

WHY SHIPS WRECK
DISCOVERIES OF UNDERWATER ARCHAEOLOGISTS

By

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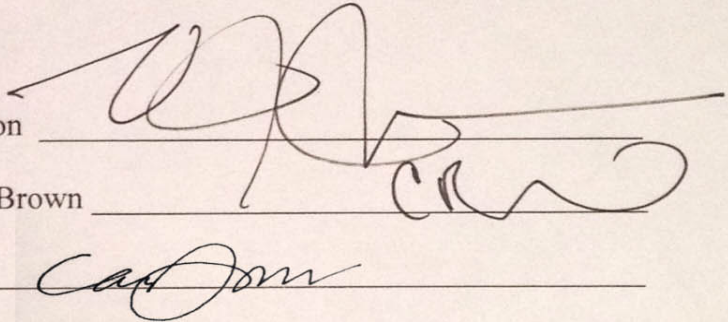
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Why Ships Wreck: Discoveries of U.S. Navy Underwater Archaeologists

A thesis submitted in partial fulfillment of the requirements for the degree of Master of
Arts at Corcoran College of Art and Design

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DEDICATION

I lovely dedicate this thesis to my family, who have supported me each step of my life.

ACKNOWLEDGEMENTS

I would like to thank my parents for being on my side in my life, and my wonderful siblings who have been a great source of motivation and inspiration. Also, I would like to thank my friends, Jeanette, Misty and my ambitious advisor Veronica Jackson for all their support throughout this process.

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ABSTRACT

WHY SHIPS WRECK: DISCOVERIES OF U.S. NAVY UNDERWATER ARCHAEOLOGISTS

Shima Nejabat, MA

Corcoran College of Art + Design, 2013

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The “Why Ships Wreck” exhibit at National Museum of the U.S. Navy informs visitors about the history of scuba diving, the process of Finding, Mapping, Identifying and conserving the shipwrecks, and presents case studies of found shipwrecks. Included are artifacts and images from the U.S. Navy’s collections. The “Why Ships Wreck” exhibit represents the mysterious depths of the ocean by creating a dark atmosphere, using underwater themed interactive wall and floor projections and underwater ambient sound throughout exhibition. The intention is to transport the visitor into an environment of aquatic discovery; the visitor is the diver exploring new territory. Also, the experience is illuminated strategically by engaging the audience’s senses in the subject matter.

CHAPTER 1: Goals

Frozen in time at the bottom of the ocean, a shipwreck often acts as a time capsule, untouched and forgotten. Every object contained within, from large cannons to small buttons, reconstructs a story that is often left untold by other sources.

Archaeologists discover the rise and fall of a ship, its sailors, and their lives at sea by exploring and interpreting wreck sites that would otherwise be lost to time and decay.

CHAPTER 2: Interpretive Mission Statement

The mission of the “Why Ships Wreck” Exhibition is to display the U.S. Navy’s underwater archaeologist’s discoveries and share its peacetime contributions in exploration and humanitarian service. The exhibit is to also inform and educate naval personnel and the general public about the process of underwater archaeology and in discovering U.S. Navy shipwrecks.

CHAPTER 3: Teaching Points

Inform and educate visitors on:

- U.S. Navy underwater archaeology's process
- U.S. Navy history and culture
- U.S. Navy high technology
- U.S. Navy Shipwrecks

CHAPTER 4: Take Aways

The takeaway for this exhibition is to educate public on:

- Challenges that archaeologist face to
- Shipwrecks
- Historical importance
- Technological importance

CHAPTER 5: Exhibit Audiences

Primary audience for “Why Ships Wreck” Exhibition are, people who are at least 14 years of age, who show interest in science, history, technology, and design; “U.S. Navy Shipwrecks” Exhibition is appropriate for whom is interested in science and history by providing information of historical and technical importance about ships, sailing, and life at sea. Also, because of the unique immersive underwater theme and technology, it has the ability to grab the attention of the visitors who are interested in technology and design.

Secondary audiences for “Why Ships Wreck” Exhibition are, tourists, and school tours.

CHAPTER 6: Exhibit Location

Selected site for this exhibition is “The National Museum of the United States Navy”, which is located in 736 Sicard Street Southeast Washington, DC 20374

Museum Introduction

The National Museum of the U.S. Navy was established in 1961 and opened to the public in 1963. The National Museum of the U.S. Navy is part of the Naval History & Heritage Command, which includes a library, archives, and photographic and other research facilities.

Close to 200,000 individuals visit The National Museum of the U.S. Navy annually. Admission to the Museum and its programs is free.

The National Museum collects, preserves, displays, and interprets historic naval artifacts and artwork to inform, educate, and inspire naval personnel and the general public. Also permanent and temporary exhibitions commemorate the Navy’s wartime heroes and battles as well as its peacetime contributions in exploration, diplomacy, space flight, navigation and humanitarian service.

The selected site space is about 2,080 Sq. Ft., This site is located between “The Great White Fleet Exhibit” on the north side, and “World War 2 Exhibit” on the south side. There is an emergency exit door, located on the west, and two possible entrance or exit opening to the exhibition, one on the south and one on the north. Also, the exhibition ceiling is about 32’ high.

The National Museum of the U.S. Navy, as one of 14 Navy museums throughout The United States, it is the only one that presents an overview of U.S. naval history. This museum embodies vision of sharing the Navy's history and traditions with the world. The "Why Ships Go Down?" Exhibition's mission is to inform and educate visitors by providing information of historical and technical importance about ships, sailing, and life at sea. Regarding the mission of "The National Museum of the U.S. Navy" and "Why Ships Go Down" Exhibition, this museum is a suitable site for this exhibition.

CHAPTER 7: Content Outline

- **What is underwater archaeology?**
 - Introduction
 - Scuba diving gear timeline
- **Why is underwater archaeology important?**
 - History
 - Culture
 - Technology
 - Why do ships go down?
- **What is under The water?**

Finding:

- What are Archaeologists looking for?
 - Shipwreck
 - Artifacts
 - Histories
- How Archaeologists go through bottom of the ocean?
 - What tools and techniques do archaeologist use for diving?
 - What dangers and challenges do archaeologist face to?
 - Limitation imposed by breathing a fixed amount of air

- Physiology of breathing air under pressure limits the time divers can stay under the water.
- Combating the cold
- Communication
- Limited visibility
- Photography and video-graphy
- How do archaeologist find lost shipwrecks?/ Technologies.
 - Accidentally by local fisherman
 - Magnetometer
 - Sonar devices
- **Mapping**
 - Using underwater grids
 - Photo-mosaic map
 - Magnetic Contour mapping
- **Identifying**
- **Conservation**
 - Some challenges of conservation
 - What does it add to the understanding of an object?
- **• Why do ships wreck?**
 - Introduction
 - Founded shipwrecks:
 - Mary Rose
 - Penobscot
 - Monitor
 - Alligator
 - Housatonic/Hunley

CHAPTER 8: Exhibit Narrative

What is underwater archaeology?

Covering nearly three-quarters of Earth's surface, water is the source of all life on our planet. Water-borne transportation has allowed exploration of much of the globe and facilitated the rise and fall of great empires. Beneath the surface of our oceans, lakes, rivers, and wetlands lies a physical record of humankind preserved in prehistoric and historic shorelines, shipwrecks, inundated cities, harbor works, and other traces of our past.¹ Archaeology is the scientific study of the human past through the investigation of artifacts (the physical remains of material culture), structures, the use of animals and plants, and human remains. Its goal is greater knowledge about past human cultures and behavior. Underwater archaeology carries these studies into a specialized environment, one containing numerous challenges and rewards for archaeological investigators. Underwater archaeology is archaeology practiced underwater.² Archaeology helps to understand the past and it completes the puzzle of human history by providing information of great historical importance about ships, sailing, and life at sea.³ Every object contained within, from large cannons to small buttons, reconstructs a story that is

¹ Advisory Council on Underwater Archaeology, "what is underwater archaeology." Accessed December 7, 2012. <http://www.acuaonline.org>.

² Akesson, Per. "A history of underwater archaeology" Nordic Underwater Archaeology.

³ US Navy, "underwater Archaeology." Accessed December 9, 2012. <http://www.history.navy.mil/index.html>.

often left untold by other sources. The majority of underwater archaeologists specialize in the study of nautical archaeology: the study of the construction and operation of all types of prehistoric and historic watercraft. For these specialists, shipwrecks are the focus of research, many of which (but by no means all) may be found underwater.

Archaeologists discover the rise and fall of a ship, its sailors, and their lives at sea by exploring and interpreting wreck sites that would otherwise be lost to time and decay.

Underwater archaeology is an interdisciplinary field that combines a wide range of subjects, reaching from Earth science to anthropology. The practice of underwater archaeology is truly interdisciplinary, combining the methods of various allied fields of study including anthropology, chemistry, ethnography, geology, history, naval architecture, oceanography, and paleography.⁴ The difficulties inherent to the field, however, are far outweighed by the benefits it provides. Exploring shipwrecks produces evidence for the causes of a sinking as well as information on past shipbuilding techniques. This research can also reveal the identity or location of unknown and missing ships. Through the investigation of shipwrecks, archaeologists are able to learn about life aboard diverse types of vessels. Likewise, historians use artifacts recovered from shipwrecks to learn about events and aspects of life often not mentioned in written records. Through underwater archaeology, we are able to create tangible links to histories that would otherwise remain unknown at the bottom of the ocean.

⁴ Advisory Council on Underwater Archaeology, "what is underwater archaeology." Accessed December 7, 2012. <http://www.acuaonline.org>.

Finding Shipwrecks

A single shipwreck is very small in comparison to the vast open spaces of ocean floor or riverbeds. Sometimes a shipwreck is stumbled upon accidentally by local fisherman who notice that their nets always catch in a particular spot, or by recreational divers who observe something out of the ordinary. In other cases, underwater archaeologists looking for a particular ship go through a long process of historical research and scientific deduction in order to narrow their search. Archaeologist choose an area to search based on their historical research. Learning about the history helps determine where they might be more likely to find a wreck site. But the depth, visibility of the water, the speed of the current, and other factors might make it impossible to see a shipwreck with the naked eye. They then employ different tools in order to find wreck sites. One such tool is a magnetometer, which reports concentrated levels of metal on the ocean floor. Sonar devices are also very important in detecting objects under water. Divers may then enter the water to learn more.

Magnetometer

During World War II, Allied forces used magnetometers to detect enemy submarines. Archaeologists now use them to find the large quantities of iron or steel underwater that usually indicate a shipwreck site. However, this method of searching can prove problematic, as magnetometers work by detecting variations in the magnetic field. They often pick up many different sources of metal in addition to shipwrecks: buried

pipes, discarded materials like refrigerators. While magnetometers are very helpful in the initial search, their results must be confirmed through other methods as well.

Sonar Devices

Sound Navigation and Ranging (SONAR) is another method that can successfully be used to find and confirm underwater wreck sites. Unlike magnetometers, sonar yields much more specific data. It emits sound and analyzes the echo, enabling people to detect objects underwater, their size, shape, and other factors. Underwater archaeologists use several types of sonar that work in different ways to achieve different results.

Side-scan sonar devices work by sending sound pulses in a continuous fan shape down to the ocean floor. Reflections are then received and recorded in slices that are placed together to form a two dimensional picture of the seabed. This enables archaeologists to efficiently survey large portions of the ocean floor by noting differences in material and texture that may indicate a wreck-site.⁵ Also “Multibeam” sonar devices have enhanced capabilities, able to measure and record depth.

Identifying

Once a ship has been discovered, archaeologists try to must determine its identity. Sometimes, when archaeologists find a ship they have been specifically looking for, the name of the ship has already been determined. Other times, when a ship is discovered inadvertently, materials the ship was constructed with, design, and artifacts within the shipwreck become important clues. These observations can tell an archaeologist what

⁵ Panchyk, Richard. *Archaeology for kids*. Chicago: Chicago Review Press, 2001.

time period the ship belongs to and significantly narrow the search. Historical records can then be used to find ships from the same period that disappeared in the area. If archaeologists are lucky, they are able to find the ship's bell, which has the name of the ship engraved on it. In some cases, nonetheless, all of these methods fail, and the identity of the ship remains a mystery.⁶

Mapping

Mapping a shipwreck site is a crucial step in the excavation process. Having a site properly mapped ensures that there is an accurate record of exactly where each object was found in relation to the ship and the other objects. The location of an item is often an important clue to its identity or function. Furthermore, a record of exactly where and how the ship is situated on the ocean floor as well as the location of all its contents can aid in discovering the cause of a wreck. For example, by accurately mapping the wreck of the *Mary Rose*, archaeologists discovered the misplacement of one of the guns. The imbalance that would have resulted may have caused the ship to heel and sink.

Underwater archaeologists use several different methods to map a site, such as using underwater grids to help create a scale diagram of the wreck. Recently however, technology has introduced several new methods. One method is to carefully photograph sections of the ship and piece them together to form a comprehensive image called a photo-mosaic map. Archaeologists took many different photographs of the wreck site and

⁶ US Navy, "underwater Archaeology." Accessed December 9, 2012.
<http://www.history.navy.mil/index.html>.

pieced them together to create this composite image of the wreck site. The image is important in recording everything in its original place as well as giving archaeologists a broad visual reference of the entire site and its contents.

Sonar and digital imaging also continue to grow as useful mapping techniques. Most underwater archaeologists map a wreck site using a grid before they begin excavating any artifacts. This important step helps them to record the exact locations of their findings, sketch drawings, and build models of the site.

The challenges of working underwater

Different geographic areas offer certain advantages and challenges for underwater archaeologists, and the Great Lakes are no exception. The lakes' cold fresh water offers unparalleled site preservation, often preserving entire ships and their contents intact. Conversely, the cold temperatures of the Great Lakes offer a formidable challenge to archaeologists. In addition to the "normal" challenges of working underwater, doing underwater archaeology in Wisconsin's Great Lakes requires special equipment, such as dry suits, heavy gloves, and a hood.⁷

Underwater archaeologists spend many hours beneath the surface studying and documenting a single shipwreck. Other than the limitations imposed by breathing a fixed amount of air (80 cubic feet in a standard scuba tank), the single greatest problem for divers is combating the cold. Even in water that is 80 degrees, a diver will eventually get

⁷ Wisconsin Historical Society, "The Challenge of Working Underwater." Accessed December 9, 2012. <http://www.wisconsinhistory.org>.

cold, because his or her body (at 98 degrees) will constantly give up heat to the colder water. In the Great Lakes, underwater archaeologists usually work in water that is between 40 and 60 degrees.

These frigid temperatures make a dry suit a necessity for prolonged diving in the Great Lakes. Different than a wetsuit, which allows a thin layer of water between the diver's skin and the suit, a dry suit keeps a diver completely dry. Tight seals around the diver's neck and wrists keep water out and also allow the diver to inflate the suit. The air inside the suit helps the diver maintain buoyancy and offers insulation. The major advantage of a dry suit is that the diver is dry and can wear very warm clothes under the suit.

The physiology of breathing air under pressure also limits the time divers can stay underwater. The air we breath everyday is comprised of 21 percent oxygen and 79 percent nitrogen, and a diver must know how both of these gases will affect him or her while diving. Depth (and therefore pressure) and dive time will influence the properties of oxygen and nitrogen and must be monitored closely by the diver. A build up of nitrogen in the bloodstream can be a potential hazard, and even oxygen can become toxic at a certain depth.

Communication also poses a challenge for underwater archaeologists. Divers cannot talk casually to each other underwater, making careful planning essential before each dive. Underwater archaeologists often use a pre-determined set of hand signals to facilitate working in pairs underwater. Specialized communication equipment can also be

used, but that introduces more links in the chain of equipment, planning, and execution more links that can break.

Limited visibility is another problem. Due to variable water clarity, sometimes divers can see only a few feet, making sketching, note taking, and other documentation difficult. Photography and videography are also difficult in low visibility conditions. Due to limited visibility and the large size of most shipwrecks, it is rarely possible to view an entire wreck at once. Generally, only small segments can be seen at a time. Consequently, archaeologists produce detailed drawings of the wreck, called site maps. Pieced together section by section, site maps allow archaeologists to “see” the entire wreck for the first time and to determine how individual features fit together.⁸

Tools and gear for different Kinds of diving⁹

Diving bells:

In the 19th century, the diving bell concept was put to use for underwater construction. Engineers used compressed air to keep water out of shafts or tunnels being dug underwater. Large airtight chambers called caissons were also used to shelter workers who carried out underwater construction projects such as building bridge foundations.

⁸ Wisconsin Historical Society, “The Challenge of Working Underwater.” Accessed December 9, 2012. <http://www.wisconsinhistory.org>.

⁹ University of Wisconsin Sea Grant Institute, “Underwater Exploration.” Accessed December 1, 2012. <http://seagrant.wisc.edu/madisonjason11/>.

Diving bells continue to be used today as part of modern diving systems, providing a method of transporting divers to their work sites while under pressure and, once at the site, of supplying breathing gas while the diver works. Smaller diving bells called personnel transfer capsules (PTCs) are used to transfer divers from one place to another. For example, from a ship to an underwater destination and back, while maintaining high pressure. After snorkels, diving bells were the next successful method of increasing endurance underwater. These bells consisted of a weighted chamber, open at the bottom, in which one or more people could be lowered underwater. The early use of bells was limited to short periods in shallow water, but later bells became quite popular when inventors developed methods of supplying fresh air to the bell using barrels and hoses.

Hamlet (Hard-Hat) Diving:

Although early diving bells provided divers some protection and an air supply, they limited the diver's mobility. In the 17th and 18th centuries, a number of devices (usually made of leather) were developed to provide air to divers and to afford greater mobility. However, most of these devices were not successful because they relied on long tubes from the surface to provide air to the diver and thus did not deal fully with the problem of providing adequate quantities of compressed air.

The first major breakthrough in surface-supplied diving systems came in the early 19th century in the form of a helmet-and-suit apparatus that consisted of a rigid helmet sealed to a flexible waterproof suit. Pressurized air was pumped down from the surface into the helmet. This type of equipment, with a few refinements, is still in use today.

In the 20th century, hard-hat divers learned that breathing mixed gases, in particular a helium-oxygen mixture permitted them to dive to greater depths for longer periods than had been possible with regular air mixtures. Although surface-supplied diving has several advantages in terms of stability, air supply, and length of work period, major problems with hard-hat gear include severely limiting the diver's mobility, requiring support personnel on the surface, and cost. Scuba gear frees the diver from surface support and enables extraordinary mobility never before achieved in diving.

Scuba Diving:

The development of self-contained underwater breathing apparatus, or scuba, provided the free-moving diver with a portable air supply which, although finite in comparison with the unlimited air supply available to the helmet diver, allowed for better mobility. Scuba diving is the most frequently used mode in recreational diving and is also widely used to perform underwater work for military, scientific and commercial purposes.

There are two types of scuba, "open" and "closed" scuba. The two types of scuba designs include the "open" scuba design, where the diver breathes air from a cylinder or canister and the exhaled air goes into the water and rises to the surface as bubbles. The diver must return to the surface before or when the supply of air runs out. The "closed" scuba rig design allows a diver to reuse the same gas. A diver's exhaled breath is passed through a chemical in one of the cylinders to remove the carbon dioxide and the diver then breathes the "cleaned" gases over and over again. New oxygen is added

automatically as consumed. Using this system, the diver can stay underwater longer and no bubbles come to the surface.

Saturation Diving

“Saturation diving” is a technique developed by the U.S. Navy in the late 1950s that permits divers to remain at high pressures for weeks or months without having to often undergo decompression and waste the diver’s time. Researchers discovered that when a diver is underwater for a long time days or weeks, for example, the time needed to decompress reaches a maximum and stable point. The diver becomes “saturated” and no longer accumulates additional gas such as nitrogen or helium. In other words, decompression time for a diver who has been underwater for one day may be the same as for a diver who has been down for a week.

Why do ships wreck? ¹⁰

Throughout nautical history, sailors have faced the grave possibility of their ship succumbing to weather, battle, or even structural and mechanical failure. A torrential storm could quickly overcome a ship or cause fatal damage. Equipment trouble was also a concern; leaks, engine trouble, or problems with the sails and rigging were all common perils. Maneuvering and navigation could also be treacherous, especially during wartime. Occasionally, ships are abandoned and destroyed by their own crews, a tactic called scuttling. While historical documents and personal accounts of survivors make the cause

¹⁰ US Navy, “underwater Archaeology.” Accessed December 9, 2012.
<http://www.history.navy.mil/index.html>.

of some wrecks clear, sometimes there is no record of the ship's last few moments. In those circumstances, underwater archaeologists must explore the wreckage of sunken ships for clues. Finds such as a misplaced cannon or evidence of damage to the ship can provide an explanation, while other times the cause of the shipwreck remains a mystery.

U.S. Navy shipwrecks:

Penobscot

The Penobscot Expedition of 1779 was comprised of about 40 American ships that laid siege to the British-occupied Fort George on Penobscot Bay, in present day Maine. On the verge of victory, the Americans were forced into a hasty retreat up the Penobscot River when a British relief squadron arrived and blocked the entrance to the bay. Only 10 of the original 40 ships survived the retreat upriver to the city of Bangor. A number of ships were either captured or abandoned and burned during the initial retreat; most were scuttled on the way up the river. The remaining 10 ships attempted to save the flagship; however, it was set ablaze on the captain's orders before the other ships could reach it. With no hope of victory or escape, the remaining ships were abandoned and set ablaze. Within 48 hours of the British relief squadron entering the bay, most of the American fleet was in ruins along the Penobscot River. (To be determined)

Artifacts:

Swivel gun: This type of smaller gun could easily be moved from place to place and required only a few crew members to fire. This particular gun has two unique characteristics that may be closely linked. The muzzle on the gun is completely missing,

and there is a strong possibility that the reason for this is that the gun tube in the barrel was bored off-center, leaving one side of the barrel thinner weaker.

Bar Shot

Ships carried a wide variety of shot, all designed to serve different purposes. Bar shot was used to disable an opponent's sails, rigging, lines, and spars to make the enemy slower and difficult to steer. Three unique examples of bar shot were recovered from the Penobscot Bay wreck site. Typically, bar shot is made of a wrought iron bar with semi-hemispherical heads on either end. These bar shot are made of one piece of cast iron and have flat, rather than rounded heads.

Round Shot: Unlike bar shot, which was used to target and disable parts of an enemy ship, round shot was a much less strategic option; it was used to pound the enemy into submission. The various round shot found among the ammunition at this site were of many different sizes and would have been used in a variety of ways; in grape shot, canister ammunition, or in smaller guns like the swivel gun.

Broad Arrow shot: This example of shot is unusual because of the distinctive "Broad Arrow" insignia just visible on the shot. This symbol dates back to as early as the reign of Edward III in the early 14th century in England and is believed to have been the king's coat of arms. For centuries the mark was used to denote property of the British government. The presence of a British shot in the Penobscot site brings up some interesting questions regarding how far up the river British ships perused the Americans

and whether or not the British and American ships came within firing distance of each other earlier in the battle.

Shovel Fragments: Shovel fragments are another example of wrought iron artifacts that survived at the Penobscot River wreck site. Shovels, characterized by slightly concave blades, were used primarily as entrenching tools in the eighteenth century.

Shoe Buckle: This brass buckle, comprised of a brass fork and loop assembly held together with a brass axle, is missing the frame. It is likely that the buckle belonged to an officer or someone of higher than average social and financial status due to the quality of its brass and copper alloy metals.

Boca Chica Channel

The wreck site located in the Boca Chica Channel, near Key West, Florida, dates to the second half of the eighteenth century; however, many intrusive objects dating from other periods were excavated from the site as well. During the American Revolution, British and Spanish ships battled in the channel, and after 1819 the area was settled and developed. This eventually led to the construction of a railroad and then a highway over the water near the site, which could account for the many intrusive items found at the site.

Artifacts:

Ocho Reale Coin: This Ocho Reale coin minted in Mexico City, during the reign of Carlos III, was found in the mast step of a ship, the place where the mast is fitted into the keel. It is a long held tradition of shipwrights to place a new silver coin, usually one

that marks the date the builders stepped the mast, into the mast step to pay tribute to the winds for luck. Spanish coinage was widely used throughout the English colonies in North America and was treated as a commodity, much like gold and silver bars.

Lead Shot: This Ocho Reale coin minted in Mexico City, during the reign of Carlos III, was found in the mast step of a ship, the place where the mast is fitted into the keel. It is a long held tradition of shipwrights to place a new silver coin, usually one that marks the date the builders stepped the mast, into the mast step to pay tribute to the winds For luck. Spanish coinage was widely used throughout the English colonies in North America and was treated as a commodity, much like gold and silver bars.

Spoiled Round Shot

El Morro Cook Pot: Six shards found at the wreck site were pieced together to form two-thirds of an El Morro glazed earthenware pot. This type of earthenware was mass-produced between 1600 and 1770. The pots were wheel-thrown with red clay and typically glazed only on the inside. They were designed to be used as cooking vessels. This use is confirmed for the Boca Chica Channel example by the charcoal staining on the bottom of the pot; the result of being heated over an open fire.

Olive jars

Rouen blue-on-white Faience plate: This Rouen style faience plate dates back to the latter half of the 18th century and may have been used by the officers. As is typical of this style of pottery, the underside is coated in a brown glaze, and the top is decorated with floral and geometric patterns.

Alligator

Built in 1820, USS Alligator enjoyed a brief yet remarkable career as the best of the five schooners built to suppress the African slave trade and to combat piracy under the presidency of James Monroe. Alligator was also used by the American Colonization Society to look for land in Africa to resettle former slaves. In 1822, USS Alligator ran aground on an uncharted reef off the eastern coast of Florida. Though the crew labored to free the vessel for two days, they were ultimately unsuccessful and forced to transfer their cargo to other ships. They abandoned and burned the ship to prevent pirates from salvaging it.

Artifacts:

Heavily Corroded Iron Fastener: Iron corrodes rapidly in the presence of moisture, and even more rapidly if salt is present. Seawater, therefore, is one of the most corrosive environments for iron artifacts. An iron object will often completely corrode away, leaving only rust to indicate that an artifact was once there. If an iron artifact is taken out of the sea and allowed to dry without proper conservation, it will continue to corrode severely, often at an increased rate. Even if it is coated in paint or lacquer, it will eventually re-corrode and break apart. This historic iron fastener is one such example; it was found heavily corroded under water, then excavated, dried, and allowed to sit in an uncontrolled environment without proper conservation. It continues to corrode and fall apart today.

Copper Alloy Spike: Unlike the iron fastener, these copper alloy pieces are examples of well-preserved artifacts. Conservation is not an exact science. Each excavated metal object will have a different degree of corrosion and different preservation requirements. It is the job of the archaeologist preserving the artifact to determine how many layers of corrosion should be removed. Some of the layers of corrosion that covered the small spike were removed in order to find the original shape and technological features of the object. However, much of the corrosion was left in place, as it maintains the spike's original shape. In this case keeping the corroded layers intact actually makes the object more identifiable. Note the defined edges near head of the spike.

Concretions: This encrusted lump may look like nothing more than a rock, but it is, in fact, a historic artifact. It is common for shipwreck artifacts to become coated in layers of encrustation when they are deposited in warm saline seas. The encrustation is a combination of marine life, sediment, and calcium carbonate precipitated from the seawater. The encrustation may also incorporate nearby artifacts, forming a rich conglomerate of historic material. Archaeologists usually call the encrustation-artifact unit a "concretion." The shape of the concretion rarely gives a clue as to what lies beneath, and many surprises can be found. X-radiography is required to see what is hidden inside and is usually the first step in the investigation.

Cast Epoxy cast of concretion: When the epoxy had set, the concretion was carefully cleaned off and an epoxy replica of the original shackle remained. This replica preserves more information than the corroded iron core that remained inside the concretion.

Housatonic and H.L Hunley

The USS Housatonic, a Union steam sloop-of-war built in 1861, joined the South Atlantic blockade in September 1862, where she was part of Admiral DuPont's failed attempt to take Fort Sumter. The ship is best remembered, however, for becoming the first ship ever to fall victim to a submarine attack. On 17 February 1864, the ship's crew spotted what they believed to be a porpoise surfacing. By the time the object was close enough to be correctly identified as the H.L. Hunley, a Confederate submarine, it was too close for the Housatonic's guns. The submarine rammed a single torpedo into the stern of Housatonic, causing the ship to sink within minutes. Meanwhile, the Hunley sank without a trace on its way back to base and remained lost for over 130 years.

Copper Alloy Socket: This copper alloy socket from USS Housatonic shipwreck retains 3 of its 4 original countersunk wood screws. Clearly visible on the rim are the Roman numerals VII. These numbers may identify where the socket belonged on the ship.

Copper Alloy Fasteners: Six long copper alloy bolts were found scattered among iron fastener concretions and some copper sheathing. One of these fasteners even has what appears to be a "washer" or rove still attached to it. Here, we see that only copper

hardware was used in the construction of the submerged hull. Mixing metals--using both copper and iron fixtures together, in this case--would have produced a corrosive electric current, attacking the weakest present metal, iron. This damaging reaction is further catalyzed by saltwater. The nature of ships makes their structures particularly susceptible to this, called galvanic corrosion.

Copper Sheathing and Tack: Covering the bottom of the ship with copper sheathing was the most common method shipwrights used to protect submerged timbers from rotting, fouling, and shipworm infestation. Copper-sheathed ships could go faster, remain at sea longer and be quickly repaired because the copper was durable and remained clean for longer periods of time than other metals. To attach the thin copper plates to the ship, thousands of copper-alloy tacks like this one were used.

Lead Sheet: During the Civil War period, all ships in the U.S. Navy carried hundreds of pounds of lead sheeting, such as this, which was used to make repair patches, weights, bullets, linings and other items.

Brass Tube with Rubber: Sometimes excavated artifacts are not easily identified. This brass tube and rubber fragment look as though it has been damaged forcefully and may have been part of the ship's machinery or could belong to the ship's ordnance.

Brass Pistol Trigger Guard from Aston Pistol: Artifacts can often tell us about individuals on board as well as the ships themselves. This brass trigger guard appears to be from a Model 1842 Aston pistol. Usually, such weapons bear just an inspector's stamp or arsenal marks. What makes this artifact unique is that it also bears the inscribed letters

AA. According to the rescue ship's logbook, Andrew Anderson was the only member of Housatonic's crew with those initials. Although he was recorded as the cook, there is evidence he was issued a weapon at some point; he is listed as a participant in the attack on Fort Sumter on 9 September 1863.

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