts. Ibid., 64.

Chapter 3

Research Methodology

The primary goal of the archaeological investigations at Topsail Inlet was to conduct a magnetometer and side scan sonar survey to locate the remains of the Spanish Plate Fleet vessel *El Salvador*. The vessel was reported to have run ashore in the vicinity of Topsail Inlet during a hurricane in August 1750. A limited amount of material was recovered from the wreck shortly after its grounding, but shifting sands quickly buried the site and no further attempts were made to relocate and salvage the vessel. As a consequence of this wrecking process, the vessel's remains may represent one of the few instances in which virtually the entire archaeological record of a Spanish Plate Fleet vessel survives intact.

To locate *El Salvador*, investigators employed remote sensing equipment and techniques that are comprehensive in coverage and sensitivity. All magnetic and acoustic anomalies containing signature characteristics suggestive of submerged cultural resources were investigated by divers. Those targets determined to contain shipwreck material were test excavated to identify the resource and make an assessment of the state of preservation of the remains. Should *El Salvador* be located the results of this survey will provide data for planning a more comprehensive examination and excavation of the wreck.

A secondary goal of this project was to provide a cultural resource examination of the Topsail Inlet area. Historical research conducted at the

Underwater Archaeological Unit of the North Carolina Division of Archives and History, East Carolina University, and the Institute for International Maritime Research revealed that at least eleven ships have been reported lost in the Topsail Inlet vicinity (Appendix). To date, no submerged cultural resource investigations have been conducted in this area. As a consequence, all cultural resources found during the survey were documented and attempts made to identify sites determined not to be *El Salvador*. This material will provide the state of North Carolina with an inventory of wreck sites in the Topsail Inlet area that can be included in its database of North Carolina shipwrecks.

Historical Considerations for Locating Wreck

Historical documents relating to the 1750 Fleet provide limited information on the location of *El Salvador*. Two areas along the North Carolina coast appear to match the descriptions in the records. Those two areas are Beaufort Inlet and New Topsail Inlet. Both inlets were known as Topsail Inlet during the colonial period, Beaufort as Old Topsail and Topsail as New Topsail. Topsail has been selected as the focus of this research as a result of information gathered from geographical resources, historical accounts, and material salvaged at the inlet in recent times.

Historical accounts of the loss record that the vessel ran aground approximately 15 leagues south of Ocracoke.[1] Both inlets lie approximately 15

[1]There are a number of interpretations of the value of a Spanish marine league during the eighteenth century. Pearson and Hoffman calculated a league to equal approximately 3.43 miles in their research on the Spanish fleet vessel *El Nuevo Constante* in 1980. Another value was

leagues from Ocracoke, depending upon how the distance is measured. Beaufort Inlet lies close to 15 leagues on a direct line while Topsail is located approximately the same distance south of the latitude of Ocracoke. The direct vector method of measuring was commonly used for land based calculations while those based on latitude were chiefly employed by mariners. The historical records do not note who provided the information on the position of the wrecks. If the locations came from the Spanish survivors they may very well be based on latitude and, as a result, indicate that the position of *El Salvador* is near New Topsail Inlet.[2]

Colonial settlement patterns along the coast of North Carolina lend additional support for Topsail being the site of the wreck. The New Topsail Inlet area was located in a remote section of New Hanover County during the Colonial period and was sparsely settled (Figure 3). Though the inlet, with its 10 foot depth of water, was marked on maps as an anchorage, the surrounding waters were very shallow inhibiting the development of population centers. The only settlements were scattered plantations located on the mainland. It is conceivable that a valuable Spanish Plate Fleet vessel wrecked in this remote area and was quickly forgotten after one brief salvage attempt.

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derived by Commander J. B. Hewson in his study of the history of navigation. In his research, Hewson calculated a Spanish league to be about 3.24 miles. Since the precise measurement of a Spanish league is unknown it may be assumed that it falls somewhere between 3 and 3.5 miles. From this assumption, the 15 leagues from Ocracoke stated in the historical records corresponds to a distance of between 45 and 52 miles. Charles E. Pearson and Paul E. Hoffman, The Last Voyage of the El Nuevo Constante The Wreck and Recovery of an Eighteenth-Century Spanish Ship off the Louisiana Coast (Baton Rouge: Louisiana State University Press, 1995), 2n; Commander J. B. Hewson, A History of the Practice of Navigation (Glasgow: Brown, Son & Ferguson, LTD., 1983).

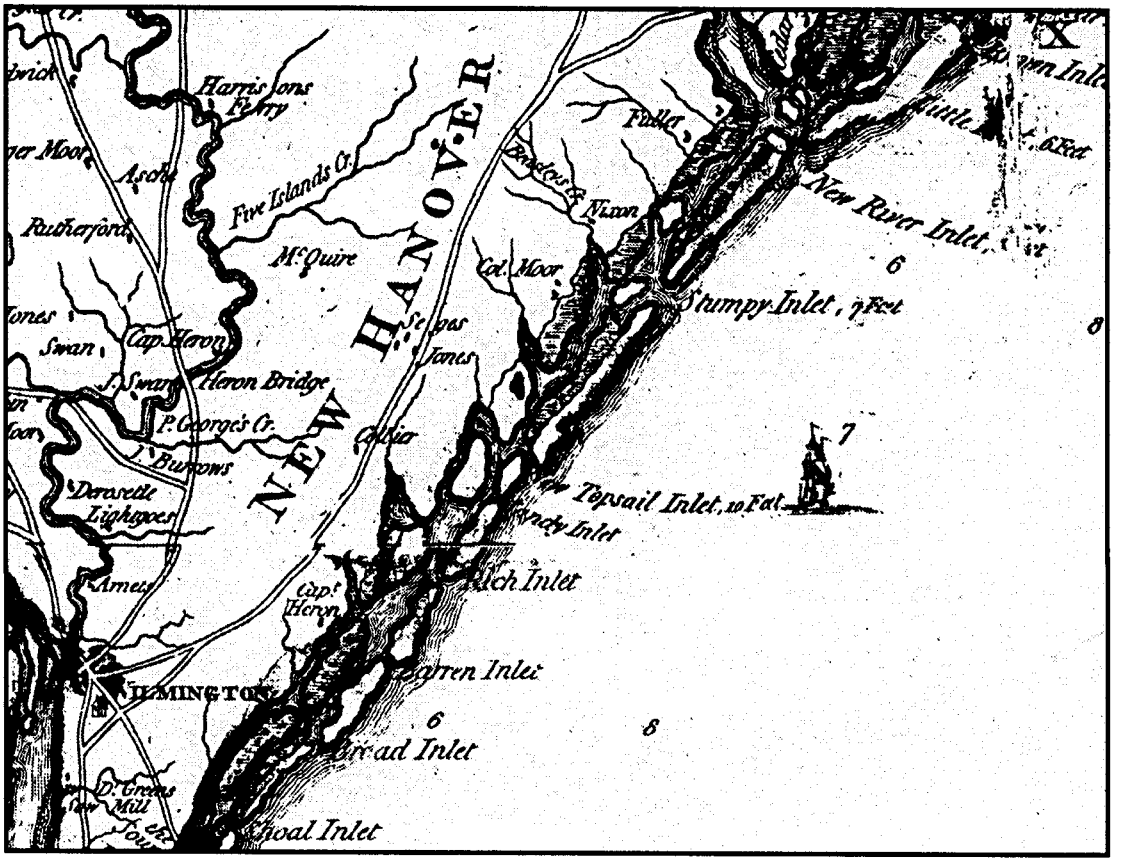

Figure 3. 1775 Mouzon map illustrating settlements in the Topsail area.

On the other hand, it would be unlikely for such to occur at Beaufort. Beaufort was a significant town during the Colonial period. It was a port of entry for North Carolina and a major center for fishing, whaling, lumber, and naval stores production. Though the town was small its population swelled on a seasonal basis.[3] In addition, Spanish activities in the Beaufort area during the

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[2]It should be noted that a land-based system for recording the location of the wrecks could have been used as the ships were wrecked on the coast and were accessible or at least visible from shore.

[3]In 1748, the North Carolina list of taxables documented 320 taxable people in the Beaufort area. Of those only 32 were probably permanent inhabitants of the area. Taxables were white males over sixteen years of age and Negroes and mulattos of either sex over twelve years of age. Charles L. Paul, "Beaufort, North Carolina: Its development as a Colonial Town," North Carolina Historical Review 47, no. 4 (1970): 113.

War of Jenkin's Ear (1739-1744) and King Georges War (1744-1748) generated negative feelings toward Spain as well as a plethora of written documentation.[4] For such an active area it is difficult to understand how a Spanish Plate Fleet vessel could have grounded in the vicinity and yet receive little attention.

The New Topsail Inlet hypothesis is further supported by the recovery of an historic anchor in the vicinity of the inlet by fishermen in the early 1900s. No provenience or location is known beyond that its recovery in the Topsail area.[5] The anchor was identified as British and is similar to those employed during the eighteenth century.[6] The shank is 9 feet 11 inches long and the anchor measures 5 feet 6 1/2 inches between the arms. The anchor is currently in the collections of the Mariners' Museum in Newport News, Virginia and is catalogued under accension number DA-3.

Archaeological Considerations for Locating Wreck

In order to develop a strategy for locating *El Salvador* an assessment of how underwater sites are created and what forms they may take must first be explored. As Keith Muckelroy noted, an excavated underwater archaeological resource, i.e. shipwreck, is the product of a number of processes which include: 1. the process of wrecking, 2. salvage operations, 3. disintegration of perishables,

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[4]During these conflicts Spanish privateers operated freely in the vicinity of Beaufort and even captured the town for a short period in August 1747.

[5] Information on the Mariners' Museum record sheet does not indicate when the anchor was recovered. The record only provides a brief description of the recovery, the anchor's dimensions, who donated it, and when it was donated. Record Sheet, Artifact DA-3, Mariners' Museum.

[6] *El Salvador* was originally British built and owned. This anchor may have been part of the ship's original equipment prior to its capture in 1747.

4. sea-bed movement, and 5. characteristics of excavation.[7] It is only through the understanding of these processes that archaeologists can develop methodologies and interpretations on the archaeological record of a site. In order to understand the conditions in which shipwreck material might survive underwater Muckelroy developed a series of classes which grade the survivability of structural remains, the artifact assemblage, and the distribution of site material.[8] These classes range from an intact site with structural and artifactual integrity to scattered sites with no surviving structure and few artifacts. While Muckelroy's classification provides a framework for developing methodologies in conducting archaeological studies, he acknowledges that it has limitations.

By using Muckelroy's models on shipwreck processes as a guide inferences can be made on the potential survivability and state of the archaeological record associated with El *Salvador* by comparing that record with two other known and investigated Plate Fleet vessels. These vessels, *El Nuevo Constante* and the *San Esteban* were both lost as the result of storm activity but in differing environments. These different wrecking environments have played an important role in the surviving archaeological material present at each site.[9]

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[7]Muckelroy represented the evolution of a shipwreck as a closed system with the ship as the input and, depending on conditions, a number of different outputs. Keith Muckelroy, Maritime Archaeology (New York: Cambridge University Press, 1978), 159.

[8]This classification was constructed from a database of 20 shipwreck sites within British waters. In developing the classification 11 environmental attributes were compared to see if there were correlations between the environment and the nature of the archaeological remains. Muckelroy, Maritime Archaeology, 160-165.

[9]*El Nuevo Constante* was lost off the coast of Louisiana in 1766. The surrounding coast is comprised of marshes and the bottom sediment of the adjacent waters are composed of silt and clay. The *San Esteban* was one of three ships of the 1554 New Spain fleet lost off Padre Island, Texas. Padre Island is a typical barrier island with offshore sediments being comprised mainly of sand. For detailed descriptions of the excavations of both wrecks see Pearson and Hoffman, El

While both vessels grounded intact, the *San Esteban* laid in the surf zone and suffered major structural damage as a result of the impact and subsequent wave action. *El Nuevo Constante*, on the other hand, settled in mud and was quickly buried to its water line. Both vessels were extensively salvaged and records indicate that their remains were visible for some time after their loss. After the vessels were salvaged and forgotten the local environment provided the final input into the current state of the surviving remains. *El Nuevo Constante* was located in an area characterized by shallow mud flats and moderate to occasionally high currents. The soft, poorly oxygenated sediments protected the wreck from erosion and helped preserve the surviving organic remains.[10] The *San Esteban*'s local conditions consisted of a highly oxygenated environment with shifting sand and high currents. Evidence that the remains have been repeatedly exposed and reburied since the vessel's loss in 1554 help explain the scattering of the remaining material and the lack of surviving organic remains.[11] As a consequence, these two different wrecking environments have produced contrasting archaeological records: an intact site with a large degree of surviving hull fabric and a concentration artifacts at the *El Nuevo Constante* site and widely scattered remains with almost no surviving hull structure at the *San Esteban* site.

The potential condition of *El Salvador*'s remains can inferred by studying these two wrecks. The wrecking process and local environment of *El Salvador* most closely corresponds with that of the *San Esteban*'s. *El Salvador* grounded in

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Nuevo Constante and Arnold and Weddle, The Nautical Archaeology of Padre Island: The Spanish Shipwrecks of 1554 (New York: Academic Press, 1978).

[10]Pearson and Hoffman, 102, 108.

the surf zone but, unlike the *San Esteban*, was broken up by the storm and quickly buried. The cargo and hull structure associated with the upper parts of the vessel were probably scattered over a wide area while those from the lower hull became buried. The energetic environment around Topsail Inlet has undoubtedly re-exposed some or all of the surviving remains on occasion, further scattering and eroding the archaeological record. In light of this reasoning the current survey has been designed along methods similar those used in locating the vessels of the 1554 fleet.

Project Location and Environmental Conditions

Topsail Island and the barrier islands of North Carolina formed approximately 18,000 years ago in the general submergence of coastal areas during the Holocene epoch. During the last period of glaciation high sand ridges were built up along the mainland beaches by wind and water action. When the sea level began to rise this ridge system was breached and the low lying area behind flooded creating shallow sounds and lagoons.[12] Barrier islands formed from the remnants of these former dune ridges, the size of which depended upon the amount of sand present prior to submergence and the degree of disturbance from wave and wind action. The evolution of a barrier island may proceed along one of three directions. An island may stabilize as a balance is reached between

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[11]Arnold and Weddle, The Nautical Archaeology of Padre Island, 195-197.
[12]John H. Hoyt, "Barrier Island Formation," Geological Society of America Bulletin 78(1967): 1130. Thomas D. Schoenbaum, Islands, Capes, and Sounds: The North Carolina Coast (Winston-Salem, NC: John F. Blair Publisher, 1988), 11.

submergence, wave/wind influence, and the rate of sediment deposition.[13] An island may migrate seaward if the sediment supply increases beyond the other two factors or migrate landward if the supply falls below that of the others.[14] Conditions along the North Carolina coast have produced islands which are slowly migrating shoreward and are maintained by a process known as overwash.[15] This process of island formation has allowed the North Carolina's barrier islands to migrate as much as 50 miles inland since their formation 18,000 years ago.[16]

Wave action and shifting sand have created many inlets through narrow sections of the coastal islands. The majority of these inlets are temporary, either migrating along the coast or closing altogether as near shore currents transport sand parallel to the coastline. The only permanent inlets occur along the southern coast where the mouths of significant rivers provide enough force to maintain stable inlets.[17] In the vicinity of New Topsail Inlet this migration has varied over time. Research by Wilson Angley has indicated that the inlet was stable through much of the Colonial period.[18] But by the beginning of the nineteenth century the inlet began a northward migration which continued until

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[13]Hoyt, "Barrier Island Formation," 1131.

[14]The rate of submergence plays a key role in the survival of barrier islands. If the rate is too great the islands could be inundated and totally eroded by the sea. If the rate slows down too much the lagoons may fill in and the islands become connected to the mainland. Ibid., 1131.

[15]Overwashing occurs when storms and tides breach the dune line and transport sand inland away from the shoreline. The slack waters of the lagoons and bays behind the islands act as sand traps, allowing sand carried in from the ocean to settle out, building up the barrier islands from the back side. Schoenbaum, Islands, Capes, and Sounds, 11-12.

[16]This process has slowed during the last 5,000 years as the rate of sea level rise has declined. However, this process has not stopped. The rate of sea level rise today is approximately one foot per century. Ibid., 12.

[17]Ibid., 12.

last quarter of the that century.[19] Modern studies of the inlet indicate that a reversal of the migration pattern has begun. Between 1939 and 1972 the inlet has migrated 2,680 feet to the south, an average movement of over 25 feet a year.[20]

New Topsail Inlet is located along the southern coast of North Carolina approximately 20 miles northeast of Wilmington. The inlet is bounded by Topsail Beach to the north and Lea Island to the south. The survey area encompasses a 6-square-mile area centered on the inlet (Figure 4). It lies parallel to the shoreline beginning just beyond the surf zone and continues offshore to the approximate location of the 30-foot contour.[21] The project area extended three miles on either side of the inlet. Coordinates for the survey area in North Carolina State Plane Lambert Coordinates, NAD 1983 are:

Point	Easting	Northing
A	2418172	229711
B	2421745	225821
C	2398435	204365
D	2394859	208254

[18]Wilson Angley, An Historical Overview of New Topsail Inlet (Raleigh, NC: North Carolina Division of Archives and History, 1984), 7.

[19]Comparisons between the Mouzon Map of 1775, Price-Strother Map of 1808, and the U.S. Coast Survey Map of 1865 shows a net northward migration of approximately four miles. Ibid., 7.

[20]This southward migration is not regular. Almost half of that migration (1,286 feet) occurred during a 7-year period between 1949-1956. The study which charted this movement concluded that the inlet would continue its southward migration. Jay Langfelder, et al., A Historical Review of Some of North Carolina's Coastal Inlets, Center for Marine and Coastal Studies, Report No. 74-1 (Raleigh, NC: North Carolina State University, 1974), 30.

[21] The 30-foot contour was chosen as the termination for the survey because the vessel was known to have grounded during the storm. A vessel of *El Salvador*'s size would normally have a draft not exceeding 15 feet.

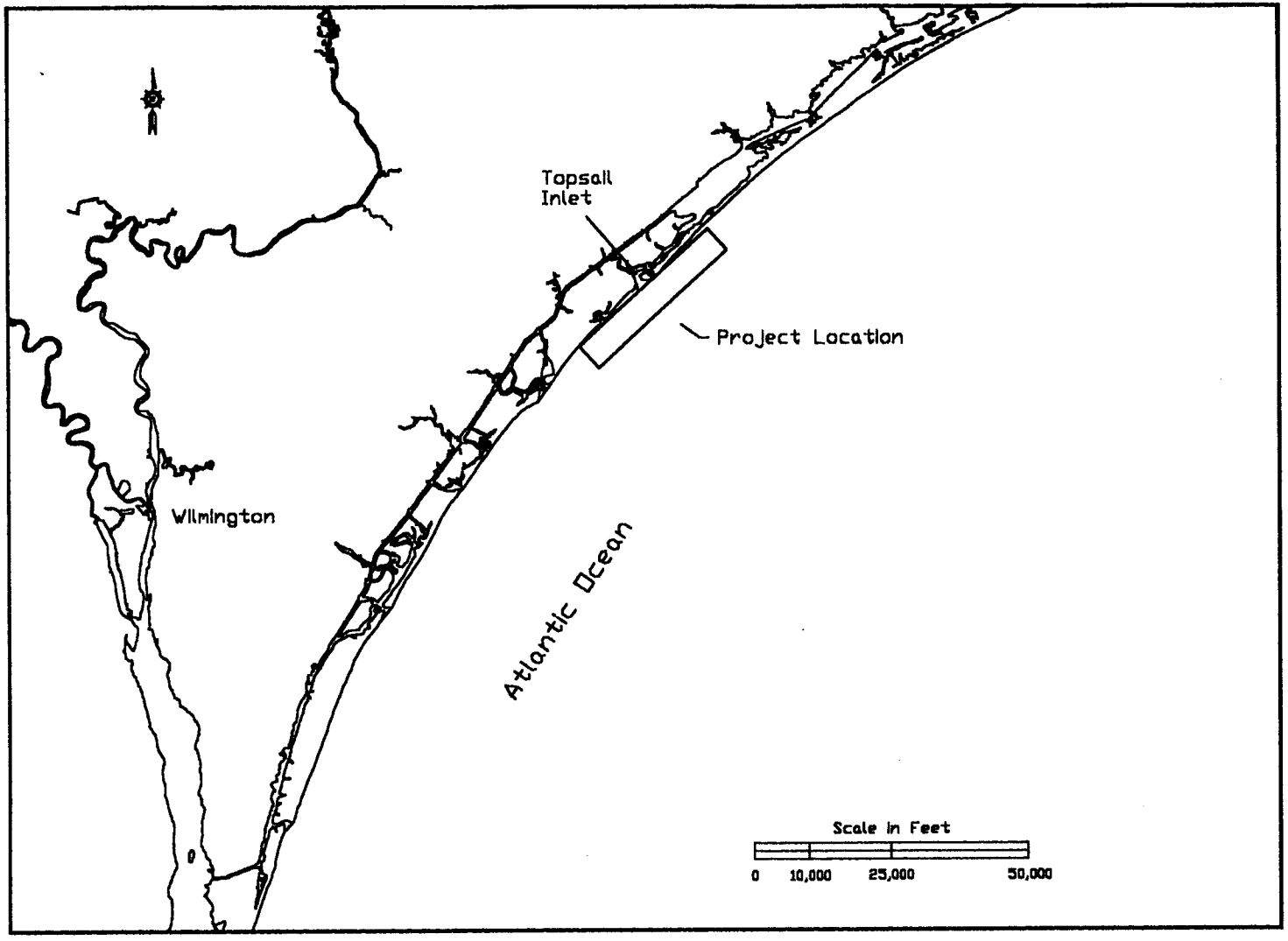

Figure 4. **Location of *El Salvador* Survey Area.**

Remote Survey

The remote sensing survey was conducted from a 25-foot research vessel capable of operating in shallow inshore areas as well as deeper waters. Researchers systematically surveyed the study area with an EGG 866 proton precession magnetometer capable of +/- 1 gamma resolution. To minimize the influence of modern debris and shoal water the magnetometer sensor was towed just below water surface. The magnetometer was also towed a minimum distance of 50 feet behind the survey vessel to prevent engine noise from affecting the record. Magnetic data was collected both electronically and on a paper recorder to provide a permanent hard copy of the data.

A 500 kHz Klein 521 side scan sonar was employed after the general magnetometer survey to investigate magnetic anomalies which contained signature characteristics suggestive of shipwreck material. This methodology was used because the long shore currents and sandy bottom have a tendency to bury exposed objects after relatively a short time. The sonar sensor was towed just below the water surface to account for the varying water depth in the survey area. The sonar was set on a 50 meter (150 foot) scale to provide adequate coverage of the bottom surface in the vicinity of targets.

During the survey, vessel positioning and lane spacing were controlled by a NavStar XR5-M Differential Global Positioning System in conjunction with a notebook computer utilizing Coastal Oceanographics' Hypack navigation and positioning software. Differential corrections were received from the United States Coast Guard beacon at Fort Macon. All data was recorded in North

Carolina State Plane Lambert Coordinates, 1983 North American Datum. Positioning data generated by the NavStar system was correlated to magnetometer and sonar records by annotations.

The 6-mile-square survey area was divided into six 1-mile-long sections (Figure 5). Survey lanes were established parallel to the shore with lane spacings maintained at 75-foot intervals.[22] The number of lanes surveyed depended on the location of the 30-foot contour for each area. All anomalies located during the survey were resurveyed on a 30-foot lane spacing to further refine the target's signature and eliminate signatures which may have been generated by electromagnetic disturbances such as solar flares or sun spots. Diurnal variation, slow changes in the magnetic field from solar winds, do not normally affect surveys designed to detect sudden changes in the magnetic field caused by ferrous objects.[23] Though of little relevance in terms of the objects for the current survey, the effects of diurnal variation were noted, when encountered, during analysis.[24]

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[22]During the Texas Antiquities Commission's 1974 survey to locate the remains of the 1554 New Spain fleet project archaeologists postulated the maximum lane spacing that could used which would still be sensitive enough to detect sites that were scattered in nature but had a central concentration of hull remains/artifacts. In that study it was determined that sites of a scattered nature with a maximum depth of around 30 feet a maximum lane spacing of 165 feet would provide close to 100% assurance of locating all shipwreck sites within the survey area. J. Barto Arnold, A Matagorda Bay Magnetometer Survey and Site Test Excavation Project, Publication No. 9 (Austin, TX: Texas Antiquities Commission, 1982), 56. As the Topsail survey would cover water depths to at least 30 feet deep it was determined that a 75-foot lane spacing would be sensitive enough to discover sites which may be located in the deeper reaches of the project area and in addition, provide extra coverage to locate small scattered objects that may be associated with *El Salvador* site.

[23] In general, corrections for diurnal variation are needed if anomalies are broad and typically less the 20 - 50 gammas or if the objectives of the survey is to obtain a good magnetic contour map expressive of deep-seated anomaly sources such as geologic features. S. Breiner, Applications Manual for Portable Magnetometer (Sunnyvale, CA: Geometrics, 1973), 12.

[24] Diurnal variation was documented in a number of the survey blocks. See chapter five for further details on this phenomenon.

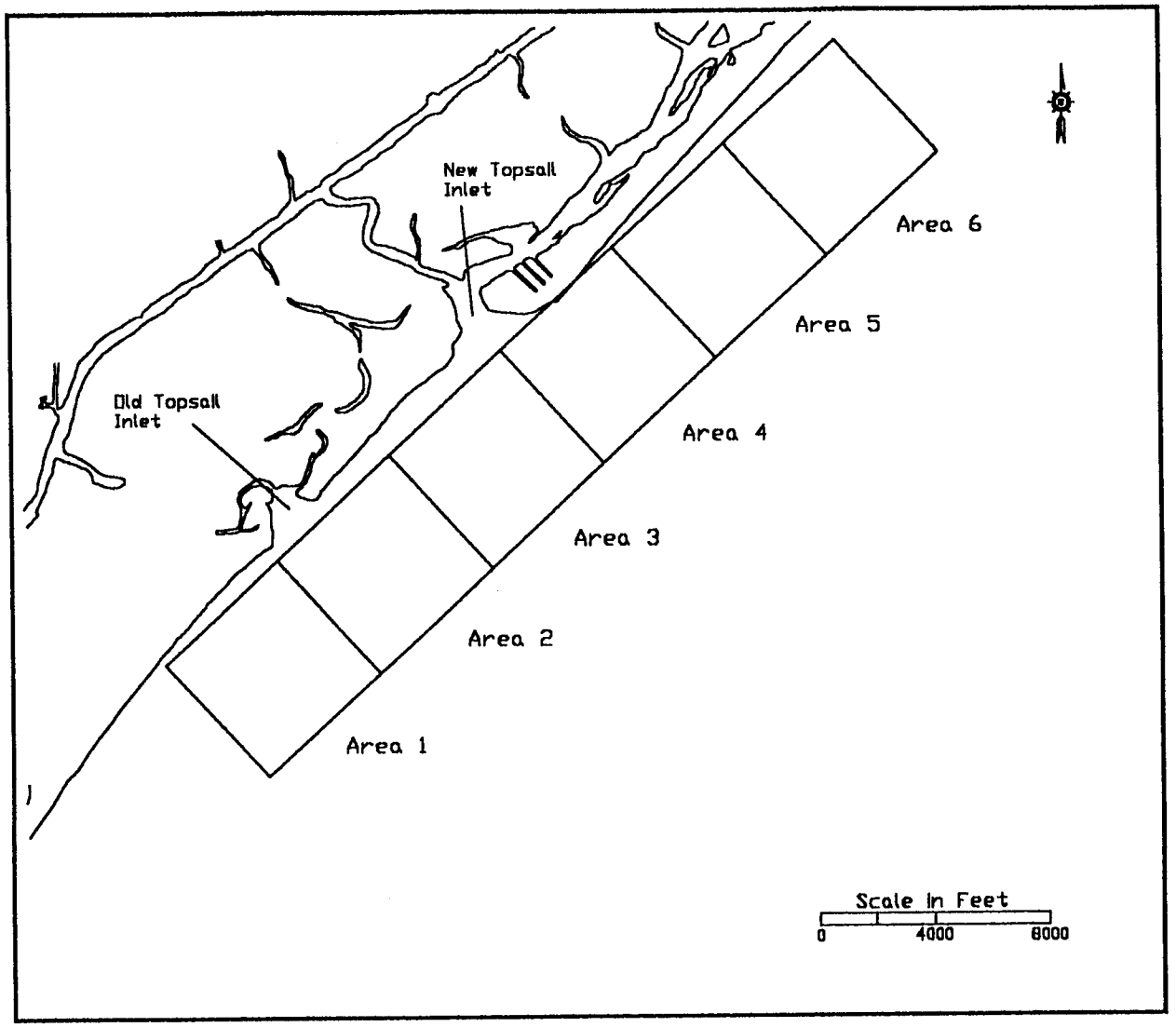

Figure 5. Division of Survey Area.

Data Analysis

Analysis of each target located during the remote sensing survey included location in North Carolina State Plane Coordinates, description of signature characteristics and depth, and significance of target based upon comparison with signatures previously identified as historically significant submerged cultural resources.[25] Magnetic signatures were analyzed according to intensity, duration, and extent. Acoustic signatures were analyzed according to intensity, height, and extent. Using QuickSurf software, magnetic data was contour plotted at 10-gamma intervals for analysis and accurate location of the material generating each magnetic anomaly. Acoustic records were correlated to the magnetic data by event marks to aid in target analysis and identification.

Diver Reconnaissance

Targets determined to represent potentially significant cultural resources were investigated by divers. Each target was relocated by magnetometer. Once relocated, each anomaly was marked by a buoy which served as a control point for conducting a systematic search of the bottom surface. Each site was investigated by divers utilizing SCUBA diving equipment and Aga masks to provide diver-to-surface communication. Underwater reconnaissance was conducted by employing a circle search pattern. A line was attached to the target buoy and concentric circles were searched at 5-foot intervals. If that search failed

[25] The following chapter provides a comparative analysis of remote sensing signatures to identify characteristics which may be useful in identifying shipwreck sites.

to locate the object generating the signature, the area was re-examined using a Quatro Sensing hand-held underwater magnetometer.

If the material producing the remote sensing signatures proved to be modern, a sketch map was prepared with a description of the material and photographs taken, if possible. If the material was determined not to have any significance according to the criteria established by the National Register of Historic Places, no further investigation was carried out. At the conclusion of testing, the material was re-covered with sediment to ensure protection of the object.

Where target sites proved to be potentially significant and eligible for inclusion in the National Register of Historic Places, the investigation focused on providing information for identifying and assessing the resource. A baseline was deployed to provide a reference for data collection. All material exposed above the bottom surface was mapped using triangulation and photographed, if possible. Diagnostic material was only recovered to assist in determining and documenting the nature and significance of the archaeological record at the site. At the conclusion of field investigations, all exposed material was re-buried to protect the resource from deterioration.

Chapter 4

Comparative Analysis

The previous discussion on the wrecking process of *El Salvador* provides clues to the potential of the archaeological record associated with the vessel. Though high seas broke up the upper section of the packet boat, shifting sand buried the remaining hull and cargo under seven to eight feet of sediment within a matter of days. Evidence from other wrecked Plate Fleet vessels indicate that the survival of a significant part of the material culture associated with *El Salvador* may be high.[1] In all likelihood, that record will consist of the lower hull, the cargo stored there, and any heavy objects, such as cannons or anchors, from the upper works that were too heavy to be dispersed when that section of the ship broke up.

As this thesis is geared toward locating *El Salvador,* diver investigation of likely targets has been limited to a minimal assessment level of disturbance.[2] Due to these restrictions, locating the vessel will rely on the identification of a small amount of uncovered material. To help refine the search for *El Salvador* this chapter focuses on developing criteria, based on three comparative studies,

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[1]Archaeological investigations of the 1554 fleet in Texas, *El Nuevo Constante* in Louisiana, and salvage ventures and archaeological investigations of the 1715 and 1733 fleet losses in Florida revealed the extent of the archaeological record for 12 vessels. These vessels all lie in dynamic environments, many of which were exposed on the ocean bottom, and were heavily salvaged by the Spanish. Despite those conditions a number of them were noted to be relatively intact and have yielded large collections of artifacts. Arnold and Weddle; Pearson and Hoffman; James P. Delgado, Encyclopedia of Underwater and Maritime Archaeology (New Haven, Yale University Press, 1997).

which may prove useful in identifying eighteenth century shipwreck sites and Spanish Plate Fleet vessels in particular. First, the remote sensing records of seven contemporary wrecks were analyzed for signature characteristics that may aid in defining a wreck during the archaeological survey. Following that, the hull remains of seven previously investigated eighteenth century wreck sites were examined to study the evolution of merchant ship design during the period. Finally, the artifact record from eight eighteenth century Spanish Plate Fleet vessels were studied in an effort to classify diagnostic artifacts that may be useful in distinguishing that type of wreck site from other period wrecks. Information obtained from these studies will be used during the archaeological investigation as a means for locating potential wreck sites and possibly identify *El Salvador*.

Remote Sensing Signature Comparison

The principal and perhaps the most effective method for locating submerged cultural resources is a combination of magnetometer and side scan sonar. These two systems, one for identifying exposed objects and the other for detecting ferrous material on and below the bottom surface, are ideal for locating historic wrecks. They are also, however, excellent for finding non-shipwreck material such as dredge pipes, cable, rocks, and other debris. To aid in differentiating anomalies which may represent submerged cultural resources it is

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[2]Stipulations of the permit between the State of North Carolina and the Institute for International Maritime Research allowed for only a small amount of excavation to identify and assess the source of any potentially significant remote sensing target.

useful to study the data of previous surveys in which wrecks were located and identify characteristics which may delineate wreck material from modern debris.

Since the survey methodology focuses primarily on a magnetometer with complementary use of a side scan sonar on identified targets, efforts have been directed toward studying the types of magnetic disturbances which may constitute a possible shipwreck site. To aid in this search the remote sensing records from seven eighteenth century sites have been selected for analysis. These wrecks included Site 0003BUI (tentatively identified as the *Queen Anne's Revenge*) and the Otter Creek wreck in North Carolina; the tentatively identified *Industry* site in St. Augustine, Florida; *El Nuevo Constante* in Louisiana; Site 38BK426 in Charleston; and HMS *Fowey* and the Boca Chica Channel wreck in Florida. Strip charts and contour maps from these sites were analyzed for field intensity, duration, area influenced, and other characteristics which might aid in identifying similar shipwreck sites (Table 1).

Magnetic anomalies are a product of a number of factors including distance and orientation of the object from the sensor, speed of survey vessel, and mass of the detected ferrous material. The impact from these various influences produce anomalies which can vary in type of signature, intensity, and duration; even for anomalies created by the same object. The seven examined sites illustrate the impact of those biases on their recorded signatures. Each of these sites has been investigated or is currently being investigated and the extent

Table 1

Magnetic Signature Characteristics of Seven Eighteenth Century Shipwreck Sites

Site	# of lanes detected	Lane spacing	Area influenced	Maximum intensity	Maximum length of detection	Maximum duration
0003BUI	4	50 ft	40,500 sq. ft.	214 g	175 ft.	21 sec.
Industry	2	75 ft	84,000 sq. ft.	101 g	195 ft.	15 sec.
El Nuevo Constante	4	50 ft	26,000 sq. ft.	68 g	300 ft.	58 sec.
Otter Creek wreck	1	50 ft	Not documented*	44 g	50 ft.	9 sec.
Boca Chica Channel wreck	4	15 ft**	1,000 sq. ft.	20 g	40 ft.	5 sec.
38BK426	3	Varied***	17,500 sq. ft.	25 g	150 ft.	30 sec.
HMS *Fowey*	1	90 ft	21,600 sq. ft.	35 g	130 ft.	9 sec.

*The area influenced could not be determined because of the limited nature of the site's survey which consisted of only two lanes.
**As the Boca Chica Channel survey followed the curving navigation channel strict survey lines were not followed. The boat maintained its 15-foot lane spacing by line of sight; some lanes passed close to each other and even crossed in some areas as a result.
***The survey was conducted using a radial pattern originating from a station on shore.

of the surviving remains are mostly known.[3] Data from those sites show that signatures produced from individual lane data often does not reflect the true

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[3]The Boca Chica Channel wreck was located in approximately 10 feet of water. Nearly 27 feet of lower hull structure survives under the ballast pile. The Otter Creek vessel was documented at 58 feet long and was preserved to the turn of the Bilge. It lies in lies in 4 feet of water. Site 38BK426 was recorded at 85 feet long and was nearly intact to the turn of the bilge on the port side and partially intact on the starboard side. It is located in 10 feet of water. HMS *Fowey* consisted of only a 40-foot section of hull structure lying in approximately 28 feet of water. Sites 0003BUI and the *Industry* are currently under investigation. Both lie in approximately 20 feet of water. At 0003BUI a limited amount of hull structure has been observed along the edges of the 25 x 15 foot ballast pile which contains 11 cannons, 3 anchors, and a number of iron hoops. At the *Industry* site a similar limited amount of wood was noted around the periphery of the concentration of eight cannon, two anchors, a number of bar stock, and a scatter of shot. The site covers an approximate 13 1/2 by 10 1/2 foot area. David Grant, Naval Historical Center, personal communication, 26 February 1999; Claude V. Jackson, III, "Historical and Archaeological Investigations of a Sunken Federal Period Vessel near Oriental, North Carolina" (M.A. thesis, East Carolina University, 1992); Gordon P. Watts, Jr., "Submerged Cultural Resource Survey and Assessment of the Mark Clark Expressway, Wando River Corridor, Charleston and Berkeley Counties, South Carolina." (Columbia, SC: South Carolina Department of Highways and Transportation, 1980); Matthew Russell, National Park Service, personal communication, 4 March

nature of a site. While concentrations of ferrous material appear to produce more intense anomalies the magnetic signature obtained from the *Fowey* site indicates that the presence of ferrous material does not guarantee a strong signature.[4] Also, the lack of concentrated *in situ* ferrous material may make sites with significant surviving hull structure, such as the Otter Creek wreck, appear in the records like those with limited material like the Boca Chica Channel site.

Furthermore, modern material can just as easily produce individual signature characteristics identical to shipwreck material. Surveys in the vicinity of Morehead City, North Carolina and the Elizabeth River, Virginia produced magnetic signatures comparable to those observed for the wrecks above. These anomalies were only identified as objects other than shipwreck material through ground truthing.[5] Ground truthing of these anomalies involved a visual inspection of the bottom surface and/or limited excavation to expose subsurface

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1999; Mark V. Wilde-Ramsing, "A Report on the 1997 Archaeological Investigations at North Carolina shipwreck site 0003BUI" in Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference, eds. Lawrence E. Babits, Catherine Fach, and Ryan Harris (Atlanta, GA: Society For Historical Archaeology, 1998), 54-60; John W. Morris et al., "The St. Augustine Maritime Survey: 1998 Report on the Tube Site 8SJ3478" (Pensacola, FL, Southern Oceans Archaeological Research, Inc., 1998); John William Morris III, personal communication, 4 March 1999.

[4]The track of the survey vessel passed nearly over the known cannon as well as a number of other iron artifacts in the northern part of the site. Investigations of the wreck of the *San Estaban* at Padre Island also encountered iron artifacts of low magnetic intensity. On that site a 345 kg anchor was found to have created a 30 gamma anomaly while two wrought iron cannons with breeches produced only a 10 gamma target. Arnold and Weddle, 197.

[5]Four anomalies from those surveys, targets MHC-10 (59 gammas, 8 seconds) and MHC-20 (73 gammas, 11 seconds) at Radio Island and targets ER-02 (16 gammas, 9 seconds) and ER-13 (145 gammas, 15 seconds), contained signature characteristics similar to those produced by the *Industry*, Otter Creek, and Boca Chica Channel wreck. These targets were all determined by diver investigation to have been produced by modern material such as wire cable, iron pipe, and other miscellaneous debris. Gordon P. Watts, "Underwater Archaeological Remote Sensing Survey and Site Investigation Adjacent to Radio Island, Morehead City, North Carolina" (Raleigh, NC: Rust Environmental & Infrastructure, Inc., 1998), 34, 52; Gordon P. Watts, "Underwater Archaeological Site Documentation at the Southern Branch of the Elizabeth River, Norfolk Harbor, Virginia"

material. Because of this large degree of variety among signature types, identifying sites by individual lane data alone, without ground truthing is extremely difficult if not impossible.

Contour maps produced from a survey's collected data provide a more useful tool for identifying the characteristics of shipwreck sites than individual lane data. Such maps indicate the mass and distribution of ferrous material on a site. The contours for the above sites suggest that submerged cultural resources influence the earth's magnetic field over fairly sizable areas. Five of those sites created disturbances detectable over 20,000 square feet or more.[6] The resulting contours were generally irregular in shape and multi-component in nature (Figures 6, 7, 8, 9, 10, 11).[7] Areas with concentrations of ferrous material appeared as point sources within the site's contours. The ballast pile and its associated cluster of iron artifacts at site 0003BUI and the anomaly recorded south of *El Nuevo Constante*'s hull represent such point sources.[8] Lesser clusters of material, possibly indicating scatters of debris, appear as weak disturbances as was noted at site 38BK426 and in the northern and northwestern parts of 0003BUI.

The magnetic features of the seven examined sites has revealed attributes which may prove useful in identifying shipwreck sites during remote sensing

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(Wilmington, NC and Norfolk, VA: U.S. Army Corps of Engineers, Wilmington and Norfolk Districts, 1997), 14, 17.

[6]The limited hull structure and poor condition of the few surviving iron artifacts were responsible for the small contour map generated by the Boca Chica Channel site.

[7]The *Fowey*'s relatively simple looking contour was the product of the contouring programs effort to compensate for the single lane detection and large sampling distance.

[8]That target produced an intense 155 gamma disturbance. The site's researchers, however, did not have the opportunity to investigate the target. Pearson and Hoffman, 104.

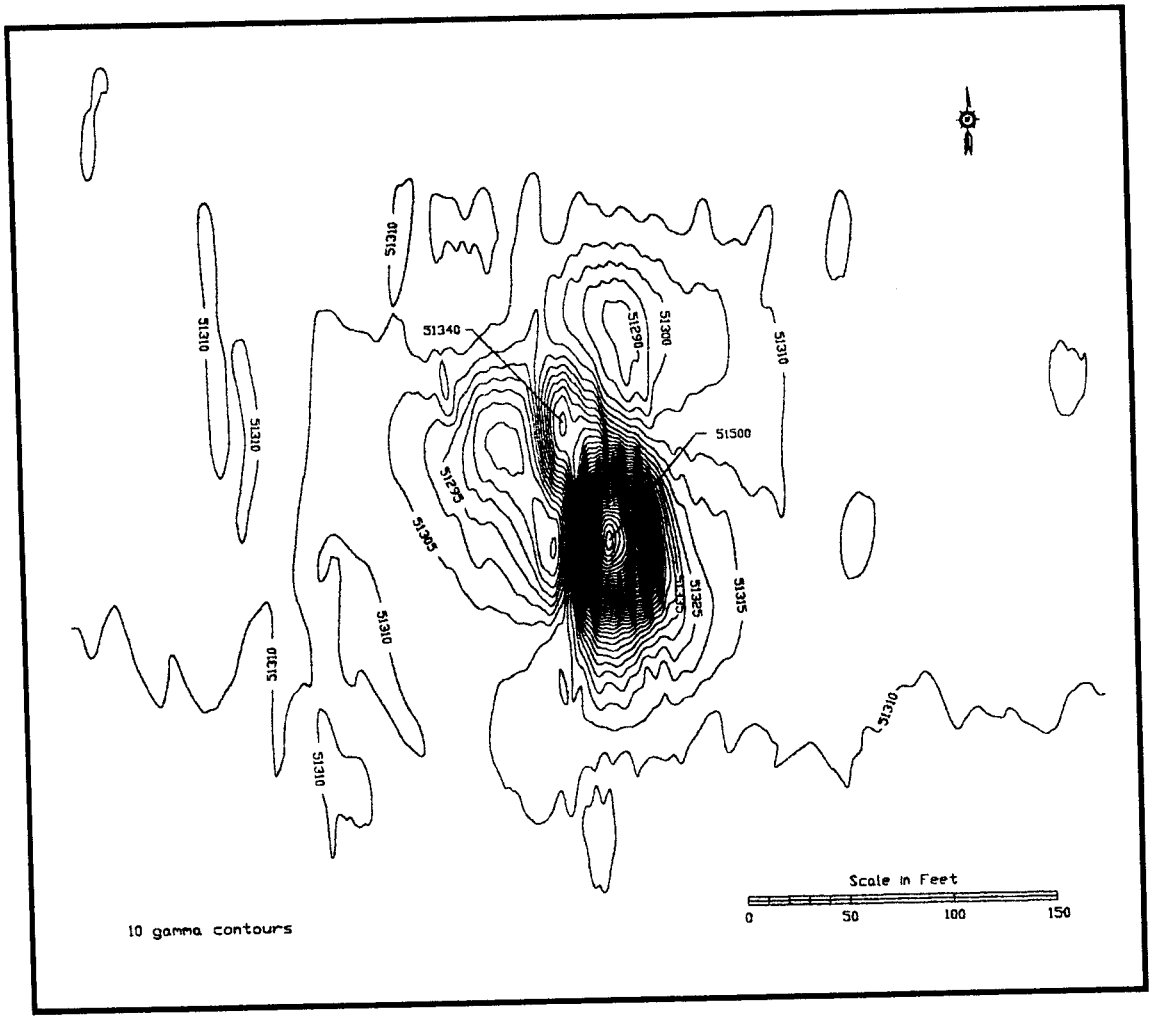

Figure 6. Magnetic contour map, 0003BUI site (Courtesy of the Underwater Archaeological Unit, Fort Fisher, N. C.

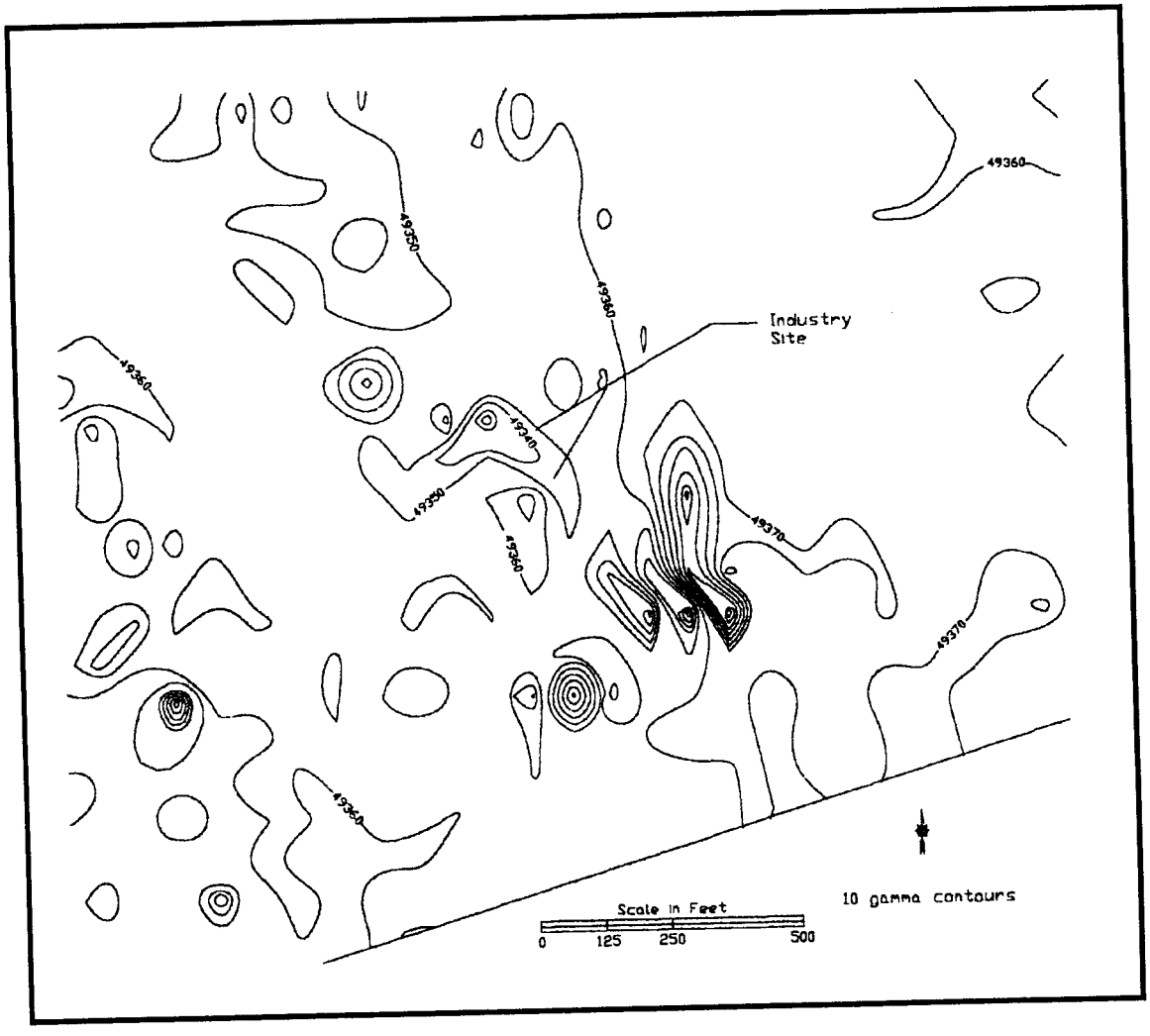

Figure 7. Magnetic contour map, *Industry* site (Courtesy of Southern Oceans Archaeological Research.

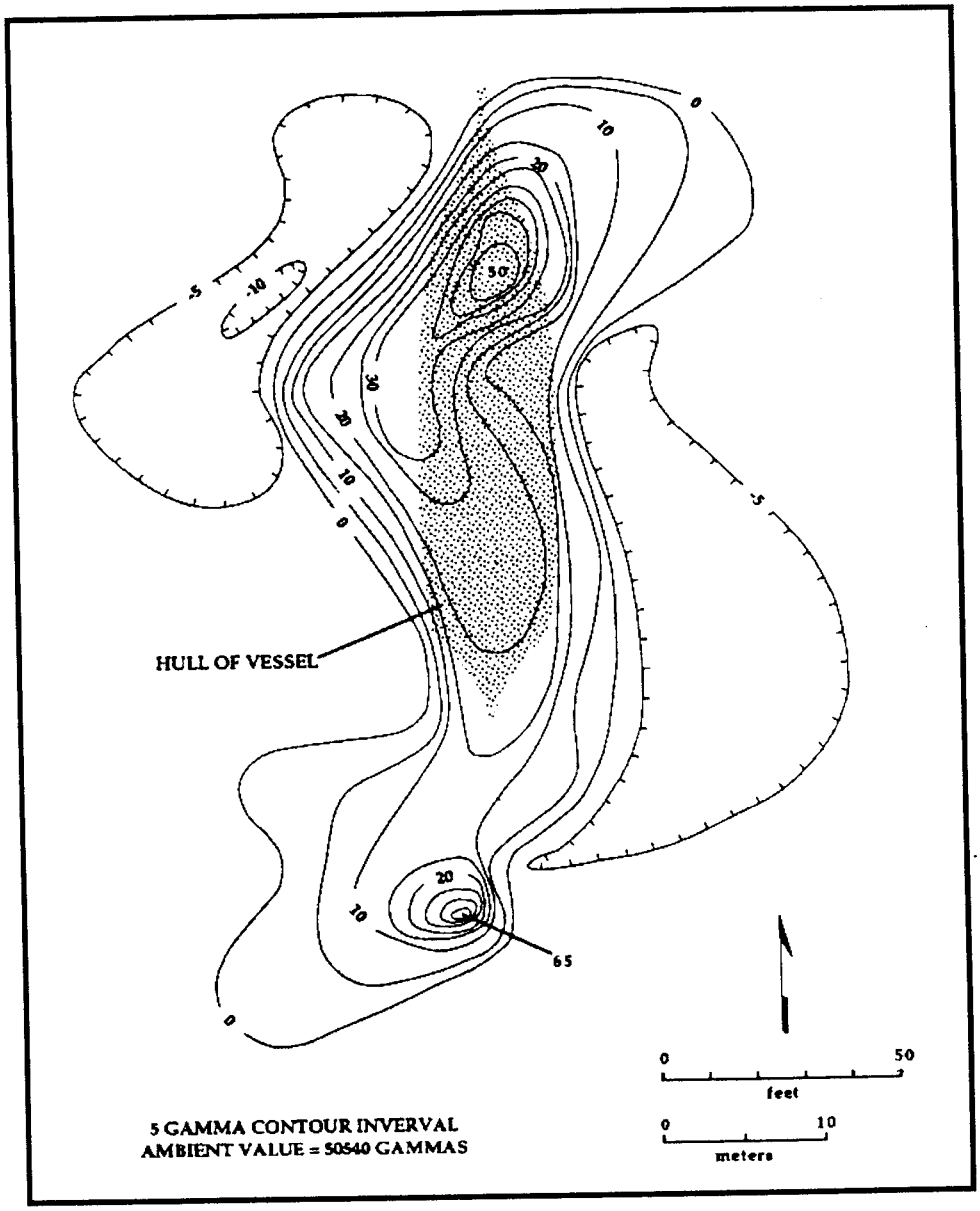

Figure 8. Magnetic contour map, *El Nuevo Constante* site (Pearson and Hoffman, 105).

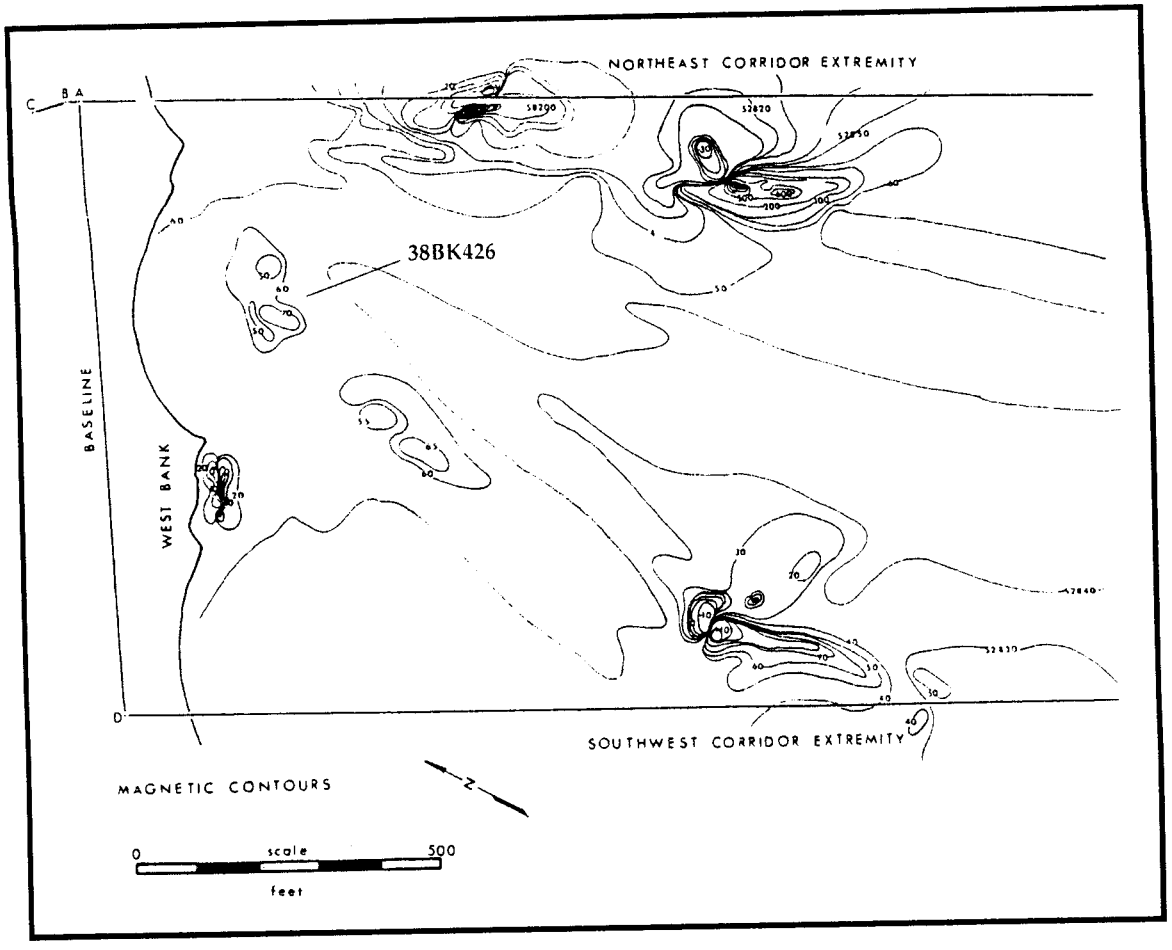

Figure 9. Magnetic contour map, 38BK426 site (Watts 1980, 25).

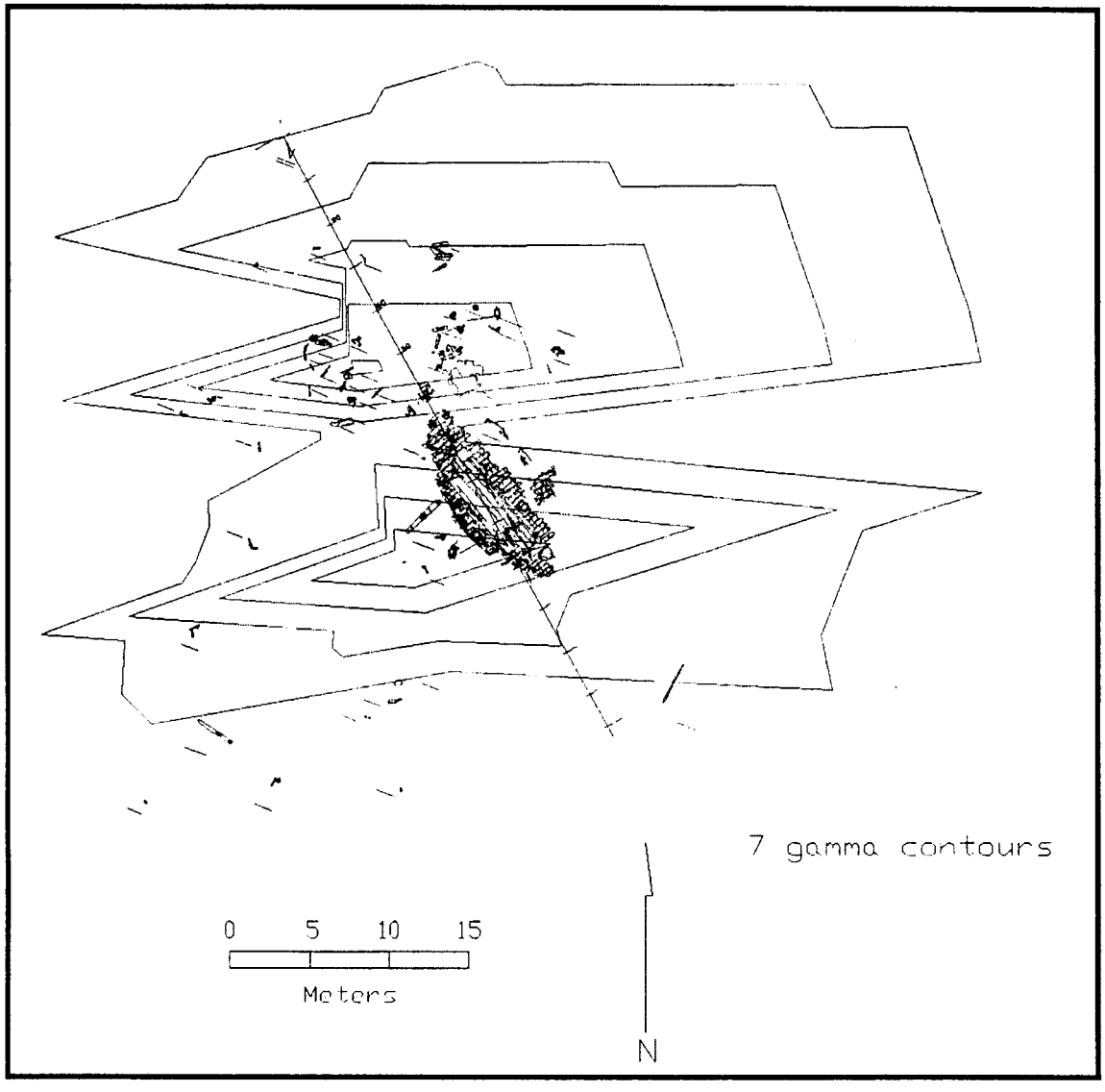

Figure 10. Magnetic contour map, HMS *Fowey* site (Courtesy of the Naval Historical Center and the National Park Service).

surveys. The examined sites indicate that the analysis of individual lane data alone is not recommended when attempting to identify sites.[9] None of the sites appear to be defined by any specific type of signature and in many cases, the signatures of modern debris can easily exhibit the same characteristics as wreck sites. Due to these limitations, Murphy and Saltus (1990) have suggested that any magnetic signature as small as 10 gammas detected over a distance of 45 feet using a lane spacing of 90 feet or a 5 to 10 gamma anomaly detected over two consecutive lanes should be considered potentially associated with shipwreck remains and be investigated to determine their identity.[10]

Contour maps, on the other hand, appear to offer a better indication of the nature of an anomaly, suggesting the size and distribution of material on the bottom. Such maps indicate that wrecks typically create complex magnetic disturbances that are detectable over relatively large areas. Even sites of low ferrous content, such as the 38BK426, have the potential to produce large, though less intense, complex signatures. However, caution should also be used when analyzing contour maps as modern debris may also simulate the contours of shipwreck sites and can only be distinguished from them by ground truthing.

It should also be noted that the nature of a site's signature characteristics is a product of the survey's methodology. Sites 0003BUI and *El Nuevo Constante*

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[9] In addition, single lane anomalies are in many cases the product of noise originating from either the boat's electrical system or electromagnetic activity such as solar flares or sunspots. Targets produced from such occurrences can be eliminated by properly grounding the equipment and/or resurveying target locations after completion of the general survey.

[10] Larry E. Murphy and Allen R. Saltus, "Considerations of Remote Sensing Limitations to Submerged Historical Site Survey" in Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference, ed. Toni L. Carrell (Tucson, AZ: Society For Historical Archaeology, 1990), 94-95.

were each surveyed in more detail after they were located and identified. Their surveys were designed to accentuate important features and confirm their extents. As a consequence, their contours were complex and very detailed. Conversely, the *Industry* and 38BK426 sites were located during typical archaeological surveys. Their methodologies were designed to locate all targets within their respective survey areas using the most efficient lane spacing. Their contours, though still covering a large area, were less intense on average. These last two sites most likely represent the types of anomalies commonly to be encountered during a remote sensing survey. It also illustrates that lane spacings as large as 75 feet are adequate enough to conduct a survey efficiently and still locate any potentially significant submerged cultural resource in the area.

Eighteenth Century Ship Construction

After a wreck site is located efforts typically shift to identifying the vessel and its period of construction. Wrecks with little or no associated artifacts can often be dated by structural evidence because, like any other technology, ship construction is fluid, constantly changing as new methods and materials are discovered and adapted for use. The eighteenth century was characterized by a number of changes in the design of merchant vessels. These changes reflected a desire to find more efficient techniques and were influenced by two major concerns: 1) problems of rot within ships and 2) the elimination of waste in the wake of a shortage of quality ship timber. Efforts to combat these problems can

be seen in alterations in the methods of framing vessels and the adoption and/or elimination of structures which increased efficiency and lowered costs.[11]

To assist in identifying potential eighteenth century sites located during the remote sensing survey data from other investigated contemporary vessels were examined for attributes commonly associated with English merchant ships from the period.[12] For this study, the hull remains of seven eighteenth century wreck sites were examined.[13] These wrecks include: the Rose Hill wreck (1725-1750), the Otter Creek wreck (post 1750), the Reader's Point vessel (post 1765), the *Betsy* (1772), the Bermuda wreck (post 1770), Fig Island Vessel 20 (late eighteenth century), and Fig Island Vessel 2 (late eighteenth-early nineteenth century) (Figures 12, 13, 14, 15, 16, 17, 18). Due to the limitations of the collected data this study focused only on those structures or features where enough information existed to make comparisons between the seven vessels meaningful (Table 2).

Deterioration was a major concern for builders as the decay of a hull could shorten a vessel's life span. A number of techniques employed during the seventeenth and early eighteenth century created conditions which favored rot.

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[11]Nearly every aspect on framing was altered during this period. Among the major changes to occur was a decrease the length of individual frames, an increase in the number of frame components, changes in joining frame components, shifting of the heels of the first futtocks toward the vessel's centerline, an increase in the spacing between frame sets, an increase in the molded dimension of the frames, and the adoption of cant frames. Modifications in framing patterns were not the only diagnostic characteristic for the period. Other noted modifications included the elimination of a hogging piece and alterations in the fastening pattern of the keelson.

[12] English merchant vessels were the primary focus because research has determined that the *El Salvador* was English built.

[13]Since it is usually the lower hull of a ship that survives in the archaeological record only those features, up to the turn of the bilge, will be examined.

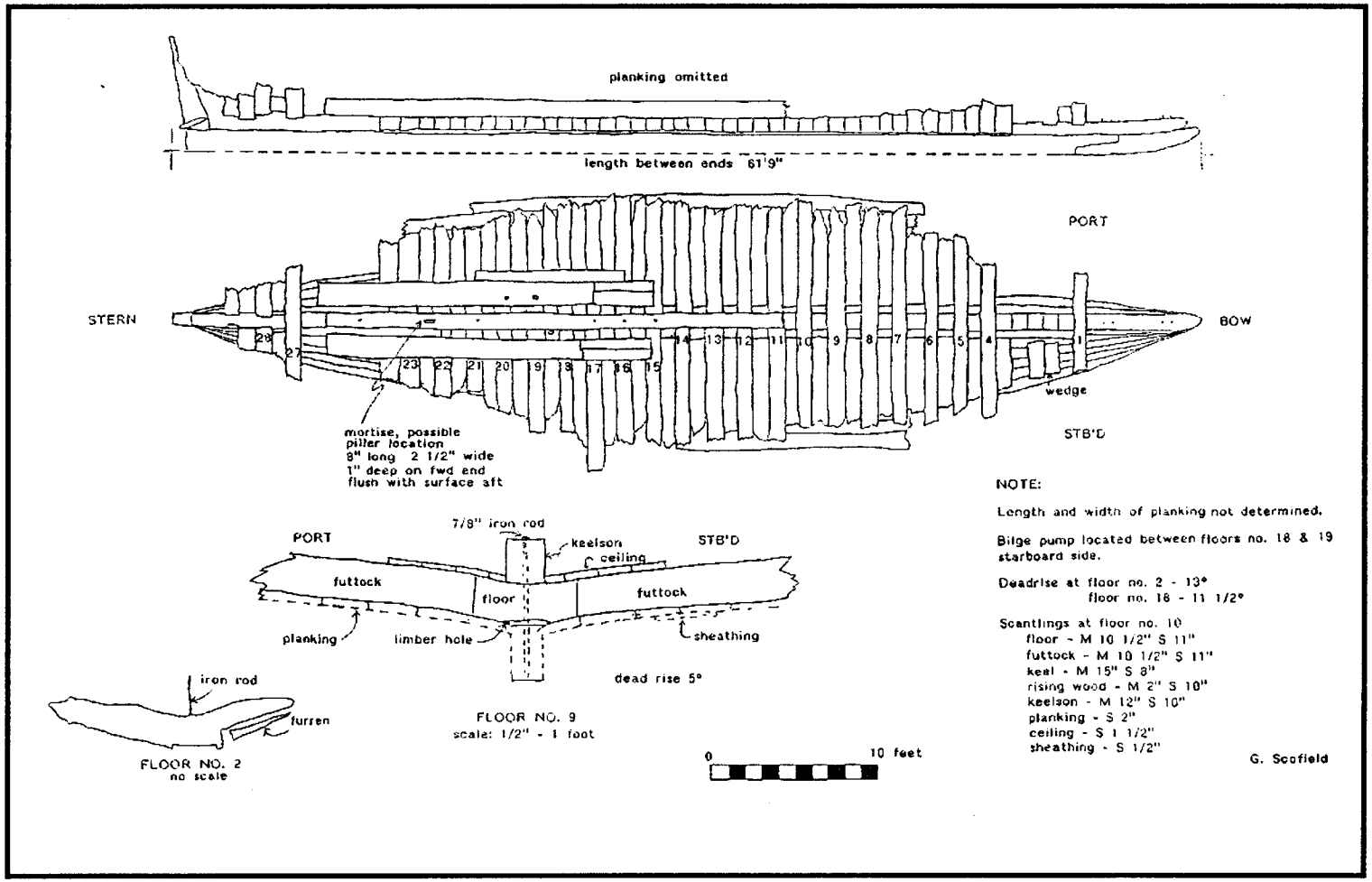

Figure 12. Hull Plan, Rose Hill vessel. (Wilde-Ramsing and others, "The Rose Hill Wreck: Historical and Archaeological Investigations of an Eighteenth Century Vessel at a Colonial River Landing near Wilmington, North Carolina" (Kure Beach, N. C., Underwater Archaeological Unit, North Carolina Division of Archives and History, 1992), 38).

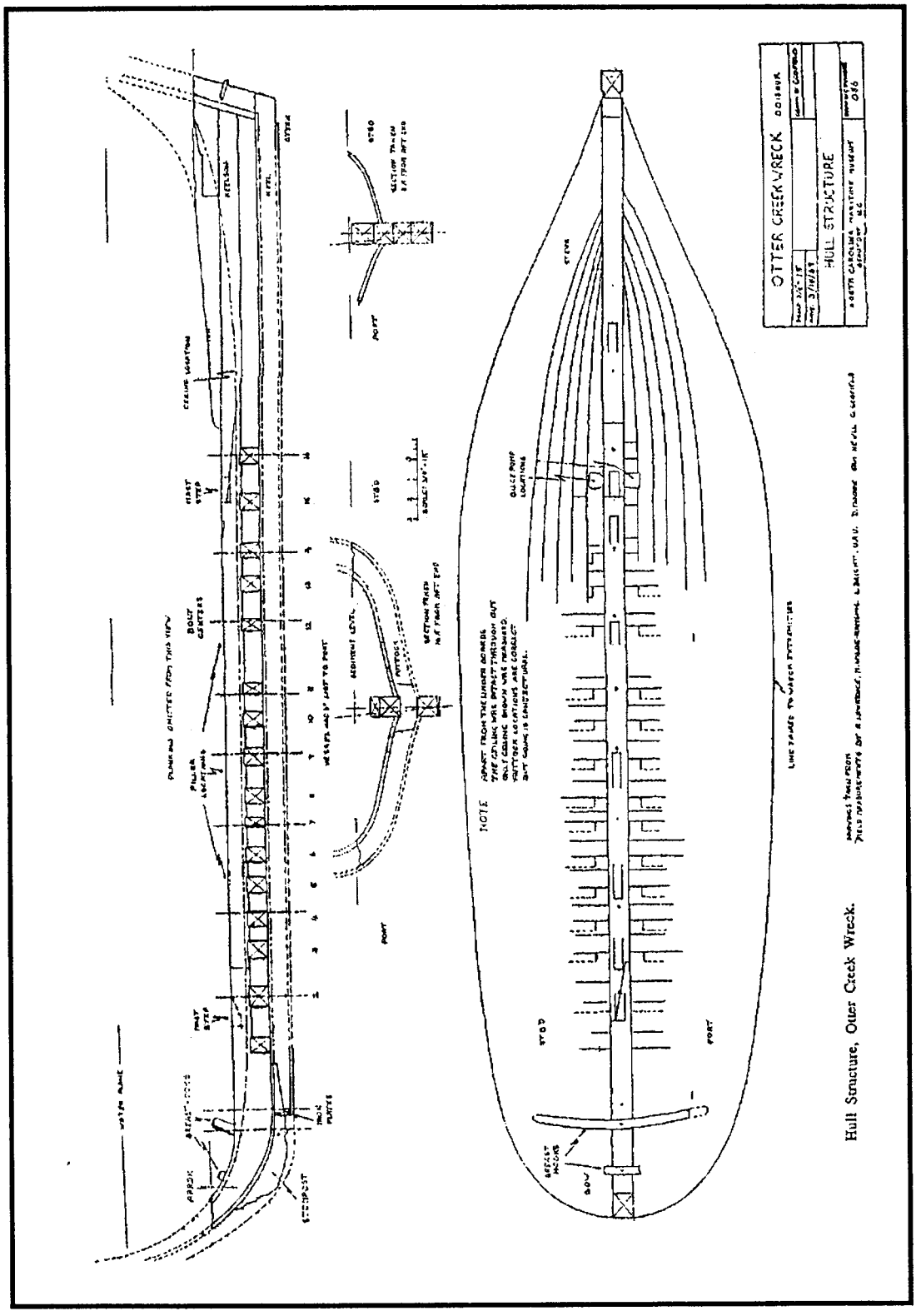

Figure 13. Hull Plan, Otter Creek wreck (Jackson, 62).

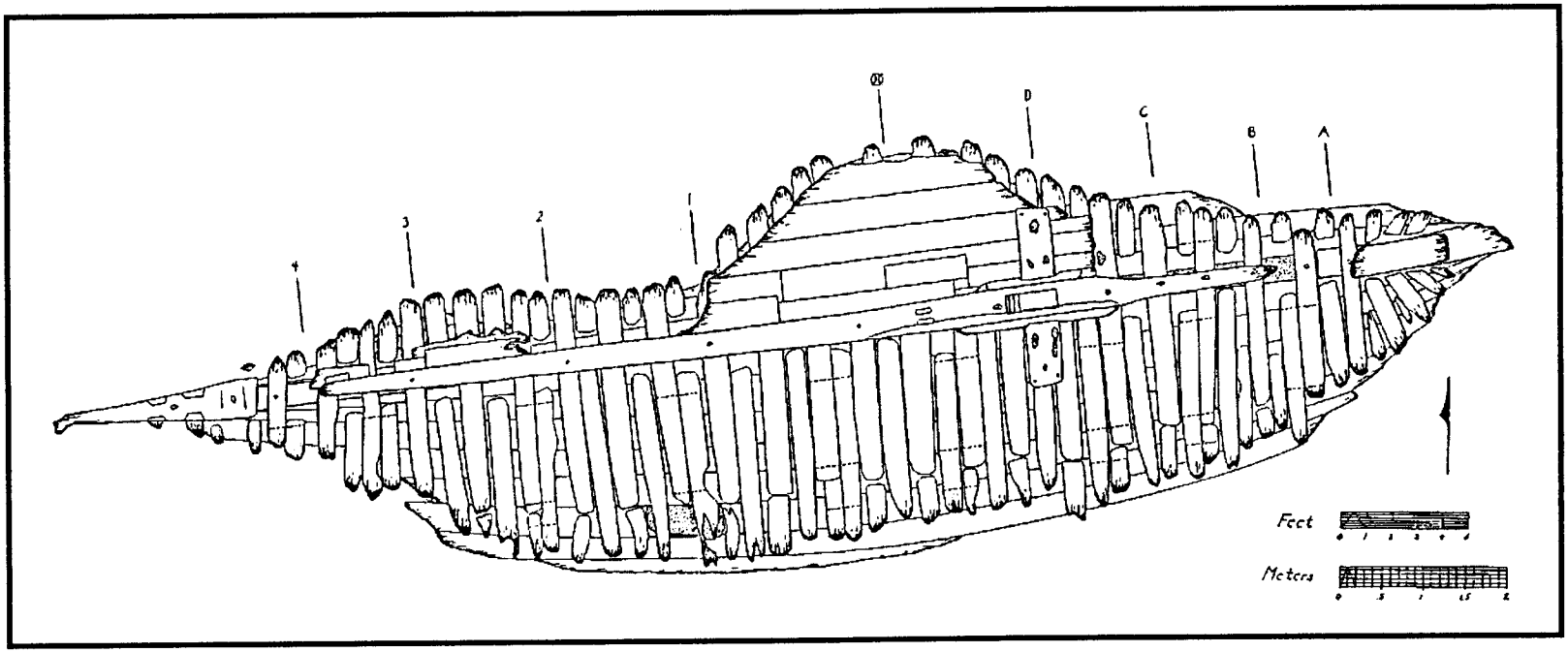

Figure 14. Hull Plan, Readers Point vessel (Gregory Cook, "The Readers Point Vessel: Hull Analysis of an Eighteenth-Century Merchant Sloop Excavated in St. Ann's Bay, Jamaica" (M.A. thesis, Texas A&M University, 1997), 110).

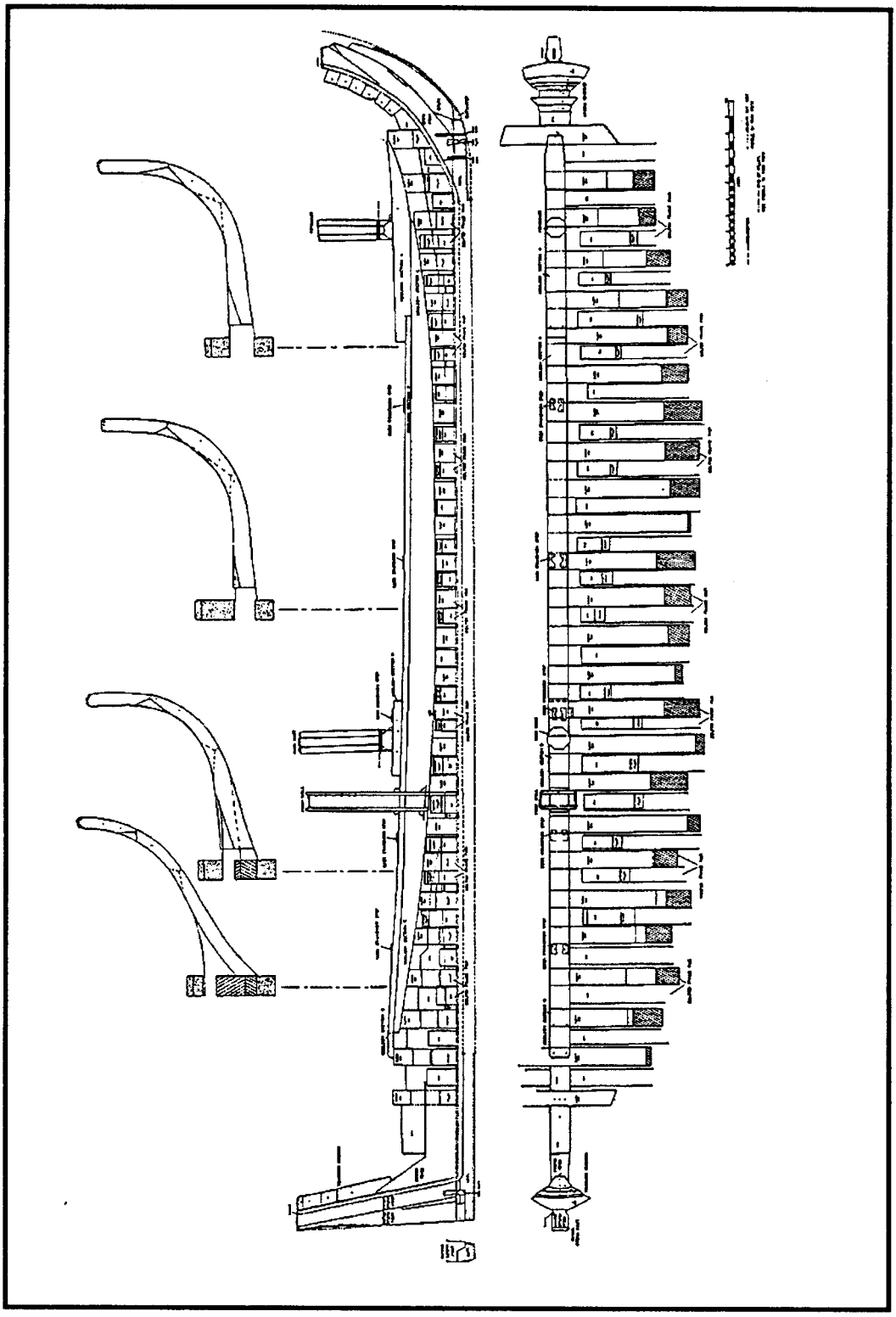

Figure 15. Hull Plan, *Betsy* (John D. Broadwater, "Final Report on the Yorktown Shipwreck Archaeological Project, Volume I: Project Summary" (n.p., 1996), 91).

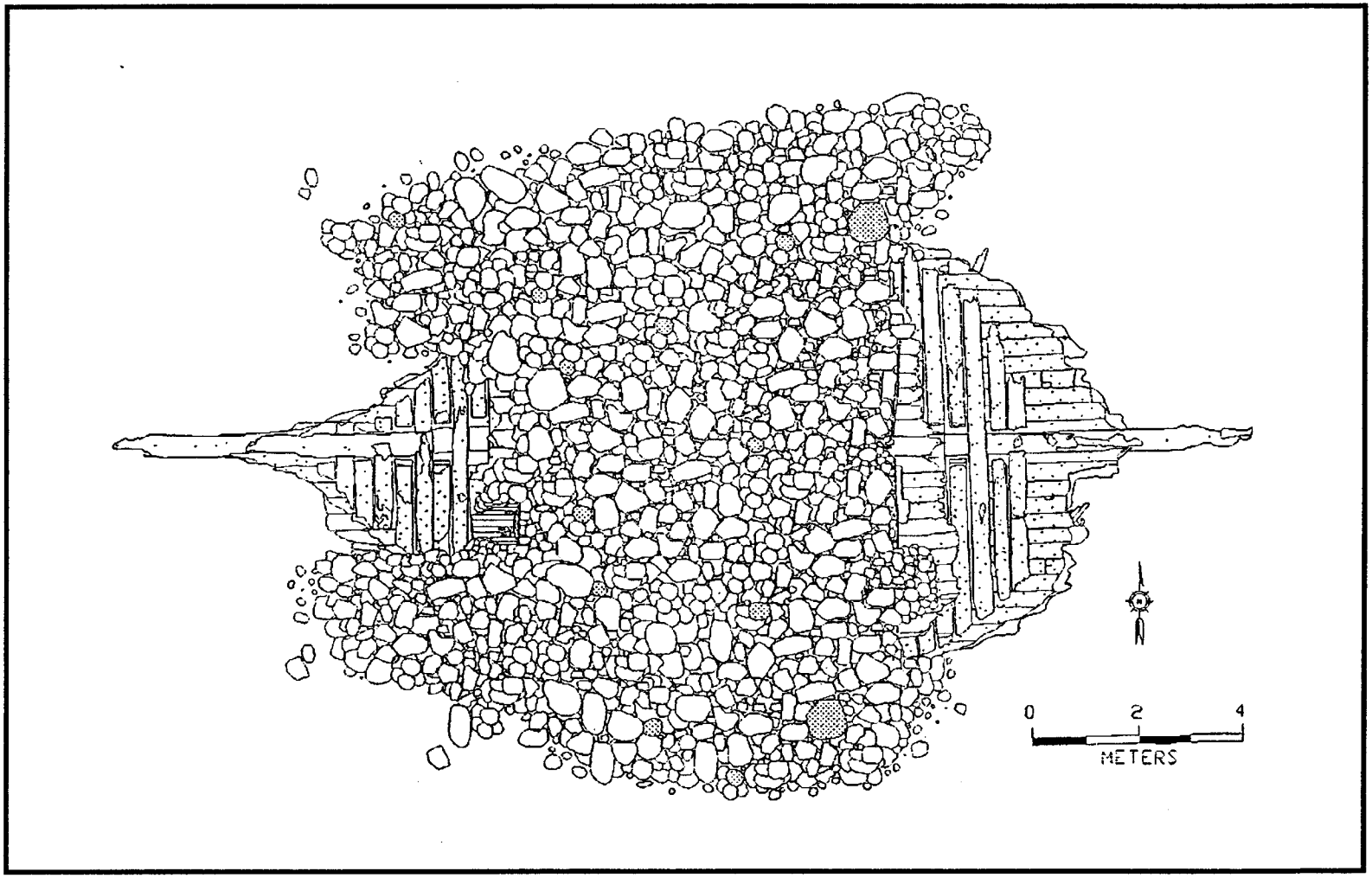

Figure 16. Hull Plan, Bermuda wreck (Michael Cameron Krivor, "Archaeological Investigation of an Eighteenth-Century British Merchant Vessel, Chub Heads Cut, Bermuda" (M.A. thesis, East Carolina University, 1998), 15).

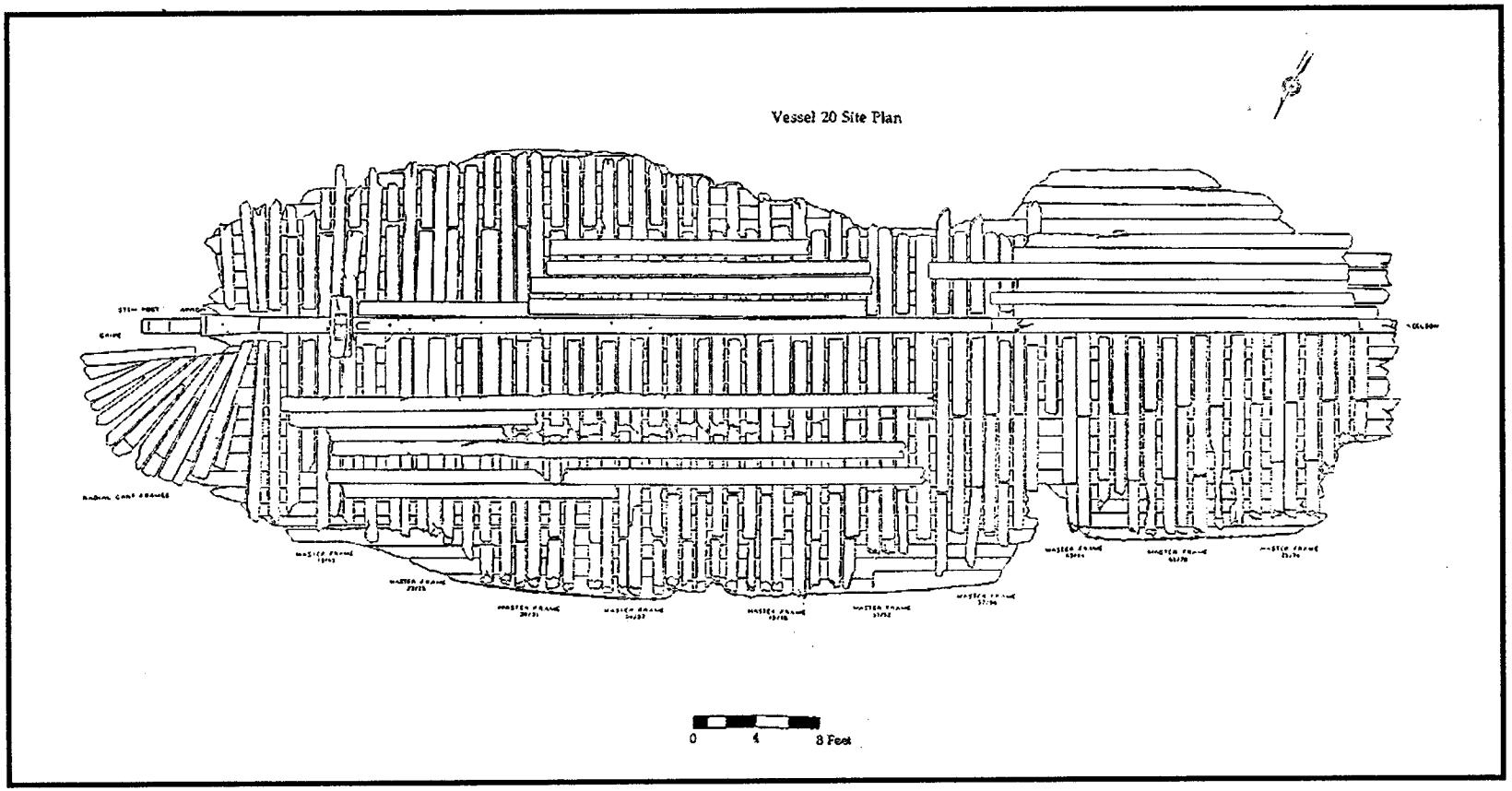

Figure 17. Hull Plan, Vessel 20 (Gordon P Watts, Jr. "Phase II Archaeological Data Recovery Area1 Fig Island Channel Site Savannah Harbor, Georgia" (Savannah, Ga.: U.S. Army Corps of Engineers, Savannah District, 1996), 51).

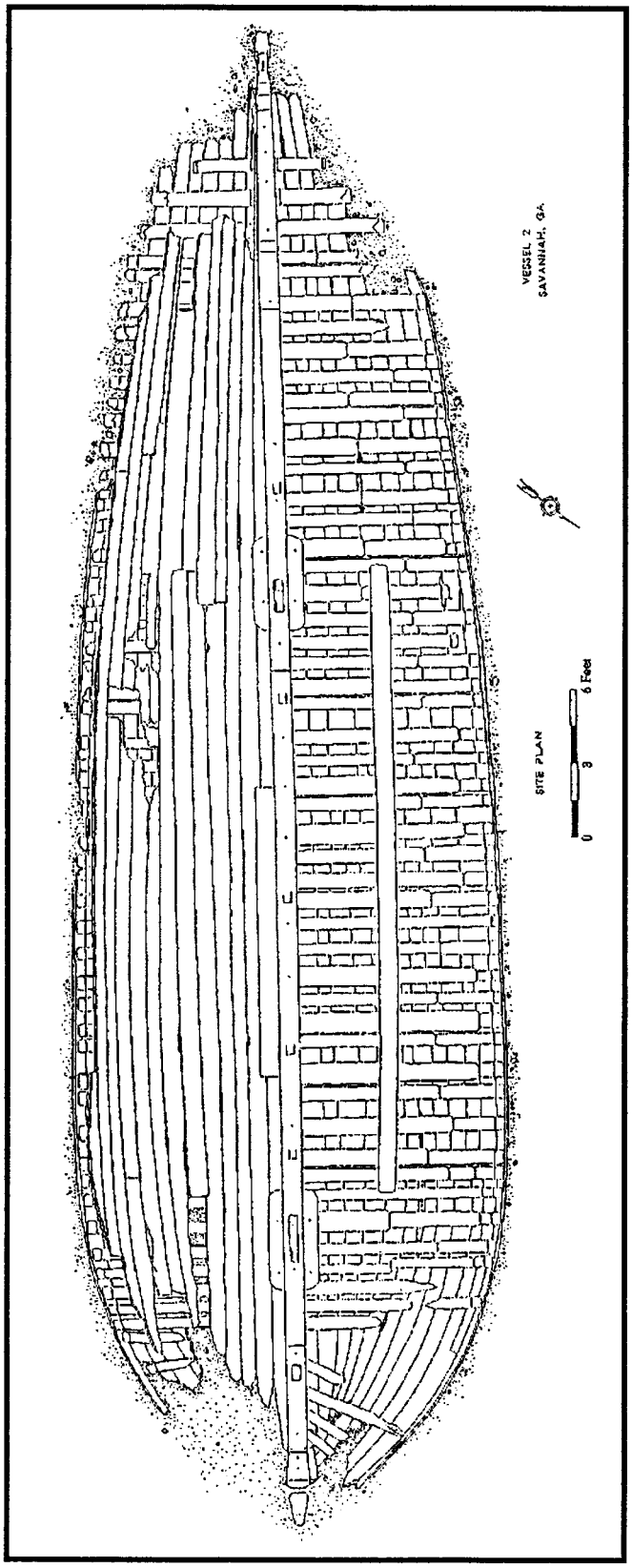

Figure 18. Hull Plan, Vessel 2 (Gordon P Watts, Jr. "Archaeological Data Recovery Area1 Fig Island Channel Site Savannah Harbor, Georgia" (Savannah, Ga.: U.S. Army Corps of Engineers, Savannah District, 1996), 65).

Table 2

Hull Characteristics of Seven Eighteenth Century Shipwreck Sites

	Rose Hill (1725-1750)	Otter Creek (post 1750)	Readers Point (post 1765)	Bermuda Wreck (post 1770)	Betsy (1772)	Vessel 20 (late 18th century)	Vessel 2 (late 18th-early 19th century)
Space*	None	Small, random between sets	Small, random between sets	Small, random between sets	Small, random between sets	Small, random between sets	Large, random between sets
Molded dimension	10 1/2 inches	12 - 13 inches	8 1/2 inches - 1 foot 1 1/2 inches	12 - 13 inches	Approx. 11 to 13 inches	8 1/2 - 11 inches	6 1/2 inches**
Sided dimension	11 inches	6 - 13 inches	7 1/4 inches - 1 foot 1/4 inches	12 inches	12 inches or greater	8 - 12 inches	6 1/2 - 11 1/2 inches***
1st Futtock offset	11 inches	13 1/2 inches	6 inches - 1 foot	6 - 8 1/2 inches	10 3/4 inches	At least 6 inches	Cross line of keelson but do not touch
Frame scarfs	Not preserved	Obscured by ceiling	Butt	Diagonal scarf	Butt	Butt	Butt
Cant frames	Not preserved	Obscured by ceiling	Yes, radial - most members touch centerline	Not preserved	Yes, radial - segmented apron and transom chocks, most members touch centerline	Yes, radial - most members touch centerline	Yes, unknown whether most members touch centerline or all do
Hogging piece	Yes	No	No	Yes	No	No	No
Notched frames	Yes	No	No	No	No	No	Yes
Keelson fastening	Random	Every floor	Every floor forward of the mast step and every third floor aft of step	Every floor	Possibly every floor, partially obscured	Obscured	Random

*Exact measures of the room and space were not fully noted. Space determination was made from site plans where sided dimensions of floors and 1st futtocks made educated guess possible.
**One floor measured 5 1/2 inches molded
***One floor measured less than 6 1/2 inches sided. That floor was sided 5 inches.

Principal among these were the use of tight framing and the placement of the first futtocks far from the vessel's centerline.[14] Tightly packed frames prevented fresh air from circulating within the bilge, allowing water which collected in the gap between the first futtocks and the keel to stagnate and become putrid. As leakage was an inevitable part of shipping builders focused on finding ways to inhibit the formation of rot. The problem was alleviated by increasing in the distance between the frames sets.[15] This new space allowed air to circulate from the upper decks to the bilge, keeping the collected water fresher prior to its removal by the pumps and also provided a watercourse below the ceiling to protect the cargo from water damage. In conjunction, builders also began to shift the heels of the first futtocks closer to the centerline as a means to offset the loss of strength caused by the new pattern of framing.[16]

An examination of the hulls for the above vessels appear to indicate that the use of fairly tight framing was retained by builders throughout most of the century. The earliest vessel, the Rose Hill wreck, retained the pattern of no space between the frame sets while the rest, all from the later part of the period, contained only small gaps between sets. That gap appeared to vary randomly through the vessels. By the turn of the century that distance became more significant. Vessel 2, constructed during that time, contained frame spaces that were half the width of an individual frame or greater.

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[14]Prior to the eighteenth century the first futtocks were placed approximately 18 to 24 inches from the centerline of a vessel. Peter Goodwin, The Construction and Fitting of the English Man of War, 1650-1850 (Annapolis, MD, Naval Institute Press, 1987), 15.

[15]Some open space was needed within the bilge to prevent water from rising above the ceiling and damaging cargo.

The migration of the first futtock heels on the other hand appears to have been a gradual but steady process. Four of the vessels (Rose Hill, Otter Creek, Reader Point and *Betsy*) show that by the third quarter of the century the first futtocks were being set approximately 10 to 14 inches from the centerline. That distance decreased to nearly 6 inches during the last quarter, as seen in the Bermuda wreck and Vessel 20, and by the turn of the nineteenth century they had crossed the keelson line.

Additional techniques were employed to conserve timber without compromising the strength of the hull. Along with the increase in the space between the frames there was a corresponding increase in the thickness of each frame. This increased molded dimension compensated for the strength previously given by more numerous but thinner frames. In addition, alterations in the joining methods between individual frames allowed for the use of smaller sections of timber as allowances no longer needed to be made for the formation of a scarf when sizing a frame.[17] These changes saved on valuable timber as smaller segments could be employed in the construction of the frames.

This effort to conserve is readily apparent in the studied wrecks. Only the Rose Hill vessel contained frames with a smaller molded to sided ratio. Those dating afterwards exhibited molded dimensions which equaled or were greater than the sided measure. That trend culminated in Vessel 2, which had all its

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[16] In addition, to accommodate that extra space between the frames builders reduced the number of frames used during construction which further eroded the strength of the hull.

[17] Initially a chock was inserted at the beveled ends of two continuous frames to form the joint. In many areas, by the middle of the century that method of joining was abandoned in favor of a simple butt scarf. It formed just as secure of a joint and saved on timber. Ibid., 16.

molded measurements exceeding their corresponding sided measure.[18] The frame joints for these vessels appear to confirm the rapid switch to butt joints. Though the two earliest vessels did not have recorded joint measures the rest, except for one, employed butt scarfs.[19] The Bermuda wreck employed a shorten, nearly vertical type of diagonal scarfing.

The adoption of cant frames also conformed with the trend towards conservation.[20] Cant frames allowed vessels to be constructed with less timber in their extremities without compromising the integrity of the hull. Prior to their adoption, vessels were constructed with closely set perpendicular frames and half frames which were beveled at their heads to follow the contour of the hull. Early cant frames were characterized by angled half frames with beveled heads. These frames terminated once the angle to the keel became less than 45°; after that point hawse pieces were inserted to fill the remaining space to the stem (Figure 19). Merchant vessels carried this evolution further with the adoption of the radial form.[21] In this form, hawse pieces were eliminated and additional

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[18]As with most aspects of ship construction during the period there was no standardization in timber dimensions. Components were cut to proportion but the exact dimensions often varied between timbers.

[19]The Rose Hill and Otter Creek vessels lacked frame scarf measurements. Those on the Rose Hill wreck were not preserved, while those on the Otter Creek vessel were obscured by bilge ceiling which was not removed during investigation.

[20]Cant frames were not utilized on warships until after 1715 and were not common on merchant vessels until the end of the first quarter of the eighteenth century. Goodwin, 23.

[21]Early experiments produced a variety of types. Forms included: 1) canted frames in which all members touched the vessel's centerline, 2) canted frames which most of the members touched the vessel's centerline, and 3) segmented and variegated timbers (apron in the bow and the transom chocks in the stern) which formed the foundations for the heels of the cants. John W. Morris III, Gordon P. Watts, Jr., and Marianne Franklin, "The Comparative Analysis of 18th-Century Vessel Remains in the Archaeological Record: A Synthesized Theory of Framing Evolution" in Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference, ed. Paul F. Johnston (Washington, DC: Society for Historical Archaeology, 1995), 127.

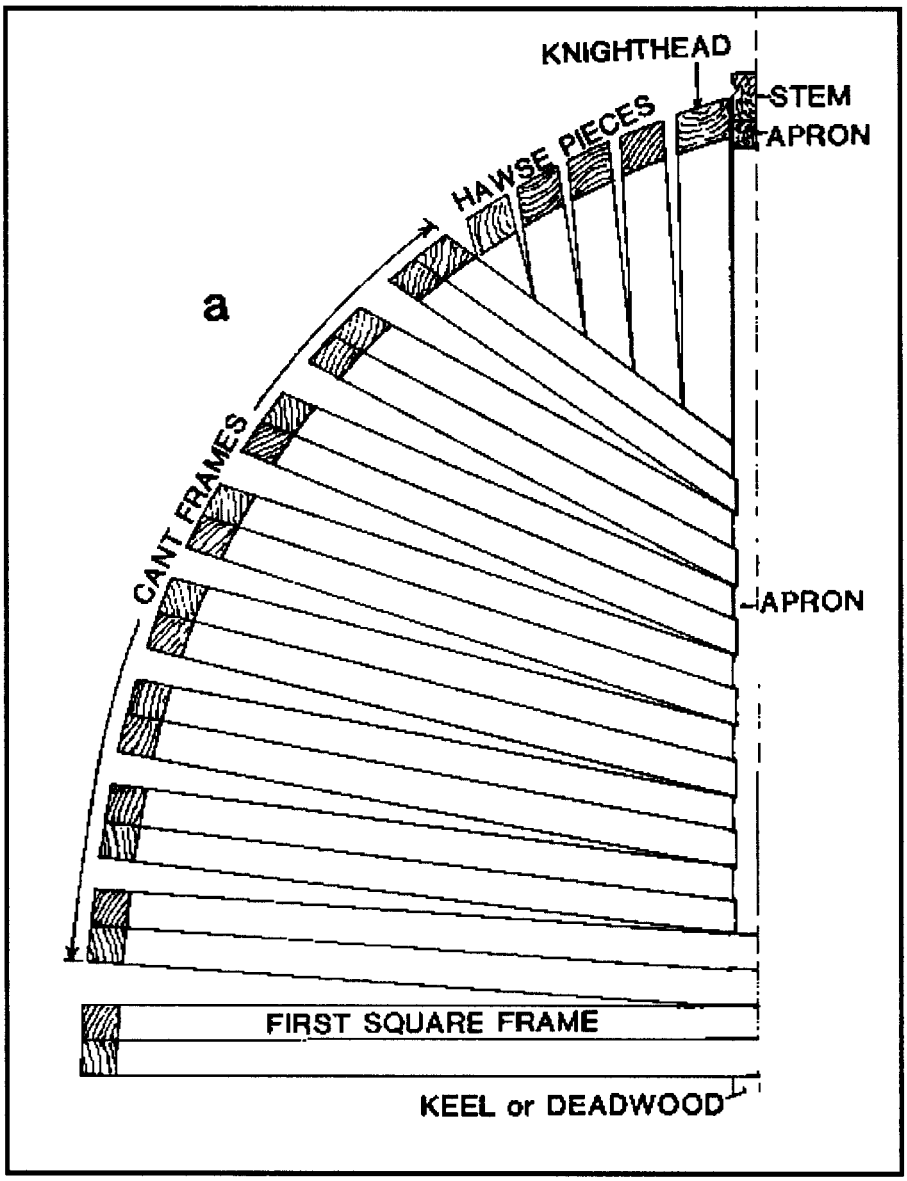

Figure 19. Illustration of the placement of cant frames and hawse pieces during construction (J Richard Steffy, Wooden Ship Building and the Interpretation of Shipwrecks (College Station, TX, Texas A&M University Press, 1994), 294).

angled cant frames were substituted in their place. Gaps created by the curving shape of the bow were often filled with filler frames. Though not as strong as the method employed by warships, the radial form was more than adequate to meet the demands of a merchant vessel and cut on timber use and lowered building costs.

Only four of the seven vessels studied contained intact cant framing. Two of those lacking cants included the two earliest vessels in the study, the Rose Hill and Otter Creek wrecks. The other vessel with missing cants, the Bermuda wreck, did not have an intact bow or stern. The variety exhibited by the remaining vessels shows the level of experimentation by builders. The Readers Point vessel and Vessel 20 contained the pattern in which most of the members touched the centerline. Vessel 2's cants were partially preserved; the surviving timbers suggest that all of the cant frames may have touched the centerline. The *Betsy* contained the unique radial form of segmented chocks in the bow and stern which accepted the heels of the cants.[22]

Another characteristic of this period was the elimination of the hogging piece and a shift in the fastening pattern for the keelson. The hogging piece was a timber set on top of the keel to form the upper part of a made rabbet.[23] This structure was common during the seventeenth century, but its popularity among builders waned during the eighteenth century as the movement of the rabbet line to half the molded thickness of the keel on merchantmen eliminated the need for

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[22]Not every member of the *Betsy*'s cant frames touched the chocks or the vessel's centerline.
[23]The hog was also thickened at either end to help give rise to the frames in the bow and stern.

the structure.[24] Hogging pieces were only observed on the Rose Hill and Bermuda wrecks.

Further efforts to economize can be seen in the methods of fastening the keelson.[25] Cost cutting measures often resulted in the employment of less bolts and the use of them in non standard patterns. Three of the examined vessels exhibited either random fastenings or a non-standard pattern. Both the Rose Hill wreck and Vessel 2 were randomly fastened and the Readers Point vessel was fastened at every floor forward of the mast step and every third floor aft of the step. The Otter Creek vessel retained the earlier pattern of fastening at every other floor while the Bermuda wreck employed the newer method of every floor. The *Betsy*'s fastening pattern was partially obscured by an additional keelson component. Where visible, the keelson was fastened at every floor. The fastener pattern for Vessel 20 was obscured by two thin laminated components bolted on top of the keelson.

This discussion on eighteenth century ship construction techniques identified a number of trends employed in constructing merchant vessels during the eighteenth century. The earliest of the seven studied vessels, the Rose Hill vessel, exhibited all or nearly all of the design features common prior to the middle of the century (see Table 2).[26] The rest of the vessels, all post dating 1750, bore evidence of features designed around efficiency and cost effectiveness.

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[24]The timber was rarely used on vessels after 1780.

[25]Prior to the nineteenth century the keelson was bolted through to the keel at every other floor; after that date it was bolted at every floor. Goodwin, 28.

[26]Only two features, frame scarfs and cant frames, were not noted as they did not survive in the archaeological record.

Many of these changes arose out of the timber shortage which plagued the shipping industry during this period and efforts to prolong the life of a vessel. Constructing ships with greater frame spacing lowered costs as less timber was used and increased a vessel's operating life by lowering the incidence of rot. The adoption of chocks and the move to simple butt scarfs to join frame components eliminated the need for perfectly formed compass timber. Despite cost cutting, strength was maintained as frames were made thicker and first futtocks were brought to the centerline for further rigidity. Some early techniques, such as the hogging piece, were eliminated as other more efficient structures or methods were employed. All of these trends contributed to the eventual standardization of form common to nineteenth century vessels.

This study also suggested that the application of new techniques varied. New methods often did not become universally accepted until success was proven. Some designs which showed clear advantages, such as the move to butt joints, gained popularity fairly rapidly while others, like the adoption of cant framing and the movement of the first futtock's heels, underwent a period of experimentation before a standard form was accepted. The desire to minimize costs also influenced design. The wide range of keelson fastening methods seen on the seven sites may indicate that the need to produce ships on a budget may have caused builders to cut corners. Retention of older methods may also have been the result of preferences of individual builders or may have reflected features that were specific to a particular type of vessel. The use of diagonal scarfs on the Bermuda wreck may have been a builders preference while others,

such as, thicker and wider timbers as seen on the Bermuda wreck and *Betsy* may have been characteristics typical of heavy duty colliers. When studying shipwreck sites the characteristics of the entire hull needs to be considered when dating a site. Reliance on individual features may prove misleading as evidence of experimental or conservative techniques may mask the true period of construction.

Material from Contemporary Eighteenth Century Plate Fleet Assemblages

Because *El Salvador* was not extensively salvaged after wrecking the archaeological record associated with the vessel has the potential of being intact or nearly intact and may, as a consequence, provide new information on shipboard life or the state of the Indies trade during its waning years. What might this record look like and how might it be distinguished from non-Plate Fleet sites? An answer to that question may be gleaned from a survey of the archaeological assemblages of other contemporary wrecked vessels of the Indies trade. Collections from *El Nuevo Constante*, sunk in 1762, and selected vessels from the 1733 Fleet were examined for artifacts which might characterize the material culture of Plate Fleet sites.[27] These vessels were selected for study

[27]Material for the 1733 Fleet comes from a study conducted by Russell Skowronek in 1984. That study compared the archaeological assemblage of seven vessels of the fleet with the assemblages of three terrestrial sites in St. Augustine, Florida in an effort to study Spanish Colonial system. Vessels from the fleet used in the study included the *San Pedro* (site 8MO104); *Nuestra Señora de Rosario, San Antonio y San Vicente* (site 8MO133); *San José y las Animas* (site 8MO101); *San Fernando* (site 8MO137); *San Ignacio* (site 8MO142); *Nuestra Señora de las Angustias y San Rafael* (site 8MO131); and the *Capitana - El Rui* or *Ribi* (site 8MO146). Russell K. Skowronek, "Trade Patterns of Eighteenth Century Frontier New Spain: The 1733 Flota and St. Augustine," Volumes in Historical Archaeology (Columbia, SC: South Carolina Institute of Archaeology and Anthropology, University of South Carolina, 1984).

because they were lost within a 15 to 20 year span of *El Salvador* and may have contained material similar to that carried on it.[28]

An examination of the inventories from those sites revealed that despite being heavily salvaged in the past and present they still possessed a wealth of artifacts offering details on ship operations and shipboard life. Those inventories included artifacts ranging from military gear, ship's hardware, subsistence items, personal possessions, and cargo. Though many of these artifacts, such as gear necessary for operating a vessel (tools, tackle, rigging, etc.) and items of adornment and leisure (jewelry, combs, inkwells, buttons, etc.) are common to most shipwreck sites, they often provide few clues to nationality.[29]

Other types of artifacts are clearly associated with the Indies trade and Spanish lifestyles and as such appear in greater frequency on Spanish ships.[30] Such artifacts include bullion, dye products, and Spanish ceramics. Individually these artifacts may not provide conclusive proof of a Spanish Plate Fleet site but if found in high concentrations and *in situ* they may provide enough diagnostic evidence to suggest a Spanish ship employed in the Indies trade. To gain a better understanding of the archaeological record associated with Spanish Plate fleet

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[28]All the vessels in the study grounded intact or mostly intact in various depths of water. All were extensively salvaged by the Spanish, the success of which was determined by the level of accessibility.

[29]Though cannons and anchors are typically used for identifying underwater sites, they were not a part of this comparison. Few examples were recovered from the examined sites and those that were (on *El Nuevo Constante*) proved to be English. As items necessary for the safety of a vessel they were usually taken as prizes from captured vessels or, as in the case of *El Nuevo Constante*, remained with their vessels after a legal transfer of ownership. Like the *Constante*, *El Salvador* was English owned prior to its capture in 1747. It too may have held some of its English equipage which, if found alone, could easily lead to misidentification of the vessel.

[30] Tobacco pipes, an artifact common on most European sites, are rare in Spanish contexts. Prior to its sanction in 1820, the Crown discouraged tobacco use among its citizens. However,

sites each of these artifact classes were studied for forms present and for how prevalent they were on the examined sites.[31]

Perhaps the most diagnostic artifact to symbolize the Indies trade was bullion. It was the primary reason for the existence of the trade. Bullion was transported in coin, bar, and ingot form and wrecks of Plate Fleet vessels usually contain representatives of one or more of these forms. Both *El Nuevo Constante* and the ships of the 1733 Fleet were extensively salvaged by Spanish authorities and records of those activities indicated that all of the Royal bullion was recovered.[32] Using historical sources alone, one might suspect that very little bullion would be found on those sites, but modern salvage efforts and further archaeological investigations of the sites proved otherwise.[33]

Thirty ingots of silver, 10 of gold, and 96 of copper were recovered during modern salvage and scientific research on *El Nuevo Constante*.[34] Nearly all of

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enforcement of the ban was impossible and when it was used it was mainly in the form of snuff and cigars.

[31]It should be noted that none of the 1733 Fleet ships had undergone a rigorous scientific study. Though the exposed remains of a number of the sites were documented by researchers in 1977, 1988, 1992, and 1993, the only intrusive examination of the sites had been conducted by salvers who mostly excavated trenches across the sites to recover valuable items. Much of the material collected by these groups is poorly documented or inaccessible and no doubt many uninspiring artifacts were overlooked or were not recognized as significant.

[32]Pearson and Hoffman, 216; Skowronek, "Trade Patterns," 25. In the case of the 1733 fleet it was also noted that more treasure was salvaged than was listed in the official manifests.

[33]Most of the details on bullion comes from *El Nuevo Constante*. Researchers of the site provided excellent descriptions of the materials recovered and interpretations. Very little information was useful from the 1733 Fleet material besides counts of bullion related artifacts. This was probably the result of the methods of investigation. The sites were all worked by salvers and records were marginal and most of the valuable materials were retained by the salvers. In addition, Skowronek's thesis was biased toward comparing the material culture of underwater and terrestrial sites with an emphasis on artifacts which impacted on the daily lives of the colonists. Bullion was an item for the coffers of the Crown and while its presence was noted in the appendix no thorough treatment of the subject was conducted.

[34]Pearson and Hoffman, 207, 209, 210, 219.

these ingots were disk-shaped, flat on one side and convex on the other.[35] They varied in size but were made to be easily carried by a single man. Several irregular shaped silver artifacts, as well as, 13 cup-caked shaped silver ingots, known as *piñas*, were also recovered. Of the seven wrecks of the 1733 Fleet studied by Skowronek only five yielded bullion; 397 of these artifacts were in coin form and an additional 18 artifacts labeled as miscellaneous gold and silver.[36] No ingots were observed in the inventories of their assemblages; if any were part of the cargo they were most likely recovered by the Spanish.

One of the more surprising artifact groups to have survived on the sites were examples of dye products. Nearly all of this material was recovered from *El Nuevo Constante* site. The lack of this type of material on the 1733 sites may be due to a total destruction of the resource prior to discovery, destructive techniques employed by salvers, or non recognition of the resource.[37] The artifacts documented from *El Nuevo Constante* provide an indication on how this resource may appear in the archaeological record.

Seventy six complete or nearly complete pieces of the 1,032 *varas* (sticks) of logwood were recovered from the *Constante*. These examples ranged in length

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[35]The form was known as *planchas*. They typically exhibited a crudeness in manufacture with bubbles, pits, striations, and/or swirling throughout.

[36]Fifty-seven coins were recovered from the *San Pedro*, 331 on the *San José*, 3 on the *San Fernando*, 3 on the *Angustias*, and 3 on the *Capitana*. No information on the nature of the coins such as their denomination, date of manufacture, or place of manufacture was reported. Skowronek, 208, 213, 216, 219, 220. Apparently not all of the precious metal artifacts made their way into the State inventory. Roger C. Smith of the Florida Bureau of Archaeological Research reported that thousands of coins were recovered from the *San Pedro* and *San José*. No doubt more were found on the other wrecks and were not reported or were lost prior to cataloging. Roger C. Smith, "Treasure Ships of the Spanish Main: The Iberian-American Maritime Empires," in Ships and Shipwrecks of the Americas: A History Based on Underwater Archaeology, George Bass, ed. (New York: Thames and Hudson, 1988), 102.

from 27 to 64 inches and were of a size easily carried by a single person. The logs appeared to have been shipped in a raw state; none exhibited evidence of saw marks or splitting. The other dye products present in the assemblages were shipped to Spain in powder, paste, and/or seed form and do not usually survive in the archaeological record. The few examples that appeared in the *Constante*'s artifact collection offer clues on how this resource was prepared for transport. Several blocks of *anatto* were documented on the site. This dye was shipped in barrels or boxes depending on the grade and the objects recovered were block shaped, indicating that they were of the boxed variety. Impressions on the blocks also indicated they were wrapped in cloth prior to packing. The blocks appeared to represent different grades of the dye; some were composed of fine grain powder while others were noted to contain inclusions of seeds and stem fragments. One piece of indigo was also found and, though not found itself, evidence of the cochineal cargo was found as staining on some of the leather pouches or *zurrones* recovered.[38]

Ceramics provide another marker for identifying a wreck. Nearly all of the ceramics found on the ships surveyed were of Spanish/Spanish American origin.[39] These ceramics were represented by fragments of coarse earthenwares and export products. The coarse earthenwares were used mainly to store, cook, and serve food. The varieties present in the archaeological assemblages were all

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[37]Only two of the 116 wooden artifacts on the seven ships in Skowronek's study were identified as dyewood.

[38]Pearson and Hoffman, 199.

[39] Non-Spanish European ceramics were virtually absent on the sites examined. They formed .01% of the ceramic assemblage for the 1733 Fleet while none were noted on the *El Nuevo*

common during the eighteenth century and included Olive jars, Spanish storage jars, Mexican Redware, El Morro ware, Greyware, and Reyware. Olive jars formed the bulk of the coarse earthenwares, comprising approximately 32% of the ceramic assemblage on the *Constante* and nearly 14% on the 1733 ships.[40] They were the standard storage jar of the period holding everything from food stuffs, dyes, and other miscellaneous items.[41]

Export ceramics also formed a significant portion of the ceramic assemblage for the sites. Majolicas, a refined earthenware similar to English tin-glaze, and Guadalajara Polychrome, a fine coarse earthenware, formed the bulk of this material, comprising nearly 12 pounds of material on the *Constante* and approximately 43% of the ceramics on the 1733 ships. Forms during this period reflected styles popular in Europe and came in plates, cups, and other tablewares. Majolica was made in both Spain and Mexico and the varieties found on the sites represent types common throughout the eighteenth century. These included Blue-Green Basin, Puebla Blue on White, San Agustín Blue on White, and Marineware. Guadalajara Polychrome originated solely in the Guadalajara district of Mexico. The clays of this ceramic type were extolled for

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Constante. In addition, evidence of the Manila trade was reflected by examples of Chinese porcelain found on the wreck sites.

[40]Other ceramic forms included flat-bottomed, restricted mouth jars known as *tinajas*, deep globular pots called *ollas* or *carcerolas*, deep plates called *platos*, jars with constricted necks and flared mouths called *jaros*, and flower pot shaped vessels called *basins*.

[41] Olive jars were used to fill many of the same functions as glass bottles did in Northern Europe. Because of this multi-purpose use of olives jars glass artifacts typically form a smaller percentage of the total assemblage on most Spanish sites than they do on contemporary sites of Northern European origin.

their unique properties and were in much demand in Europe.[42] These wares came in plates, bowls, and decorative pieces such as animal figures and miniature musical instruments, shoes, and bowls.

This brief examination of the artifact assemblages from ships associated with the Spanish Indies trade provides some insight into the nature of the artifacts found on Plate Fleet sites. Though these sites contained a wide variety of artifacts only a small number of them may be strictly classified as Spanish in origin and an even smaller percentage as indicative of the Indies trade. The survivability of these resources in the archaeological record is often the product of the preserving environment and the level of salvage. This proved especially true of the dye and bullion artifacts from the examined sites. Dye products were mainly noted on *El Nuevo Constante* wreck. That site was not disturbed after its initial salvage and the anaerobic environment provided ideal conditions for preservation of this resource once the wreck became buried.[43] Bullion was found in varying concentrations on the sites examined. Their presence on vessels supposedly salvage of all their treasure may reflect storage patterns or the thoroughness of the salvage effort.[44]

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[42]These thin delicate vessels produced a pleasing aroma when wet and was sometimes eaten. Pearson and Hoffman, 64-65, 187.

[43]The 1733 Fleet sites may have had little of this artifact type preserved because the dynamic environment in which they were deposited. Also, these sites have been disturbed by professional and amateur salvers since the late 1950s and as a consequence, the sites have been repeatedly exposed which may have further contributed to the disintegration of the archaeological resource.

[44]As all the official treasure was recovered, this material either represented the small amount of unregistered legal bullion allowed to be carried by crew and passengers or may be an example of the rampant illicit trade. This later material was most likely stored or hidden in the hold and may have been inaccessible during salvage attempts.

Ceramics offer one of the best methods for dating archaeological sites. Found mostly as scattered fragments, ceramics usually comprise a significant portion of the archaeological assemblages of nearly all sites. In addition, as one of the most studied artifact groups their production histories are often well documented. The ceramics from the above collections were all common during the eighteenth century and represent a variety of uses ranging from export items, cooking and serving vessels, and storage jars. A number of these wares were in use for only part of the eighteenth century and by noting the varieties present they may provide important clues to the date of operation and possibly the identification of a site.[45]

Discussion

The findings furnished by this study have provided research parameters for locating *El Salvador*. They serve as useful guides for conducting field investigations and have provided some insight into the potential archaeological record associated *El Salvador*. Observations of the data obtained from remote sensing records from the studied wrecks suggest that the remains associated with *El Salvador* will most likely create a magnetic disturbance detectable over a fairly large area. As the vessel was known to carry at least five anchors and eight cannons, the associated signature may resemble that observed at site 0003BUI or, because of the survey's 70-foot lane spacing, the signature may be more similar

[45]Those which were produced prior to the loss of *El Salvador* include Redware, San Agustín Blue on White, and decorated Marineware. Varieties not introduced until after 1750 included

to that obtained for the *Industry* which was surveyed with a comparable spacing. Anomalies located during the investigation with such characteristics will be given high priority during ground truthing. However, as noted by Murphy and Saltus, even small disturbances have the potential to represent shipwreck material. Because of the possibility that the remains of *El Salvador* may be limited in size any signature as small as 10 gammas that is detected over a distance of 45 feet will be marked and examined by divers should the investigation of the priority targets prove negative.

Vessels located during the ground truthing phase of investigation were examined closely for details of construction and diagnostic artifacts which may aid in identifying the vessel. Examination of exposed hull structure focused on those characteristics which were noted to represent eighteenth century vessel types. Since *El Salvador* was built prior to 1750, its hull will most likely be comprised of structures typical of vessels built during the early part of the century. Structures characteristic of that period include frame components with little or no intervening spaces, large first futtock offsets, larger sided to molded ratios, early cant framing, and hogging pieces. As a result, the structural remains associated with the vessel may most likely resemble those noted for the Rose Hill and Otter Creek vessels.

Due to the stipulations in the survey permit only a limited number of artifacts will be recovered for analysis should a site be found. Artifacts retained for analysis will include those with attributes which may support the

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Greyware and Blue-Green Basin. Kathleen Deagan, Artifacts of the Spanish Colonies of Florida

identification of the site as *El Salvador* or at least, a vessel dating to the eighteenth century. As noted in the above study three classes of artifacts have been identified as being closely associated with Spanish vessels operating in the Indies trade. These artifacts include bullion, dye products, and Spanish style ceramics. If found in concentrations on a identified site they may provide conclusive evidence to identify the site as *El Salvador*. If found, other diagnostic material will also be recovered for analysis. These artifacts may provide supporting data to recommend further investigation of the site if no other conclusive material is found to make a positive identification.

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and the Caribbean 1500-1800 (Washington, DC: Smithsonian Press, 1987), 1:28-29.

Chapter 5

Field Investigations

Target Analysis

The remote sensing survey of New Topsail Inlet identified 14 anomalies within the six survey areas. No anomalies were found in Areas 1 or 6. Two magnetic targets were located in Area 2, one in Area 3, ten in Area 4, and one in Area 5. Of those targets only seven exhibited signature characteristics which may be indicative of submerged cultural resources. A description of the characteristics and recommendations of each anomalies is discussed below.

During preparation of the general contour maps the phenomena known as diurnal variation or the natural drift of the Earth's magnetic field was recorded. As the survey was conducted when weather and scheduling permitted actual days in the field were non-consecutive, often spanning months at a time and resulted in each area containing sets of data that exhibited magnetic readings that shifted over a wide but consistent level. Preliminary analysis produced contours with thick, tightly spaced lines at the juncture of the different sets of data (Figure 20). Since this type of variation represents the slow natural drift in the magnetic field its affect was only noted during generation of the contour maps. It had no impact on the detection of individual anomalies. The diurnal variation was cancelled out by adding a correction factor to the data prior to the production of the final maps.

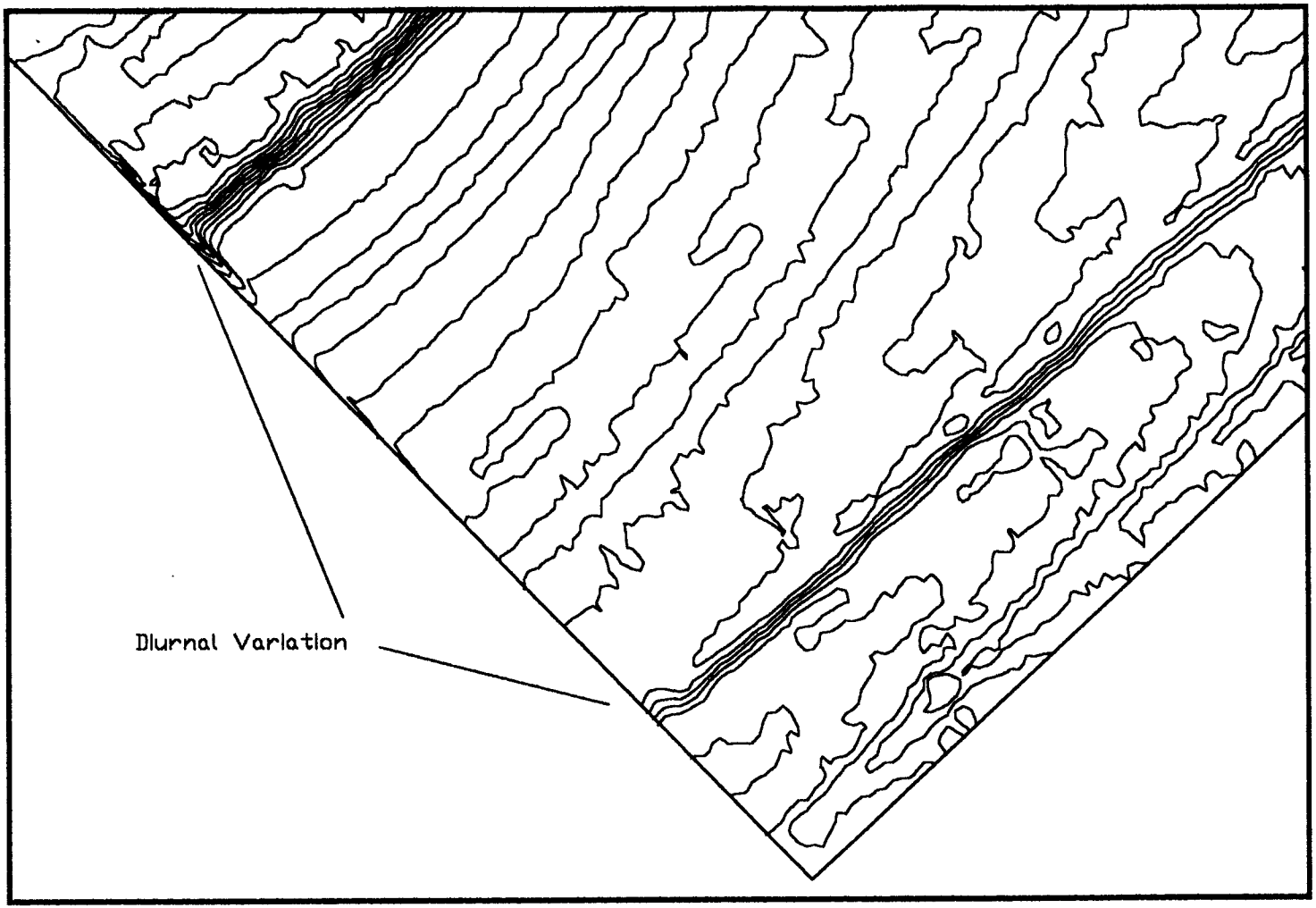


Figure 20. Example of diurnal variation from preliminary contour map of Area 2.

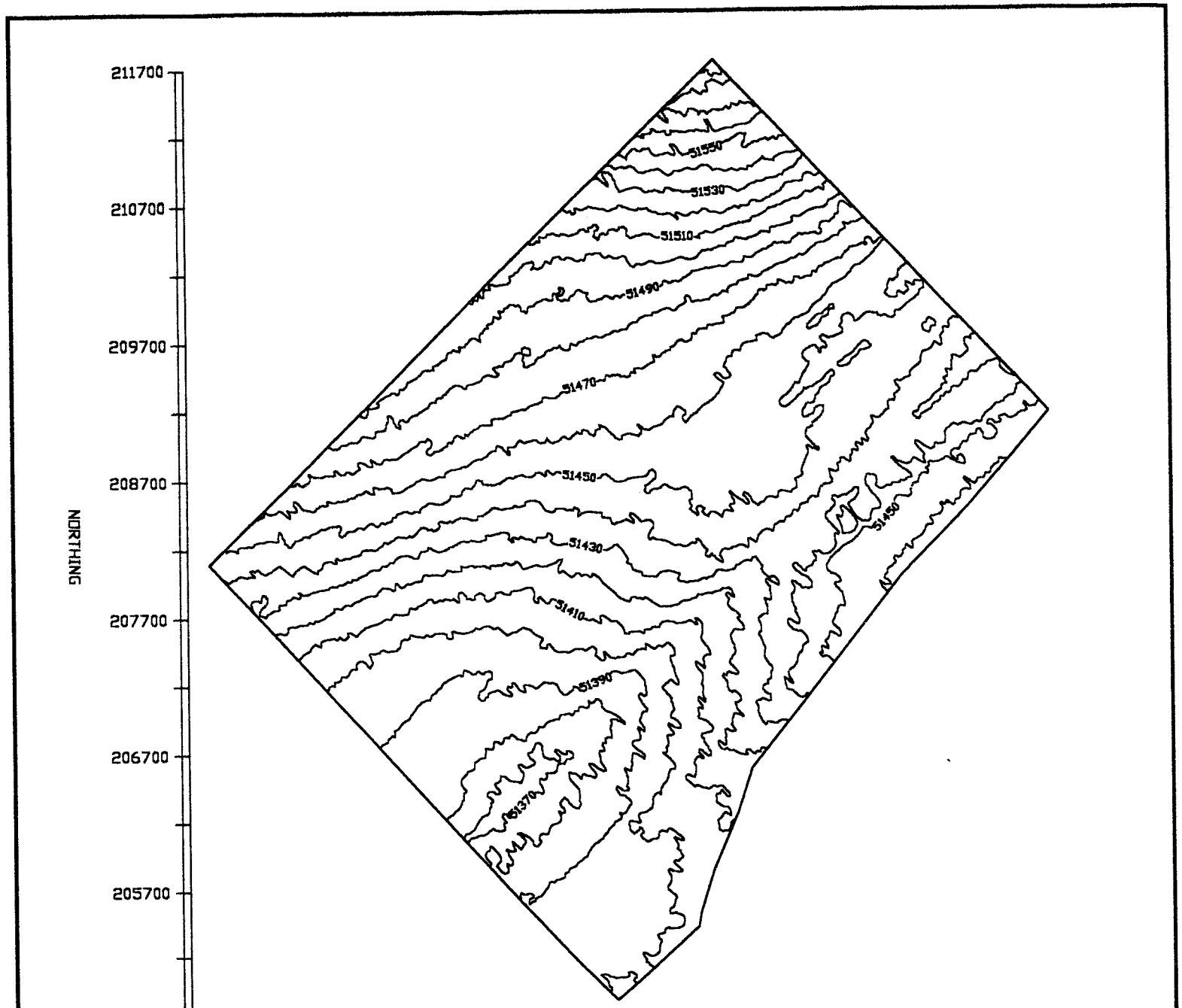
Area 1. Analysis of the remote sensing data for Area 1 revealed no anomalies in the survey area (Figure 21).

Area 2. Analysis of the remote sensing data for Area 2 revealed three anomalies in the survey area (Figure 22). One of these was produced by the buoy marking the entrance to Topsail Inlet. The buoy was red and white and labeled "NT." Targets TI2-01 and TI2-02, exhibited characteristics suggestive of modern debris.

Target Designation	Northing	Easting
TI2-01	215242	2402457

Priority: Low

Target TI2-01 was located on lane 1C and was identified in the magnetometer records as 2-1. The signature had a maximum intensity of 22 gammas and was detected for a maximum duration of 75 feet (Figure 23). The contoured signature revealed a dipolar anomaly which influenced an area of approximately 7,650 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics suggested a single object of low ferrous mass. Such low intensity, short duration signatures are commonly associated with isolated point sources such as small modern anchors, pipes, or other small debris. Additional surveying of the target on a 30-foot lane spacing confirmed the target's similarity to modern debris.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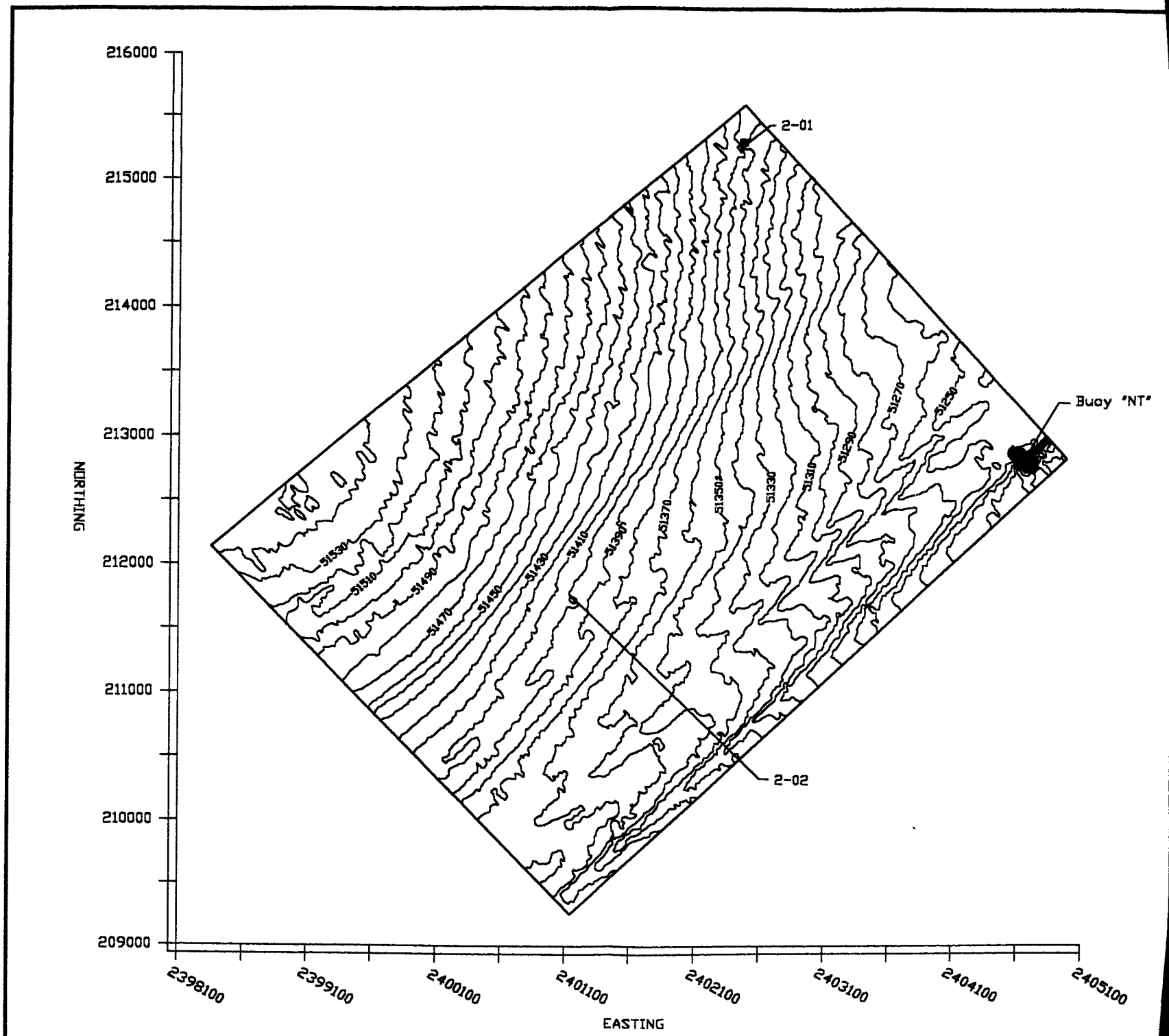
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NORTHING
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2402100
2403100
2404100
2405100
EASTING
2-01
2-02
Buoy "NT"
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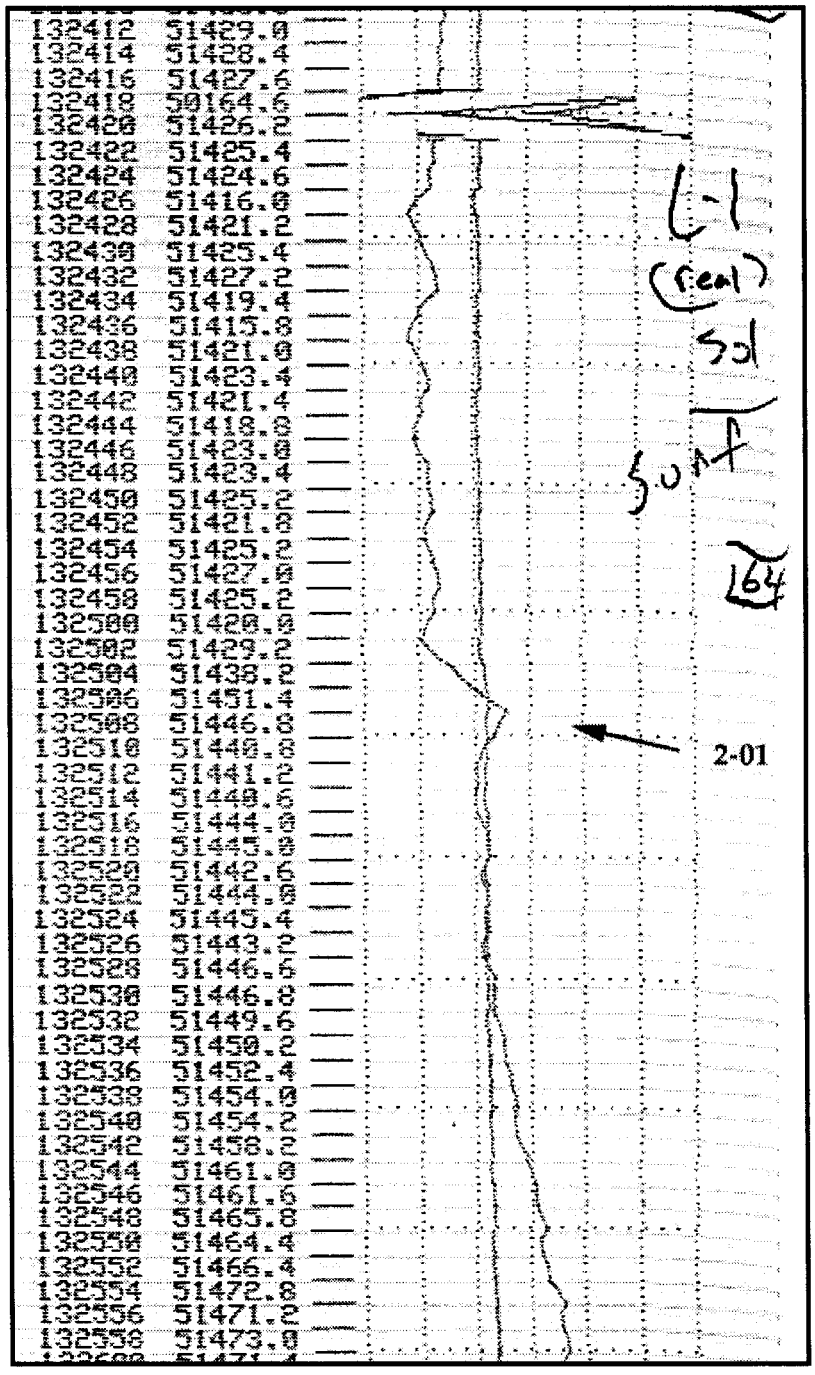


Figure 23. Magnetic signature of TI2-01.

Target Designation	Northing	Easting
TI2-02	211714	2401159

Priority: Low

Target TI2-02 was located on lane 24 and was identified in the magnetometer records as 2-2. The signature had a maximum intensity of 25 gammas and was detected for a maximum duration of 40 feet (Figure 24). The contoured signature revealed a simple dipolar anomaly which influenced an area of approximately 2,600 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics suggested a single object of low ferrous mass. Such low intensity, short duration signatures are commonly associated with isolated point sources such as small modern anchors, pipes, or other small debris. Additional surveying of the target on a 30-foot lane spacing confirmed the target's similarity to modern debris.

Area 3. The survey for Area 3 encompassed the shoal which surrounds the entrance to the inlet. Survey lanes which bisected the shoal were only run in deep water, north and south, up to the shoal line. Because of the hazardous conditions no surveying was conducted on or inside the limits of the shoal. Analysis of the remote sensing data for Area 3 revealed one anomaly in the survey area (Figure 25). The anomaly contained signature characteristics suggestive of modern debris.

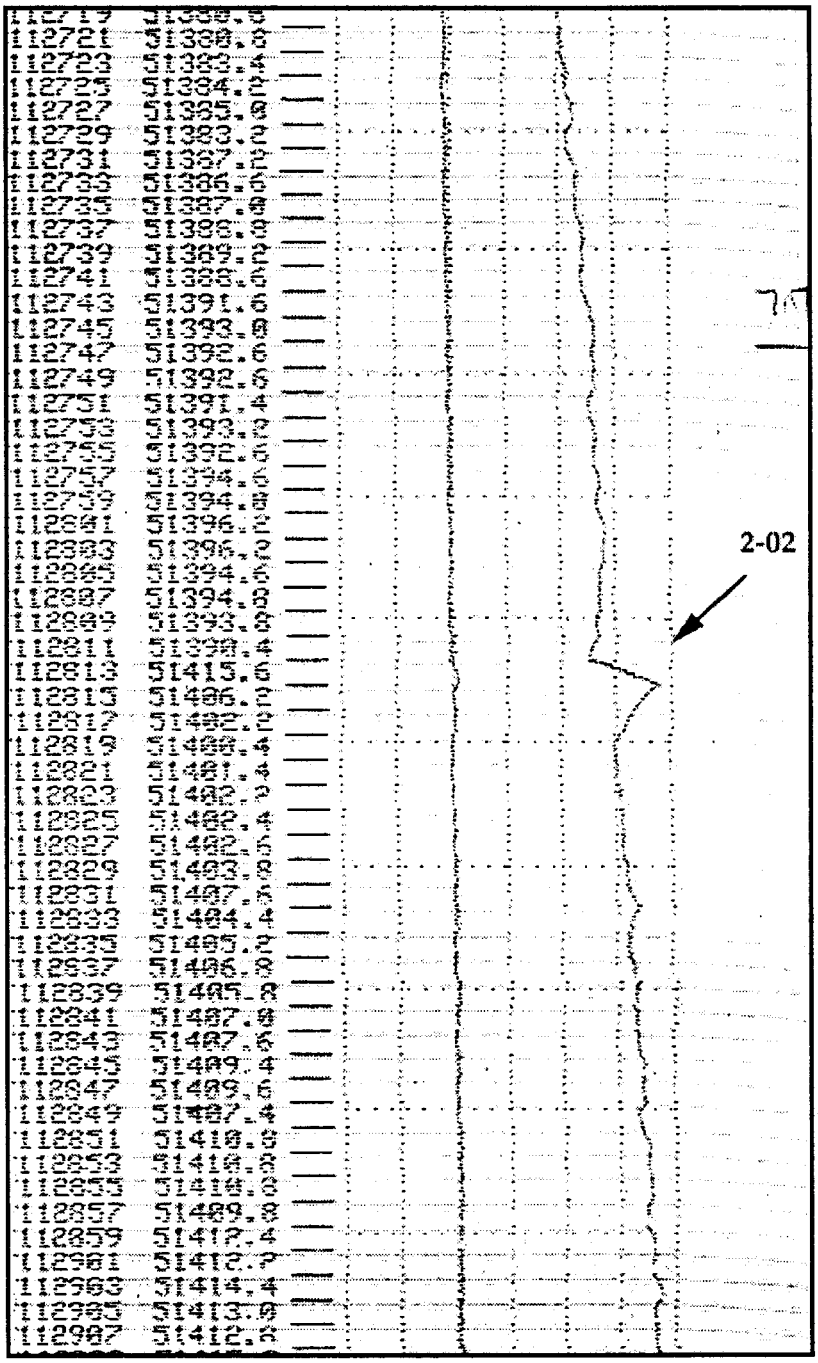
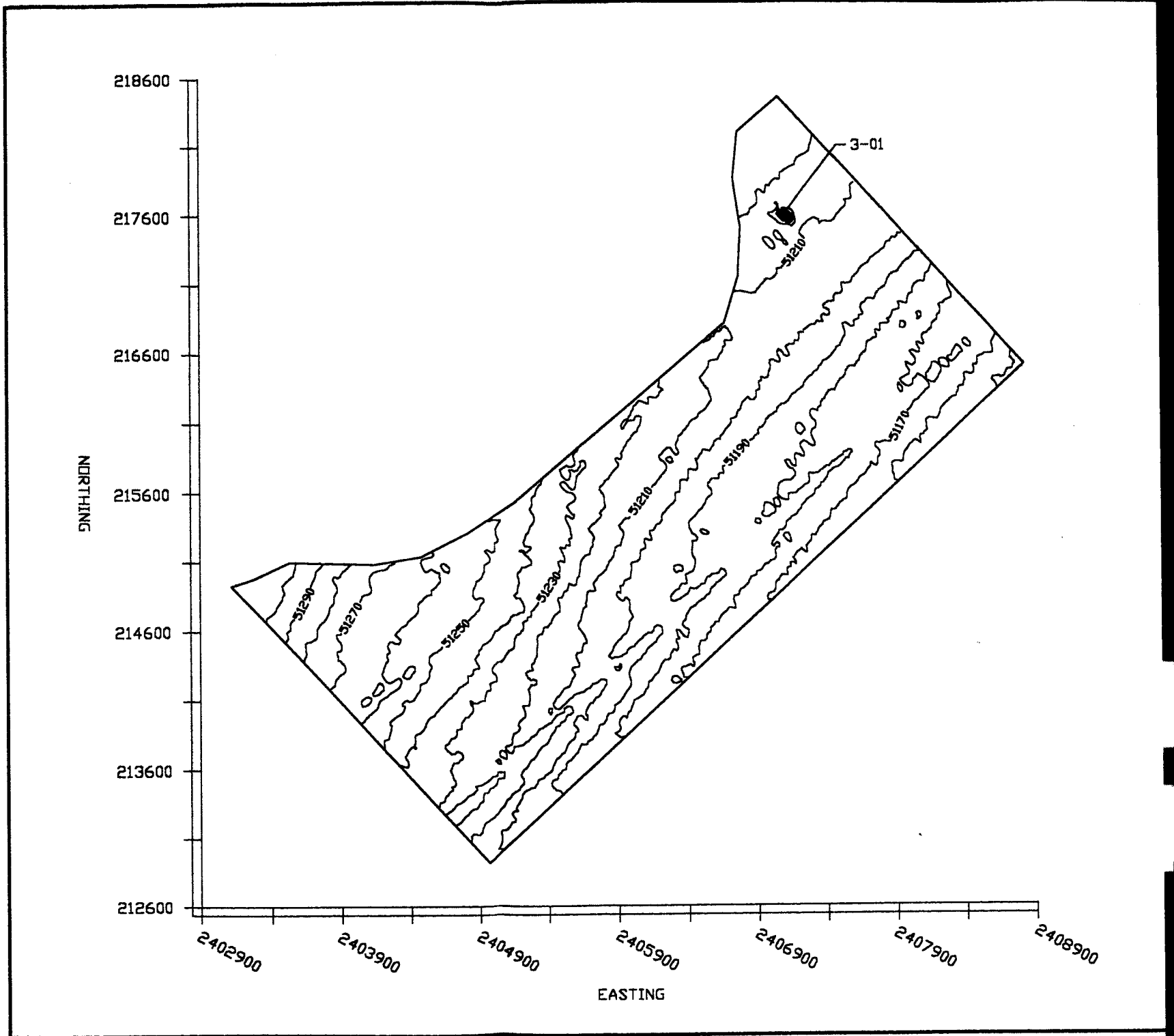


Figure 24. Magnetic signature of TI2-02.


218600
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212600
NORTHING
3-01
51210
51190
51170
51230
51250
51270
51290
2402900
2403900
2404900
2405900
2406900
2407900
2408900
EASTING

Target Designation	Northing	Easting
TI3-01	217566	2407077

Priority: Low

Target TI3-01 was located on lane 20 north just on the outer edge of the shoal on the northern side of the inlet and was identified in the magnetometer records as 3-1. The signature had a maximum intensity of 122 gammas and was detected for a maximum duration of 75 feet (Figure 26). The contoured signature revealed an intense, dipolar anomaly which influenced an area of approximately 10,200 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics indicated an object of high intensity, low ferrous mass distributed over a small area. Similar high intense, small duration signatures have been observed in association with modern material such as pipe and wire cable.

Area 4. Analysis of the remote sensing data for Area 4 revealed ten anomalies in the survey area (Figure 27). Two of the targets, TI4-01 and TI4-02, contained signature characteristics suggestive of modern debris. Six of the targets appeared to form two clusters of anomalies. Four of these targets, TI4-04, TI4-05, TI4-06, and TI4-07 appeared to be spatially associated and may represent the remains of scattered shipwreck material. Another two, TI4-08 and TI4-09, also appeared to be spatially associated and contained signature characteristics indicative of wooden-hulled vessels. Target TI4-03 was located in the vicinity of

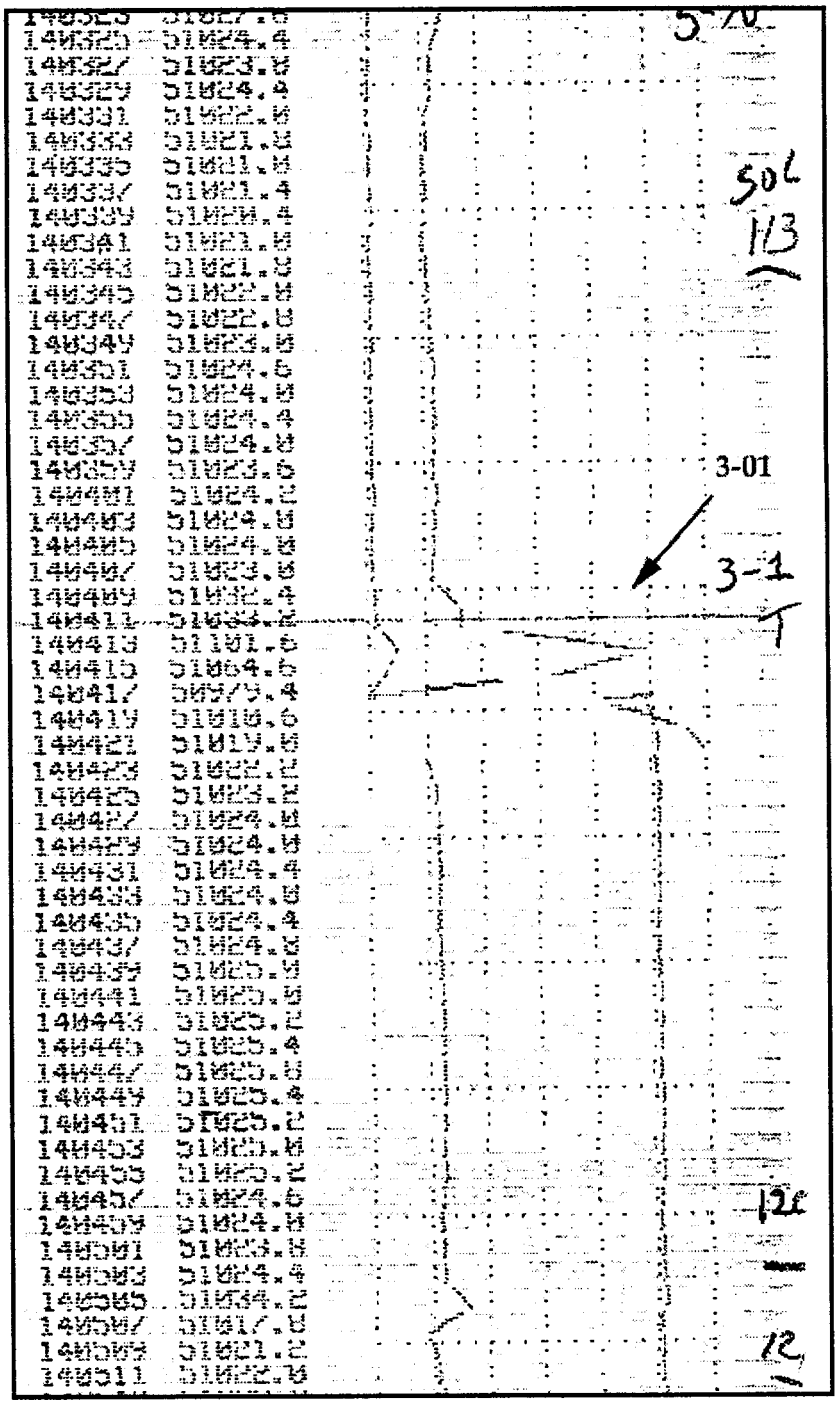
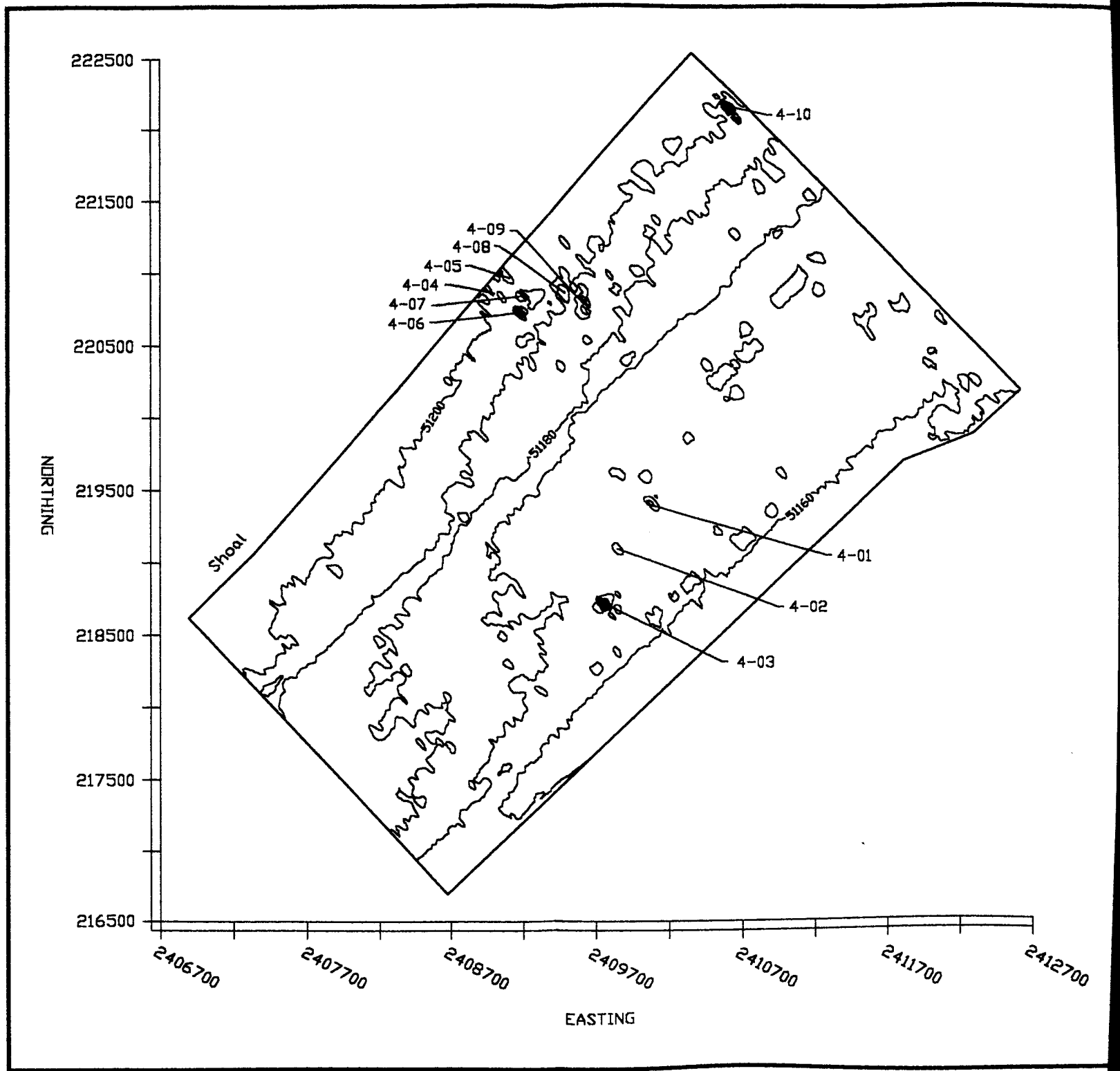


Figure 26. Magnetic signature of TI3-01.


222500
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2412700
EASTING
4-10
4-09
4-08
4-05
4-04
4-07
4-06
4-01
4-02
4-03
5120
5140
5160
Shoal

a known wreck. The final target, TI-10, contained signature characteristics suggestive of modern debris.

Target Designation	Northing	Easting
TI4-01	219388	2410068

Priority: Low

Target TI4-01 was located on lane 29 and was identified in the magnetometer records as 4-1. The signature had a maximum intensity of 21 gammas and was detected for a maximum duration of 43 feet (Figure 28). The contoured signature revealed a simple positive monopolar anomaly which influenced an area of approximately 5,100 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics suggests a single object of low ferrous mass. Such low intensity, short duration signatures are commonly associated with isolated point sources such as small modern anchors, pipes, or other small debris. Additional surveying of the target on a 30-foot lane spacing confirmed the target's similarity to modern debris.

Target Designation	Northing	Easting
TI4-02	219093	2409862

Priority: Low

Target TI4-02 was located on lane 30 and was identified in the magnetometer records as 4-2. The signature had a maximum intensity of 10 gammas and was detected for a maximum duration of 55 feet (Figure 29). The

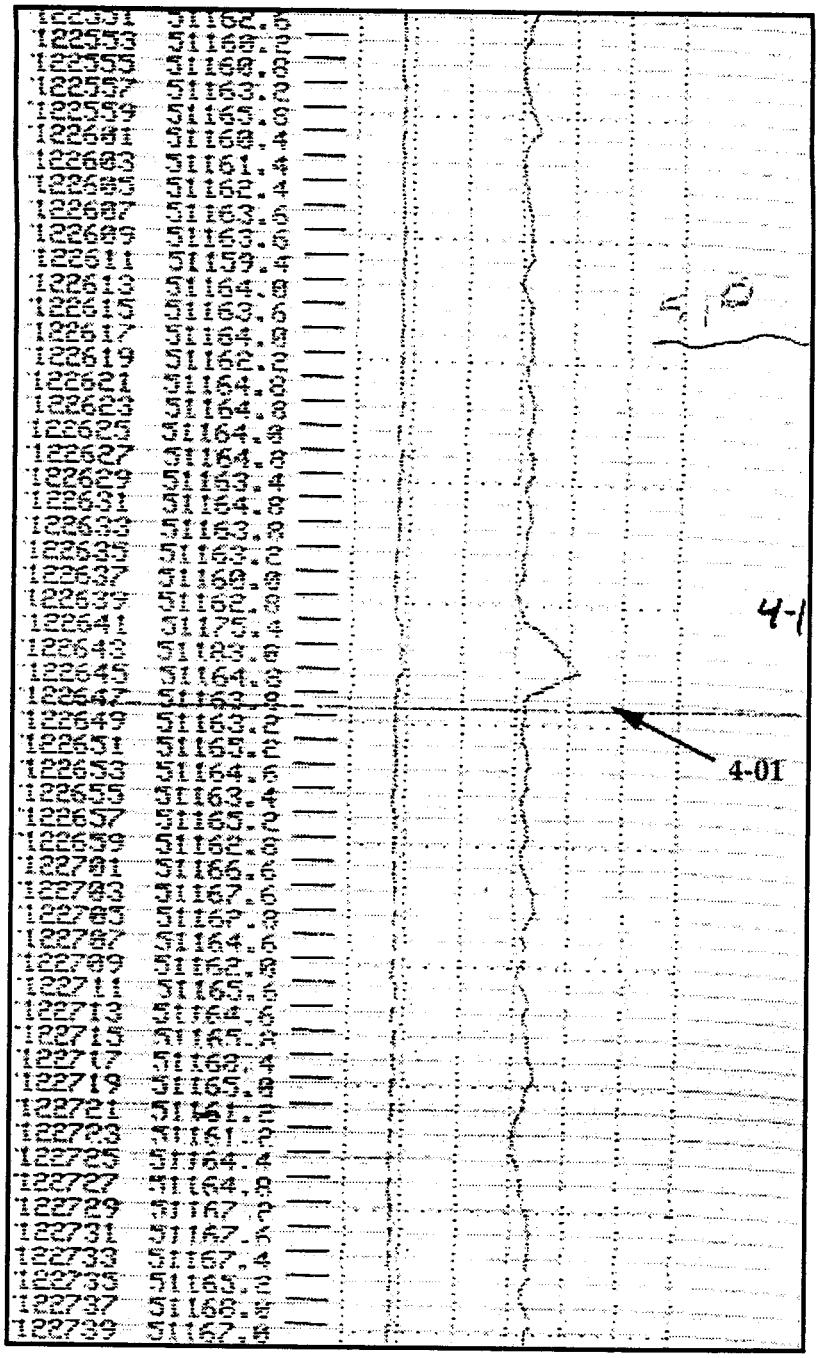

Figure 28. Magnetic signature of TI4-01.

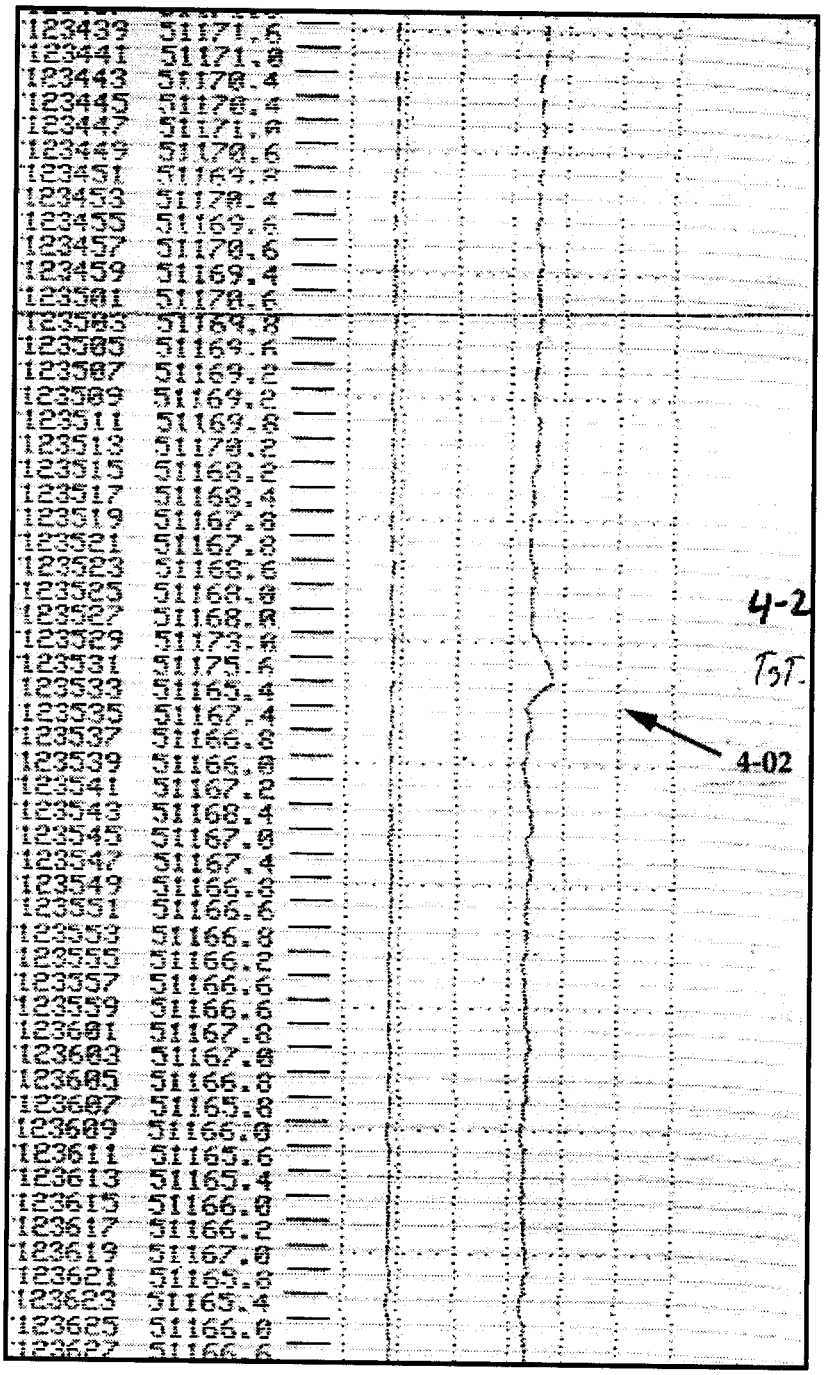

Figure 29. Magnetic signature of TI4-02.

contoured signature revealed a simple positive monopolar anomaly which influenced an area of approximately 4,900 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics suggests a single object of low ferrous mass. Such low intensity, short duration signatures are commonly associated with isolated point sources such as small modern anchors, pipes, or other small debris. Additional surveying of the target on a 30-foot lane spacing confirmed the target's similarity to modern debris.

Target Designation	**Northing**	**Easting**
TI4-03	218693	2409746

Priority: High

Target TI4-03 was located on lanes 33 and 34 and was identified in the magnetometer records as 4-3 and 4-4. The dipolar signature had a maximum intensity of 95 gammas and was detected for a maximum duration of 135 feet (Figure 30). The contoured signature revealed a sharp dipolar anomaly which influenced an area of approximately 16,200 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics indicated an object or cluster of objects of moderate ferrous mass distributed over a moderate sized area. Similar moderately intense, broad duration signatures have been observed in association with iron-fastened, wooden-hulled wrecks containing additional *in situ* iron material such as cannons and anchors. An examination of National Oceanic and Atmospheric

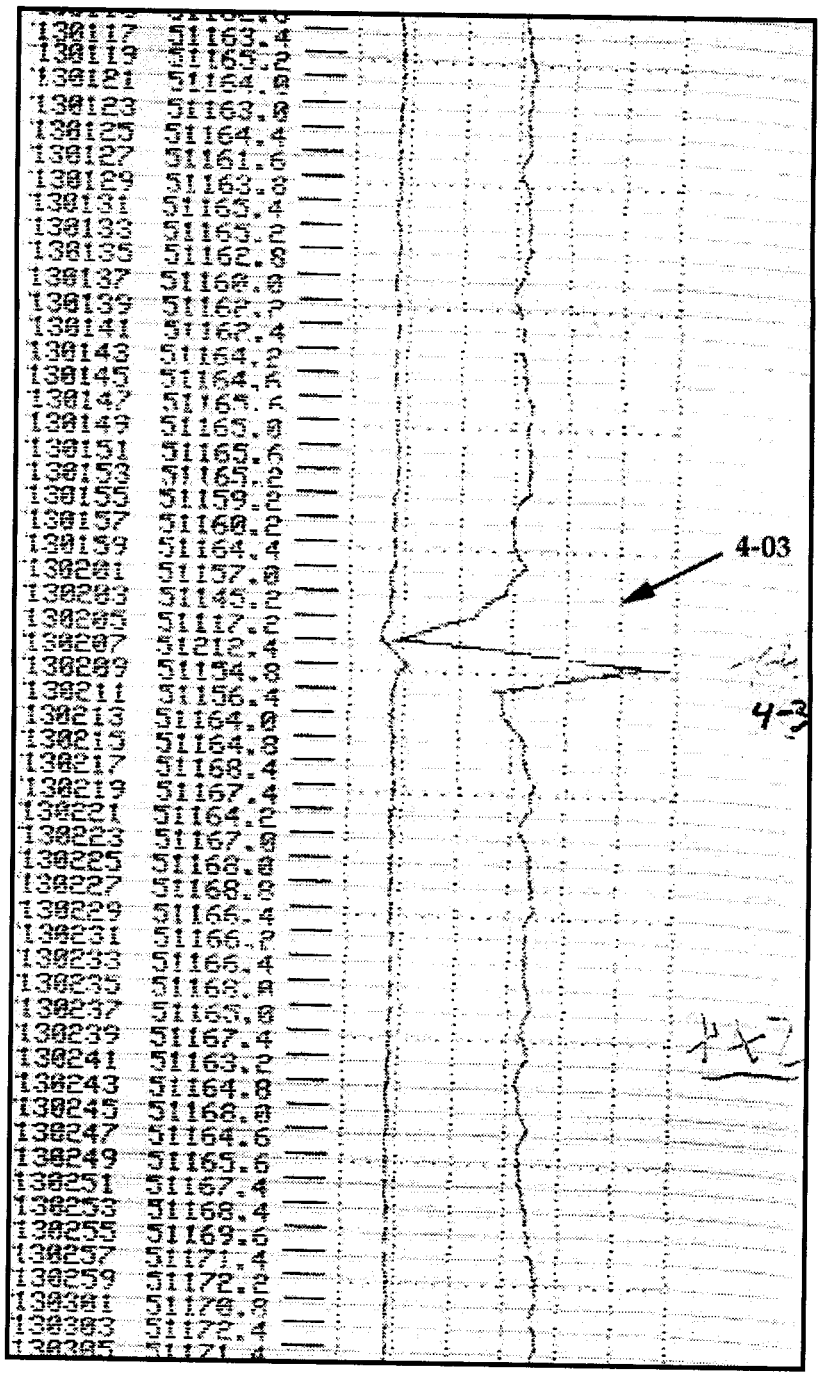

Figure 30. Magnetic signature of TI4-03.

Administration (NOAA) charts 11539 and 11541 indicated a wreck in the vicinity of the anomaly (Figure 31).[1]

Target Designation	Northing	Easting
TI4-04	220885	2408968

Priority: Moderate

Target TI4-04 was located on lanes 5 and 6 and was identified in the magnetometer records as 4-5 and 4-7. The signature had a maximum intensity of 12 gammas and was detected for a maximum duration of 85 feet (Figure 32). The contoured signature revealed a multi-component anomaly which influenced an area of approximately 12,300 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics indicated an object or cluster of objects of low ferrous mass distributed over a moderate sized area. Similar low intensity, broad duration signatures have been observed in association with iron-fastened wooden-hull wrecks with little or no additional surviving ferrous material. Targets TI4-05, TI4-06, and TI4-07 were also noted to lie within 200 feet of the anomaly and may be spatially related. NOAA charts 11539 and 11541 indicated an obstruction in the area of the four targets (Figure 33).[2]

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[1] Searches of the NOAA wreck and obstruction database on the internet and correspondence with the Operations Branch, Hydrographic Surveys Division of NOAA revealed no information on the identity of the wreck in the vicinity of the target. Stephen Verry, Operations Branch, NOAA Hydrographic Surveys Division, personal communication, 5 December 1998.

[2] Searches of the NOAA wreck and obstruction database on the internet and correspondence with the Operations Branch, Hydrographic Surveys Division of NOAA revealed no information on the identity of the obstruction in the vicinity of the targets. Stephen Verry, Operations Branch, NOAA Hydrographic Surveys Division, personal communication, 5 December 1998.

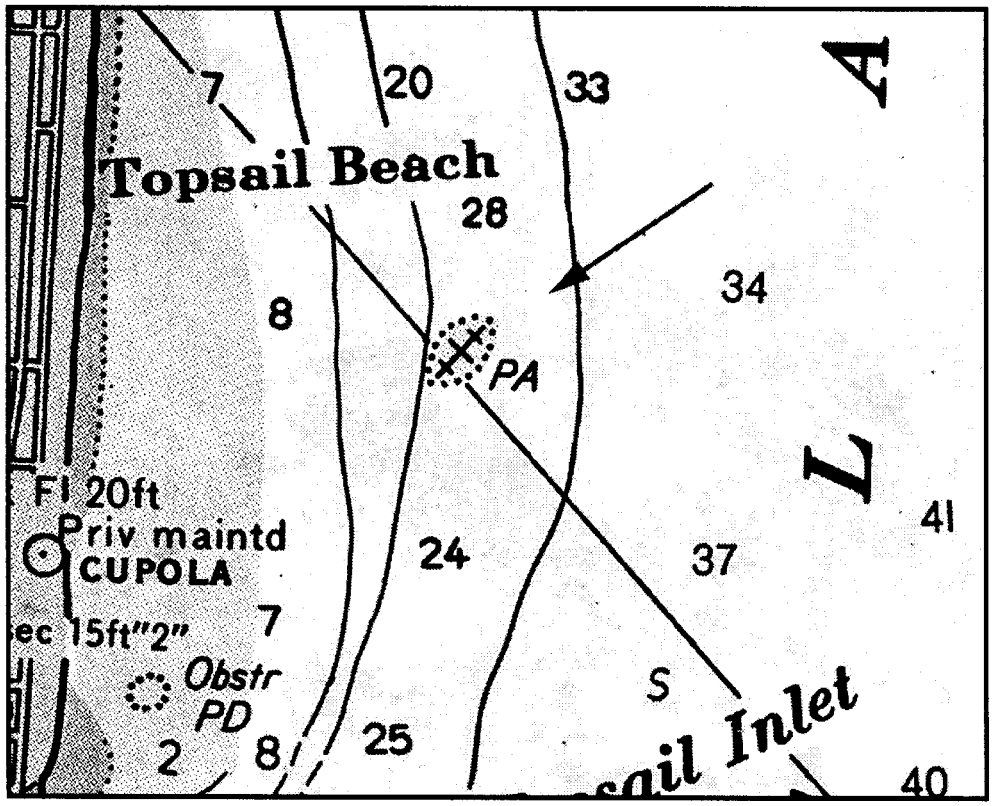

Figure 31. Charted wreck in the vicinity of target TI4-03 (Nautical Chart 11541, Intracoastal Waterway Neuse River to Myrtle Grove Sound, North Carolina).

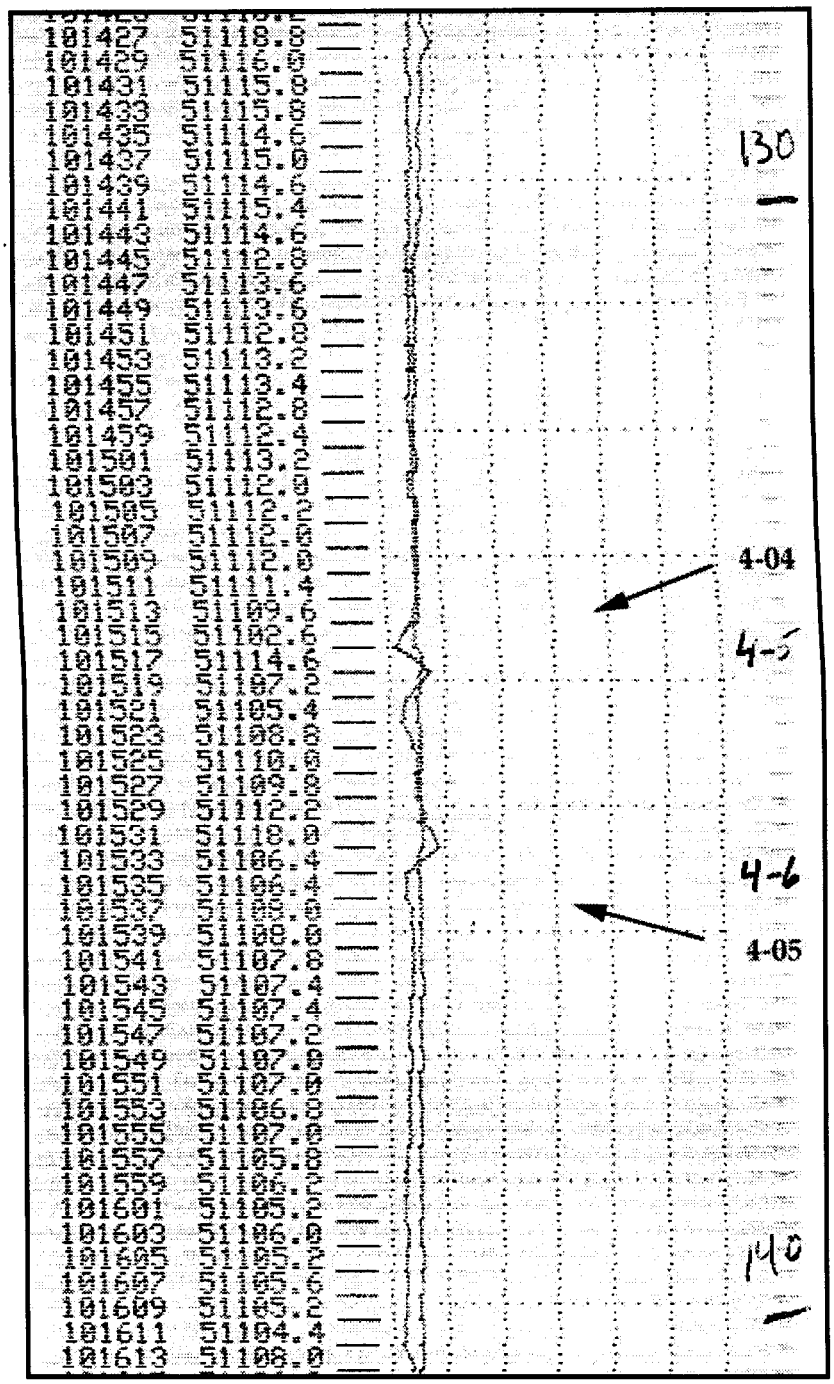

Figure 32. Magnetic signature of TI4-04 and TI-4-05.

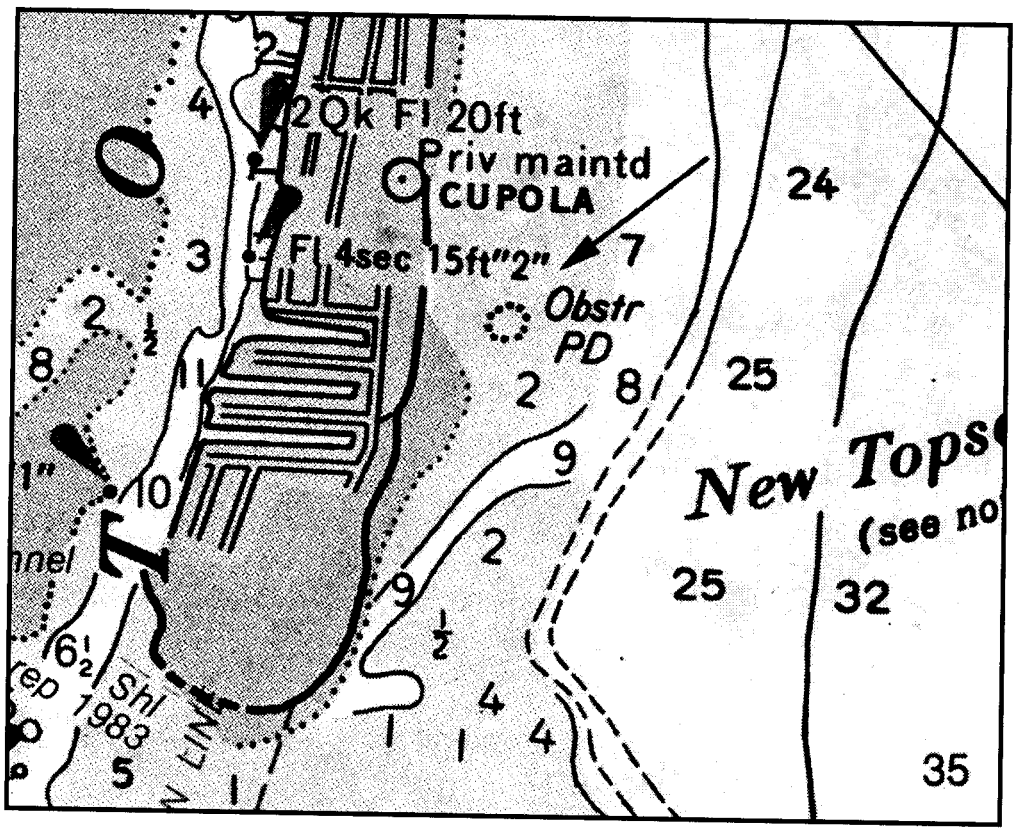

Figure 33. Charted obstruction in the vicinity of targets TI4-04, TI4-05, TI4-06, and TI4-07 and TI4-08 and TI4-09 (Nautical Chart 11541, Intracoastal Waterway Neuse River to Myrtle Grove Sound, North Carolina).

Target Designation	Northing	Easting
TI4-05	220991	2409087

Priority: Moderate

Target TI4-05 was located on lane 5 and was identified in the magnetometer records as 4-6. The signature had a maximum intensity of 12 gammas and was detected for a maximum duration of 50 feet (Figure 32). The contoured signature revealed a simple dipolar anomaly which influenced an area of approximately 5,200 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics suggests a single object of low ferrous mass. Such low intensity, short duration signatures are commonly associated with isolated point sources such as small modern anchors, pipes, or other small debris. Though the object contained signature characteristic s of modern material it appears to be spatially associated with targets TI4-04, TI4-06, and TI4-07.

Target Designation	Northing	Easting
TI4-06	220721	2409165

Priority: Moderate

Target TI4-06 was located on lane 8 and was identified in the magnetometer records as 4-10. The signature had a maximum intensity of 42 gammas and was detected for a maximum duration of 75 feet (Figure 34). The contoured signature revealed a simple positive monopolar anomaly which influenced an area of approximately 8,600 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the

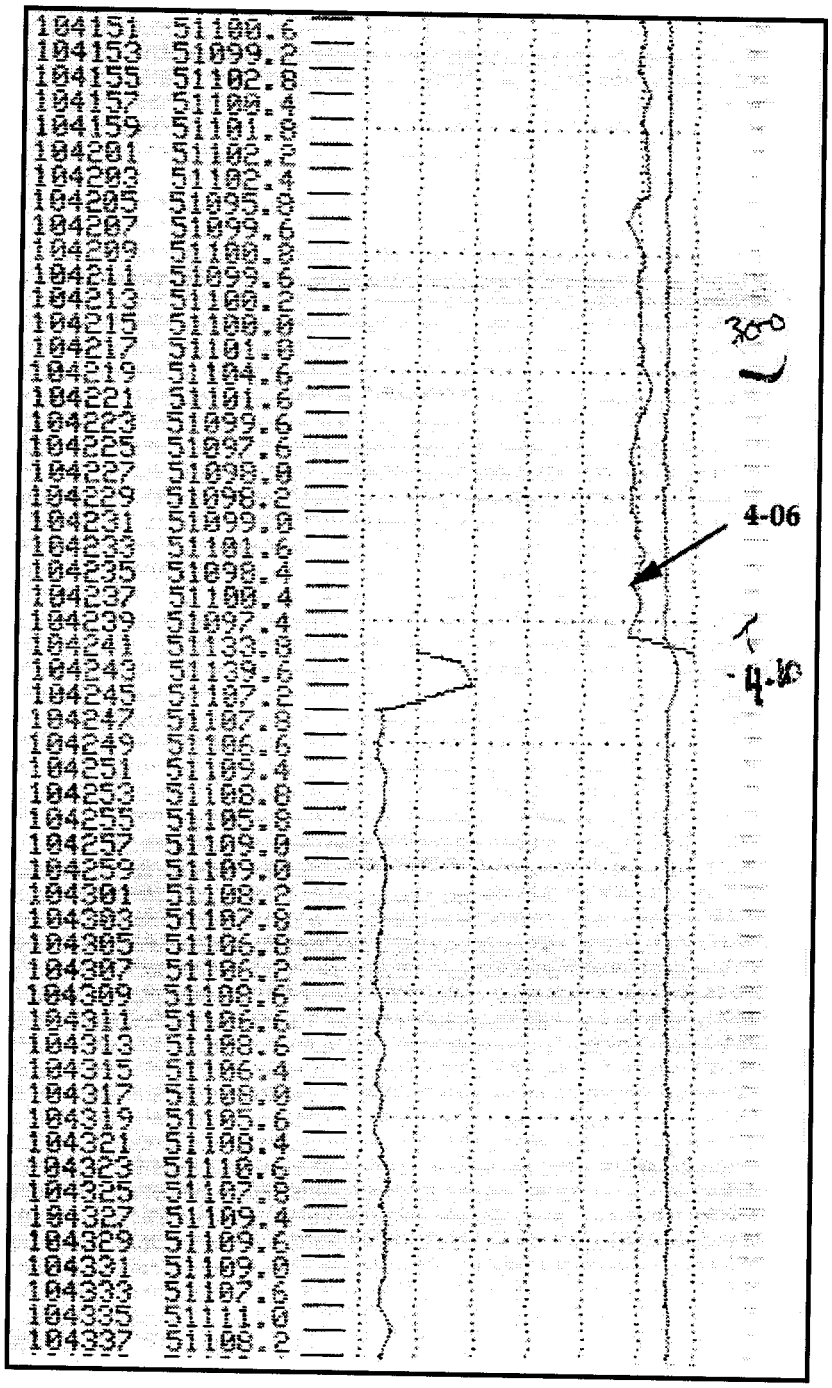

Figure 34. Magnetic signature of TI4-06.

signature characteristics indicated an object or cluster of objects of low ferrous mass distributed over a moderate sized area. Similar low intensity, broad duration signatures have been observed in association with iron-fastened, wooden-hulled wrecks with little or no additional surviving ferrous material. The object creating the anomaly appears to be spatially associated with the targets identified as TI4-04, TI4-05, and TI4-07.

Target Designation	Northing	Easting
TI4-07	220832	2409199

Priority: Moderate

Target TI4-07 was located on lane 7 and was identified in the magnetometer records as 4-8. The signature had a maximum intensity of 29 gammas and was detected for a maximum duration of 80 feet (Figure 35). The contoured signature revealed a simple dipolar anomaly which influenced an area of approximately 10,800 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics indicated an object or cluster of objects of low ferrous mass distributed over a moderate sized area. Similar low intensity, broad duration signatures have been observed in association with iron-fastened, wooden-hulled wrecks with little or no additional surviving ferrous material. The object creating the anomaly appears to be spatially associated with the targets identified as TI4-04, TI4-05, and TI4-06.

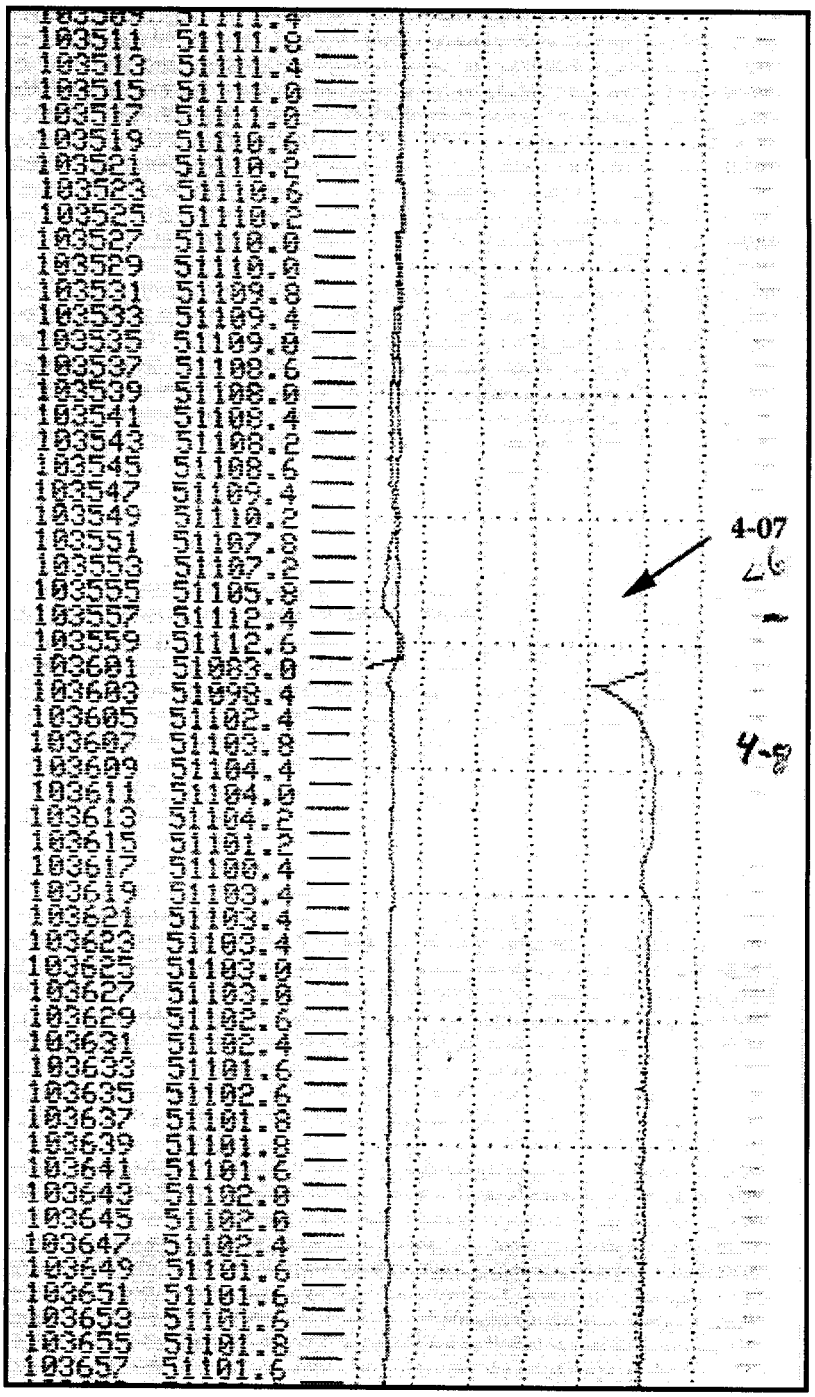

Figure 35. Magnetic signature of TI4-07.

Target Designation	Northing	Easting
TI4-08	220845	2409433

Priority: Moderate

Target TI4-08 was located on lanes 9 and 10 and was identified in the magnetometer records as 4-11 and 4-12. The signature had a maximum intensity of 29 gammas and was detected for a maximum duration of 121 feet (Figure 36). The contoured signature revealed a simple dipolar anomaly which influenced an area of approximately 21,000 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics indicated an object or cluster of objects of low ferrous mass distributed over a large area. Similar low intensity, broad duration signatures have been observed in association with iron-fastened, wooden-hull wrecks with little or no additional surviving ferrous material. The target may be associated with Target TI4-09 which lies approximately 140 feet to the south east.

Target Designation	Northing	Easting
TI4-09	220812	2409607

Priority: Moderate

Target TI4-09 was located on lanes 11 and 12 and was identified in the magnetometer records as 4-13 and 4-14. The signature had a maximum intensity of 27 gammas and was detected for a maximum duration of 85 feet (Figure 37). The contoured signature revealed a simple dipolar anomaly which influenced an area of approximately 19,200 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature

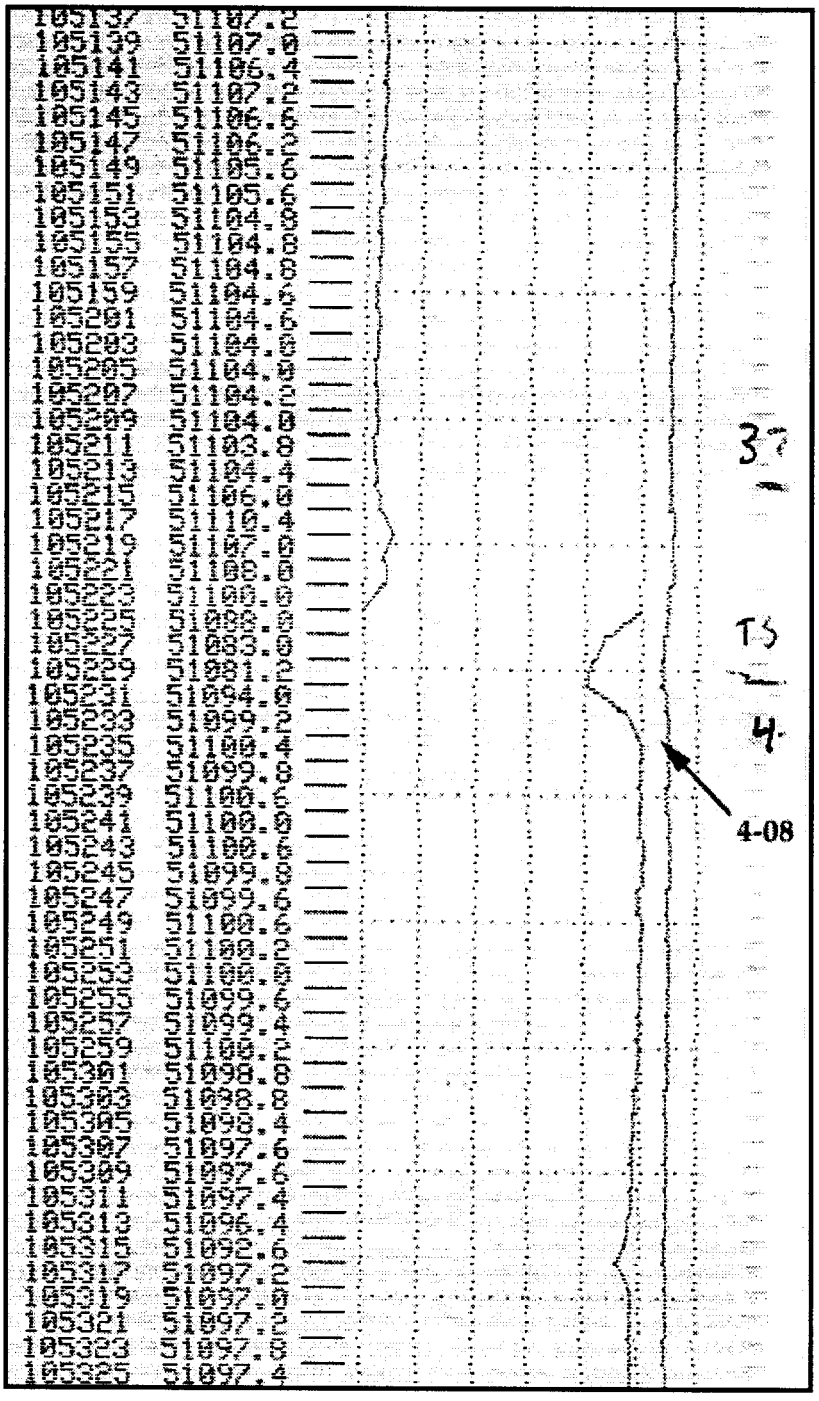

Figure 36. Magnetic signature of TI4-08.

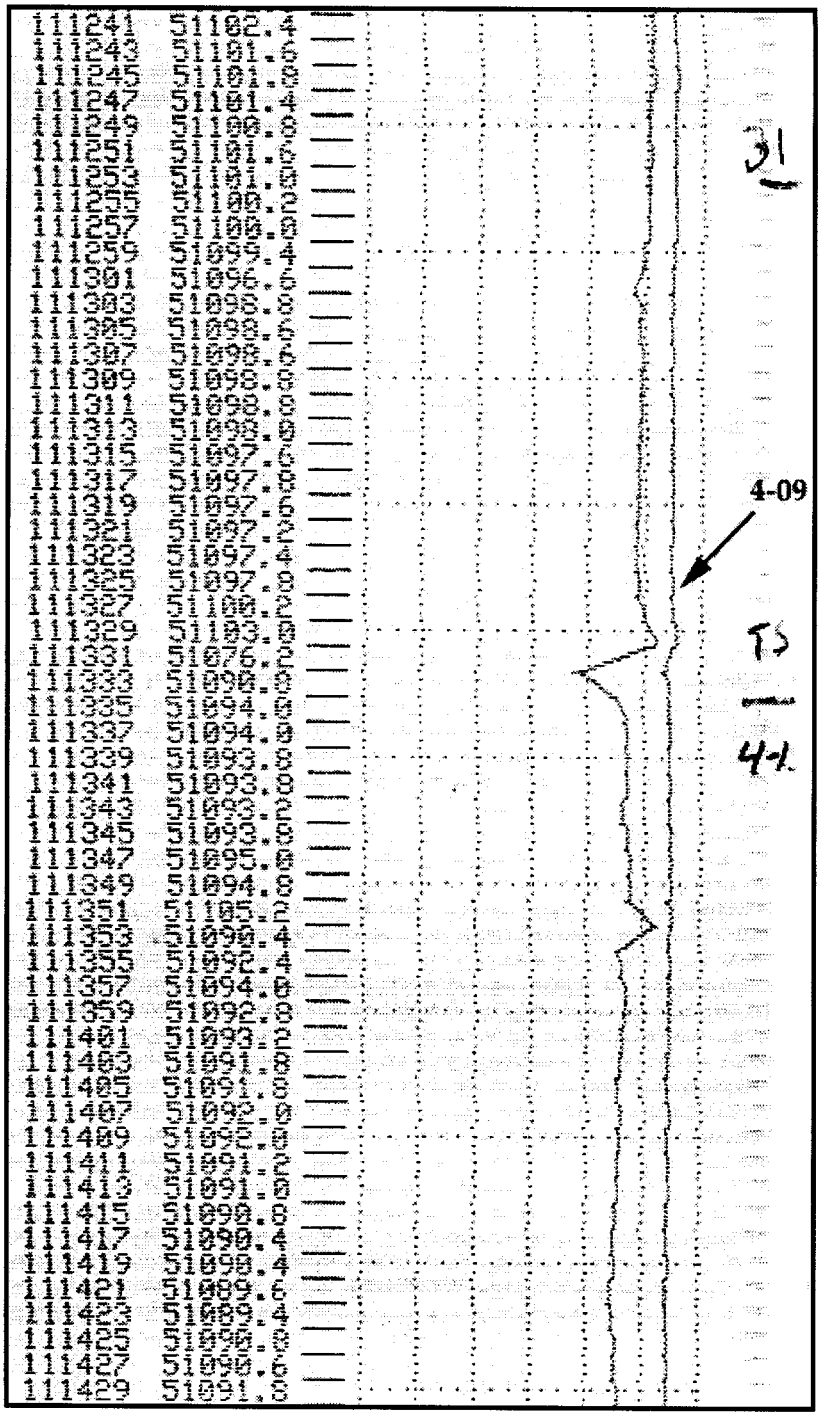

Figure 37. Magnetic signature of TI4-09.

characteristics indicated an object or cluster of objects of low ferrous mass distributed over a moderate sized area. Similar low intensity, broad duration signatures have been observed in association with iron-fastened, wooden-hull wrecks with little or no additional surviving ferrous material. The target may be associated with Target TI4-08.

Target Designation	Northing	Easting
TI4-10	222129	2410609

Priority: Low

Target TI4-10 was located on lane 7 and was identified in the magnetometer records as 4-9. The signature had a maximum intensity of 119 gammas and was detected for a maximum duration of 75 feet (Figure 38). The contoured signature revealed an intense, simple negative monopolar anomaly which influenced an area of approximately 10,000 square feet. Additional surveying in the vicinity of the anomaly revealed that the target's magnetic signature dropped to zero within 30 feet of the original reading. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics indicated an object of high intensity, low ferrous mass distributed over a small sized area. Similar high intense, small duration signatures have been observed in association with modern material such as pipe and wire cable.

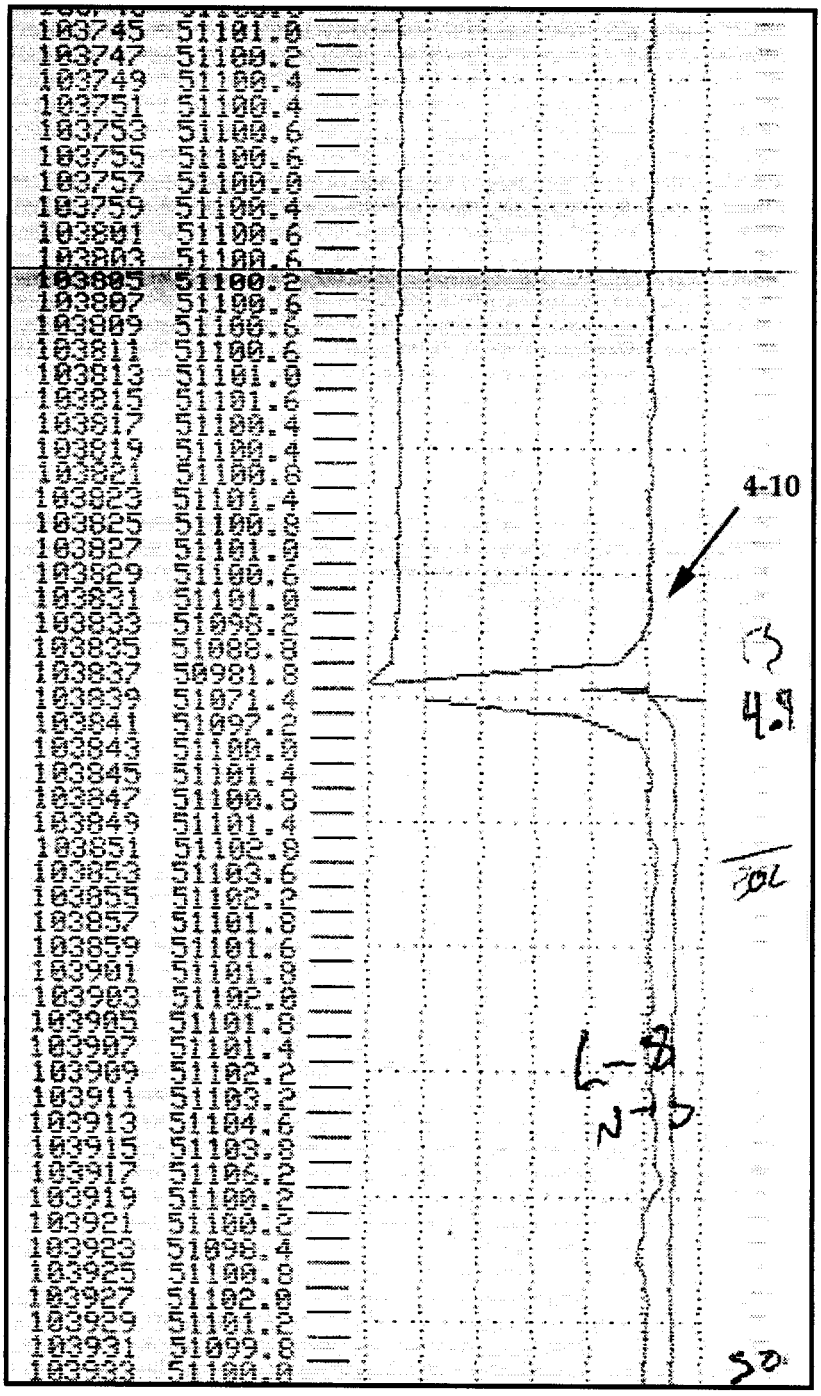

Figure 38. Magnetic signature of TI4-10.

Area 5. Analysis of the remote sensing data for Area 5 revealed one anomaly in the survey area (Figure 39). The anomaly contains signature characteristics suggestive of modern debris.

Target Designation	Northing	Easting
TI5-01	223499	2411697

Priority: Low

Target TI5-01 was located on lane 4 and was identified in the magnetometer records as 5-2. The signature had a maximum intensity of 54 gammas and was detected for a maximum duration of 85 feet (Figure 40). The contoured signature revealed a simple positive monopolar anomaly which influenced an area of approximately 15,000 square feet. No sonar signature was associated with the material generating the magnetic signature. Analysis of the signature characteristics indicated an object of low ferrous mass distributed over a small area. Similar low intensity, small duration signatures have been observed in association with modern material such as pipe and wire cable. Additional surveying of the target on a 30-foot lane spacing confirmed the target's similarity to modern debris.

Area 6. Analysis of the remote sensing data for Area 6 revealed no anomalies in the survey area (Figure 41).

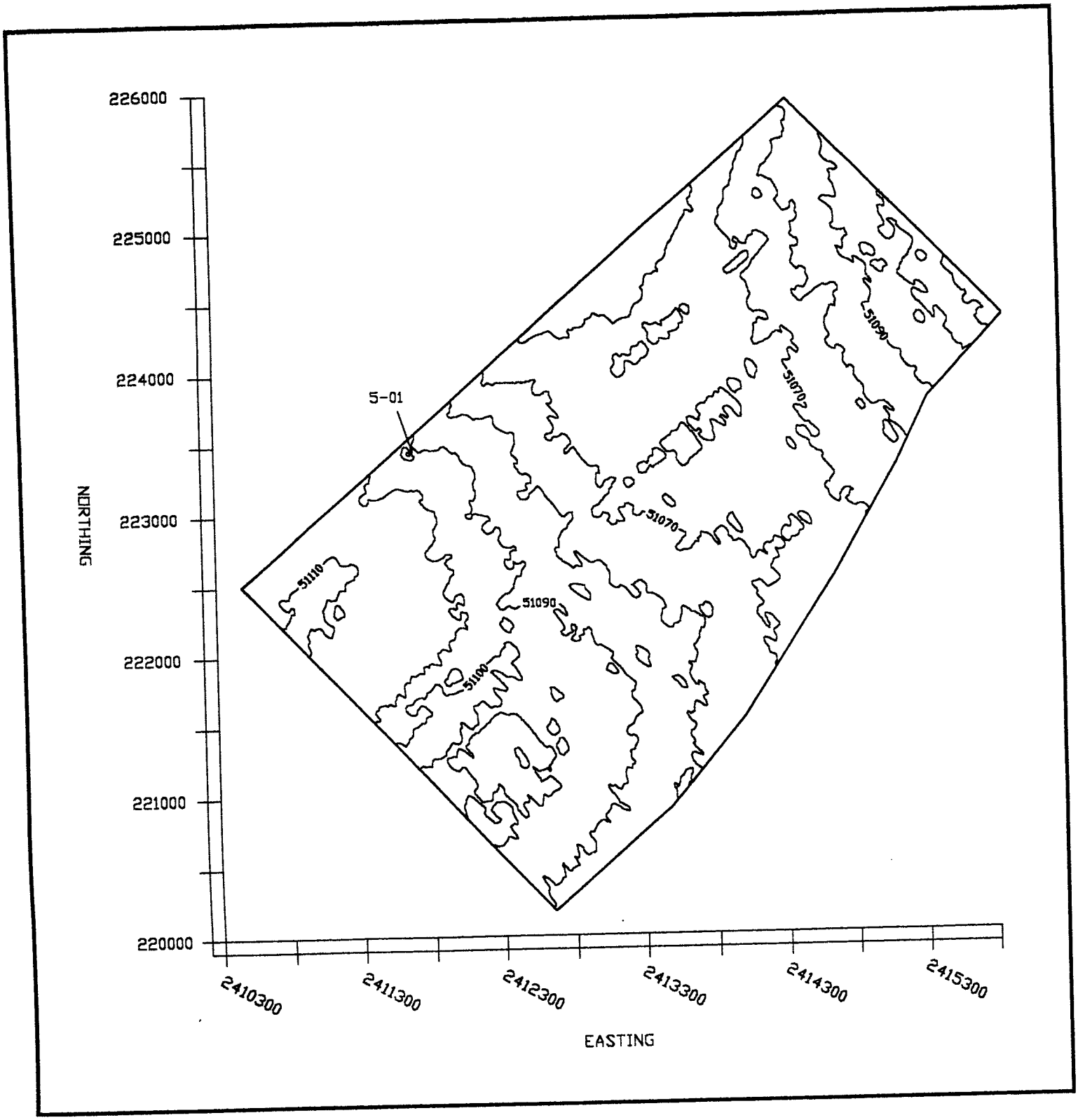

Figure 39. Contour map, Area 5.

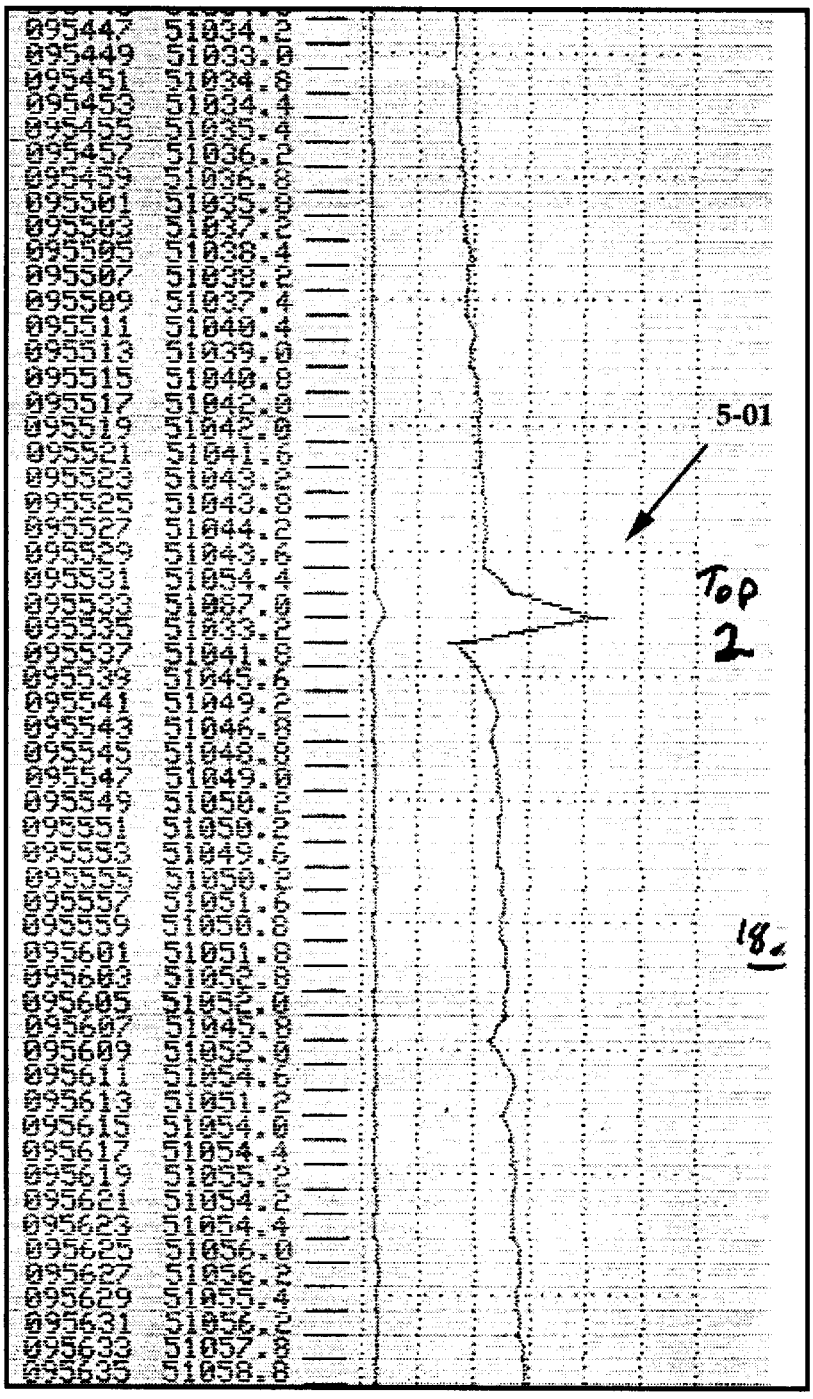

Figure 40. Magnetic signature of TI5-01.

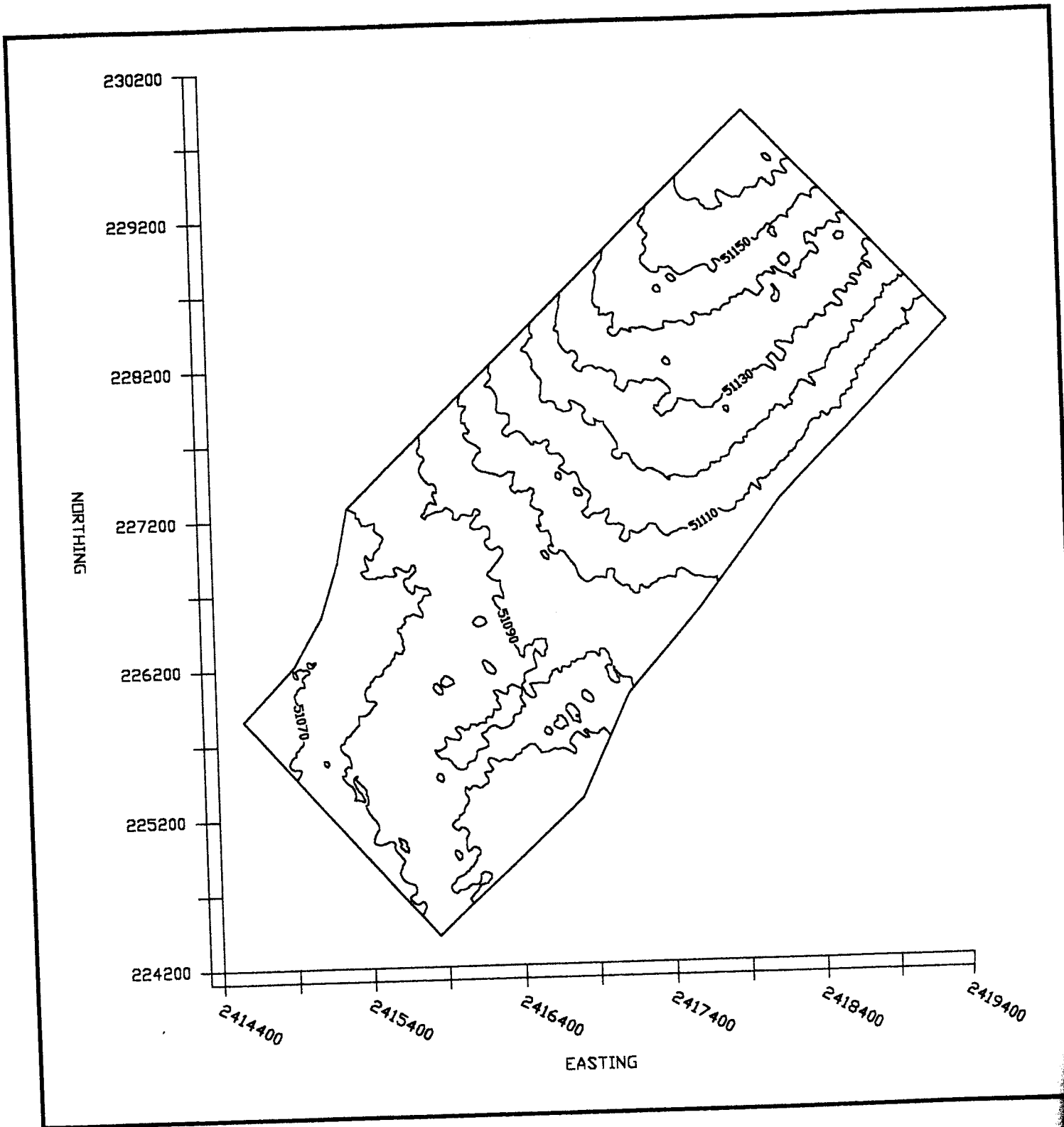

Figure 41. Contour map, Area 6.

Diver Investigation

NOAA Obstruction Site. After completion of the general survey, the cluster of anomalies associated with TI4-04, TI4-05, TI4-06, and TI4-07 and TI4-08 and TI4-09 was re-surveyed using a 30-foot lane spacing. Because of the results of the survey and the following diver investigation the cluster of anomalies has been designated as the NOAA Obstruction site. This additional surveying provided a more detailed map of the distribution of ferrous material associated with the targets and lent further support for the probable association of the six anomalies. The resulting data was used to plan the most efficient method for investigating the targets.

The data was contoured on a 5-gamma scale and revealed three clusters, or tight scatters, of ferrous material and three point sources lying roughly perpendicular to shore oriented on an east to west axis (Figure 42). The three magnetic clusters (A, B, and C), located near the center and eastern part of the contour map, exhibit differing magnetic signatures. The easternmost cluster (A) appears to contain a concentration of objects of low magnetic intensity. Four targets were identified in this area, all of which produced magnetic signatures of under 30 gammas. Similar signatures have been noted on wreck sites containing mainly fasteners, ship's hardware, and/or other small iron artifacts. Clusters B and C, on the other hand, appear to be dominated by one or more objects of moderate intensity such as anchors, cannons, or other larger iron objects. Cluster B was composed of three targets, one of which contained a 63 gamma signature and the other two signatures of 26 and 12 gammas. Cluster C contained four

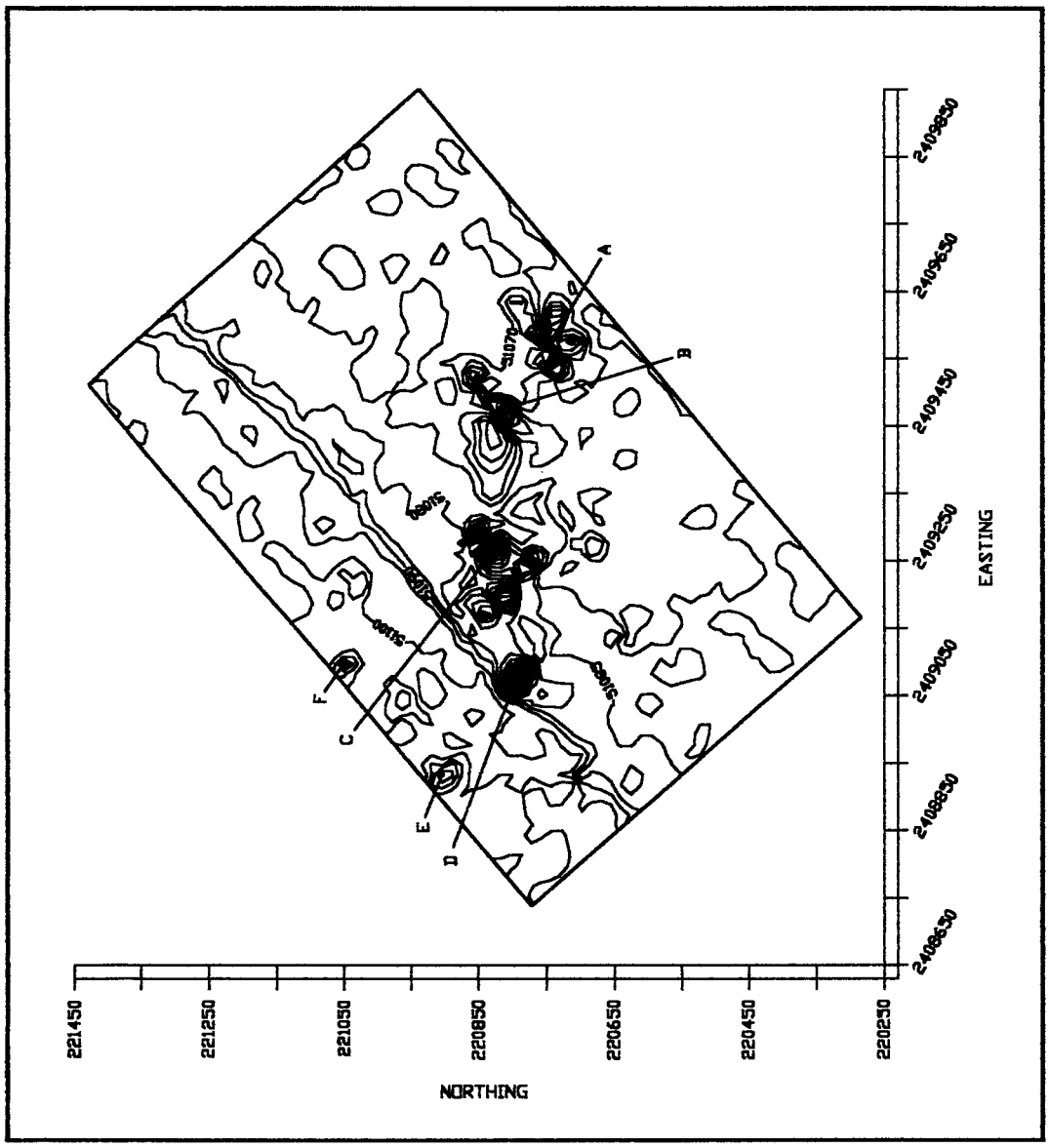

Figure 42. Five gamma contour map of anomalies associated with TI4-04, TI4-05, TI4-06, and TI4-07 and TI4-08 and TI4-09.

targets, one had a 78 gamma signature, another a 48 gamma signature, and the other two signatures of 36 and 20 gammas.

The three point sources (D, E, and F) were found closer to shore. The signature of one of these, D, suggests that it was generated by a single object of moderate intensity such as a canon or anchor. It's signature was generated by an object of 70 gamma intensity. The other two point sources, E and F, contained signature characteristic s typical of small ferrous objects like those produced by Cluster A. The magnetic signatures for these two targets were 29 and 26 gammas.

This distribution pattern is consistent with a shipwreck which had grounded during a storm with wave action pushing material associated with the wreck shoreward as the vessel broke up. However, the anomalies may also represent shore material, such as a house, which was destroyed and carried offshore during one the many hurricanes documented along the North Carolina coast.

Due to time constraints, the cluster of anomalies at A and C and Point Source D from the NOAA Obstruction site were selected for investigation to determine whether the material generating the magnetic signatures were shipwreck related or not. Each target was marked with a reference buoy and a hand-held magnetometer was swum on the surface in the anomaly's vicinity to further refine its location which was then marked by additional buoys. As the sonar survey revealed no exposed objects on the bottom surface at any of the targets each was investigated with a 10-foot-long water jet probe.

At Cluster A, the anomaly in the southwestern part of the cluster was chosen for investigation by divers. The area was probed every foot for a distance of 30 feet along a line between the two reference buoys. Water depth in the vicinity of the target location was 17 feet. The probe detected a hard metal object buried approximately 2 feet below the bottom surface. Once the target was located, an underwater dredge was employed to remove the overlying sediment to identify the source of the material.

Excavation revealed two lengths of 1 1/2 inch diameter cable coiled in a circle 5 feet in diameter located just below the bottom surface. These lengths of cable were wrapped together by two sections of 1/4 inch rope. The cable was heavily corroded, indicating that it was exposed on the bottom surface for some time before being buried. A log, 8 inches in diameter and stripped of bark, was found lying underneath the coil. The log did not exhibit signs of discoloration or other weathering.

As the cable appeared to be modern a second anomaly within the cluster was tested to determine whether the cable was associated with the site or was a modern intrusion. Excavation of the second target revealed a 23-foot 10-inches-long, 3-foot 6-inches-wide intact plug stock oak rudder (Figure 43). The 15-foot 1-inch-long blade was composed of 4 pieces of timber (12 inches, 14 inches, 12 inches, and 3 inches wide respectively) fastened together with 1 1/4-inch iron bolts. The blade was 16 inches wide on its forward side and tapered down to 6 inches on its aft end. Both edges of the blade were also faceted. The corroded remains of the shackle plate were found on the upper aft side of the blade. The

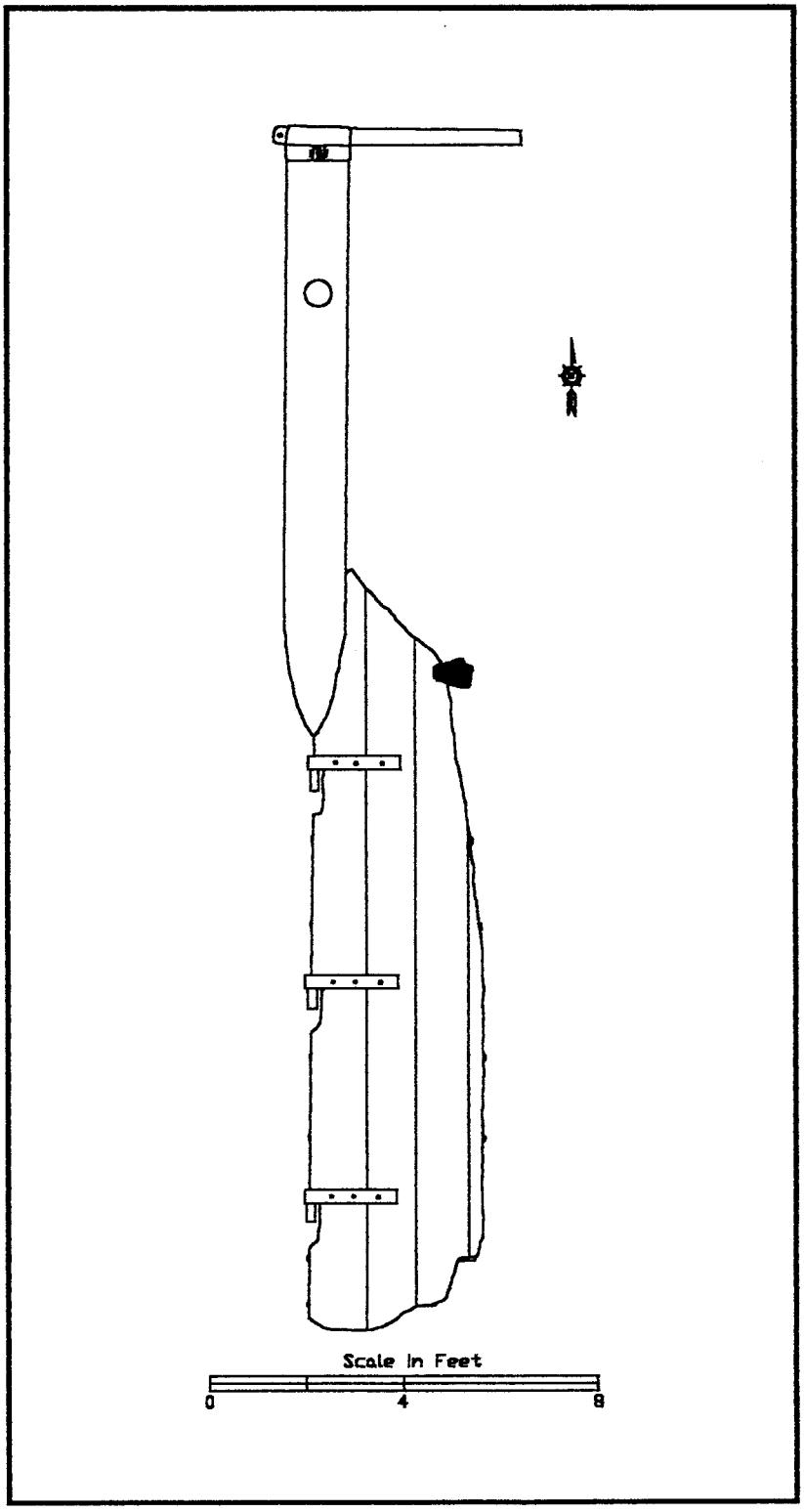

Figure 43. Drawing of rudder uncovered at Cluster A.

shackle plate, along with the rudder pendants, served to secure the rudder should it become unshipped.

The rudder was secured to the stern post by three bronze pintle straps, each containing an intact pintle. A 10-inch-long, 3-inch-deep rebate was cut into the blade below each strap to allow the pintles to be fitted into its matching gudgeon strap. Each pintle measured 2 inches in diameter and 5 inches long. The straps were 22 inches long, 3 inches wide and were secured to the rudder blade by three 1 1/2 inch diameter bronze bolts.

The rudder's stock measured 12 feet 2 inches long and 15 inches in diameter. The stock tapered to a rounded point 5 inches above the uppermost pintle strap. A 6-inch-diameter hole was cut into the timber 3 feet 3 1/2 inches below the top. The upper end of the stock was capped by two 4-inch-wide iron collars. A 3-foot 4-inch-long, 4-inch-square iron beam protruded from the upper collar. That timber served as a mount for the steering chains of the wheel.

At Cluster C, the anomaly in the northeastern part of the cluster was chosen for investigation by divers. The area was probed every foot for a distance of 30 feet along a line between the two reference buoys. Water depth in the vicinity of the target location was 12 feet. Probing indicated a scatter of objects buried approximately 4 to 5 feet below the bottom surface. A dredge was used to expose the largest concentration of material.

Excavation of the anomaly revealed two wooden deadeyes, a section of wire rigging, iron chain plates, and two lengths of anchor chain (Figure 44). Each of the deadeyes measured 10 inches in diameter. One of the deadeyes was

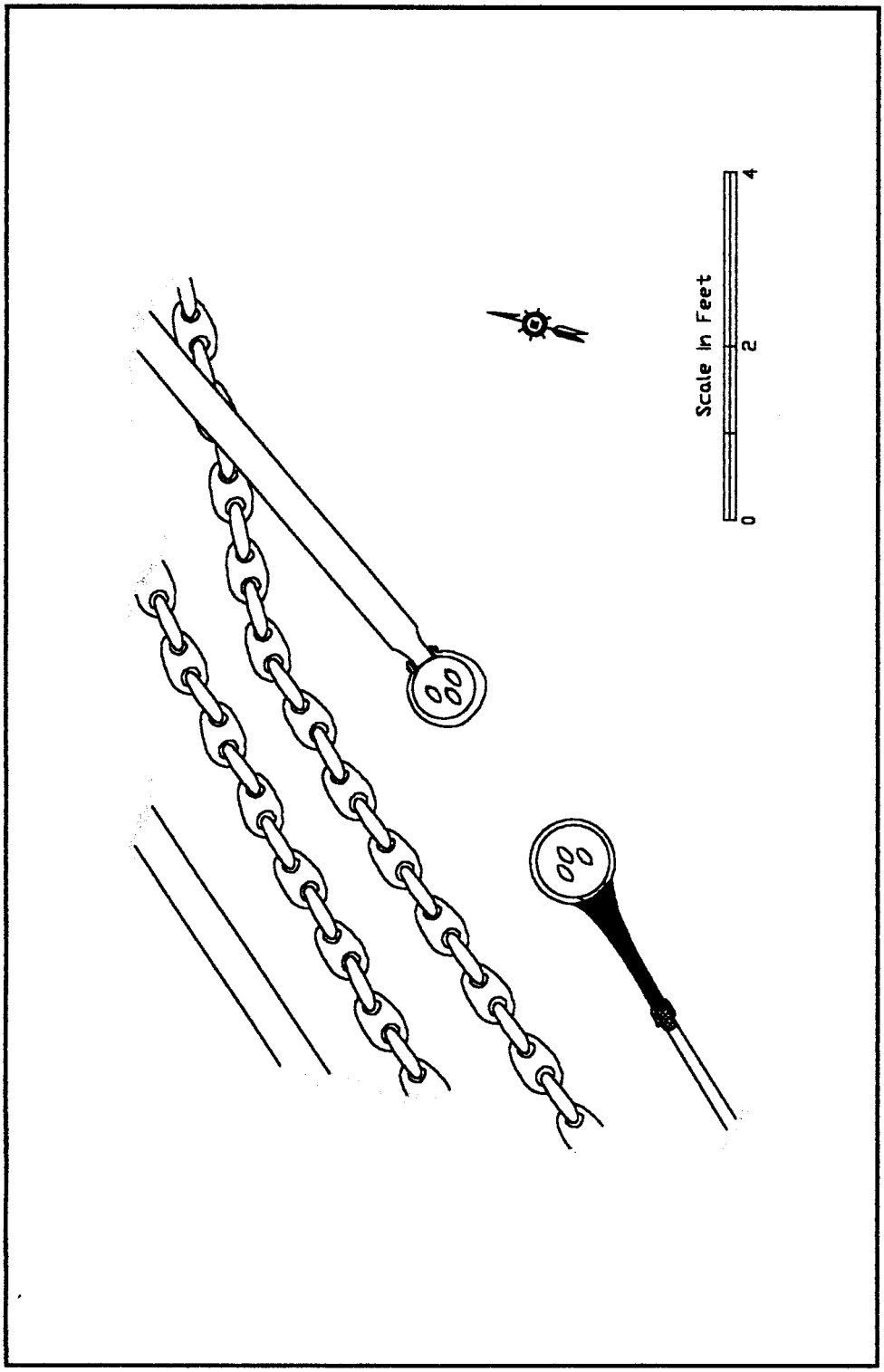

Figure 44. Drawing of objects uncovered at Cluster C.

wrapped in 1 1/2-inch wire cable that served as rigging for one of the masts. The other was bolted with a 1-inch-iron bolt to a section of chain plate. The chain plate measured 5 inches in width and 1/2 inch in thickness. A second chain plate of similar width and thickness was found 2 1/2 feet northeast of the first. Two sections of iron stud-linked anchor chain was uncovered between the sections of rigging. Each link measured 9 inches long, 5 inches wide, and 2 1/2 inches thick.

The anomaly at Point Source D was probed every foot for a distance of 20 feet along a line between the two reference buoys. Water depth in the vicinity of the target location was 7 feet. Probing indicated an object approximately 6 feet long lying 6 feet below the bottom surface. The target's extreme depth and its location at the edge of the surf zone precluded any further attempt at investigation.

NOAA Wreck Site. Anomaly TI4-03 was also re-surveyed using a 30-foot lane spacing. The data produced during this survey was contoured on a 5-gamma scale and revealed a multi-component anomaly of 59 gammas intensity lying roughly parallel to the shore oriented on a southwest to northeast axis. Analysis revealed that the anomaly influenced an area of approximately 13,200 square feet and was composed of two concentrations of ferrous material, one near the center and at the northern end of the site (Figure 45). As a results of this additional survey the anomaly has been designated as the NOAA Wreck site. The northern target was chosen for investigation by divers.

Target TI4-03 was relocated by archaeologists and investigated by divers. Water depth in the vicinity of the target location was 28 feet. Probing revealed a scatter of material buried approximately 9 to 10 feet below the bottom surface. Material struck by the probe included wood, deteriorated iron, and other dense matter covering an area at least 30 feet square. Further identification of the objects generating the magnetic signature could not be established due to the target's extreme depth. As a consequence, no further investigation of TI4-03 was carried out in conjunction with the current project.

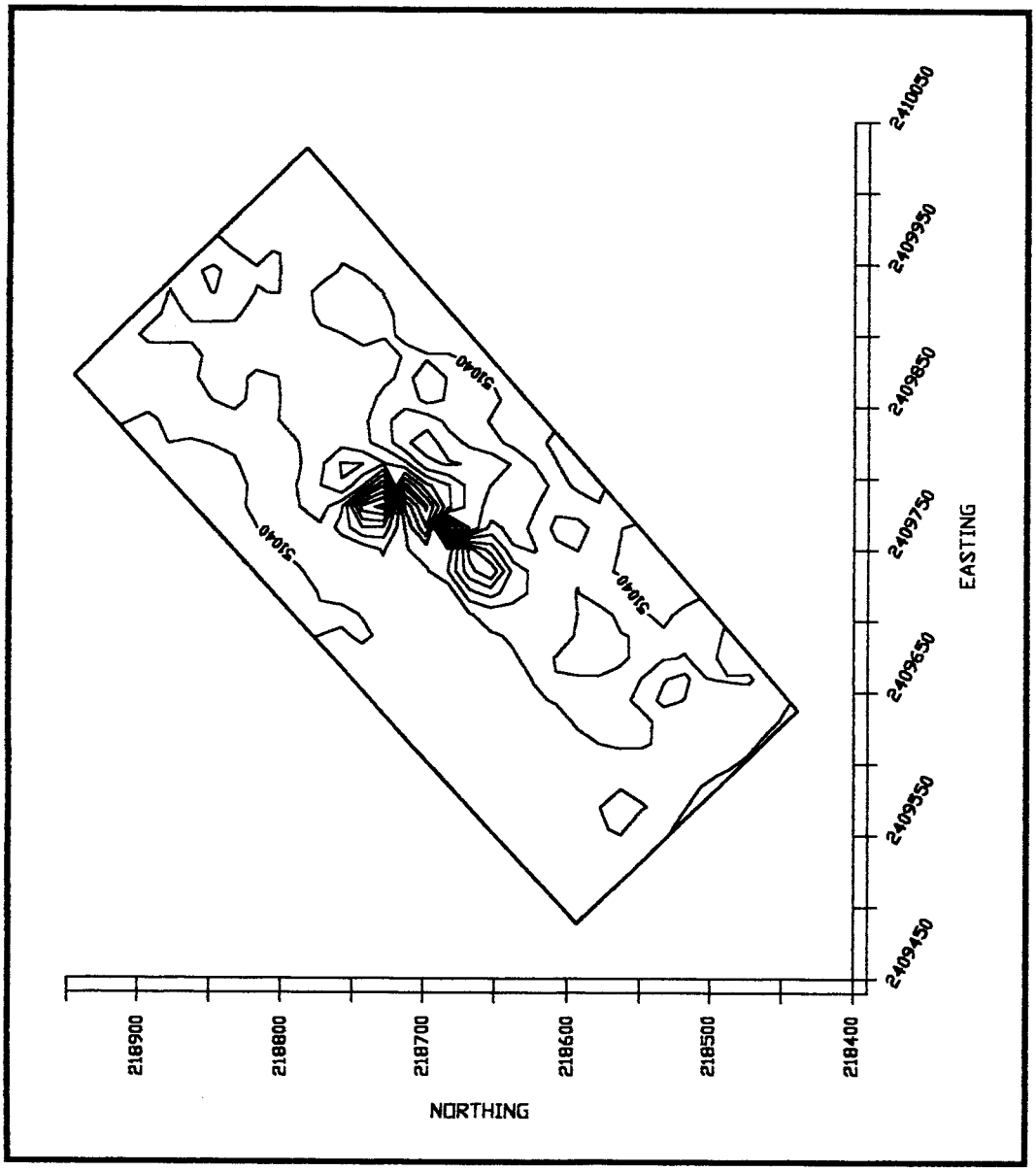

Figure 45. Five gamma contour map of anomalies associated with TI4-03.

Chapter 6

Conclusions and Recommendations

The purpose of the archeological investigation at Topsail Inlet was to locate the remains of the Spanish Plate Fleet vessel *El Salvador*. That packetboat was one of four ships from the 1750 Fleet lost in a hurricane which struck the flotilla during its homeward voyage. *El Salvador* suffered almost total loss of life, only four crewmen survived, and the hull was broken up and buried within a matter of days of the accident. Documents concerning the loss refer to the vessel as wrecked in the vicinity of Topsail Inlet. However, during the late Colonial period two stretches of the North Carolina coast were known as Topsail Inlet: the area of modern Beaufort Inlet and that of modern New Topsail Inlet. Documents describing the position of the wreck in relationship to the frigate *Nuestra Señora de Guadalupe*, another of the fleet that put into Ocracoke, further clouds the issue of the vessel's location. These documents indicate that the *El Salvador* wrecked 15 leagues from the frigate. Both inlets, however, lie approximately 15 leagues from the position of the *Guadalupe* depending on how the measurement is taken. Beaufort Inlet lies close to 15 leagues on a direct line from the *Guadalupe* while New Topsail Inlet is located approximately the same distance south of the latitude of Ocracoke. Due to these geographical coincidences there has been a lack of consensus as to the location of the wreck site. Historical research and material recovered in the vicinity of New Topsail

Inlet in the early twentieth century have led the focus of this research to New Topsail.

Prior to the initiation of field activities, research was conducted to establish criteria for identifying anomalies and sites that may represent *El Salvador*. These criteria were developed from a comparative study of data from three sources: 1. remote sensing surveys in which shipwreck material were identified, 2. site investigations which yielded information on eighteenth century ship construction, and 3. material culture of Spanish shipwreck sites. These studies provided diagnostic information useful in the identification or elimination of potential anomalies and sites during analysis of the field data.

Archaeological research on the *El Salvador* consisted of a magnetometer and side scan sonar survey of a six-mile-square area centered on the modern Topsail inlet. To facilitate data collection and analysis, the project area was divided into six 1-mile-square survey blocks with a survey lane spacing of 75 feet. During the survey, 14 magnetic anomalies were identified in four of the areas. Two of those targets were located in Area 2, one in Area 3, ten in Area 4, and one in Area 5. Of these 14 targets, only seven exhibited signature characteristics suggestive of submerged cultural resources. Those targets were all found in Area 4 and included anomalies: TI4-03, TI4-04, TI4-05, TI4-06, TI4-07, TI4-08, and TI4-09. These targets were also recorded on NOAA marine charts for New Topsail Inlet. TI4-03 was indicated in the charts as a wreck while those of the other six were labeled as an obstruction. As a consequence of their listing on NOAA charts, the material associated with TI-03 has been designated as the

NOAA Wreck site and the cluster of material associated with TI4-04, TI4-05, TI4-06, TI4-07, TI4-08, and TI4-09 as the NOAA Obstruction site. The rest of the anomalies exhibited characteristics similar to modern debris such as pipe, cable, modern anchors or other similar debris.

The seven potentially significant targets were resurveyed to obtain a more detailed map on the distribution of ferrous material and, as in the case of the NOAA Obstruction site, to test if the signatures were associated with one another. That additional surveying provided further support to the hypotheses that these targets may represent shipwreck material.

The data produced for the NOAA Wreck site revealed a tight cluster of moderately intense ferrous material with little or no peripheral magnetic disturbances. The object or objects creating the magnetic signature were oriented roughly parallel to the shore. Similar signatures have been observed in sites in which the vessel wrecked intact and disintegrated slowly over time. Data produced during the investigations of sites 0003BUI (*Queen Anne's Revenge*) and the *Nuevo Constante* serve as examples of this type of site formation. Historical records indicate that both vessels grounded intact and broke up after months of exposure. At Site 0003BUI, remote sensing indicated an intense magnetic disturbance roughly 200 feet in diameter with few outlying components. Investigations of the site have revealed a ballast pile, cannons, cannon balls, anchors, iron hoops, and other material clustered in a 75 by 35 foot area. A similar situation existed at the *Nuevo Constante* site. Analysis of that site's data revealed that nearly all of the recovered artifacts came from within or adjacent to

the surviving hull structure. A remote sensing survey conducted after excavation confirmed the lack of peripheral material, though one isolated point source, not investigated, was noted approximately 35 feet south of the hull.

The data from the NOAA Obstruction site revealed three clusters of low to moderate ferrous objects and three point sources suggesting single ferrous material. These anomalies are scattered over a linear distance of 700 feet and are oriented roughly perpendicular to shore. The three clusters lie offshore in 12 to 17 feet of water while the point sources lie closer to the beach in water less than 10 feet deep. This distribution of the anomalies is consistent with a vessel that had broken up rapidly after grounding during a storm. The point of grounding would represent the farthest offshore component of the site and would be composed of segments of the lower hull, ballast, and items stored there. As the vessel came apart, wave action would have transported the remaining hull structure, cargo, and equipment shoreward, dropping heavier objects nearer to the point of contact and transporting lighter material farther shoreward.

The wrecks of the 1715 Fleet in Florida and *San Esteban* in Texas demonstrate a similar distribution of material. Although no contour maps of the sites where produced, the site maps of the *Nuestra Señora de la Regala,* the *Urca de Lima,* and the *Santo Cristo de San Roman* from the 1715 Fleet exhibit artifact distribution patterns comparable to the magnetic signatures at the NOAA Obstruction site.[1] These three wreck sites contained offshore ballast piles, hull

[1] The wrecks of the 1715 Fleet were salvaged by treasure hunters during the 1960s through 1980s. The site maps produced by the salvers consisted mainly of material already exposed on the bottom surface and excavated areas containing precious objects. These maps do not represent the

structure, cannon, and other material indicative of the lower hull. Shoreward of the site of impact were a scatter of additional cannon, bullion, personal items, and other artifacts.

The *San Estaban* site further illustrates the scattering effect of a high-energy environment on material associated with shipwreck sites. Documents concerning the historical salvage of the vessel indicate that the *San Estaban* was partially intact after sinking; later storms buried and scattered the rest of the vessel's remains. Contour maps produced during remote sensing showed that the archaeological record associated with the vessel was distributed over a 300-foot linear area. Heavy surf and storms had widely scattered the remaining material from the main site area. The investigators had also noted marine growths on many of the conglomerates, suggesting that material was periodically exposed and reburied in the energetic site environment.[2]

After completion of the second survey and analysis of the resulting data, selected anomalies were chosen for investigation by divers to determine whether they represented shipwreck material. At the NOAA Wreck site, the northern anomaly was selected for investigation while at the NOAA Obstruction site, the inner and outermost cluster of anomalies (A and C) and Point Source D were selected. Each target was marked with a reference buoy and a hand-held magnetometer swum on the surface in the anomaly's vicinity to further refine its

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complete archaeological record for each site. As a consequence, only those wrecks that were heavily salvaged and contained the most detailed maps of the distribution of materials found were included in the discussion above. Robert Weller, Sunken Treasure on Florida Reefs (Oviedo, FL: Mickler's Floridiana, 1987; reprint, West Palm Beach, FL: Florida Treasure Brokers, 1993).

[2] Arnold and Weddle, 195, 197.

location. As the sonar survey revealed no exposed objects on the bottom surface at any of the target locations each was investigated with a 10-foot-long water jet probe. Once the probe struck a subsurface obstruction the reference buoy was repositioned over the spot and a 4-inch induction dredge employed to expose the material generating the magnetic signature for identification.

NOAA Wreck Site

At the NOAA Wreck site, the water jet probe repeatedly struck solid material 9 to 10 feet below the bottom surface. This material consisted of wood, deteriorated iron, and other dense matter covering an area of at least 30 feet square. No further identification of the objects generating the magnetic signature could be made due to the target's extreme depth. In all likelihood, this target does not represent *El Salvador*. The 28 foot depth of water at the site is too great for it to be the packetboat; historical documents indicated that the vessel grounded in shallow water. With a recorded depth of hold of 9 feet 3 inches, *El Salvador* would have certainly been carried much farther inshore before striking bottom. As a consequence, no further investigation of the NOAA Wreck site was carried out in conjunction with the project.

NOAA Obstruction Site

Hydro probing at Point Source D indicated an iron object approximately 6 feet long lying nearly 7 feet below the bottom surface. The depth of overburden

above the target site precluded any further investigation to determine the source of the material generating the magnetic signature.

Artifacts exposed at Clusters A and C are associated with the remains of a scattered shipwreck. That material included wire rigging, iron chain plates, a section of anchor chain and an intact plug stock anchor. Taken together these artifacts indicate that the site represents a nineteenth or twentieth century sailing vessel. Round stocked rudders were introduced during the last quarter of the eighteenth century but did not gain wide acceptance until the first quarter of the nineteenth.[3] In addition, prior to the nineteenth century rudders were fashioned with straight edges on their after side with hancings or steps being employed to reduce the width of the blade as it approached the stock.[4] Rounding of the after edge like the one found during investigation did not come into use until the early nineteenth century. Both wire rigging and iron anchor chain were introduced around the turn of the nineteenth century and stud-linked chain in 1813 but varying quality and conservatism within the shipping industry delay wide acceptance of iron support fixtures such as these until after the second quarter of the century.[5]

Historical research on shipwrecks in the vicinity of New Topsail Inlet suggested a possible candidate for the remains located during the survey. That vessel is the *William H. Sumner*. The *Sumner* was wooden merchant schooner that ran aground on the shoals near the entrance to New Topsail Inlet on 7 September

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[3] Goodwin, 10.
[4] Ibid.

1919. The vessel was built in Camden, Maine by I. Coombs & Co. in 1891 and was registered as measuring 165 feet long, 35.5 feet wide, 13 foot depth of hold, and a gross/net tonnage of 543/489.[6] When it was lost, the *Sumner* was returning to New York from a voyage to South America with a cargo of phosphate rock, mahogany logs, and iron wood. High waves stymied all attempts to save the ship and when the vessel broke its back after two days aground salvage crews began removing as much cargo, machinery, and rigging as possible before it broke apart.[7] The Coast Guard later blew up what remained to remove it as a navigation hazard.

Photographs taken of the vessel shortly after it grounded show a number of features that correspond to the artifacts uncovered during the investigation. One of these pictures, depicting the vessel on its port side, clearly shows the rigging of the vessel which includes heavy sets of chain plates very similar to those uncovered at Cluster A (Figure 46). Another picture, taken from the bow sprit, shows the *Sumner* with heavy stud-linked anchor cable and wire rigging, also similar to the artifacts found (Figure 47). Though these photographs do not provide conclusive proof that the vessel discovered at New Topsail Inlet is the *William H. Sumner* they corroborate that the material found is typical of a vessel dating to the nineteenth or twentieth centuries and not that of the mid-eighteenth century merchant vessel.

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[5] Robert Park MacHatton, "Evolution and Introduction of Chain Cables," United States Naval Institute Proceedings 66, no. 445 (1940), 362-363.

[6] Lloyd's Register of Shipping, Lloyd's Register of Shipping. Vol. II (London: Lloyd's Society Printing House, 1891); Lloyd's Register of Shipping, Lloyd's Register of Shipping. Vol. II (London: Lloyd's Society Printing House, 1919).

[7] John Randt, "Murder mystery lingers only in memories," Wilmington Star-News, 25 June 1972.

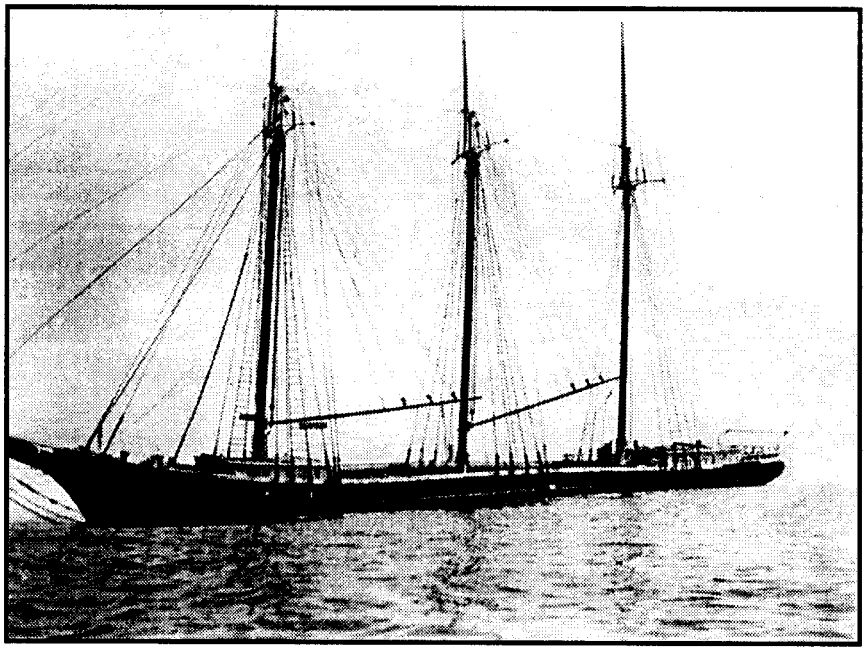

Figure 46. Photograph of the port side of the *William H. Sumner* (Courtesy Cape Fear Museum, Wilmington, NC; 1988.39.233; Image Archive).

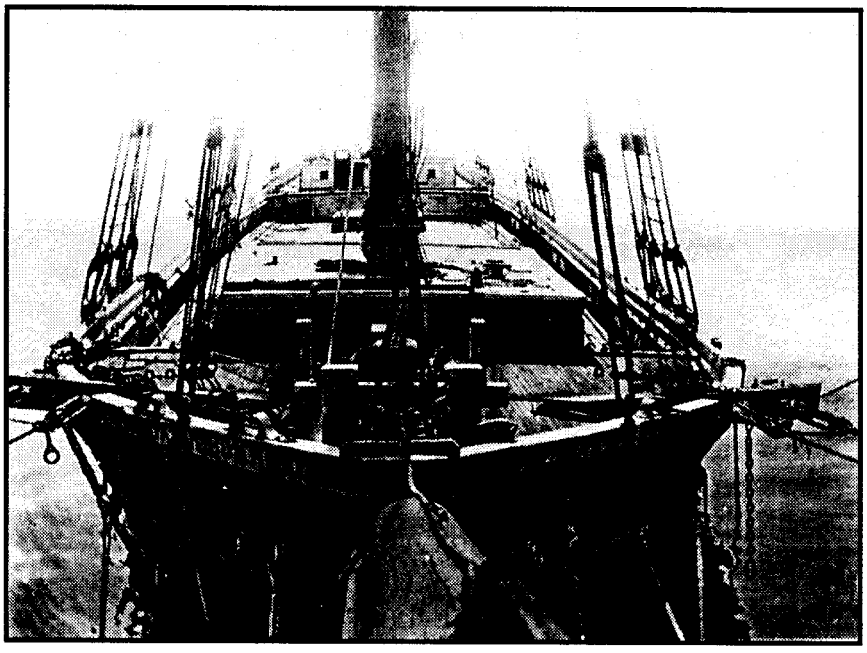

Figure 47. Photograph of the bow section of the *William H. Sumner* (Courtesy Cape Fear Museum, Wilmington, NC; 1988.39.234; Image Archive).

Recommendations

None of the sites located during the survey appear to be the remains of *El Salvador*. Though the NOAA Wreck site was not identified, the depth of water in which it was located and the limited extent of the magnetic signature associated with it does not give the impression of a wreck broken up and scattered by a hurricane. The other site, the NOAA Obstruction site, did represent the remains of a vessel in the condition similar to that expected for *El Salvador*. However, material on the wreck dated from the late nineteenth to early twentieth century.

Though *El Salvador* was not located, the remains of the vessel still could be located near the vicinity of the surveyed area. The 15 leagues recorded in the historical record were not precise measurements and determining distance during that period was not an exact science. As a consequence, the position given as the location of the wreck should be viewed as a starting point and subsequent investigations should continue both northward and southward.

New survey blocks should concentrate immediately north and south of those just completed. Since the present survey located one wreck and confirmed another listed on the NOAA charts, a 75-foot lane spacing appears to be more than adequate to locate anomalies indicative of shipwreck material. In addition, as *El Salvador* was known to have wrecked in shallow water those surveys should be conducted from the surf zone out to no more than the 30-foot contour like the initial survey. Any located targets should be resurveyed on a closer lane spacing to determine which may represent possible shipwreck material and

which may be considered to represent modern debris. Divers should investigate all potential targets.

Should these surveys prove to be fruitless consideration should be given to searching in the vicinity of Beaufort Inlet and Cape Lookout. These areas have been identified in the historical recorded as being another possible location for the wreck and a number of private salvage ventures have been conducted there in recent times. As a number of areas have already been leased to these ventures, permits should be obtained to survey in those areas not already leased but still have the potential to locate shipwreck remains.

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Appendix. Known Shipwrecks Located in the Vicinity of New Topsail Inlet, North Carolina.

Name Of Vessel	Type	Tons	Built	Date Lost	YEAR	Location	Cause
El Salvador	Nao			Aug 8	1750	Topsail Inlet	Hurricane
Unknown	Brig			Sept.	1769	Below Topsail Inlet	Ran ashore
Betsy	Merchantman, English				1771	Old Topsail Inlet	
Adelaide	Schooner, Blockade runner			Oct 22	1862	Mouth of New Topsail Inlet	Chased aground by the U.S.S. *Ellis* and abandoned. Cargo: 600 barrels of turpentine, 36 bales of cotton, and a small amount of tobacco.
Alexander Cooper	Schooner, Blockade Runner			Aug 22	1863	In New Topsail Inlet	Burned by U.S.S. *Shokon.*
Industry	Schooner	200		Feb 2	1863	5 miles north of Topsail Inlet	Burned by U.S.S. *Mount Vernon.* Cargo: Salt
Phantom	Steamer, iron propeller	266 (500)	1862, Liverpool	Sept 23	1863	200 yards offshore in 30 feet of water, near Rich Inlet	Run aground and burned. Cargo: Government stores consisting of arms, medicine, lead ingots, and sundry merchandise. Length-190', Beam-13'4", draft-8'6", Speed-18 knots
Unknown	Schooner			Jan 22	1863	Westward of Stump Inlet	Run ashore
Wild Dayrell	Side-Wheel Steamer, two stacks	440		Feb 3	1864	Near New Topsail Inlet	Grounded and burned. Cargo: Shoes, blankets, and valuable merchandise
Mary Bear	Schooner			Sept 9	1881	New Topsail Inlet	Foundered
Wiiliam H. Sumner	Schooner	543-G (489-N)	1891, Camden, Maine	Sept 7	1919	Topsail Inlet	Grounded