

The Shipwreck of the SS *Republic* (1865). Experimental Deep-Sea Archaeology. Part 1: Fieldwork & Site History

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Between October 2003 and February 2005, Odyssey Marine Exploration surveyed and conducted an extensive excavation on the shipwreck of the 19th-century sidewheel steamer the SS *Republic* at a depth of approximately 500m in the Atlantic Ocean, over 150km off the southeastern coast of the United States. The *Republic* was en route from New York to New Orleans with passengers and a composite commercial and monetary cargo when she foundered during a hurricane on 25 October 1865.

Some 262 ROV dives took place on the *Republic*, accumulating approximately 3,500 hours of bottom time on the seabed. 16,000 digital still photographs were taken and over 3,000 hours of video footage recorded. During the archaeological excavation 14,414 artifacts and 51,404 coins were recovered, recorded and conserved. These assemblages have produced a unique image of daily life in post-Civil War America, unparalleled in scale and diversity on any wreck of a steamship. The project provided an opportunity to develop and experiment with advanced robotics, navigation, photographic and excavation methods and techniques on a Remotely-Operated Vehicle (ROV) for the nascent discipline of deep-sea shipwreck archaeology. Part 1 of the report focuses on fieldwork, the wreck's site formation and the history of the *Republic*.

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1. Introduction: The SS *Republic* Project

Between October 2003 and February 2005, Odyssey Marine Exploration (OME) investigated the shipwreck of the SS *Republic*, a 19th-century sidewheel steamer lost in a storm in the Gulf Stream of the Atlantic Ocean off southeastern America on 25 October 1865. This previously undiscovered deep-sea shipwreck, located at a depth of around 500m, was investigated using remote techniques in order to fulfil an interlocking set of scientific, archaeological, technical and commercial objectives:

1. To assess the archaeological level of preservation, the character and site formation of the vessel and cargo.
2. To develop new technology and techniques for the survey and excavation of a shipwreck in deep water through the exclusive use of a Remotely-Operated Vehicle (ROV).
3. To produce non-disturbance photomosaics of the shipwreck site.
4. To systematically excavate and recover a sample of the ship's unique commercial cargo, including a major consignment of coins.

5. To reconstruct the commercial orbit of the SS *Republic*'s final voyage through reference to the wreck's historically unattested cargo and in relation to economic life in New Orleans in the immediate aftermath of the American Civil War.

In the 30 years since scientists and marine archaeologists realized that deep-water technology exploited by the petroleum/gas and sub-sea cable industry – manned submersibles, ROV's and electronic survey/navigation systems – could be adapted for scientific and archaeological investigation (Bascom, 1976), progress has been continuous. Significant deep-sea archaeological investigations have included wreck surveys and excavations in the Florida Strait (Kingsley, 2003), conducted in the Mediterranean and Black Sea (Ballard *et al.*, 2000; Delaporta *et al.*, 2006; McCann, 2001), the Norwegian Sea (Sóreide and Jasinski, 1998) and the Gulf of Mexico (Ford *et al.*, 2008). These successes were rooted in interdisciplinary collaborative initiatives between archaeologists, scientists, the commercial sector and engineers familiar with the latest underwater systems and available technology.

During the summer of 2003, the *Odyssey Explorer* discovered a target believed to be the SS *Republic*. A side-scan

image clearly depicted two paddlewheels flanking the sides of a vessel, a walking beam engine standing proud of the seabed, two boilers and remains of a wooden hull (Fig. 1). The absence of sharp contours suggested that the target was not a steel wreck. The image was closely analyzed and compared against the known historical record for ship losses in the area. The dimensions and features visible on the side-scan sonar very closely matched those of the *Republic*, as documented through historical research (Fig. 2). A visual survey of the site was conducted by an inspection ROV and an Admiralty arrest claim sought to protect the wreck. A project plan was then developed for the investigation of the target and an initial pre-disturbance survey initiated to attempt to identify the site conclusively.

The shipwreck is located approximately 150km off the coast of Georgia on a deep shelf of the Gulf Stream's North American continental shelf. The *Republic* settled on a southeast to northwest axis at an average depth of approximately 500m. The seabed sediments are composed of terrigenous particles formed by the weathering of rock once situated on land and the remains of calcareous and siliceous shells. The site retains the classic elliptical shape of a ship (Fig. 4).

The observed shipwreck measures 65.5 x 30.0m within a principal wreck area of 1,965m². Including the surrounding debris field to the north and south of the stern section of the wreck, the site extends across 56,726m² (Fig. 9). It can be characterized as a continuous and coherent wreck, with articulated structural remains and cargo and a large debris field to the north and south of the stern half of the wreck. However, the upper layers of sediment and the strong 1-5 knot currents crossing the seabed have caused considerable abrasion, erosion and destabilization. The swift, deep currents present in the lower depths of the Gulf Stream have displaced part of the cargo and the wooden and metallic ship structure across the debris field.

More than 262 ROV dives took place on the *Republic*, accumulating some 3,500 hours of bottom time. Some 16,000 digital still photographs were taken and over 3,000 hours of video footage recorded. During the archaeological excavation, 14,414 artifacts were recovered, recorded, logged and conserved. A further 51,404 coins were recovered.

The platform used for the project was the 76m-long, 1,431-gross-ton dynamically positioned ship the *Odyssey Explorer*. For this project, the vessel was re-fitted to accommodate an ROV system, while working space was altered to support archaeology, data acquisition, logging and first-aid conservation. The vessel held accommodation for a crew and staff of 40 people. For the *Republic* project Odyssey modified a state-of-the-art ROV, manufactured by Soil Machine Dynamics Ltd. and renamed Zeus. This system

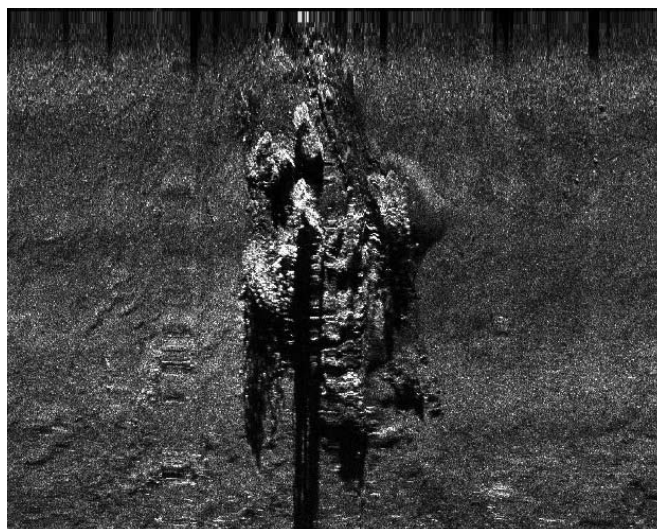


Fig. 1. Side-scan image of the wreck of the SS Republic.



Fig. 2. Reconstruction of the sidewheel steamer Republic based on a painting of the SS Tennessee in the Peabody Essex Museum, Salem, Massachusetts. Painting: by John Batchelor.



Fig. 3. The bell of the Republic in situ still retained its former name, the SS Tennessee.



Fig. 4. Photomosaic of the wreck of the Republic.



Fig. 5. The 7.26-ton, 3.7m-long ROV Zeus used during the survey and excavation of the Republic.

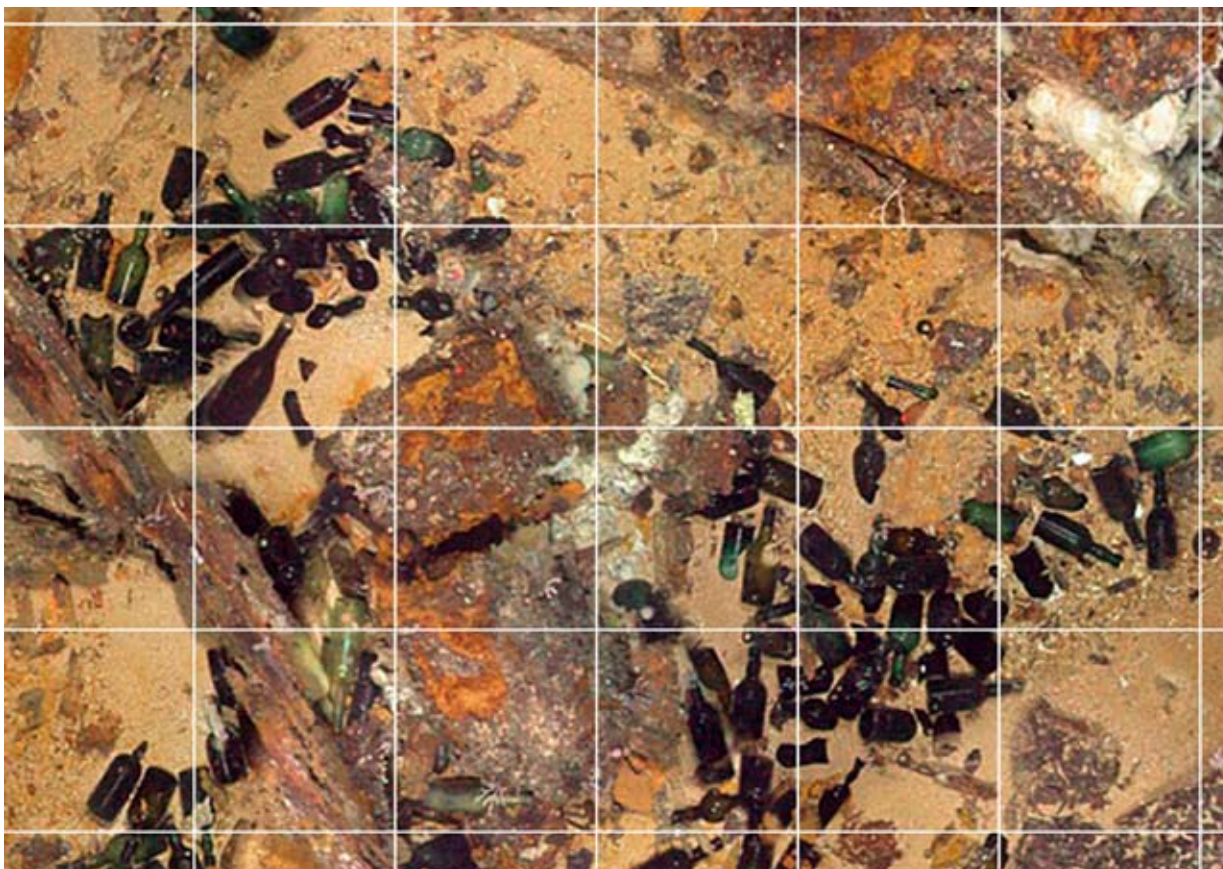


Fig. 6. Electronic grid imposed over the wreck site for contextual recording during excavation.

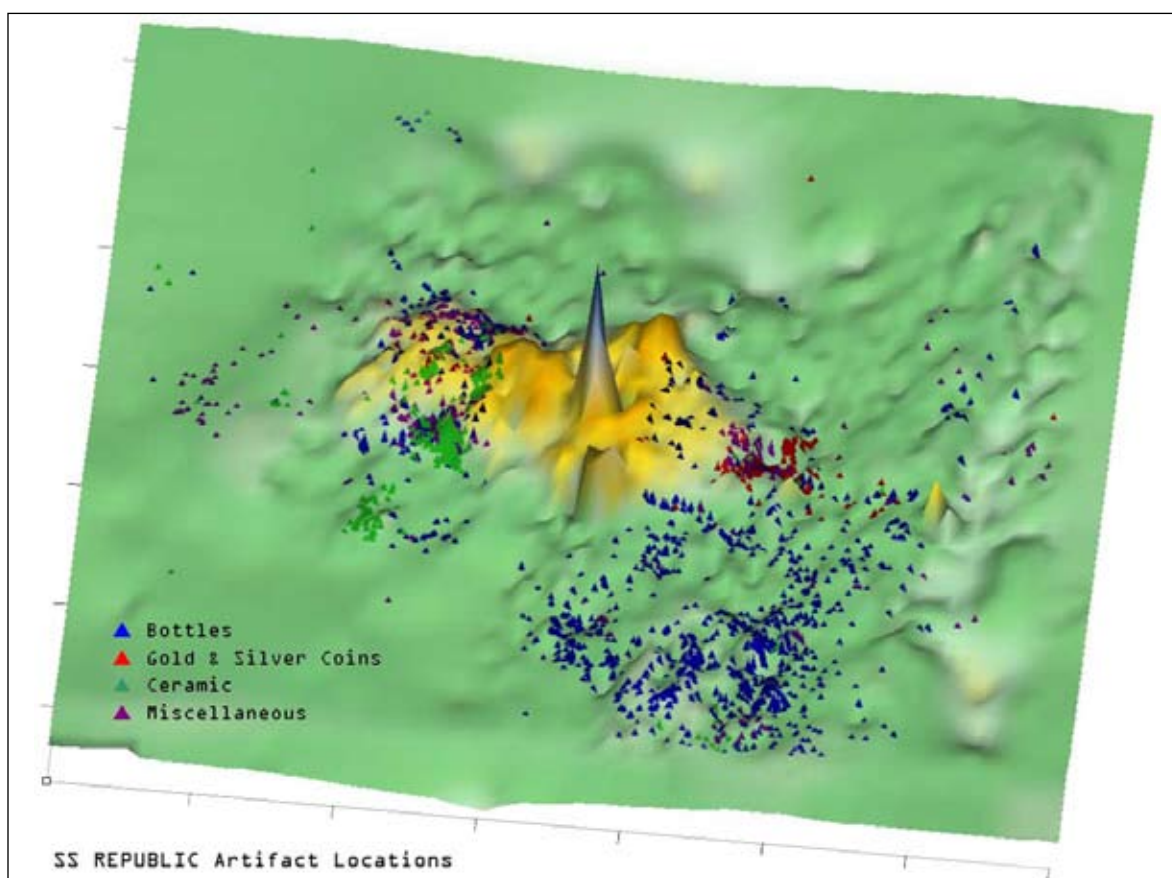


Fig. 7. Bathymetric site plan and scatter plot of artifacts (stern at right).

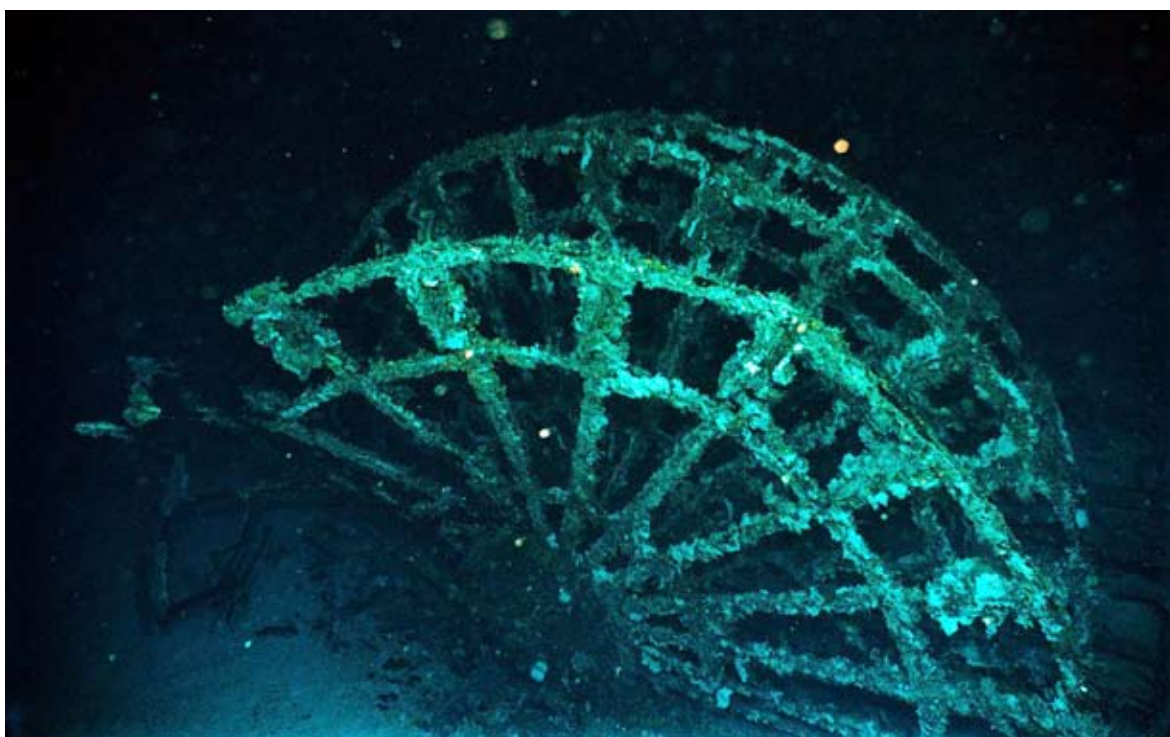


Fig. 8. The starboard paddlewheel in situ.

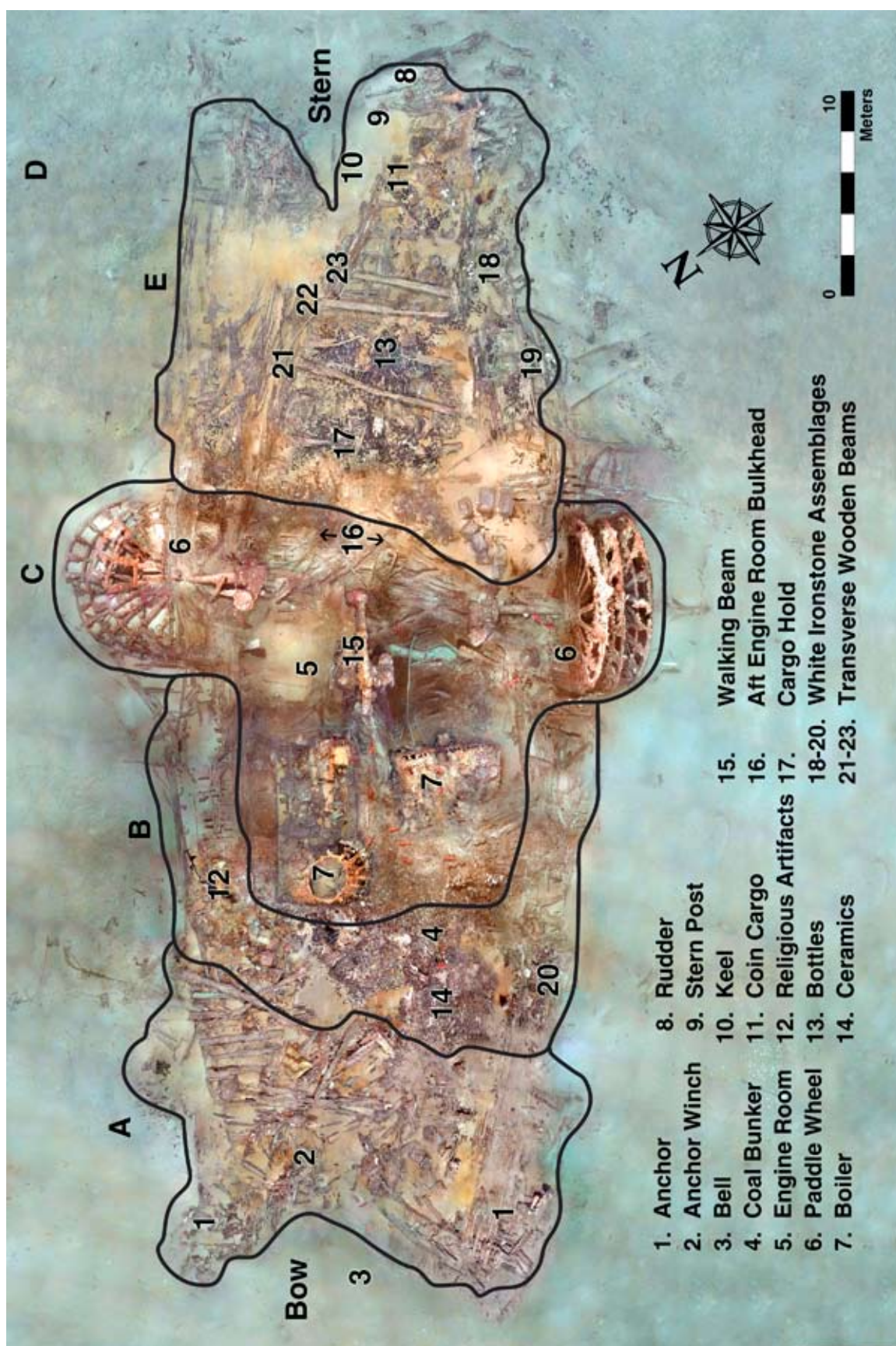


Fig. 9. Photomosaic displaying survey/excavation areas and the locations of prominent archaeological contexts.

was adapted for survey measurement, photography, manipulation and excavation. The 3.7 x 3.1 x 2.38m, 7.26 metric ton ROV was capable of operations of sustained duration down to depths of 2,000m (Fig. 5).

Zeus was fitted with two Schilling Conan seven-function master/slave manipulator arms on either side of the front of the vehicle. The manipulator arms had a reach of 1.79m, a working arc of 120° and a lifting capacity of 170kg at full extension. The master/slave feature enabled the manipulator arms to duplicate in seabed operations the movements of the operator based in the research ship. Tools were deployed from stowage positions in various points on the vehicle.

For excavation and artifact recovery, the ROV was fitted with a venturi-effect suction device, a limpet suction device and a specialized sediment sifting and collection unit (for more details of this technology, see Cunningham Dobson *et al.*, 2009: 3-6). The nozzle end of the venturi is operated by the starboard manipulator arm, allowing controlled excavation, and sediment is ejected through a hose at the rear of the ROV. Delicate artifacts were retrieved using a silicone rubber limpet suction device, which consisted of a soft bellows-shaped tube with a small suction pad at its end available in different sizes from pads of 2-10cm in diameter (Figs. 10-11).

On the wreck of the *Republic* Odyssey conducted a phase of developmental deep-sea shipwreck archaeology using the ROV Zeus, experimenting with new systems, techniques and equipment to assess a work ROV's capability to perform archaeological surveys and excavations remotely at depth to acceptable comparative archaeological practices and standards. It is important to bear in mind that no guides existed, or have any been formulated to date, for this field of archaeological science. Research was conducted as 24-hour operations for 21-28 days at a time (weather permitting), before returning to port for fuel and water. Personnel typically worked 12-hour shifts on a two-month on, one-month off rotation.

Alongside developing technology and methods for deep-sea shipwreck archaeology, an important research objective of the excavation was to recover an extensive collection of artifacts – undocumented in any cargo manifest – to permit a comprehensive interpretation of the material culture onboard this ship. Study of the cargo was expected to provide primary data about daily life and commerce in immediate post-Civil War America and to contribute to historical knowledge of life at sea aboard 19th-century paddlewheel vessels (cf. Corbin, 2006; Kane, 2004).

2. History of the SS *Republic*

The SS *Republic* was commissioned by the President of the Baltimore and Southern Packet Company, James Hooper & Co., from the John A. Robb shipyard of Fells Point, Baltimore, for the Baltimore-Charleston route. The wooden-hulled sidewheel steamship was 64m long, 10.43m wide and 5.15m deep. When she was launched on 31 August 1853, the ship was rated at 1,149 tons. The *Republic* was equipped with a vertical walking-beam steam engine, twin return-flue boilers and machinery supplied by Charles Reeder and Sons of Baltimore (*Baltimore Sun*, 29 January, 1867; Heyl, 1953: 419; *New York Marine Register*, 1857; Ridgely-Nevitt, 1981: 272). Reeder was a noted pioneering firm in steam engine development that had previously built several famous railroad locomotives and steamship engines. Former ships constructed by Robb, and for which Reeder built engines, included the *Georgia* (1836), *Palmetto* (1851) and *Mosswood* (1863) (Brantz, 1871: 435-36; Kelly, 1961: 10, 30-32; Ridgely-Nevitt, 1981: 272; Scharf, 1881: 427).

Intended for passenger and general cargo merchant service, the *Republic* was originally named the SS *Tennessee*. After being fitted out and her machinery installed, she made her inaugural commercial trip from Baltimore to Charleston on 14 March 1854 with both Hooper and Reeder aboard. During her lifetime, the *Tennessee* enjoyed a colorful service career. In June 1855 she made the first Atlantic crossing by a Baltimore steamship between Baltimore and Southampton, England. In January 1856, under the new ownership of S. de Agreda and Company, she became the first steamship to commence scheduled service between New York and South America. The *Tennessee* changed hands yet again, and by the end of 1856 was making trips to Nicaragua from both New York and New Orleans, on occasion transporting recruits for William Walker's Nicaraguan army and, in the summer of 1857, returning to New York with 275 defeated soldiers (Heyl, 1953: 419; Kelly, 1961: 11). In 1860 a new set of boilers was installed in the ship (Ridgely-Nevitt, 1981: 273-74).

By the outbreak of the American Civil War in April 1861, the *Tennessee* found herself trapped in harbor at New Orleans.¹ Early the next year she was purchased for service in the Confederate navy, but failed to penetrate the Federal blockade of the Gulf of Mexico. After the Union captured New Orleans on 25 April 1862, the *Tennessee* was seized and converted into a powerful gunboat, and was also employed as a troop transport, supply and dispatch vessel (Kelly, 1961: 11). After the battle of Mobile Bay, the



Fig. 10. A Drake's Plantation Bitters bottle being recovered by the ROV Zeus' pressurized limpet suction device.



Fig. 11. A Holloway's Ointment medicinal pot being recovered by the ROV Zeus' pressurized limpet suction device.

Tennessee was renamed the USS *Mobile* to avoid confusion with the captured Confederate ironclad *Tennessee* (Ridgely-Nevitt, 1981: 274). The ship was decommissioned at Brooklyn Naval Yard on 4 December 1864 and in March 1865 was sold out of military service to Russell Sturgis, a merchant whose family had made its fortune from the opium trade with China (Vesilind, 2005: 85). At this stage of her life she was christened the SS *Republic* (Heyl, 1953: 419; Kelly, 1961: 11; Ridgely-Nevitt, 1981: 274).²

Quickly repaired and re-fitted, the ship was chartered to William H. Robson's passenger line operating between New York and New Orleans (Heyl, 1953: 420; Ridgely-Nevitt, 1981: 274). On her fifth voyage along this line, the SS *Republic* sailed with 80 passengers and crew, a composite cargo and extensive specie probably destined for use by banks and investors in cash-deprived New Orleans and perhaps even by Yankee businessmen who had financed commercial operations with the enemy as early as 1862 following the Union capture of the city (Capers, 1965: 161, 169-171).

On the morning of 24 October 1865, while battling a hurricane in the Atlantic off Savannah, the SS *Republic's* steam engine failed. Battered by wind and waves, her paddle boxes and deck fittings were swept off deck and the ship rolled and tossed throughout the night. Cargo was jettisoned overboard and a donkey boiler labored to keep the pumps working (*Charleston Daily Courier*, 30 and 31 October 1865; Heyl, 1953: 420; *New York Times*, 3 November 1865; Ridgely-Nevitt, 1981: 274).

On 25 October the auxiliary engine failed. Helpless to stop water rising in the hold, the crew and passengers abandoned ship in two lifeboats, the captain's gig and the ship's dinghy, plus a makeshift raft. The steamer sank at 4pm. All four boats and the raft were eventually picked up at sea. Of the 14 to 18 people aboard the raft, only two survived (*Charleston Daily Courier*, 30, 31 October 1865; Heyl, 1953: 420; *Log of the US Str. Tioga*, 2 November 1865; *New York Herald*, 4 November 1865; Ridgely-Nevitt, 1981: 274). The performance of Captain Ernest Young and crew in removing all passengers from the ship during a hurricane was both a remarkable demonstration of good seamanship and an act of exceptional heroic selflessness (*Charleston Daily Courier*, 30 and 31 October 1865; *New York Times*, 3 and 8 November 1865).

The construction details of the *Republic* are historically attested. She was a typical cargo/passenger ship of her day. She was of the average length for a ship of her type and her hull was of a common design. Measuring 210ft long and with a beam of 33ft 11in, she was built of wood and fastened with iron/copper nails/spikes reflecting the refits she was subjected to during her colorful life. Her floor

timbers at throats were moulded 13.5in and sided 8in. Center-to-center frame distances were 26in. She had a solid floor, 13in wide, side and bilge keelsons. The iron lattice was braced, square-fastened throughout and coppered (*Journal of The Franklin Institute* 27.3, 1854: 199). The paddle-wheels had a diameter of 28ft. The 24 blades were 9ft long with a depth of 26in. Power was provided by a vertical walking beam engine located in an engine and boiler space of 55ft. Some 150 tons of coal were stowed in her iron coal bunkers.

3. Survey Results – Phase 1

The archaeological investigation and excavation of the SS *Republic* was divided into two phases: a pre-disturbance survey (Phase 1) and excavation (Phase 2). The first dives of Phase 1 were dedicated to ROV tests, which were conducted off-site to evaluate the functionality of all systems on the ROV and the research vessel. The objective of the initial survey dives was to determine the dimensions of the coherent wreck structures and the extent of the debris field and to characterize the archaeological deposits.

Conditions on-site were generally acceptable for ROV operations. A current of up to 1.0 knot was observed on the seabed. At times, however, 10m above in the water column currents of 3-5 knots were recorded. An understanding of the bottom currents and their direction and speed determined the best headings for the ROV to maintain good visibility through the cameras and to ensure that sediment was cleared downstream of the ROV's heading during the excavation (Phase 2). The initial ROV survey determined that the surface features of the site consist of a hull lying relatively upright, with the metal framework of both paddlewheels slightly canted outwards by 10° (Fig. 8).

The structural remains of the bow (Area A; Fig. 9) are relatively flat, but seem to reveal that the vessel settled on the seabed at an angle on her starboard bow. A very hard and cemented pan area is stratified less than 20-30cm below the sea bottom, composed of hard-packed shell and concreted, calcareous growth. The structural remains of the bow suggest that the *Republic* impacted with this hard surface at the time of wrecking, damaging the hull's sides. The starboard side is more extensively broken up than the port side, possibly indicating that the starboard bow area struck first. Unsupported by sediment, the port side then flattened out over time.

The heavily graphitized starboard anchor is located 9.5m (at right-angles) from the starboard bow (Fig. 12), and the port anchor was identified 16m aft of the port bow at a bearing of 30° (taken from the position of the postulated stem post). Sections of chain associated with both anchors appear to lead towards the chain locker remains.



Fig. 12. The starboard anchor in situ.



Fig. 13. The copper-sheathed rudder in situ.



Fig. 14. Vertical view of the bottom of the copper-sheathed rudder.



Fig. 15. Gudgeon/pintle detail of the copper-sheathed rudder in situ.



Fig. 16. Bronze pintle attached to part of the wooden sternpost.



Fig. 17. The coal pile in Area A intermixed with J.B. Thorn/James Tarrant ceramic medicine pots and lids and glass patent medicine bottles.



Fig. 18. Welsh writing slates alongside glass preserve bottles in situ in Area A.



Fig. 19. Glass and porcelain religious artifacts from a decomposed wooden crate in situ (Area B).

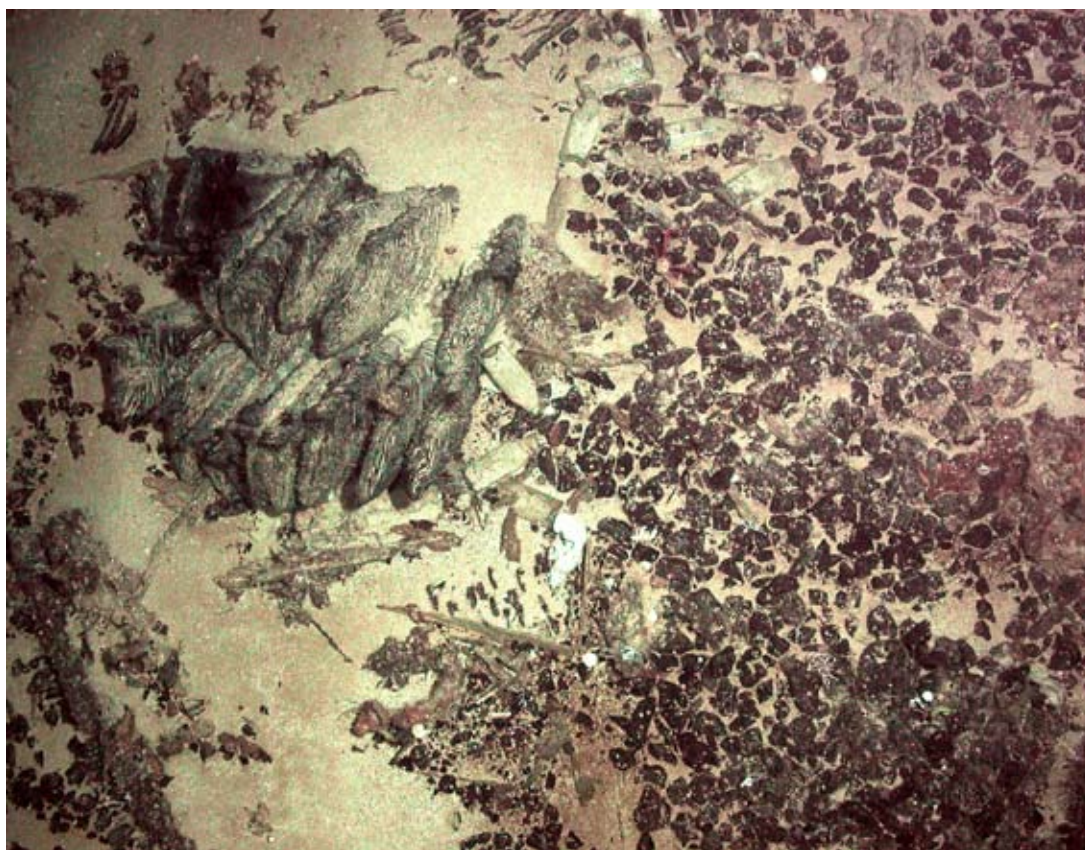


Fig. 20. Bolts of cloth in situ alongside scattered coal and glass bottles (Area A).



Fig. 21. Mixed glass bottles, many still containing their original contents, in situ (Area E).



Fig. 22. A glass and bronze porthole on top of glass champagne-style bottles in situ in Area D.



Fig. 23. Brass clock parts in situ in the bows.



Fig. 24. Iron files in situ (Area B).



Fig. 25. Section of rectangular copper hull sheathing alongside glass bitters, patent medicine and champagne-style bottles in Area C.

The anchor winch may have been dislodged when the bow hit the seabed: it was observed lying on the starboard bow at almost 90° to its original position in its hawse pipe.

Heavily broken and displaced sections of hull timbers and framing, along with sections of deck planking, are scattered across the bow area. Parts of the outer hull planking are still covered with 0.52cm-thick protective copper sheathing. Although launched in 1853, it was not until 1860 that the hull was 'metaled', meaning copper sheathed (*American Lloyd's Registry of American and Foreign Shipping*, 1865: 627). During preliminary inspections of the site while flying the ROV at a distance of about 5-6m off the port bow, the ship's bell was detected lying on its side and partly buried (Fig. 3). Clearly displaying the letters 'SSEE', part of the original name of the ship (the *Tennessee*), this discovery confirmed the identity of the vessel.

Moving astern, a relatively flat area sloping upwards towards the forward bulkhead of the engine room was investigated (Area B; Fig. 9). Covering an area of approximately 280m², it is dominated by a mound of coal protruding some 3.5m above the base of the stempost and up to 1.5m deep in places. Artifacts are dispersed throughout the coal pile, including large groups of small ceramic containers of J.B. Thorn/James Tarrant ceramic medicine pots and lids and glass wine and beer bottles (Fig. 28). Various crates lie adjacent to the port and starboard hull, some broken and their contents spilled (Fig. 19), while others are scattered and displaced from their original stowage positions.

This pattern indicates that the cargo derived from the forward cargo hold in Area B and that the coal originated in the thwart-ship coal bunker situated forward of the boiler. A wooden bulkhead would have separated the cargo hold in Area B from the engine space (Area C). The distribution of the coal suggests that when the bow and the forward section of the ship struck the seabed, the force broke the bulkhead; coal was ejected forward out of the bunker and into the cargo hold. As the ship's sides and decks deteriorated over time, crates of cargo ended up on top of – and partly buried in – the coal in Area B. Close visual inspection of the broken crates and the cargo hold area identified a wide range of merchandise and materials.

Directly aft of this area, the ship's engine room was located, consisting of two boilers, a walking beam engine, paddlewheels and associated fittings and machinery (Area C). Covering an area of approximately 482m², most of the engine room had collapsed inwards. The two boilers had been displaced forward of their mountings and were in a state of poor preservation. The walking beam was fairly intact and vertically preserved to a height of 4m. The rods connecting the walking beam to the paddle wheels were

also still whole, and both paddlewheels remained almost vertical, yet canted outwards, even though only their iron framework was preserved. No associated wooden fittings have survived, and all iron on the ship more generally is in an advanced state of deterioration.

The aft engine room bulkhead towards the stern and rudder is broken and the cargo that had been stowed against this bulkhead – largely glass beer and wine bottles – is scattered across the surface of the cargo hold. The stern area has collapsed, exposing the lower port-side hull and a 13m-long section of copper-sheathed keel timber (Area E; Figs. 26-27, 31).

The ship's rudder, 5m long, 2m wide maximum and 30cm thick, lies parallel to the keel timber and is about three-quarters complete, covering an area of 11m² (Fig. 13). Only the top section has broken off and is missing. However, the rudder timber is in an advanced state of degradation. The lower pintle and gudgeon were visible attached to the rudder and sternpost (Figs. 14-15), while a few brass draft numbers were identifiable on the surface of the rudder. Further investigation revealed that the rudder was fitted with four sets of gudgeons and pintles. The upper set was discovered on the seabed below the point where the top of the rudder had broken. One recovered pintle is 43cm long, 31cm wide and 19.6cm high (Fig. 16). After removal of the top layer of fine sediment overlying the rudder and sternpost, it was observed that both were entirely copper sheathed. This preserves the anatomy of the rudder, whose wood is otherwise completely degraded away.

Along the remains of both the port and starboard sides of the wreck, sections of hull planking attached to frames range from 14 x 3m to 4 x 1m (with planks on average 20cm wide and 4-5cm thick). Some strakes face upwards; on others the inside strake edges protrude upwards, indicating original impact damage and the ongoing process of the ship's gradual collapse during the wreck formation process. Many of these sections are still copper sheathed (Fig. 26).

Concentrations of cargo crates, some still intact, and others with their contents spilled, cluster along the break lines of the hull's sides. These include glass and ceramic religious artifacts (Fig. 19), ceramic tableware, white buttons, scissors, door locks, brown marbelized and white ceramic door knobs, horseshoes, metal files (Fig. 24), axes, coils of wire, various cosmetic and patent medicine glass bottles, organic bolts of cloth (Fig. 20), leather shoes, hats, flat irons and various other household goods and ironmongery.

Covering an area of 54,761m², the largely flat debris field (Area D) consists of random clusters of crates dispersed from the cargo holds. The majority are broken or eroded, exposing glass bottles of various types and colors. A few clusters close to the wreck site contain white ironstone

table and toilet-wares, as well as blue-gray school children's writing slates. The largest concentration is situated at the southern end of the debris field, apparently the result of the main direction flow of the bottom currents.

While the site is coherent and displays articulated timbers and some cargo integrity, the ship is in a poor state of preservation compared to other excavated steamships. It would appear from the position of the starboard paddle wheel, which is canted over to starboard, that for a period of time the vessel lay over to starboard. Eventually the unsupported bow section collapsed and the stern twisted over to portside. Because of the weight of the engines and walking beam, the engine room area remains mostly upright.

The hostile environment of the Gulf Stream, its strong currents, galvanic effects and the abrasiveness of the mobile sediments are slowly wearing the wreck away. The site has been impacted by the topography of the seabed, the interplay of burial and exposure of its elements, and by accretion and scouring by the movement of sediments. The wood from the site is generally heavily abraded, damaged by marine life (mostly wood-burrowing worms), soft and lacks structural strength. Most of the iron structure and artifacts display extensive graphitic corrosion. Other components were observed to have experienced electrochemical corrosion. The site reveals that even 19th-century shipwrecks in deep water that have not been disturbed by fishing and other man-made destructive forces are still at risk from the elements.

A key objective of Phase 1 was to produce a pre-disturbance photomosaic of the wreck site and debris field. Each standard picture was 2048 x 1536 pixels. The location of each photo was correlated to the precise position of the camera using the LBL acoustic positioning system, which resulted in a geospatially correct representation of the site. The production of the photomosaic was a complex task that required development of new techniques to account for variations in lighting and other factors. The undulating topography of the wreck was also problematic, especially the walking beam engine and paddle wheels, which forced the ROV to fly at a higher elevation to ensure safe clearance in these areas.

The final photomosaic of the SS *Republic* contained about 2,500 high-resolution images (Fig. 4). The photomosaics of the wreck site, debris field and specific sections of the wreck proved an invaluable tool in understanding the archaeology of the site and formulating excavation strategies.

4. Excavation Results – Phase 2

The first artifact to be recovered during the Phase 2 excavation was the ship's bell (Fig. 3). Observed during the initial

video survey of the port bow area, the bell was recorded *in situ* and measured at 46.5cm high and 47.5cm wide for the fabrication of a recovery container. Inspection revealed the letters 'SSEE', the end of the word *Tennessee*, which was the vessel's original name when launched. The bell was very badly corroded and was stored in a container filled with a solution of sodium sesquicarbonate until it was handed over to Odyssey's shore-based conservation facility.

Using the photomosaic as a planning tool, excavation commenced in Area E from the stern of the shipwreck's keel and sternpost, lying on their port sides, to the aft engine room bulkhead (Fig. 29). This area was chosen as the most suitable location to clear a sterile path to the keel and sternpost and for the ROV to operate into the current, so that disturbed sediment could be dispersed downstream. The area of seabed adjacent to the rudder and keel was relatively flat and devoid of artifacts and ship's structure. A 4m-wide path was excavated towards the sternpost and keel. The upper 5-20cm of mobile sediments were then removed by the ROV's Sediment Removal and Filtration System (SeRF) to expose a hard substrate composed of particles of terrigenous origin, the remains of calcareous and siliceous shells of protozoans (single-celled animals) and pteropod pelagic molluscs. Glass bottles of various types and sizes, and unidentified sections of ship timbers, were recorded and lifted in recovery baskets.

A shell-rich sandy slope leads up from the keel to the aft engine room bulkhead from the northeast to northwest at an angle of 20°. The 2m-high slope was excavated to expose the keel and allow access for the ROV to proceed towards the stern hold. While excavating the upper area of the slope, gold and silver coins were uncovered (\$20 and \$10 gold coins, as well as silver half dollars; cf. Bowers, 2009). These coins had spilled out of decomposed wooden storage barrels and become scattered near a cargo of glass bottles and disarticulated ship's structure. The coins were recorded *in situ* and recovered one at a time over a period of three months.

Excavation of the stern area revealed that the keel was intact from the sternpost to the aft engine room (Fig. 31), a distance of 15m, and visibly continued intact beneath the engine room. During the wreck formation process the stern had collapsed over to the unsupported port side, exposing the keel and a large section of hull. As the ship deteriorated, the starboard side was pushed outward and downwards, causing the cargo to spill onto the seabed. A wide variety of artifacts, including dominoes and personal items, such as ceramic figurines, horseman's spurs and even a child's tea service, provide a unique window into the daily life and culture of a mid-1860s American merchant venture.

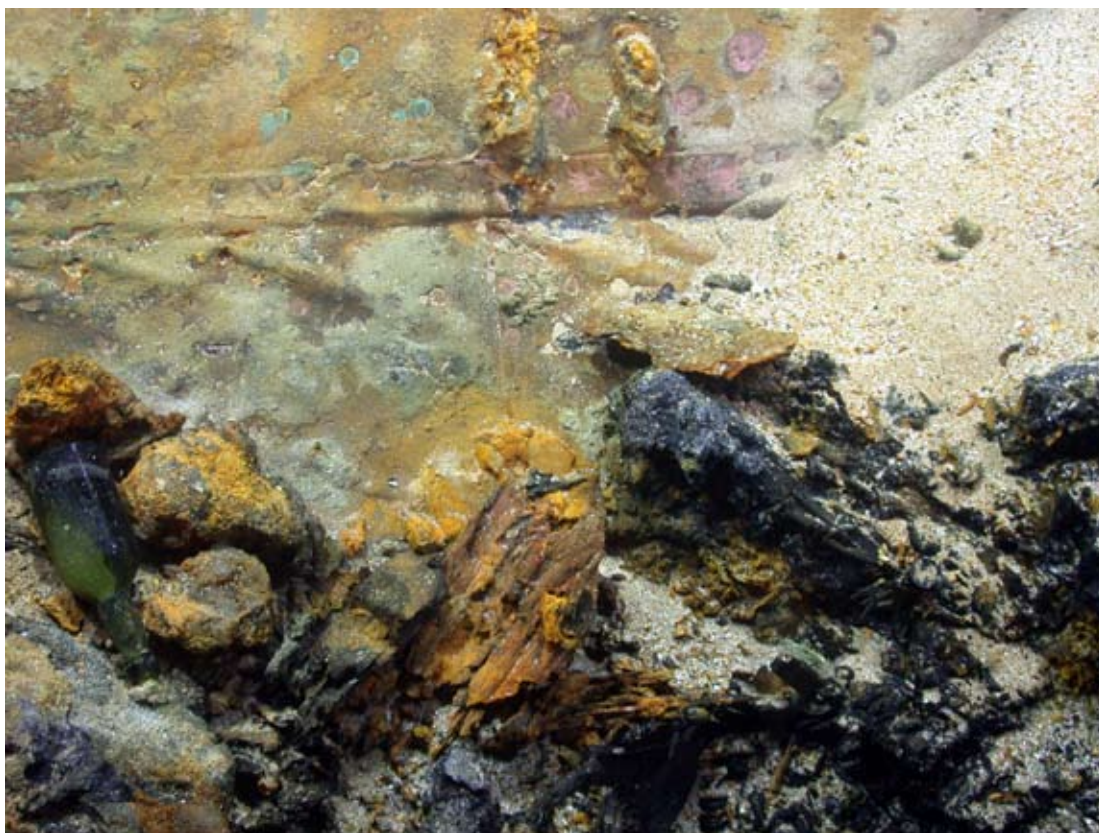


Fig. 26. Copper hull sheathing attached to outer wooden strakes (Area E).



Fig. 27. Section of keelson and floor timbers in situ (Area E).

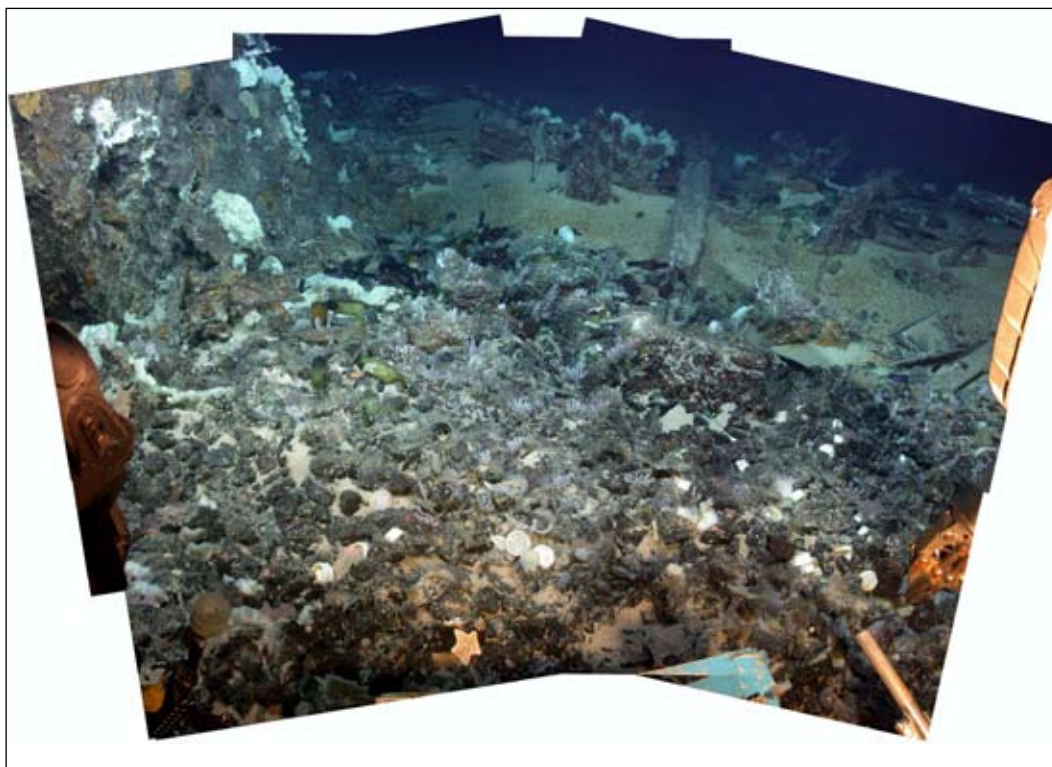


Fig. 28. Coal pile from the bunker in Area B.



Fig. 29. Composite photomosaic of the stern slope in Area E.



Fig. 30. Wooden ceiling planking and frames in Area E.

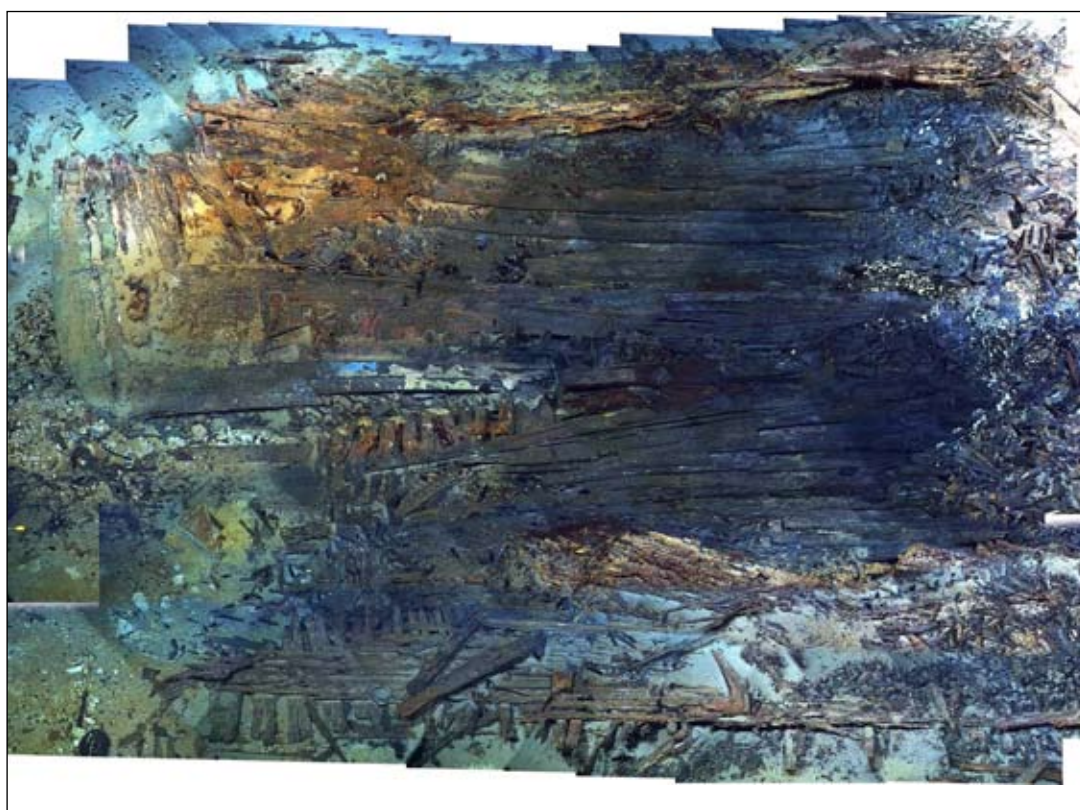


Fig. 31. Photomosaic of the stern complex (Area E) depicting at top the rudder (far left), keel and ceiling planking and strakes of portside. The starboard hull (at bottom) has collapsed outwards and is entirely dislocated from the keel.

Representative samples of each type of glass bottle were recovered from the stern cargo, and the remainder moved to an off-site storage area in a sterile zone. Similar storage areas were excavated off-site to receive broken timbers, coal and other items that needed to be cleared to expose underlying stratigraphy, but were deemed unsuitable for recovery. Detailed pre- and post-excavation photomosaics were produced of this excavated area (Fig. 31).

Area B contains the coal pile forward of the ship's boilers. The engine room (Area C) was not excavated because few cultural artifacts were visibly associated with it and because the ROV could not work easily in the area without the risk of its umbilical becoming snagged. The boilers and walking beam were recorded on video and separate close-up photomosaics created. A specially fabricated scoop and bucket was fabricated to remove the coal to a storage area in a sterile area adjacent to the debris field. Recording and recovering the hundreds of glass bottles, small ceramic containers and ink bottles located above and beneath the coal took six weeks. Removal of the sediment below this stratum exposed the badly broken up lower hull of the ship, validating the theory that the bow struck the seabed first and then broke up, spilling the cargo.

A unique discovery in Area B was a consignment of religious artifacts, which had spilled out of broken crates on the starboard side of the inner hull, just forward of the paddlewheel (Fig. 19). These included green and white glass crucifix candlesticks, ceramic candlesticks sets in the form of the Madonna and Child and St. Joseph, holy water fonts in three styles featuring angel figures, the crucified Christ, and a small ceramic 'grotto' figurine of the Blessed Virgin (Tolson and Gerth, 2009). Further along the starboard side of the vessel, partly buried in the seabed, was a large assemblage of white ironstone cargo pottery. Both paddlewheels were recorded and panoramic photomosaics produced.

Excavation in the bow area of the wreck (Area A) was limited to the forward hold because the bow was badly broken and scattered. Lower hull timbers and remains of the keel again indicated that the vessel struck the seabed bow first and slightly over to starboard. (By contrast, the sternpost, keel and rudder are all intact in the stern, suggesting that most of the force of the impact was absorbed by the bow section when the *Republic* struck the seabed.)

The final area to be selectively excavated (Area D) was the debris field. Due to its enormous surface area, it was never an objective to excavate this zone in its entirety. A Tracking Sub-Sea System (TSS) metal detector configured onto the ROV documented all metallic anomalies within the wreck, the debris field and large areas to the north of the site. The majority of the anomalies proved to be iron concretions. In addition to glass bottles, glass wares and

ceramics recovered from the debris field, this zone also contained a collection of glass lenses, corroded brass telescopes and a corroded brass barometer from a shipment of nautical instruments, perhaps destined for a Chandler serving the extensive maritime traffic of New Orleans. Spare lenses, and the equipment's location where the cargo crates spilled into the debris field, favors their identification as cargo rather than domestic assemblage.

All artifacts were recorded on Artifact Record Sheets, labelled and, where applicable, given first-aid conservation treatment. A total of 65,818 artifacts were recovered from the wreck of the *SS Republic*, ranging from ship's fittings to glass bottles, ceramics, slates, organics (cloth, leather) and coins. One of the most important archaeological assemblages is the glass bottles (Gerth, 2006), which may prove to be the largest and most diverse collection recovered from any American shipwreck. These bottles provide tangible evidence of the importance of various products in daily American life in the mid-19th century.

5. Conclusion

In conclusion, a combination of historical sources and the results of the underwater survey and excavation suggest the following site formation processes for the loss of the *SS Republic* (with historical data derived from the *Charleston Daily Courier*, 30 October 1865, 7 November 1865; the *Daily Courier*, 31 October 1865, 7 November 1865; the *New York Times*, 3 November 1865; and Vesilind, 2005: 117-32).

1. On the morning of 23 October 1865 the *SS Republic* encountered a gale off Savannah, which turned into a "perfect hurricane" before night, when the steamer was possibly off Carolina.
2. About 6am on 24 October, the engine could not be turned over manually. Almost two hours later the steam pump failed, the triangular sail was blown to ribbons and the paddle boxes and part of the paddle house were destroyed. Everything loose on deck was washed overboard and lost.
3. By around 9am the vessel was leaking badly. Four additional pumps from the forward deck were fired up. Rising water swiftly inundated the pumps and by noon had extinguished the boiler fires. All hands were set to work bailing with buckets.
4. At 11.00am the *Republic's* crew and passengers jettisoned as much cargo as possible in a last-ditch attempt to save the ship. Passengers spent at least 12 hours bailing out the hull, with one later testifying that he passed buckets of water at the extraordinary rate of 25-50 pails per minute.

5. At 9.00am on 25 October all the pumps gave out. The crew set to work building a raft because the ship's four lifeboats were insufficient to accommodate all passengers (who were otherwise still bailing water). Around 1.30pm the water level rose above the engine room. With at least 80 people, the captain abandoned ship.
6. At 4pm on 25 October 1865 the SS *Republic* "broke amidships and sank" in two sections as her deckhouse separated from the main deck and floated away. Captain Edward Young reported seeing the floating deck of the *Republic*, with her steam pipe intact, while rowing toward a rescue ship.
7. The hull impacted with the sea bottom on her starboard bow (Area A) at a depth of 500m.
8. On impact, the engine room forward bulkhead in Area C smashed open, discharging coal from the bunker northwest into the aft cargo hold (Area B). Coal and cargo became intermixed. The boilers and engine machinery broke loose.
9. The keel possibly snapped forward of the mast step. The ship then gradually settled midships to the stern and rudder, listing to starboard.
10. The uncushioned paddlewheels canted outwards until they stabilized at an angle of 10-15°. The unsupported portside at the bows collapsed over time.
11. Within a few years the strong 3-5-knot current 10m above the sea bottom rapidly eroded the ship's superstructure, scattering wooden hull remains.
12. An extensive part of the exposed cargo in the stern hold was washed more than 6m offsite by the 1-5 knot bottom current and accumulated in an unstratified debris field (Area D).

The cargo and the historical and archaeological conclusions from the wreck of the SS *Republic* are published in further detail in Part 2 of this report (Cunningham Dobson *et al.*, 2009), while the coins receive their own specialist publication (Bowers, 2009).

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Notes

1. *Official Records of the Union and Confederate Navies in the War of the Rebellion. Series I - Volume 17: Gulf Blockading Squadron (December 16, 1861 - February 21, 1862); East Gulf Blockading Squadron (December 22, 1862 - July 17, 1865), 159; Official Records of the Union and Confederate Navies in the War of the Rebellion. Series*

- I - Volume 18* (1904), 124; *Official Records of the Union and Confederate Navies in the War of the Rebellion. Series II - Volume I* (1921), 683, 687.
2. For the *Tennessee* unable to escape the river and penetrate the Federal Blockade, see *Official Records of the Union and Confederate Navies in the War of the Rebellion. Series II - Volume I* (1921), 683, 687; *Official Records of the Union and Confederate Navies in the War of the Rebellion. Series I - Volume 18* (1904), 124. For the *Tennessee's* conversion into a troop transport vessel, see entry for 30 April 1862 in *The War of the Rebellion: a Compilation of the Official Records of the Union and Confederate Armies. Series I - Volume 6* (Washington, 1882). For the *Tennessee's* use as a supply vessel see entry for 13 May 1863 in *Official Records of the Union and Confederate Navies in the War of the Rebellion. Series I - Volume 20: West Gulf Blockading Squadron (March 15, 1863 - December 31, 1863)* (Washington, 1905), 184. For the renaming of the ship the *Mobile*, see entry for 1 September 1864 in *Official Records of the Union and Confederate Navies in the War of the Rebellion. Series I - Volume 21: West Gulf Blockading Squadron* (January 1, 1864 - December 31, 1864), 621. For the ship's sale at public auction, see entry for 30 March 30 1864 in *Official Records of the Union and Confederate Navies in the War of the Rebellion. Series II - Volume 1: Statistical Data of Union and Confederate Ships; Muster Roles of Confederate Government Vessels; Letters of Marque and Reprisals; Confederate Department Investigations* (Washington, 1921), 221.
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