

The Jacksonville 'Blue China' Shipwreck (Site BA02): A Mid-19th Century American Coastal Schooner off Florida

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During the survey for the wreck of the sidewheel steamer the *SS Republic*, Odyssey Marine Exploration discovered the remains of a merchant vessel, Site BA02, located at a depth close to 370m, 70 nautical miles off Jacksonville, Florida. The wreck was brought to Odyssey's attention by fishermen, whose nets had snagged ceramic wares over the last 40 years. A small selection of artifacts was recovered in 2003 and the wreck arrested in court. The site was revisited by Odyssey in 2005 and due to observed additional impacts caused by fresh dragging of trawl nets in the interim years further diagnostic material culture was recorded in relation to its contexts prior to select recovery to identify and date the site before the wreck became even more extensively disturbed and data lost.

Site BA02 is interpreted as containing the remains of a small American coastal schooner that was transporting a consignment of British ceramics manufactured in Staffordshire in the decade 1850-60 alongside American glass wares and building materials. The most plausible theory is that the ship was lost in a hurricane, with the storms of September 1854 the most likely scenario. The vessel appears to have been a two-masted schooner typical of the East Coast's thriving regional maritime trade based in New York. The Jacksonville 'Blue China' shipwreck reflects the lure of high status, yet relatively cheap, Staffordshire and US products that prevailed across middle class America and permeated down into the lower classes.

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1. Introduction

During Odyssey Marine Exploration's research into the deep-sea waters of the Atlantic Ocean off Florida, a glazed earthenware jar snagged in a trawlerman's net at a depth of more than 350m was brought to the company's attention. Odyssey designated Site BA02 a target meriting further investigation. The wreck was subsequently discovered 70 nautical miles east-southeast of Jacksonville, Florida, at a depth of 367m on the periphery of the Atlantic Ocean's Gulf Stream current (Figs. 1-3) and was surveyed by Odyssey as part of the search operations that ultimately led to the discovery of the sidewheel steamship the *SS Republic* (Cunningham Dobson *et al.*, 2010; Cunningham Dobson and Gerth, 2010).

The wreck first appeared as an acoustic image on 11 July 2002 obtained using an EdgeTech DF1000 towed side-scan sonar unit (Fig. 1). The target was subsequently examined visually with a Deep Ocean Engineering Phantom Ultimate Remotely-Operated Vehicle (ROV) on 29 January 2003 and proved to consist of a relatively coherent shipwreck composed of a low-lying mound of

hull and conspicuous deposits of blue and white decorated ceramics, various ceramic bowls and pots, and glass bottles. Three artifacts were recovered for purposes of an admiralty 'arrest' of the site and provisionally to date and characterize the ship (a bowl and jug, which proved to contain a glass tumbler).

On 28 April 2003 an eight-hour dive was conducted using the Phantom ROV with the primary objective of producing a video survey. Three additional diagnostic artifacts were selected for recovery from the northern end of the wreck: a large stoneware jug and two ceramic Canton ginger jars decorated with blue ornamental designs. These were recovered on 29 April after the completion of the site ROV video survey.

Site BA02 consisted of a large, low-lying mound, initially estimated at measuring approximately 30 x 10m, with a relief of some 1.5m above the seabed. A large quantity of articulated hull structure was observed in various stages of deterioration and further sections underlay the sand substrata. A large concentration of ceramics and glass bottles was clustered near the southern end of the site,



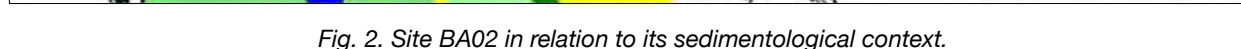
During a break from operations on the wreck of the *Republic* in 2005, the *Odyssey Explorer* – now equipped with far more technologically advanced archaeological tools and a highly sophisticated ROV – was dispatched to re-examine and re-assess the condition of additional wrecks located in the vicinity, including the Jacksonville

The 2005 visit had planned only to check the status of the site during an interval of relative quiet in the midst of the season's multiple hurricanes. However, it was clear that Site BA02 now appeared to be in imminent danger of large-scale data loss based on the alarming damage perceived. As a result, the decision was reached to use a small window of fair weather to conduct a rescue archaeology operation. Odyssey's deep-sea archaeological resources were deployed with a dual objective. Firstly, to obtain as much data as possible from the wreck in the limited weather window, including the recovery of diagnostic artifacts and intact examples of all the ceramic types represented in an attempt to characterize the vessel. Secondly, to test Odyssey's latest versions of data logging software, photomosaic production capabilities and other archaeological methods.

Legend
Continental Margin
sediment distribution

- bedrock
- clay
- clay-silt/clay
- gravel
- gravel-sand
- sand
- sand/silt/clay
- sand-silt/clay
- sand-silt/clay
- lakes
- Canada
- Caribbean
- State bounds
- NDS86k
- map extent

0 125km



2. Technology & Archaeological Tooling, 2005

The 2005 Site BA02 survey was conducted from the 76m-long, 1,431 gross-ton research vessel the *Odyssey Explorer* and relied on the newly acquired and custom-tooled Remotely Operated-Vehicle Zeus. A primary influence on the selection of this ROV system was the complexity of operating among the strong currents of the Gulf Stream. A system capable of efficiently working in this environment required mass, powerful maneuvering thrusters and strongly constructed manipulator arms. Simultaneously, an ROV needed to be well balanced to work amongst delicate artifacts and shipwreck structure.

The Soil Machine Dynamics Ltd (SMD) ROV acquired by Odyssey and renamed Zeus fitted this purpose perfectly (8 tons, 3.7 x 3.1 x 2.38m, depth range 2,000m). Zeus' propulsion system consists of eight reversible hydraulic thrusters: four 43cm-diameter units aligned on the horizontal plane and four 30cm-diameter units operating on the vertical plane. The speed of each thruster is controlled via electro-hydraulic valves, making Zeus highly maneuverable. The vehicle frame is constructed from aluminum and buoyancy is provided by molded syntactic foam.

For survey operations Zeus was fitted with a Kongsberg Simrad Mesotech 6,000m Digital Sonar and additionally with transducer/receivers fitted for navigation and survey. For manipulation, two Schilling Conan seven-function master/slave manipulator arms were installed on the front of the ROV, one to each side (reach 1.79m, working arc of 120°, lifting capacity 170kg). The ROV was equipped with a dredge pump for excavation, a limpet suction device for artifact recovery and a Sediment Removal and Filtration System (SeRF). Tools such as scales were deployed from stowage positions built into the center of the vehicle's underside.

For the Site BA02 project Zeus was configured with seven cameras, four used by the ROV pilot to monitor the vehicle's navigation and three for dedicated archaeologi-

cal recording. These consisted of an Atlas High Resolution Color Camera, an Insite Pacific Inc. Scorpion Digital Camera and a Deep Sea Systems HDTV Camera. These high-resolution cameras, combined with Halide Mercury Incandescent (HMI) lighting, supplied the archaeologist and ROV operator with high quality images. The main cameras incorporated pan and tilt controls. Various color monitors and a large format plasma screen in the Offline Room enabled the archaeologist to observe close-up images of artifacts on the wreck site only a few millimeters in size. This equipment was employed to produce a high-resolution photomosaic of the site consisting of 395 individual digital photographs before the intrusive phase commenced.

The project incorporated a unique data logging system, DataLog®, developed by Odyssey to record all events and activities, such as artifact manipulations and dive observations, by entering logs through drop-down menus accompanied by a typed comment. The program automatically logs key dive events, including time, date, dive number and X, Y, Z spatial coordinates of Zeus' movements at any one time. Every second of each dive was also recorded in triplicate on high-capacity digital video disk. Archaeological features, contexts and artifacts of particular interest were recorded in addition on DVD and High Definition tape, complemented by still photography.

Artifacts undergoing recovery were individually placed using the limpet suction device into an off-site Fourplex, a large metal lifting basket sub-divided into separate context-specific units designed to hold plastic containers. Each unit, and each division within it, was numbered, so all could be reliably tracked from context to Fourplex and onto the *Odyssey Explorer* using DataLog. Once recovered to the surface, the artifacts were recorded, logged on a spreadsheet and photographed. By formulating this sub-sea and surface recording systems, working in tandem with a separate inventory and management database maintained by the project conservator, Odyssey's archaeologists can track the history of any single artifact from its initial observation on the sea floor to its final destination and disposition.

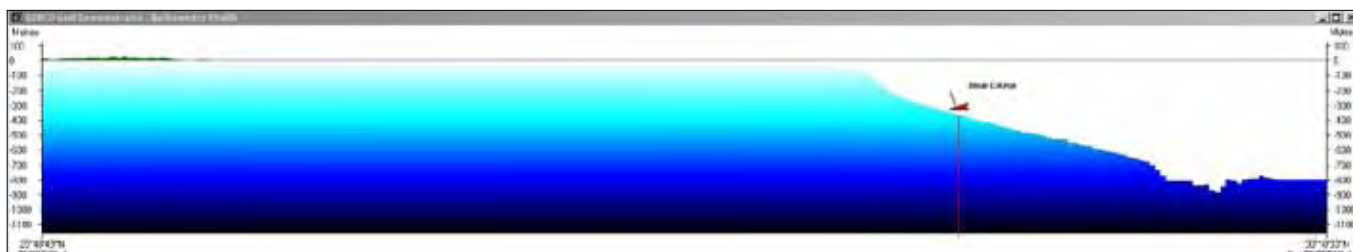


Fig. 3. Cross-section of Site BA02 in relation to its depth and gradient.

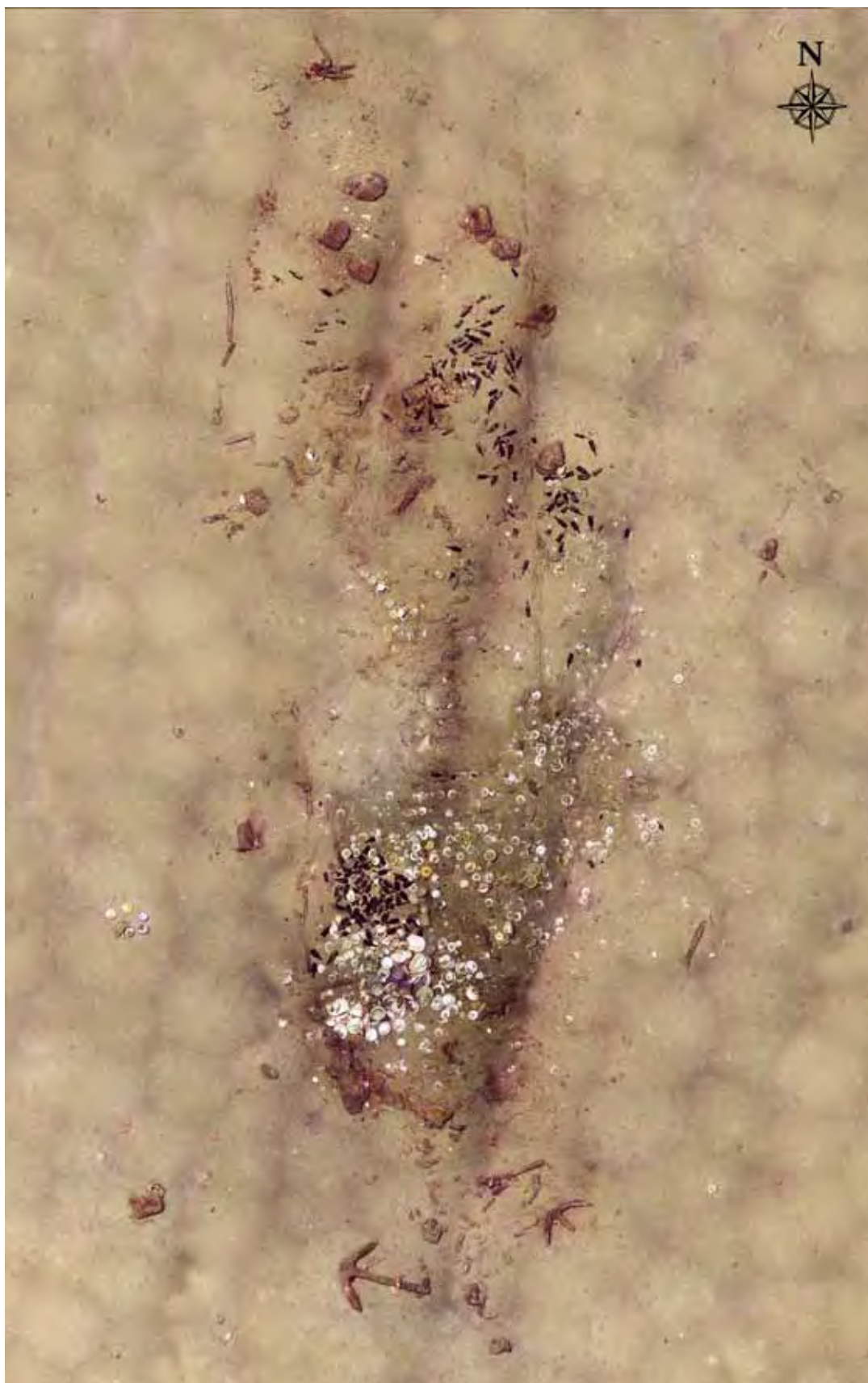


Fig. 4. Pre-disturbance photomosaic of Site BA02 (2005).

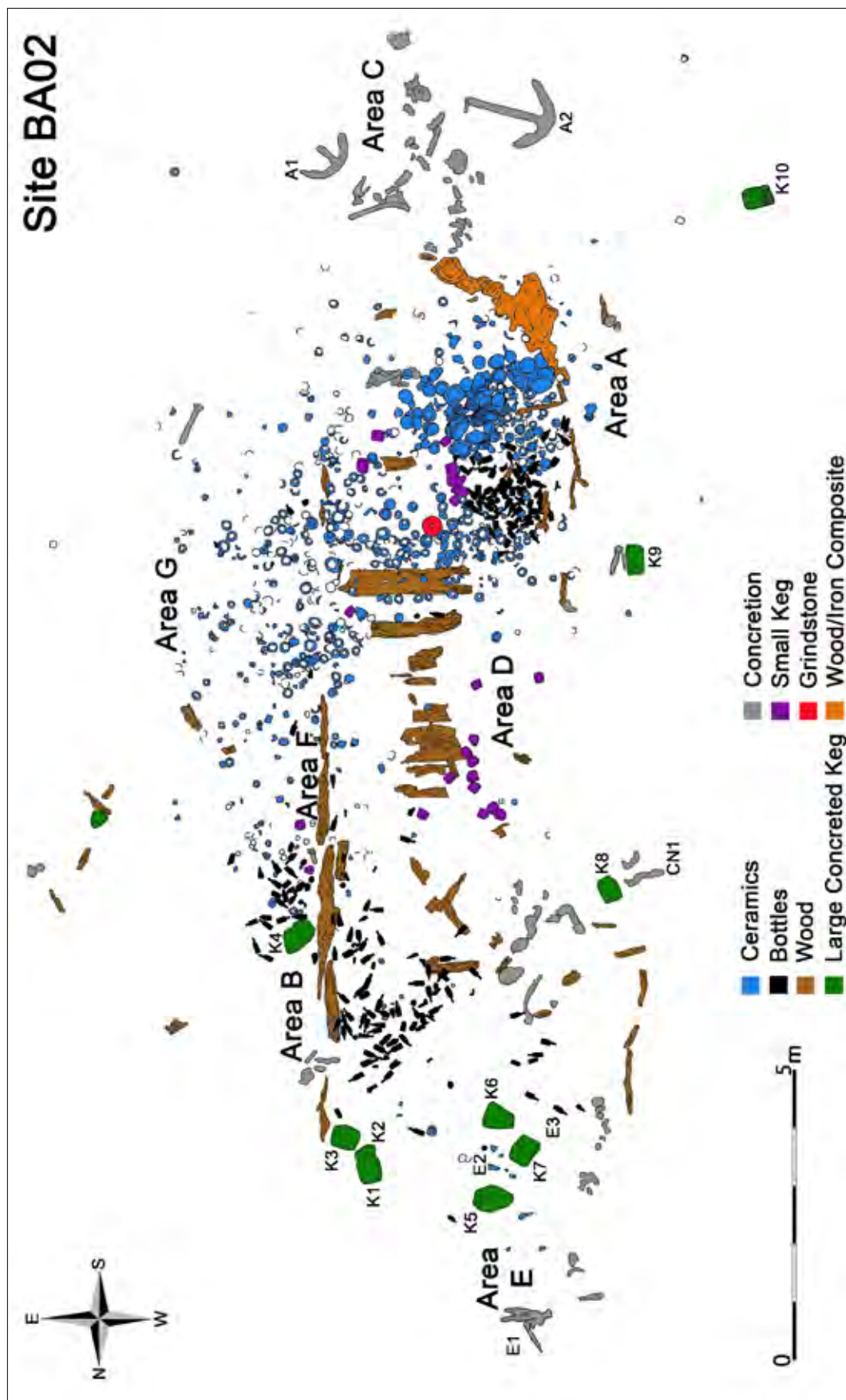


Fig. 5. Plan of Site BA02.

3. The Marine Environment

The ship wrecked at Site BA02 came to rest at a depth of 367m, some 70 nautical miles east-southeast of Jacksonville, Florida, in the Atlantic Ocean's Gulf Stream current and topographically within the 'Atlantic'-type continental margin (Kennett, 1982: 27-30; Figs. 2-3). The continental margin in this macro region sub-divides into three distinct morphological zones: a northern region extending from the Grand Banks to north of Long Island, a middle strip from north of Long Island to Cape Hatteras, and a southern one stretching from Cape Hatteras down to the Florida Panhandle. Between Maine and Florida the continental margin consists predominantly of basins and platforms, the latter covered by thin layers of sediment and numerous horsts and grabens of probable Triassic age. South of Cape Hatteras, the dominant topographic features of the continental margin are carbonate platforms between the Cape and the Puerto Rico Trench.

The northernmost carbonate platform is the Blake Plateau, a surface attached to the broader Florida Platform that projects down to a depth of 850m from the Florida-Hatteras slope (Kennett, 1982: 345-46). The Jacksonville 'Blue China' wreck lies on the Florida Platform, right at the edge of the Blake Plateau. Depth and slope data supported by an overlay of bathymetry on the US Geological Survey website and loaded into ARC GIS indicate that the wreck lies on its continental rise.

The Florida Platform is located on the south-central section of the North American Plate, extending to the southeast from the North American continent separating the Gulf of Mexico from the Atlantic Ocean. It is defined by the surrounding 91m isobath, spans more than 565km at its greatest width and extends southwards for more than 725km at its maximum length. A thick sequence of mid-Jurassic to Holocene siliciclastic-bearing carbonates and siliciclastic sediments, unlithified to well lithified, overlie the weathered surface of much of the platform.¹

With a breadth of nearly 300km, the Blake Plateau Basin is one of the widest along the whole margin and covers an area of 127,700km². Sedimentary rocks characterize its geology and Jurassic to Cretaceous carbonates subsist over the plateau. Lower and Upper Cretaceous limestones and dolomites are present along the Blake Escarpment (Miall, 2008: 486-87; Pratt and Heezen, 1964: 721; Sheridan, 1987: 257).

The Blake Plateau first started to form in the early Tertiary, when the strong Florida Current began to flow through the Straits of Florida across what was then a deepwater continental shelf, cutting off the supply of continent-derived sediment to the outer shelf. Although some sediments were

deposited on the outer Blake Plateau in the later Tertiary, the combined flow of the Florida Current and the Antilles Current, which merge over the southern Blake Plateau to form the Gulf Stream, has prevented most deposition over the plateau and has deeply scoured its base.²

The sediments covering the continental shelf can be classified into two groups based on age and their relation to the depositional environment: near-shore deposits of modern origin and in equilibrium and relict sediments (70% of the sediment cover) in disequilibrium. Modern sands are deposited in the nearshore part of the shelf, within approximately 6km of shore, and are subsequently dispersed by currents. Seaward of this area on the central and outer portions of the shelf are relict sediments. Unlike the modern sands these exhibit a coarse character, iron staining, and dissolution pitting from subaerial weathering (Kennett, 1982: 308-309).

The geological province in which the Jacksonville 'Blue China' wreck lies is beyond the southernmost Ice Age glacial advance and is thus devoid of the glacial till and gravelly outwash that predominate further north. It also does not display the fluvial sediment and reworked coastal deposits present off the central Atlantic states. Rather, South of Cape Hatteras skeletal and clean quartzitic sands typify the shelf sediments, with carbonates increasing southwards. The Blake Plateau is a northern continuation of the Bahama Bank carbonate province, whose carbonate distribution varies according to the local abundance of shells in an otherwise quartzose shelf environment (Pratt and Heezen, 1964: 724-25). Fine, silty sands form a near-shore belt and carbonates increase offshore. Sediments are richer in quartz and poorer in feldspar, a result of the erosion of coastal plain areas by rivers (Kennett, 1982: 311-12).

Localized maps of the continental margin sediments off the East Coast of North America demonstrate that Site BA02 is situated in an area of iron silicate sands, where the calcium carbonate content varies from 50-95% (Kennett, 1982: 311). United States Geological Survey coastal mapping reveals that this area of the seabed consists of surface deposits of sand, sand/silt/clay and that the wreck site is most closely aligned with an area of gravel sand. DVD footage captured during the 2005 site survey shows that the sediments are highly coarse and mixed with abundant large and fragmented shell and ripples characteristic of sand substrata. The wreck is rich in rock crab (*Cancer irroratus*), vermillion snapper (*Rhomboplites aurorubens*), with some limited conger eel documented below hull structure on the southern flank (Figs. 30, 37, 44, 113-117).

4. Site Description, 2005

The Jacksonville 'Blue China' shipwreck lies in waters affected by the flow of the Gulf Stream current, where bottom currents range from 0.5-1.0 knots. The deep seabed environment is sparsely populated by flora and fauna. Folklore amongst local fishermen abounds in tales of surface currents trapping disabled ships, creating a regional graveyard of wrecks. Site BA02 is the only disruption to a relatively featureless bottom plain beneath the rolling Atlantic waves. The wreck mound is oval in shape, 23.05 x 11.65m, and has an elevation of around 1.5m above the sea floor, with the centerline oriented north to south and the bows positioned to the south (Figs. 4-5).

Minimal modern rubbish overlying the wreck includes plastic rubbish bags, a beer can, and sections of cloth/canvas, some of which may be parts of sails. The bottom matrix consists of shallow deposits of sediment overlying hardpan, although the sediments – including dense fragmented shell and what appear to be pulverized pottery fragments – deepen northwards along the wreck to around 50cm thick. No stone or iron ballast was identified after large sections of the hull, including the keel, were uncovered. The ship was evidently fully loaded on its final voyage.

Site BA02 exhibits direct and indirect evidence of trawl impacts. The former includes physical trawl furrows on the eastern side of the keel, especially the southeastern quadrant,

drag marks cut into the sea bottom matrix, and smashed artifacts and ship's structure. Indirect evidence comprises an absence of benthic organisms, which are slow to develop and spread, and the 'desert-like' surroundings of the wreck (pers. comm. Tom Dettweiler, 15 February 2005). Since no photomosaic was produced in 2003 when the site was initially discovered, comparative analysis of the change in its level of preservation is not easily quantifiable. The level of site impact is discussed in further detail in Section 12.

The most extensive concentration of cargo is situated towards the bow end of the site in Area A in a dense cluster of pottery and glass wares covering an area of 4.1 x 1.9m (Figs. 5-6, 13-14). The repertoire of the stowed ceramic wares is clearly limited. In the southern half of Area A within a concise zone measuring 1.9 x 1.9m were at least 231 ceramic vessels, restricted in form to 109 shell-edged Type 1A and Type 1B whiteware plates and soup plates (40 within a single stack), 16 Type 1C octagonal shell-edged whiteware platters and 105 Type 2A dipped whiteware bowls (Figs. 15, 17-22, 47-48). A single Type 2B dipped jug lies outside the hull to the west. This is the only section of the wreck where shell-edged wares occur (Fig. 47). Seven Type 4C white granite/white ironstone china wash basins, five still stacked in two sets of three and two, are also present to the south of Area A (Fig. 50). All of these ceramics are of British origin (see Section 7 below).



Fig. 6. Photomosaic detail of Area A: shell-edged earthenware plates, soup plates and platters to the south, mixed with dipped whiteware bowls, and a cluster of dark glass bottles to the north. Note the structural remains at east (foreground) and far south (far right, possible stem assembly with hatch rollers to its left), and wooden kegs to the east, which helped preserve this part of the wreck from trawler damage.

The wreck's four Type 6 Canton ginger jars were discovered some 0.5-0.8m north and northwest of the northern end of Area A along a 1.8m-long line (Figs. 22, 51), giving the impression of having rolled to these points of deposition from height, perhaps having originally been stacked on the very top of the Area A ceramic cargo hold, a pattern that would have befitted the comparatively high value of these more expensive porcelain wares. Contextualized with the ceramics in the northern half of Area A, covering 2.0 x 1.9m, are 65 Type 1 black glass liquor bottles, three transparent glass tumblers and two Type 3 transparent long-necked sauce/utilitarian bottles. One Type 6 green glass cologne bottle is present on the southern flank of the main ceramics cluster (Figs. 6, 13-14, 23, 53, 54).

The concentration of cargo in Area A, including material still stacked (albeit having fallen on its side), and the far more dispersed nature of ceramics and glass wares across the rest of the site, is an unbalanced and thus artificial pattern that cannot reflect the ship's original stowage. This relationship is the result of the wreck's unique site formation. Most of the site has been heavily impacted by bottom trawling gear (see Section 12 below).

However, the Area A deposit has been cushioned by an extensive 2.38m-long section of durable concreted iron

(seemingly sheathed around a wooden core) to the south, possibly related to the largely decomposed stem (Figs. 6, 29). To the west is a comparable iron/wood part of hull structure, 2.9m-long and seemingly delineating the outer edge of the starboard hull, but today heavily ground down (Fig. 17). This is bisected at 90° by an iron/wood structure resembling a bulkhead divider. The eastern flank of Area A has similarly been protected by a deposit of small wooden kegs, 10 intact examples of which survive, each measuring between 16.8 x 16.8cm and 21 x 17.8cm, intact to the north but now highly fragmented to the south (Figs. 6, 14, 16). This eastern section beyond Area A is densely covered with a white organic deposit, all that remains of additional kegs struck by trawls. Area A owes its current preservation to a combination of fortunate localized geographical conditions.

A second less extensive concentration of cargo occurs to the north of the stern section of the wreck in Area B, where 115 Type 1 black glass liquor bottles cover an area of 5.7 x 3.9m and straddle both the eastern and western side of the keel (Figs. 5, 7, 24, 25). Although these have been scattered by trawlers and are far more loosely clustered, this deposit gives the impression of having been stowed midship in the stern. Area B is bounded on the north and east by four

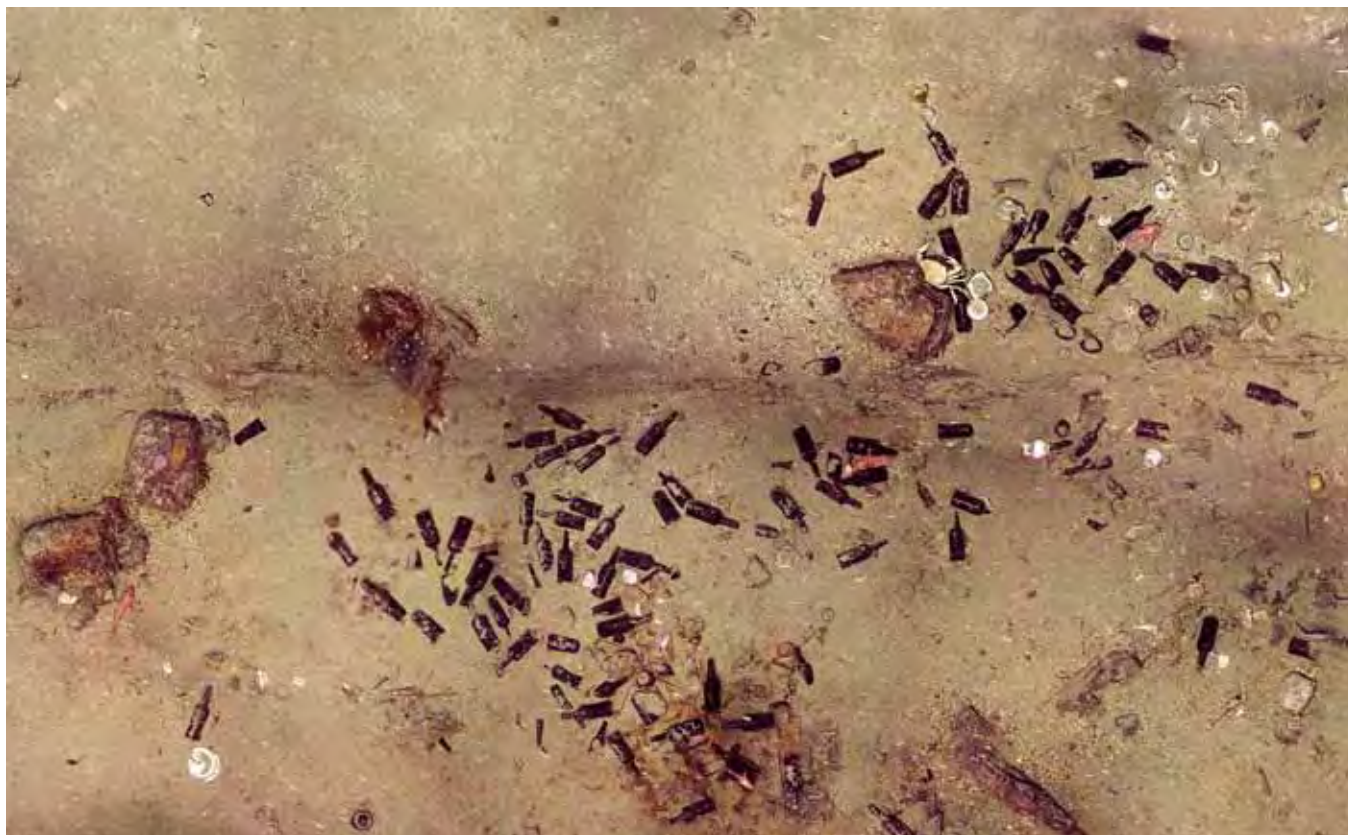


Fig. 7. Photomosaic detail of Area B: a cluster of dark glass bottles, tobacco pipes and large kegs K1-K4 with the buried keel visibly running north/south.



Fig. 8. Photomosaic detail of Area C: two iron anchors at the bows with the possible stem assembly towards the north (far left).

large wooden kegs (K1-K4), concreted through their iron hoop binding, holding unknown contents and each measuring approximately 48 x 38cm (Figs. 7, 26). (Additional examples on the site may point towards a content of musket shot and/or tobacco pipes.)

The two easternmost kegs, K3 and K4, have been seemingly struck and flattened by a trawler. Mixed amongst the bottles in Area B are 39 clay tobacco pipes, 33 within the confined limits of Area B1, 3.0 x 2.2m, and all of the ribbed Type 1 variant (see Section 8 below; Fig. 24). This is the epicenter of the scatter of 63 pipes on Site BA02 and suggests storage within one or two crates possibly stowed in this location (Fig. 52). In addition, seven of the eight ceramic salve jars and covers visible on the surface of the wreck are confined to Area B1 (Fig. 50). Two Type 4 Sand's Sarsaparilla medicine bottles lie on the western edge of keg K1 and two glass oil lamps with bases were identified 1.5m to its northwest (Fig. 55). No Types 2 or 3 dipped or underglaze painted wares whatsoever are present in the stern section of the site in either Area B or E.

Two iron anchors are visible at the southernmost section of the site in Area C, one intact (A2) and the second (A1) with just its arms and lower shank preserved (see Section 5). No wood underlies the anchors. This zone is covered with around 33 small concretions of differing sizes and appears to have been heavily impacted by trawls (Figs. 5, 8, 27, 28).

Area D immediately north of Area A contains 14 small square wooden kegs of similar dimensions to those bordering the eastern flank of Area A (16.8 x 16.8cm and 21 x 17.8cm), identified as containing white lead. All but three are clustered in the northern half of Area D within an area covering 1.53 x 1.50m (Figs. 5, 9, 30). The southern half, Area D2, is characterized by remains of an additional cargo of stacked rectangular glass window panes, each measuring some 29.8 x 25.1cm and visible across a limited area of 1.78 x 1.27m. In the two main piles preserved on the surface of the wreck the panes are stacked five to six high (Figs. 31, 53, 74). Underlying both the kegs and glass is a 3.4m-long section of articulated hull consisting of at least 14 wooden

frames aligned east/west. The hull section is 0.93m wide before it is concealed by the overlying cargo (Figs. 30, 31). A lead ingot, a section of canvas and a blue-paneled cologne bottle are associated with Area D (Fig. 75).

Area E is especially interesting because of the presence of an eclectic deposit of domestic assemblage clearly belonging to the captain and crew and once stored in the ship's cabin (Figs. 5, 10, 55). A 88cm-long tripod-shaped iron concretion, perhaps resembling part of surveying/astronomy equipment, marks the extreme north end of the site in Area E1 and from between its legs were recovered a portable brass telescope with a wooden outer tube sheath and two brass pocket compasses (Figs. 33, 76-83).

Some 2.9m due south and immediately north of the large keg K6 in Area E2 a rich deposit was examined, consisting of a glass salt cellar, a glass inkstand, part of a brass and glass sextant and a brass hinge (Figs. 34-35, 55, 84-86). To the southwest of keg K7 a cluster of six Type 1 ribbed tobacco pipes was recorded in Area E3, while another six were scattered around the north and east of keg K5 (Figs. 36, 52). A seventh example concreted to K6 may reflect the original form of their stowage within kegs. Two light aqua Type 3 sauce/utilitarian glass bottles lie on the northwestern side of keg K7 (Fig. 53). Two cupreous sail thimbles were located between Areas B and E (Figs. 43,

55, 95-99). The presence of the navigational and domestic wares, which would typically have been stored in a galley cabin, confirms the identification of the north end of the site as the position of the ship's stern.

Area F on the eastern, port side of the wreck is characterized by a spread of glass window panes covering a 1.8 x 1.2m section of wreckage and located parallel to the cluster present at the northern end of Area D (Figs. 11, 38, 53). This class of cargo was evidently originally stacked on both sides of the keel in the center of the ship. Area F coincides with the densest presence of glass tumblers that merges with the northwestern side of Area G (44 in total on Site BA02: two examples in Area A, one in Area B, four in Area D, four in Area E, seven in Area F, 25 in Area G, one next to concretion CN1; Fig. 54).

From the northeastern edge of Area A an uninterrupted deposit of largely scattered ceramic wares continues in Area G for a main range of 6.7 x 3.0m from the southwest to northeast, but with outlying deposits covering a total length of 8.5m (Figs. 12, 39-40). Cargo ceramics in Area G are far less nucleated, and bottom trawlers have seemingly heavily impacted this part of the site, which has manifested in the survival of lines of intact and broken pots lying along trawl lines (Fig. 119). Notably, no Type 1 shell-edged whitewares or glass bottles are present in this



Fig. 9. Photomosaic detail of Area D: glass window panes overlying wooden frames at right and center, with wooden kegs to the north (at left).

zone, which is characterized by three types of ceramics: 10 Type 5B yellow ware chamber pots are restricted to the southwestern half of Area G in a 3.1m-long east/west linear band (Fig. 51); the most numerous cargo form are Type 2A dipped ware bowls confined to the central and southwestern sections of Area G, but with nine Type 2B dipped ware jugs and one Type 2C dipped ware mug more widely diffused to the northeast (Fig. 48); Type 3 underglaze painted whitewares used for tea service are heavily concentrated to the northeast within a 8.6 x 2.5m north/south band (that includes its extension across Area F and into Area B; Fig. 49); spreads of Type 4 white ironstone chamber pots, bowls and basins are present throughout this zone (Fig. 50). A 7.2m-long and 0.7m-wide narrow band of 25 scattered glass tumblers extends down the northwestern side of this zone, terminating at the northern end of Area A (Fig. 54). A cluster of eight ribbed tobacco pipes along the keel line at the center of Area G may reflect the presence of another decomposed crate of these wares (Fig. 52).

The ship form present at Site BA02 was a sailing vessel that did not rely on powered machinery. No wire rigging has been identified, an absence that is indicative of a pre-Civil War timeframe (Murphy, 1993: 204), thus prior to c. 1861. The absence of cannon signifies that the vessel was neither a privateer nor an armed merchantman. It is most suitably characterized as a coastal or, less likely, a trans-oceanic trading craft.

The single intact anchor's length points towards a vessel of 100 tons or less. The length of the visible keel remains measures 17.6m, which probably reliably equates to the original keel length. The visible hull remains measure 2.5m in width between the keel and the starboard frame

edges in Area D. Despite its small magnitude, the ship was relatively heavily framed (Fig. 32): the wooden frames exposed near the middle of the wreckage between Areas D and F display sided dimensions ranging from 12-14cm (4.7-5.5in), with spacing of 11cm (4.3in). For a vessel of 100 tons the Rule VIII hull construction requirements cited in the *American Lloyd's Register of American and Foreign Shipping* (1865: xv) indicated that floors needed to measure a minimum of 9in and frames 4.5in at the plank shear and 8in at the throat. Again, this information is suggestive of a small vessel, probably under 100 tons.

5. The Anchors (Area C)

Two concreted iron anchors are associated with Site BA02 and define the southernmost flank of the wreck (Area C). Both were evidently still lashed to the bows when the ship sank (Figs. 4, 5, 8). Anchor A1 is located 2.2m northeast of the end of the visible articulated wreckage (defined by the eastern tip of a large sub-rectangular iron concretion that may be part of the stem assembly). A1 is broken and only a section of the crown, arms and the lower shank are preserved (surviving L. 57.7cm, shank W. 11.6cm; Fig. 28). The arms are gently rounded, 58.7cm long, and measure 1.1m between the fluke tips. A second section of concreted iron lying just 78cm to its southwest, surmounted by a ring, seems to be the missing section of the shank (L. 1.12m, Th. 9.4cm). This suggests a total length for anchor A1 of 1.69m, which is consistent with the dimensions of anchor A2.

Anchor A2, 1.65m long, is intact and lies 2.31m due south of the tip of the possible stem structure and 2m



Fig. 10. Photomosaic detail of Area E in the stern: a concreted tripod (E1, far left), large kegs K5-K7, and at far right keg K9 and CN1, a concreted feature, possibly a rudder gudgeon.

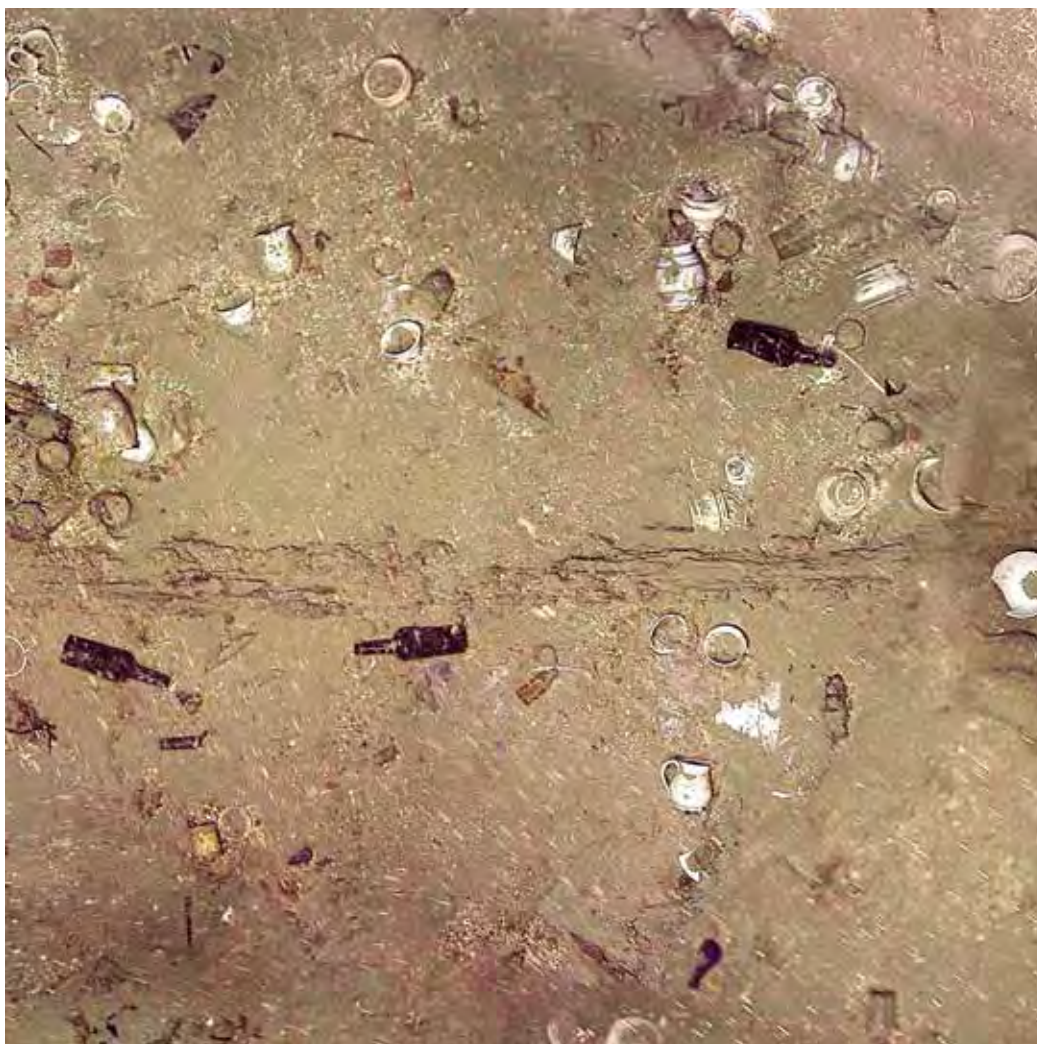


Fig. 11. Photomosaic detail of Area F: the north/south running keel at center surrounded by underglaze painted whiteware cream jugs, sugar bowls and tea bowls (tea service cargo) and glass window panes in the foreground.

west of A1 (Fig. 27). A small hawser ring (Diam. 23.1cm) survives at the top of the shank (Th. 12.6cm). Its arms, 64.9cm long, assume a more v-shaped profile than A1 and the flukes incorporate widened palms. The width between each of the two 12.6cm-wide arms is 1.3m.

Neither A1 nor A2 is associated with an iron stock, which suggests a reliance on a form of technology exploiting two pieces of oak sandwiched around the iron shank and bolted together, with the joint reinforced by iron hoops. A2 appears to feature a protrusion known as a 'nut' (Dover, 1998: 67), a design concept intended to help prevent the stock from sliding down the shank while in operation.

The use of anchors as diagnostic artifacts reflecting origins and chronology is infamously problematic. Anchor shape is not specific to places of origin and anatomy changed little over time (Marx, 1975: 97; Potter, 1972: 62). Potter (1972: 62) has proposed that the presence of an iron stock signifies a general post-1820 date. Marx (1975:

97), by contrast, argues that iron replaced wooden stocks as early as the mid-1800s. Within the British Navy, wooden anchor stocks were superseded by iron for anchors weighing less than 1,500lb in the early 1800s (Murphy, 1993: 229-30, 288). The apparent absence of iron stocks on Site BA02 demonstrates that this guide is far from uniformly applicable. No iron stocks were recorded on the wreck of the sidewheel steamer the *SS Republic*, wrecked off Georgia in 1865 (Cunningham Dobson *et al.*, 2010: 9, 17, fig. 12).

In terms of anchor forms in circulation around the time of the loss of the Jacksonville 'Blue China' wreck, the 1819 *Young Sea Officer's Sheet Anchor* (Dover, 1998: 67) lists an inventory of "one Sheet Anchor, one Spare Anchor, two Bower Anchors, one Stream Anchor, and one Kedge" for "Men of War, East Indiamen, and large Ships in the Southern Trade". The same source unhelpfully stated that "In the Merchant Service, the Anchors and Cables sometimes differ in Size and Number." Coasters, for example,

which is directly applicable to Site BA02, “and particularly in the Coal Trade from the North to London,” carried “two BOWER anchors, and in Vessels of two hundred Tons and upwards, a spare or waist Anchor.” Murphy (1993: 288) has observed that regulations around 1850 mandated that ships “carry at least two bower anchors, a stream anchor and a smaller kedge anchor”, while Tomlinson (1854: 46) reported in the decade when the Jacksonville ‘Blue China’ ship foundered that “Smaller vessels, such as brigs, cutters, and schooners, have only three or four anchors.”

The ‘sacred’ sheet anchor was the largest and strongest and was only employed in extreme emergencies, such as the wildest gales. The bower anchors were nearly the same size as the sheet anchor and were referred to as the best bower, the small bower and spare anchor. The stream anchor weighed one-fourth to one-fifth the weight of the others and was relied on for holding the vessel in station in rivers or in moderate strength streams. Finally, the kedge

anchor was half the size of the stream and was used for kedging, the process by which a vessel moved itself in the face of contrary currents or winds. This involved hauling this anchor out ahead of the vessel in a small boat, dropping it and drawing the ship ahead by pulling on the cable (Tomlinson, 1854: 46).

Identification of the type of anchors present on Site BA02 requires a determination of weight, the major factor in classification. A formula from *c.* 1854 provided a means of estimating anchor weight from the length, as follows: anchor weight in cwt (one counterweight equates to 110lb) = anchor length in feet³ x 0.0114 (Tomlinson, 1854: 47). This formula was suggested along with the caution that “for large anchors the result is too small, because the thickness is greater in proportion.” Applying this formula to the intact Jacksonville ‘Blue China’ anchor A2, which measures just over 1.6m in length, yields an estimated weight of 190lb.

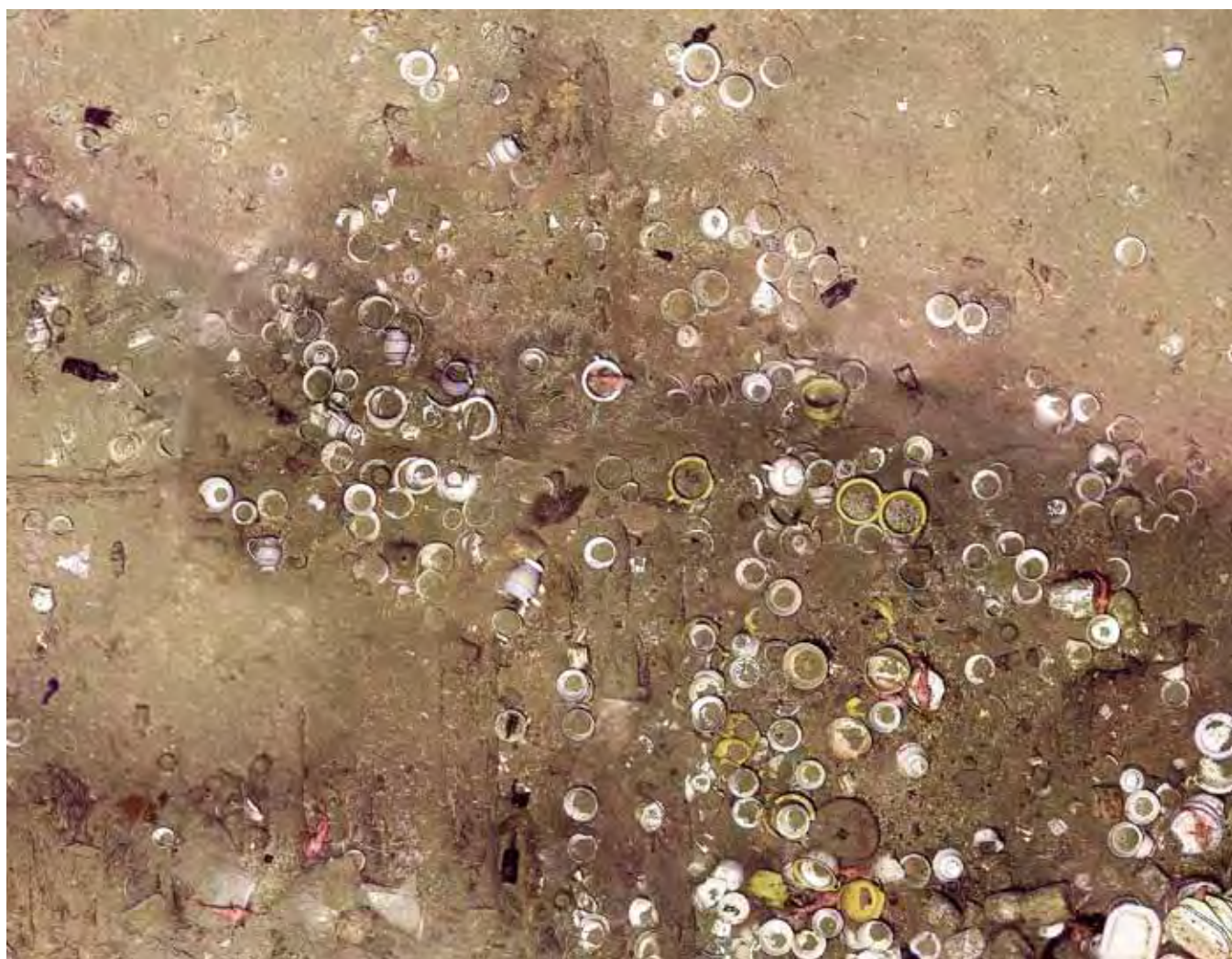


Fig. 12. Photomosaic detail of Area G: scattered white ironstone china, dipped yellow chamber pots, whitewares, and glass tumblers at left. Area A is visible at bottom right and Area D at bottom left.



Figs. 13-14. Overview of Area A: shell-edged earthenware plates, soup plates and platters to the south, mixed with dipped whiteware bowls, white ironstone china and a cluster of dark glass bottles to the north. Wooden kegs and dipped yellow ware chamber pots flank this zone.



Fig. 15. Detail of Area A from the south.



Fig. 16. Detail of Area A from the northeast, with the grindstone in the foreground flanking this zone.



Fig. 17. Concreted structural remains to the west of Area A (far right).



Fig. 18. Detail of shell-edged earthenware plates, soup plates and platters, dipped whiteware bowls, and white ironstone china chamber pots and basins in Area A.



Figs. 19-20. Detail of stacks of shell-edged earthenware plates, soup plates and platters in Area A.



Fig. 21. Detail of stacks of dipped whiteware bowls in Area A.



Fig. 22. Two of the four Canton ginger jars in situ on the western flank of Area A.



Fig. 23. Detail of dark glass bottles to the north of Area A.



Fig. 24. Detail of scattered dark glass bottles in Area B, mixed with fluted tobacco pipes. The keel runs north/south at far left.



Fig. 25. Detail of dark glass bottles and underglaze painted whitewares (tea service) to the south of Area B.



Fig. 26. Large wooden kegs K1-K3 with concreted iron hoops to the north of Area B, with the buried keel to their east.



Fig. 27. Anchor A2 in the bows at the southernmost end of Site BA02.



Fig. 28. Anchor A1 in the bows at the southernmost end of Site BA02, with its probable broken shank behind.

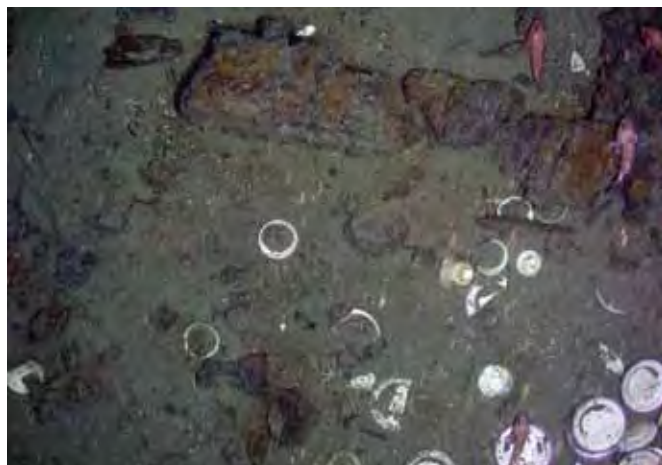


Fig. 29. Areas A and C are divided by a long section of concreted timber, possibly part of the stem assembly structure.



Fig. 30. Area D from the north with glass window panes overlying wooden frames (top) and wooden kegs in the foreground.



Fig. 31. Vertical view of glass window panes in Area D2.



Fig. 32. Hull remains in Areas D and F: the keel runs north/south (at left) flanked by a series of at least 11 starboard frames attached to underlying strakes (at right). Keel and frames are no longer interconnected.

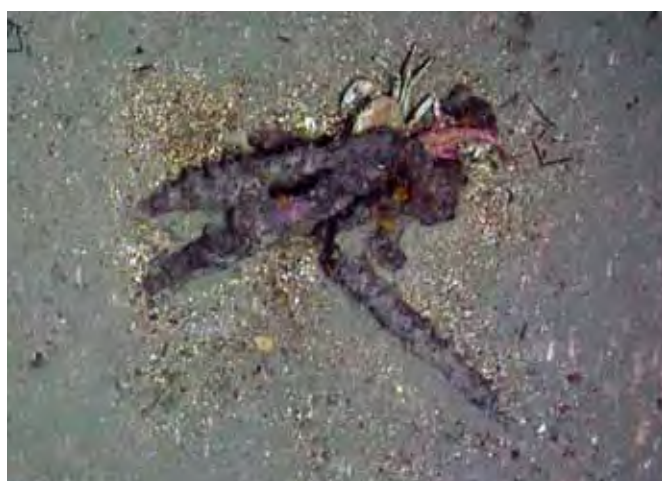


Fig. 33. Detail of feature E1 to the north of Area E in the stern, a concreted tripod possibly used for navigation/surveying purposes and originally stowed in the ship's main cabin.



Fig. 34. A glass salt cellar being recovered from Area E2 by the ROV Zeus' limpet suction device.



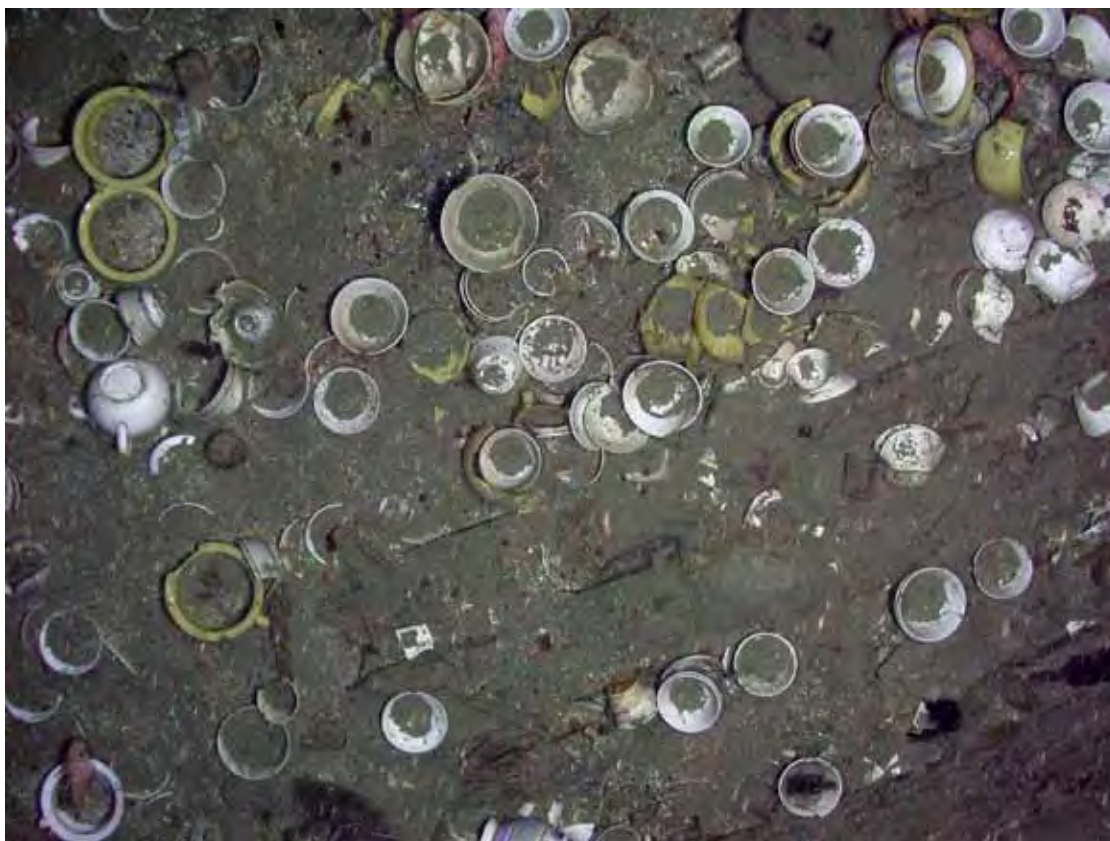
Fig. 35. A glass inkstand under examination by the ROV Zeus in Area E2.



Fig. 36 (middle left). Detail of feature E3 in Area E in the stern: glass bottles and tobacco pipes clustered around large keg K7.

Fig. 37 (middle right). Detail of concretion CN1 to the south of Area E to the west of the wreck, possibly identifiable as remains of a rudder gudgeon.

Fig. 38 (bottom left). Various glass bottles and two sides or bases of wooden crates in Area F.



Figs. 39-40. Scattered underglaze painted floral tea saucers and tea bowls, dipped yellow ware chamber pots and dipped whiteware bowls across Area G, directly overlying flattened wooden strakes.



Fig. 41. Detail of the grindstone in Area G surrounded by dipped yellow ware chamber pots and dipped whiteware bowls.



Fig. 42. Detail of a cluster of lead ingots on the northwest flank of Area G in association with a wooden keg, dipped ware jug and underglaze painted whiteware cups and saucers.



Fig. 43. Detail of a cupreous sail thimble in situ between Areas D and E.

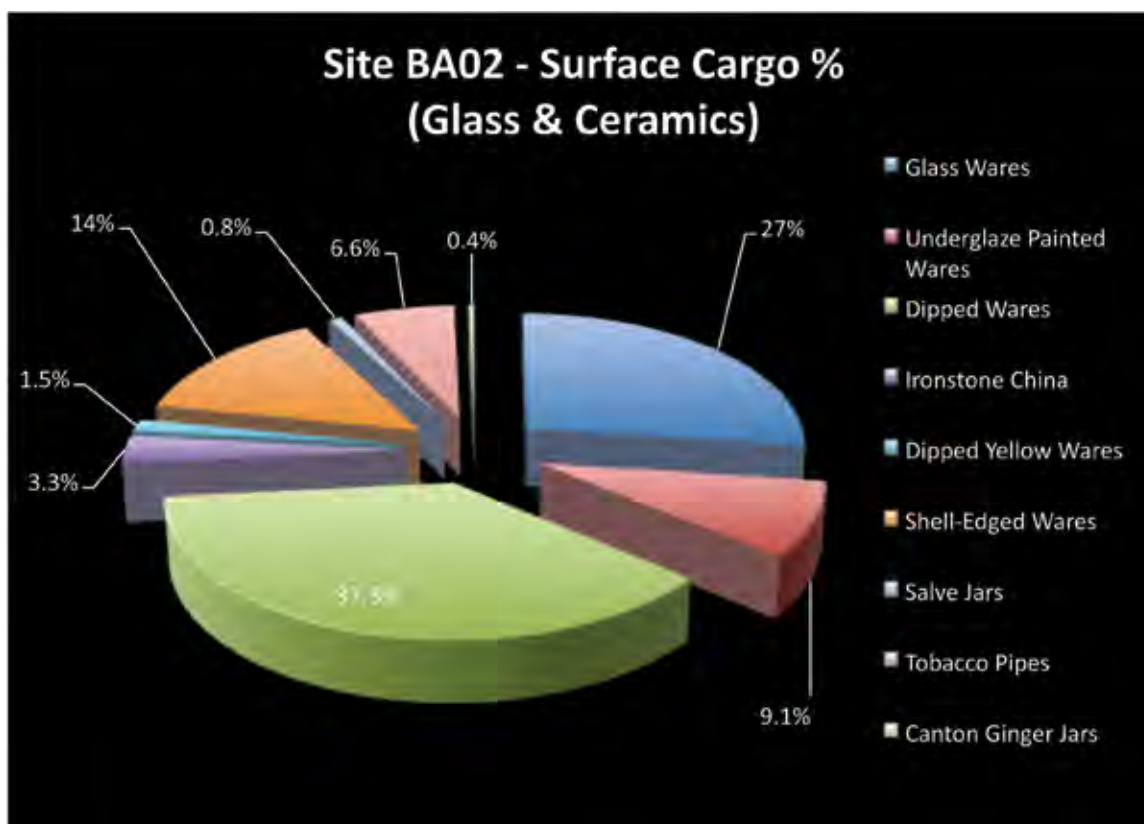
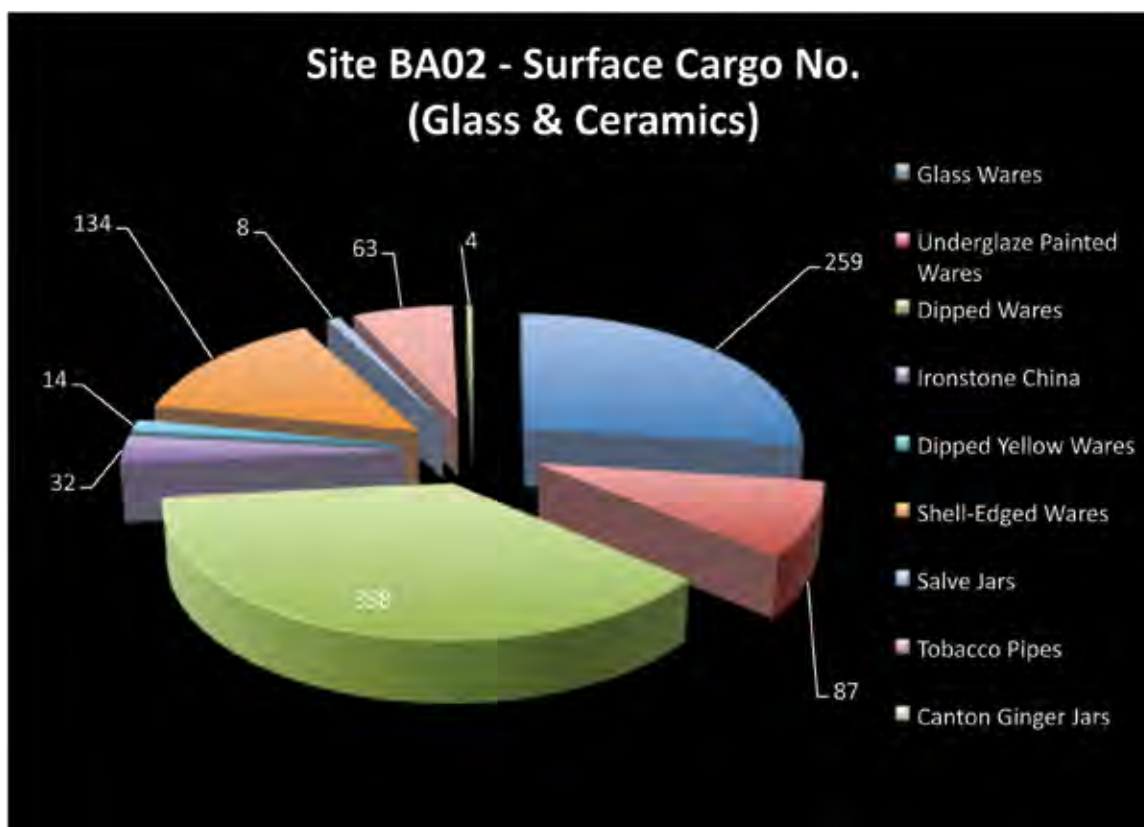


Fig. 44. A wooden hatch roller in situ in the bows to the south of the wreck.

When the two bowers were ‘weighed’ (raised off the sea floor) on a working vessel, they would have been secured on either side of the bow with the arms square to the hull. When stowed, the inner arms of the bowers overlay the gunwale (Dover 1998: 67; Tomlinson, 1854: 46). Harland (as cited in Dover, 1998: 126) noted that in Darcy Lever’s day, *c.* 1819, bower anchors were generally the same size, but “one of the Bowers was designated ‘Best Bower’. This, the ‘working’ anchor, was carried on the larboard (port) side, and had two cables bent to it.” By contrast, Murphy (1993: 288) stated that “bowers were normally carried on deck for ready deployment in coastal waters. The stream and kedge anchors would likely be below decks.”

As a consequence of the displacement and destruction of cultural material by the dragging of trawl nets across Site BA02, surface material cannot be assumed to remain in its original disposition. The absence of any snagged or otherwise lost nets suggests that no part of the site has been sufficiently rigid to withstand dragging, but it seems reasonable to work under the assumption that larger and heavier objects would have been displaced to a lesser degree than smaller and lighter ones.

The wreck’s centerline, as demonstrated by the preserved keel, extends north/south. The presence of one intact and one broken anchor at the southern end of the site is taken to denote the reliable position of the bows. The lack of wood underlying them is consistent with their having fallen off the bows following the hull’s collapse, rather than classification as spares stowed below deck. This identification is also reflected by their close proximity to each other at what is believed to be the forward end of the wreck. Intact anchor A2 seems to have been attached to the starboard bow, while A1 lies along



Figs. 45-46. The Jacksonville 'Blue China' shipwreck: surface cargo ceramics and glass cargo volumes as visible on the site photomosaic (by number and per cent).

the direct axis of the keel suggesting possible trawl dragging from portside in a northeast to southwest direction. This theory is in line with the sterile nature of the southeast quadrant of the wreck site, which has been heavily stripped of material culture.

Paasch's Illustrated Marine Dictionary of 1885 described merchant vessels as carrying bower, stream and kedg anchors of differing number and weight dependent on the size of a ship. In addition, he specified that "for a Sailing-Vessel of 100 tons" the usual complement of anchors would consist of two bowers from 5-6cwt each, one stream of about 2cwt and one kedg of around 70lb weight. With 1cwt equating to 110lb, the 190lb intact Site BA02 anchor currently seems to represent a stream anchor from a 100-ton sailing vessel or a bower from an even smaller sailing vessel.

6. Ceramic Cargo: Introduction

The diversity in type and quality of ceramic and glass cargo recorded on Site BA02 typifies a modest coastal trader, almost certainly of American origin, transporting goods on an established route to customers along the Atlantic and Gulf coasts or conceivably further into the Caribbean. The ceramic wares are largely British-made products, most likely from the Staffordshire potteries that would have

been imported initially through the major American ports, such as New York, Philadelphia, Boston and Baltimore. From there they were repackaged and shipped down the Southern coast for resale to other merchants or smaller distributors (pers. comm. William Sargent, 6 March 2003; pers. comm. Jonathan Rickard, 12 July and 28 August 2006). Inland and Southern dealers also frequently traveled to the East Coast ports to choose their purchases.

While many Staffordshire manufacturers established pottery outlets in several US cities, American importers and agents also played an essential role in the transatlantic ceramics trade. By the 1850s the bulk of Staffordshire exports was handled by New York ceramic importers and dealers, who controlled the distribution network for the internal American market. For example, the Staffordshire-based ceramic merchant John Hackett Goddard of Longton purchased ceramics from British manufacturers, while his US partners John Burgess and Robert Dale operated the American wholesale ceramic outlets from Baltimore and New York. Goddard typically toured the Staffordshire potteries to determine what wares would best suit his American customers and regularly sent out samples to his American-based partners (Ewins, 1997: 88-91, 105-107, 109).

The wares of Kentucky and Ohio that did start to compete with the products of Staffordshire were virtually

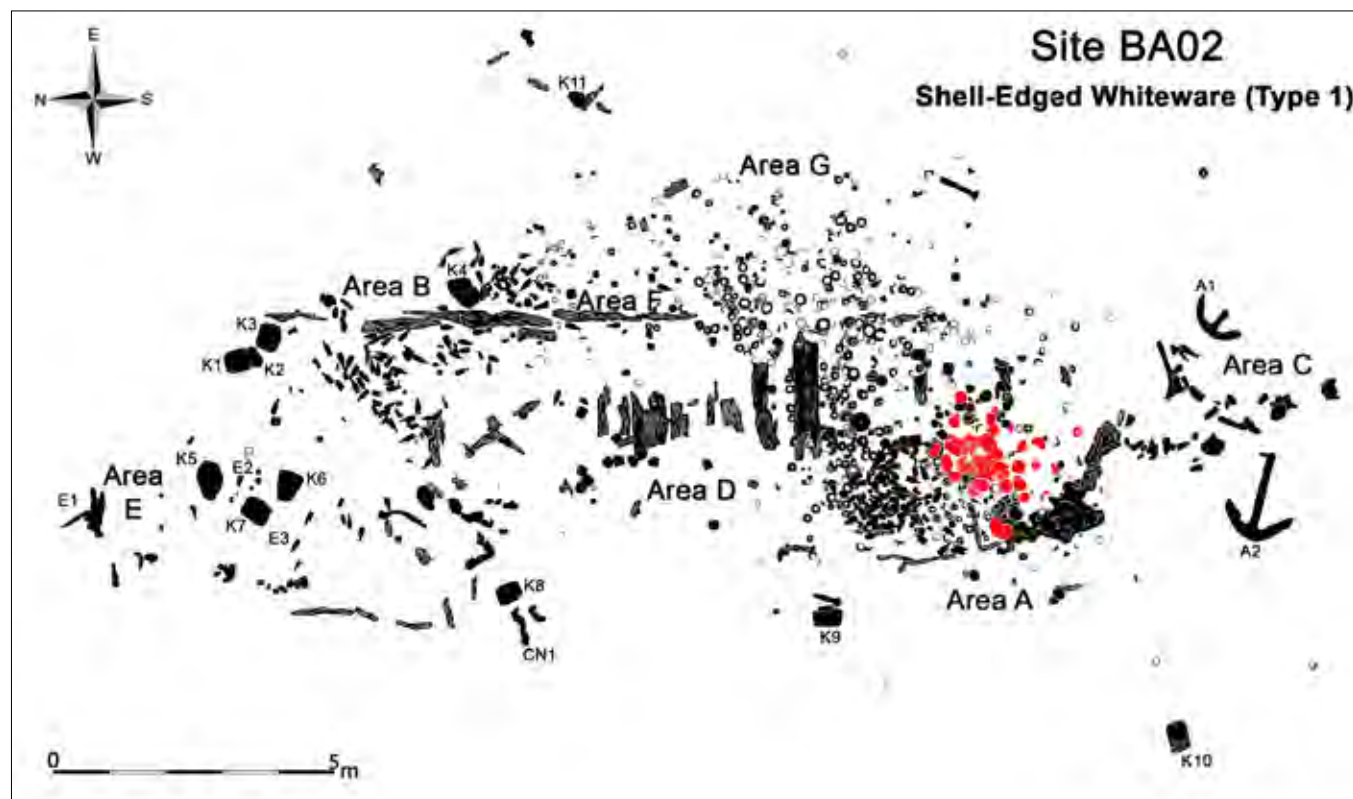


Fig. 47. The distribution of British shell-edged whitewares (Type 1) on Site BA02.

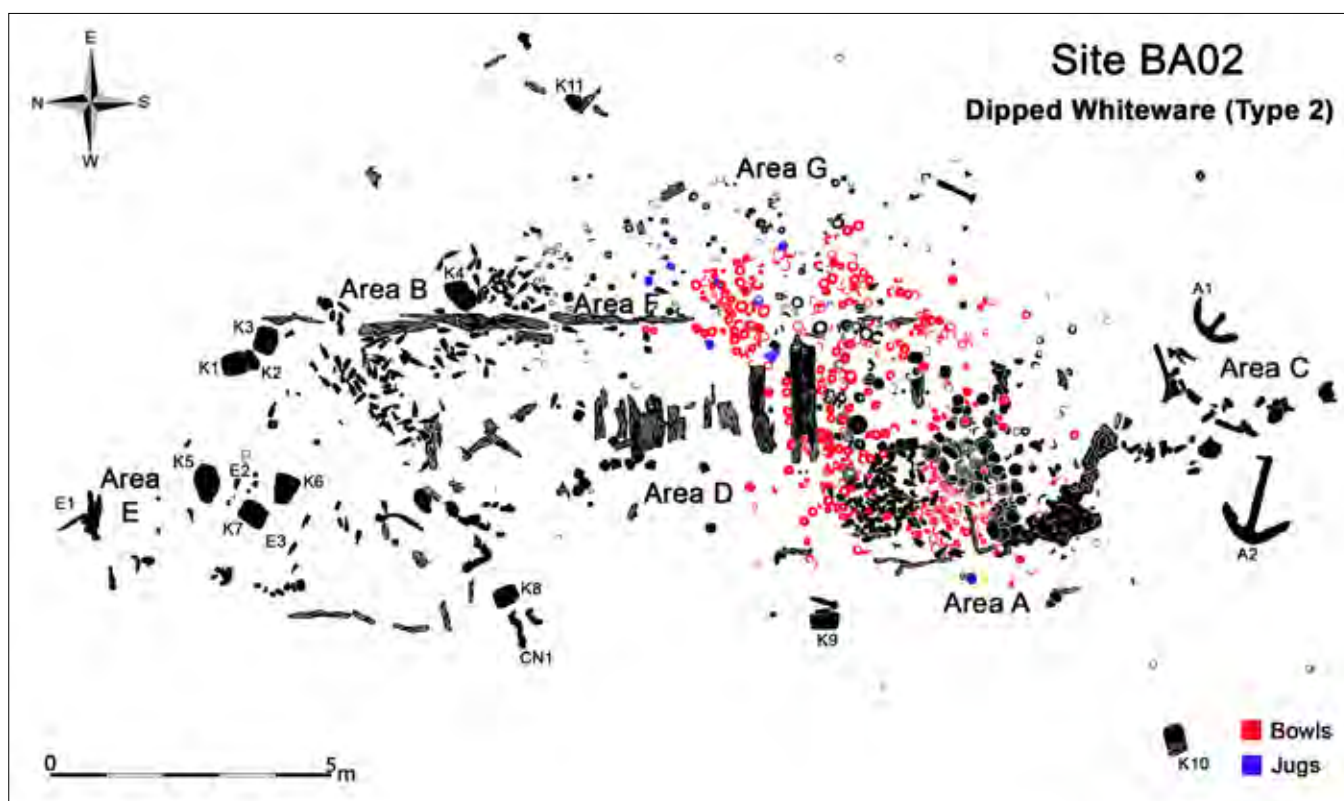


Fig. 48. The distribution of British dipped whitewares (Type 2) on Site BA02.

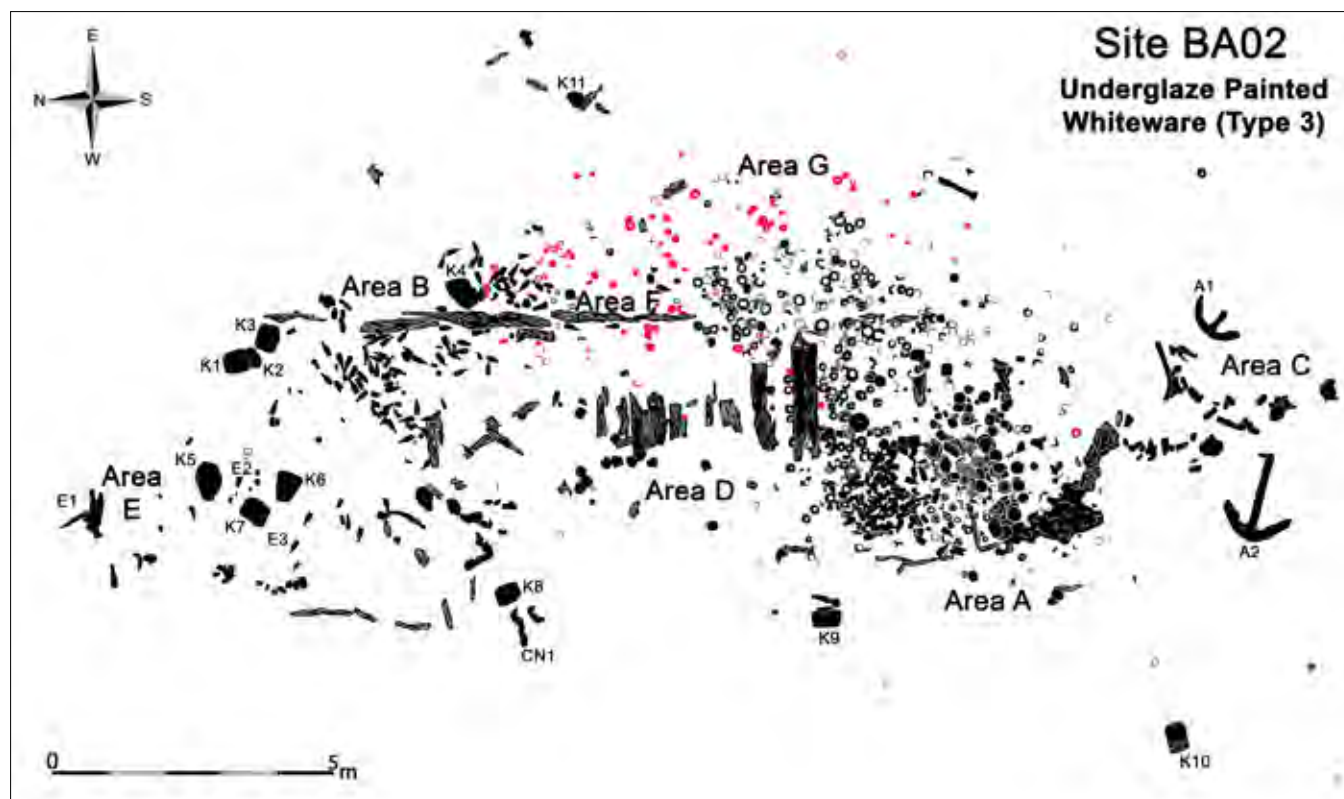


Fig. 49. The distribution of British underglaze painted whitewares (Type 3) on Site BA02.

all yellow wares, unlike the predominant British white-wares recovered from Site BA02. The latter on the wreck were produced from white firing clay, sources of which were not commercially exploited in the United States until later in the 19th century (pers. comm. Jonathan Rickard, 12 July 2006). Current data regarding the ownership and home port of the vessel wrecked at Site BA02 point towards a coastal trader originating in a port located on the Northern Atlantic Seaboard (pers. comm. Jonathan Rickard, 28 August, 2006). New York remains the most likely point of departure.

The artifacts recovered from Site BA02 have been conserved in Odyssey's laboratory in Tampa. Some have been incorporated into the company's interpretive traveling exhibits and the best examples of each duplicated class, plus unique objects such as all four Canton ginger jars, remain in Odyssey's permanent collection within the secure, climate-controlled storage of the curatorial facility in Tampa, where they are available for study.

7. Ceramic Typology Summary

The most conspicuous artifacts on the Jacksonville 'Blue China' shipwreck site are concentrations of ceramics clustered at the southern bow end in Area A and exten-

sive scatters to its northeast in Area G: everything from circular plates and soup plates to octagonal platters, colorful banded bowls, tea service cups, saucers, creamers and sugar bowls, chamber pots and wash basins (Figs. 47-51). Except for a few examples, the assemblage encompasses the full range of British tea, table and toilet earthenwares most common on North American archaeological sites between the 1850s and 1860s.

The pre-dusting site photomosaic displays a minimum of 703 ceramic wares on the surface of the wreck (Figs. 4, 45-46). The surviving consignment, as visible on the pre-disturbance site photomosaic, consisted of:

- 134 shell-edged whitewares, Staffordshire, England (Type 1; Fig. 47).
- 358 dipped whitewares, Staffordshire, England (Type 2; Fig. 48).
- 87 underglaze painted whitewares (tea service), Staffordshire, England (Type 3; Fig. 49).
- 40 white granite/white ironstone, Staffordshire, England (Type 4; Fig. 50).
- 14 dipped yellow wares, Staffordshire, England (Type 5; Fig. 51).
- Four porcelain Canton ginger jars, China, (Type 6; Fig. 51).

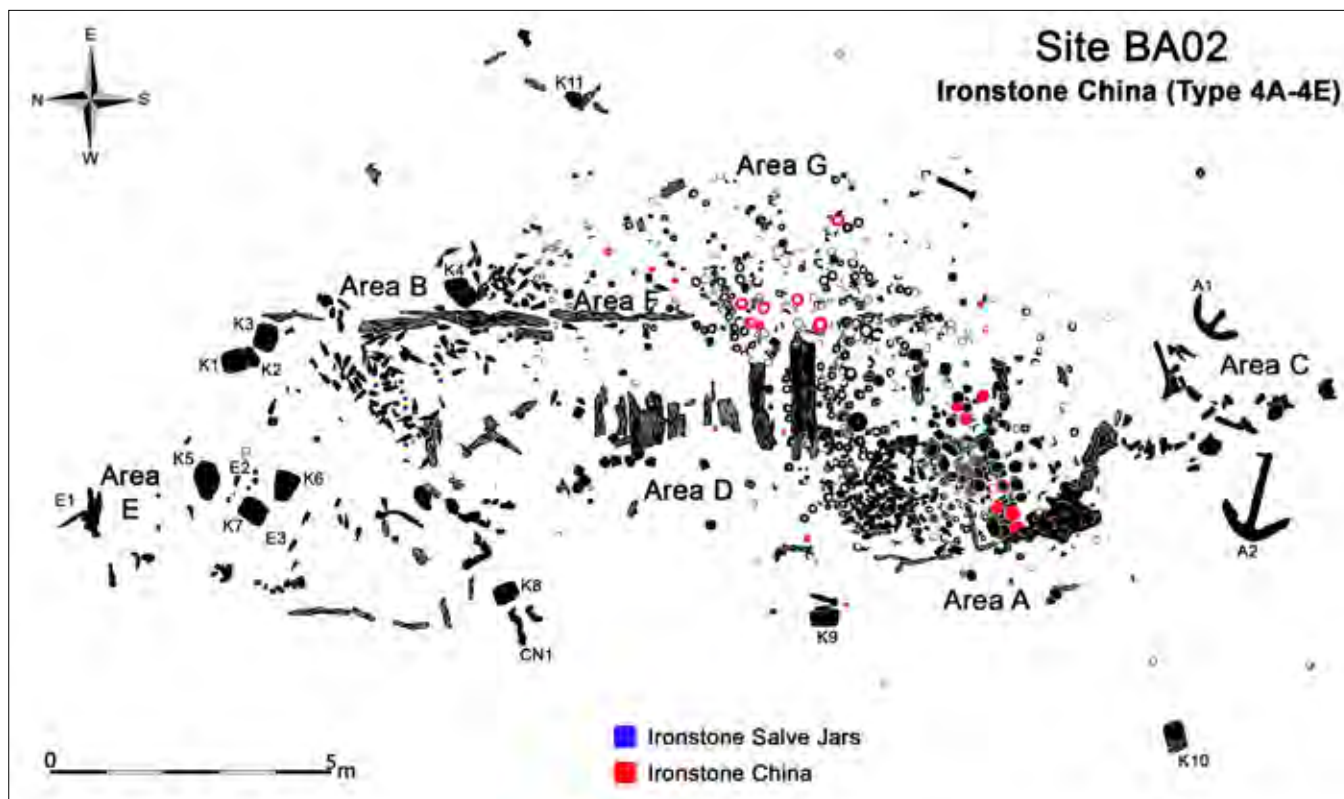


Fig. 50. The distribution of British white granite/ironstone china (Type 4) on Site BA02.

- Three stoneware vessels (two salt-glazed and one Bristol-glazed example), American/European (Types 8-10; Fig. 62).
- 63 clay tobacco pipes (Fig. 52).

A sample of 318 examples of these ceramic wares was recovered for study, enabling a further class, transfer-printed whiteware, to be added as Type 7. The ten different types of ceramic ware are classified largely by their decorative scheme, which accords to the names they were given by mid-19th century potters, merchants and consumers. The assemblage comprises largely earthenware, including shell-edged ware, dipped wares, painted wares, undecorated white granite/white ironstone china, yellow ware, and transfer-printed wares (as defined in Miller, 1988: 172), plus limited porcelain Canton ginger jars and stoneware. With the exception of a few individual examples, such as two European stoneware vessels and one American stoneware jug indicative of domestic assemblage used by the small crew, the ceramics were largely being shipped as cargo, having first arrived in one of the major American ports such as New York or Boston (Tolson *et al.*, 2008: 166). The below summarizes Ellen Gerth's detailed site pottery report published separately in *OME Papers* 20.

The Jacksonville 'Blue China' Type 1 ceramic form

consists of a sample of 153 recovered British blue shell-edged earthenware plates, soup plates and octagonal platters/serving dishes (Figs. 56-57, 62). This comprised the second largest concentration of earthenware among the cargo after Type 2. Initially marketed for upper middle class families and sold as complete dinner services, British shell-edged ware very quickly became available to the masses. The earlier shell-edged pearlware, in particular, resembles Chinese porcelain, yet was far less expensive and thus accessible across the class divide. The simple decorative pattern comprised a molded rim, frequently with blue or green underglaze paint, which excelled at framing the food on the otherwise all-white plate.

British shell-edged earthenware was produced and exported in vast volumes between 1780 and 1860 to such an extent that it permeated almost every American household. In terms of quantity it was one of the most successful developments in ceramic production throughout the Industrial Age of the 18th and 19th centuries (Hunter and Miller, 1994: 443; Miller, 2000: 91). The historical records of Staffordshire potters complement the widespread archaeological distributive evidence from land sites. Surviving invoices of American merchants reveal that shell-edge products accounted for more than 40% of dinnerware sold in America between 1800 and the eve of the Civil War in

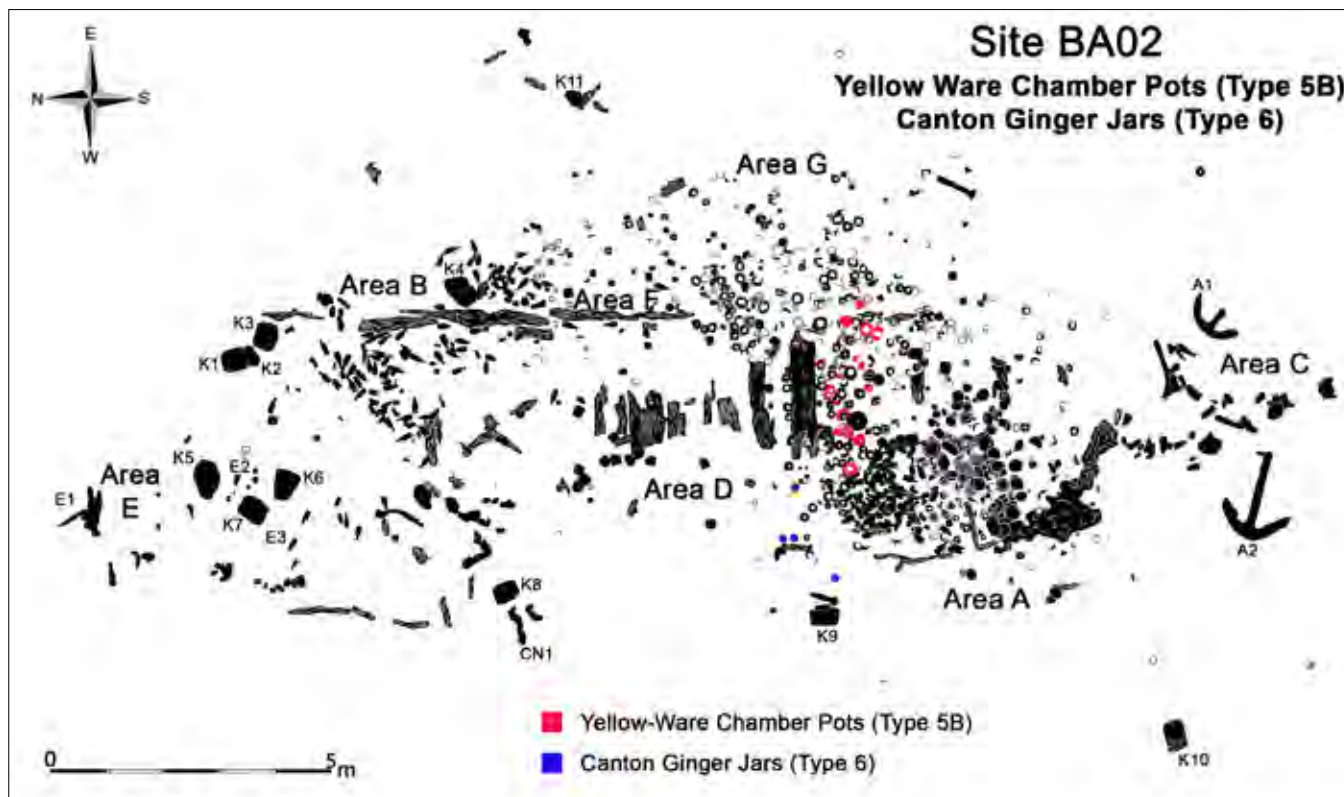


Fig. 51. The distribution of British dipped yellow wares (Type 5) and Canton ginger jars (Type 6) on Site BA02.

1861 (Hunter, 2008: 9; Hunter and Miller, 1994: 441; Tolson *et al.*, 2008: 167). They were the main staple of mid-19th century tablewares used by the average American consumer household.

The shell-edged examples recovered from the Jacksonville 'Blue China' shipwreck are heavy whitewares that feature unscalloped, straight rims impressed with simple repetitive lines colored blue, indicative of shell-edge production in the 1840s to 1850s. Over 50 British manufacturers representing all the major Staffordshire potters have been identified as producing shell-edged ware, which was also one of the standard products of potteries in Leeds, Castleford, Northumberland, Bristol and Devonshire (Hunter and Miller, 1994: 434).

The Type 2 ceramics sample recovered consists of 48 British slip-decorated utilitarian earthenware bowls, mugs and jugs referred to as dipped ware in contemporary sources (Figs. 56, 58, 59). The style was first produced by Staffordshire potters in the late 18th century on creamware and pearlware bodies, yet by the mid-19th century was featured on generic whitewares (pers. comm. Jonathan Rickard, 6 December 2010). Along with shell-edged wares, dipped wares enjoyed a long period of popularity as the least expensive imported decorated earthenware available to American consumers between the 1780s and

well into the 1850s (Miller, 1988: 178; Rickard and Carpentier, 2001: 115, 133; Tolson *et al.*, 2008: 171). The British manufacture and export of these bold and colorful products was so extensive that sherds of this type occur on nearly every American domestic archaeological site of the period (Rickard and Carpentier, 2001: 115).

The 56 underglaze painted Type 3 British whitewares of c. 1845-55 being shipped as cargo on Site BA02 incorporate four different variations of a hand-painted floral motif (Figs. 60, 63). They have been identified as elements of tea sets that include tea bowls (cups in the 'London' shape), saucers, creamers and sugar bowls. No teapots were recovered or observed, although these vessels certainly originally would have been included amongst such shipments (Tolson *et al.*, 2008: 175, 183). These floral-decorated wares have many stylistic characteristics in common with teacups and saucers discovered on other sites and amongst collections bearing the impressed maker's mark 'ADAMS'. Since 1650 the Adams family managed potteries in Staffordshire with production centers located in Tunstall, Burslem and Cobridge, Stoke-on-Trent (Jervis, 1911: 98; Rickard, 2006: 4).

Five different variants totaling 43 examples of Type 4 British undecorated whiteware, otherwise known as white granite/white ironstone, were recovered from the

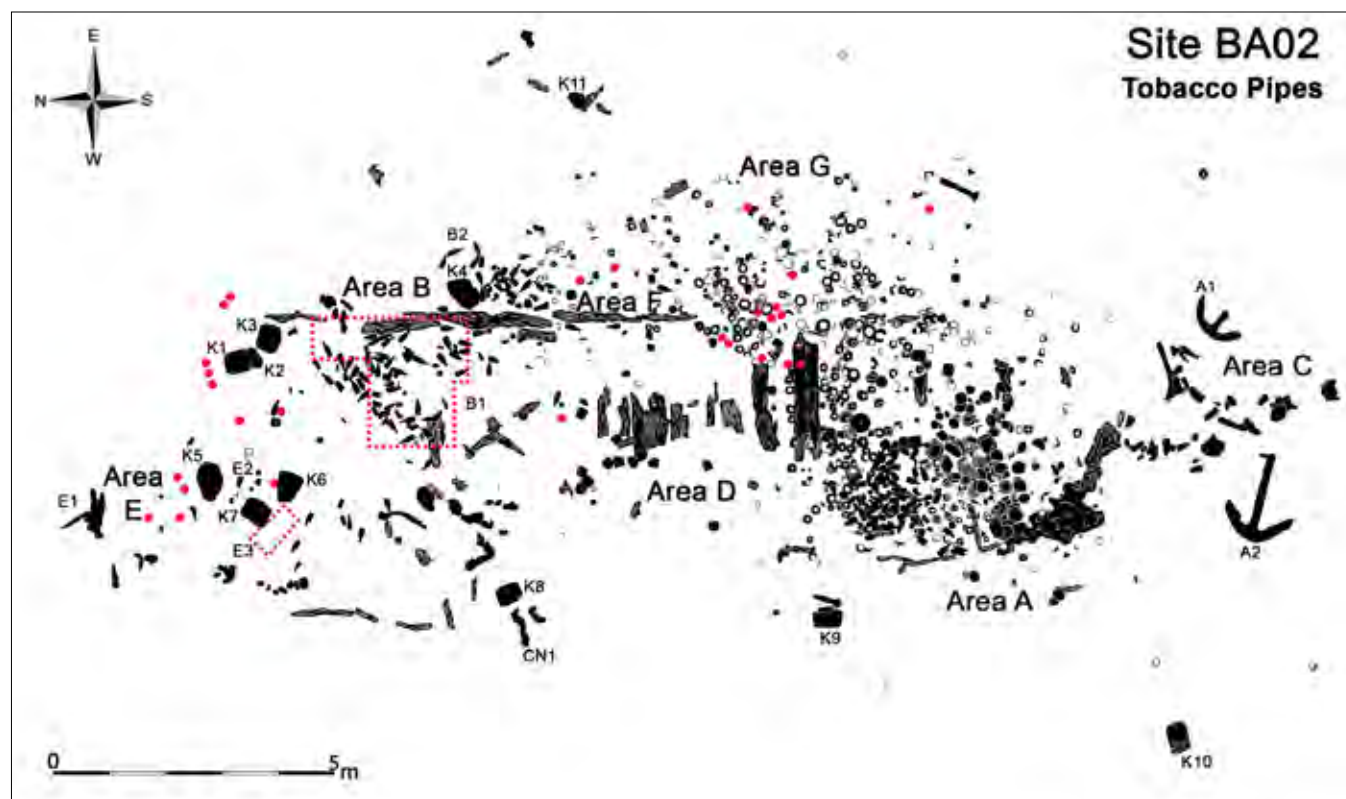


Fig. 52. The distribution of clay tobacco pipes on Site BA02.

Jacksonville 'Blue China' wreck (plates, bowls, chamber pots, wash basins and salve jars with covers; Fig. 60). This heavy, thick-bodied undecorated ceramic ware was mass-produced by England's Staffordshire potters (Blacker, 1911: 177; Godden, 1999: 160-62) and by the mid-19th century had become quite popular among both commercial and domestic American consumers (Miller, 1988: 175).

The preceding stone china and white ironstone wares first introduced in the early 19th century were heavily decorated, often in a Chinese style, and were produced to imitate the popular Chinese export market porcelains in both design and shape (Godden, 1999: 60-62; Miller, 2000: 95). However, the later ironstone forms introduced after 1830, such as those found on Site BA02, were more thickly potted, relief-molded and undecorated utilitarian vessels manufactured largely for the American market (Blacker, 1911: 177; Godden, 1999: 160-62). The ironstone china trade appears to have reached the Western frontier of America by 1839, supplied by a network of wholesalers, some of whom were working in St. Louis, and had strong ties with large-scale wholesalers and importers in Philadelphia and New York. Steady shipments of exports to America began in the early 1840s.

This modest, plain and durable product was highly desired in the 'colonies', where it could be found in

various social environments from steamboats to taverns and hotels (Blacker, 1911: 194; Ewins, 1997: 47). The ironstone china discovered on Site BA02 was found stowed as cargo alongside the bulk of the ceramics both at the bow end of the wreck in Area A, where some examples remained stacked *in situ*, and scattered more widely across Area G. It is an important collection that is contemporary with more than 100 examples excavated from the steamboat *Arabia* lost on the Missouri River in 1856 (Hawley, 1998: 203-204) and pre-dates the nearly 3,000 examples recovered from the deep-sea sidewheel steamer the *SS Republic* that sank off southeast North America in 1865 (Cunningham Dobson and Gerth, 2010: 25).

Two forms of Type 5 ceramic artifacts, slip-decorated yellow earthenware chamber pots and a single mug were recovered from a limited east/west band to the south of Site BA02, solely west of the keel to starboard (Fig. 61). Their yellow bodies resemble 'American' yellow ware produced by British immigrant potters who established several workshops in the United States in the 1830s, including potteries at Bennington, Vermont, Trenton, New Jersey, Cincinnati and East Liverpool, Ohio, and Louisville, Kentucky. The North American dipped wares of the period are not easily distinguishable from the yellow-bodied wares produced in potting centers in Great Britain. However, the Site BA02

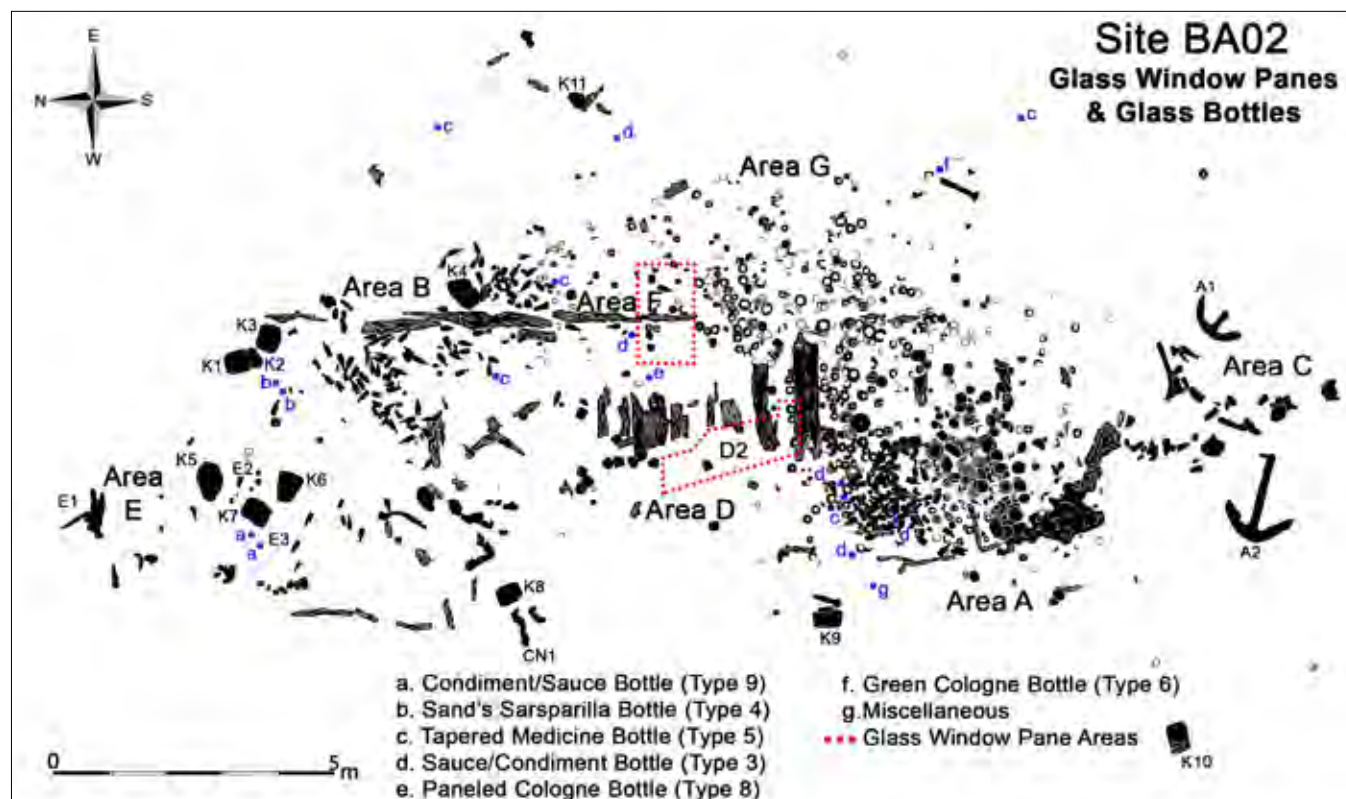


Fig. 53. The distribution of American glass bottles and window panes on Site BA02.

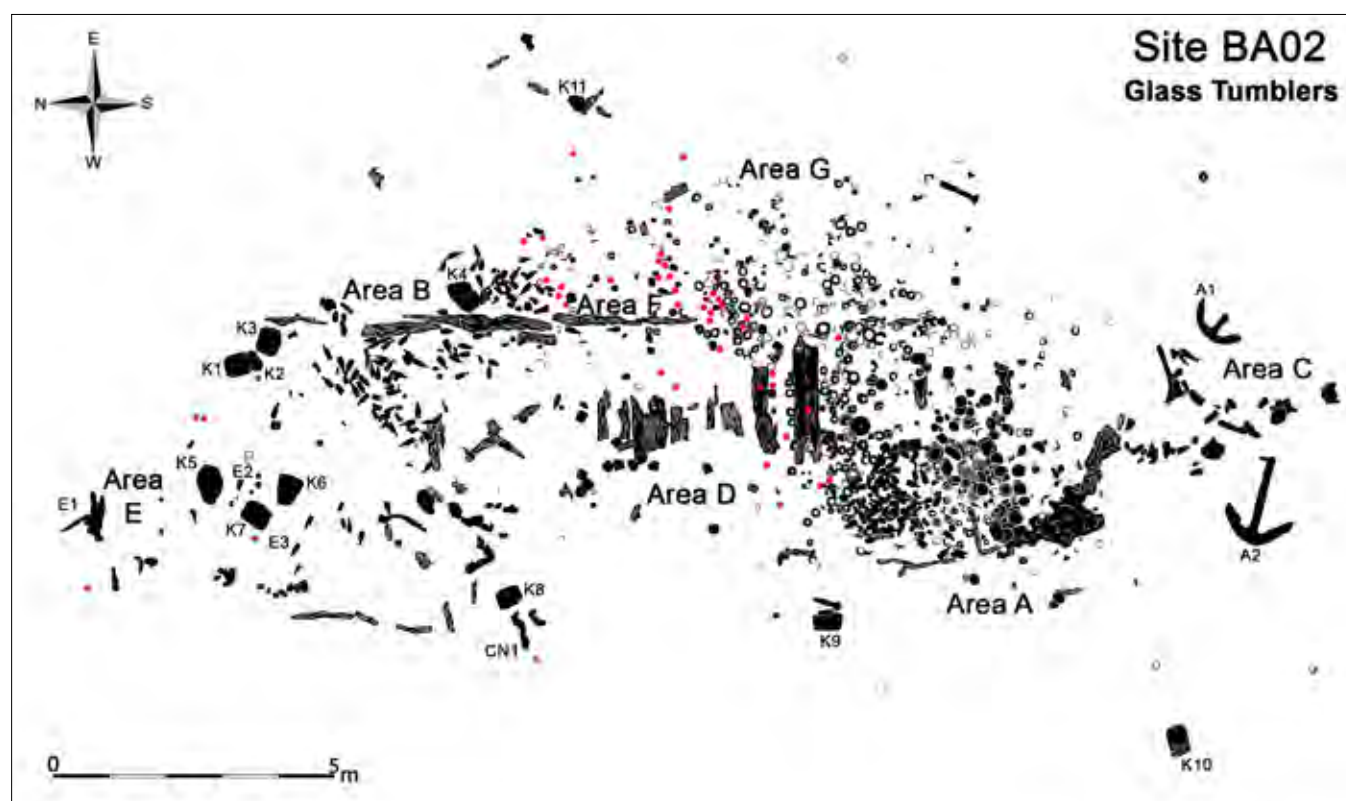


Fig. 54. The distribution of American glass tumblers on Site BA02.

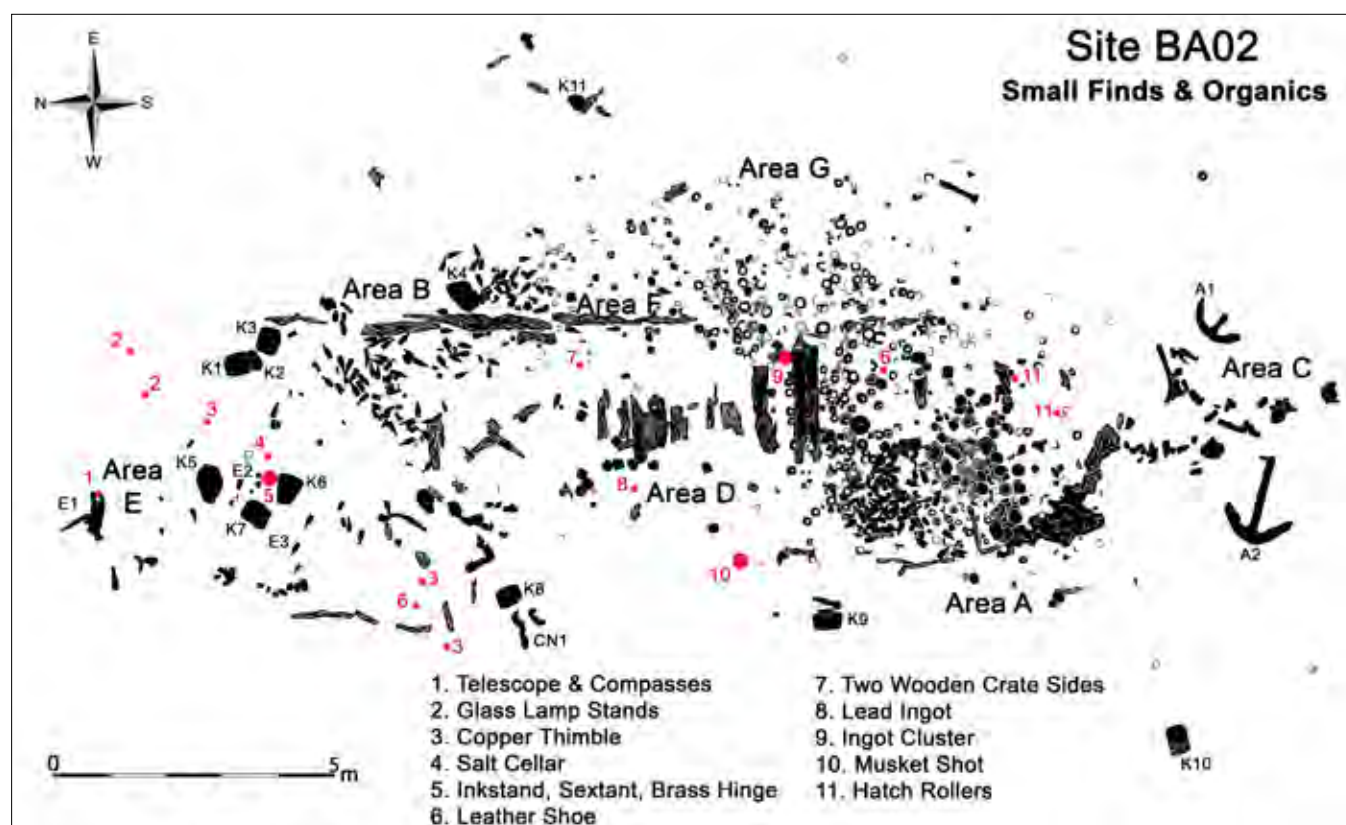


Fig. 55. The distribution of small finds and organic artifacts on Site BA02.



Fig. 56. British shell-edged whiteware platters, soup plates and regular plates (Type 1) with British dipped whiteware jugs on each side (Type 2B) and three Canton ginger jars in front (Type 6).



Fig. 57. British shell-edged whiteware platters, soup plates and regular plates (Type 1).



Fig. 58. British dipped whiteware bowls and mugs (Types 2A and 2C).



Fig. 59. British dipped whiteware jugs (Type 2B).



Fig. 60. British underglaze painted whiteware tea bowls at center (Type 3B) surrounded by white granite/ironstone china chamber pots, wash basins and bowls (Types 4B-4D, 4F).



Fig. 61. British dipped yellow ware chamber pots at center (Type 5B) flanked by British transfer-printed whitewares (Type 7A: 'Asiatic Pheasant' style at left with Primavesi stamp and 'Willow' pattern with Beech, Hancock & Co. stamp at right).



Fig. 62. An American salt-glazed stoneware jug at right (Type 8), alongside a Rhenish mineral water bottle at left (Type 9), flanked by British shell-edged whiteware plates (Type 1).



Fig. 63. British underglaze painted whiteware tea bowls, saucers and a sugar bowl (Types 3A, 3B and 3D).

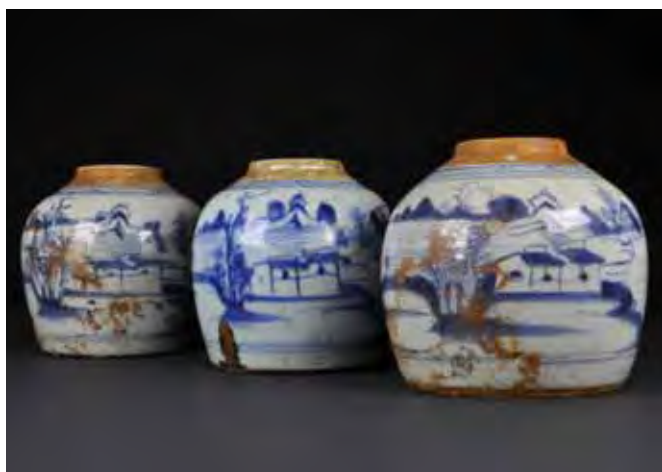


Fig. 64. Three of Site BA02's four Canton ginger jars (Type 6).

examples are of English manufacture, most likely from the south Derbyshire region renowned for its yellow-bodied wares (Rickard, 2006: 2; Tolson *et al.* 2008: 179). Four of the Type 5 chamber pots feature a distinctive tree-like surface decoration first developed in the late 18th century and known as mocha ware. The widespread popularity of mocha wares amongst American consumers is well documented in early 19th-century records, with contemporary advertisements citing the shipment of mocha to a number of eastern port cities, including Boston and New York, where Staffordshire pottery agents were based. These slip-decorated wares were most fashionable during the period 1795-1835, as documented on American sites.

Porcelain ginger jars originating in Canton, of which four Type 6 examples were found on the southwestern flank of the Jacksonville 'Blue China' wreck at the northwestern edge of Area A (Figs. 56, 64), were popular exports to both America and Britain throughout the mid-19th century. All four are missing their covers and no maker's marks are present. These vessels were frequently used for the export from China of large quantities of crystallized ginger alongside other pickled food items. The hand painted blue underglaze decoration of these wares features a house by the water, a man fishing and a sailing boat. The outline is drawn in light and heavy blue lines and the color washed to lighter shades to contrast with the white porcelain (Tolson *et al.*, 2008: 181). Canton ginger jars of this style are dated to the period 1840-60.

Three examples of Type 7 transfer-printed whiteware plates and a gravy boat were recovered from the wreck – although none were visible on the site photomosaic – and reflect one of the great English innovations in decorated ceramics (Fig. 61). Transfer printing enabled hundreds

of sets of dinnerware to be produced at a fraction of the time hand painting took and for a fraction of the cost, thus making these tablewares more readily accessible to middle class families. One of the wreck's plates is a soup plate decorated in the standard 'Blue Willow' pattern, perhaps the most renowned design on early 19th-century pottery and the cheapest transfer-printed pattern available (Miller, 1988: 174). This plate bears the maker's mark 'STONE WARE / B H & Co', which can be attributed to Beech, Hancock & Co., a Staffordshire pottery that began production at the Swan Banks Works in Burslem. The 'B H & Co' mark was used from 1851 to 1855 and thus confirms the earliest possible ceramic-based date for the Jacksonville 'Blue China' shipwreck.

A second transfer-printed plate adorned with a bird-and-flower motif known as 'Asiatic Pheasants' was one of the most popular dinnerware patterns of the Victorian era and is most closely paralleled with wares manufactured in Tunstall, Staffordshire, from c. 1838-1939. The pattern was also copied along the Clyde in Scotland, the Tyne and Tees in Northumberland, in Yorkshire, London, Devon and south Wales (Tolson *et al.*, 2008: 176). The reverse of this plate is stamped 'F. PRIMAVESI/ & SONS/ CARDIFF' and reflects the name of a firm that was active in Wales from 1850 as a pottery agent or dealer.

Three stoneware vessels were recovered from Site BA02 (Fig. 62), including a Type 8 ovoid-shaped American salt-glazed stoneware jug dating to 1850-60 – the sole identifiable American ceramic object from the wreck. This jug form typically stored bulk liquids such as water, wine, rum, vinegar and oil and was a product of the northeastern United States, in particular New York and Pennsylvania. A Type 9 stoneware vessel is a tall cylindrical pouring jug of a type used to hold various fluids better suited to dark, cool environments, including seltzer or mineral water, sarsaparilla, wine, beer, vinegar cider, oil, molasses and even ink. While the origin of this jug is Rhenish, its style is similar to stoneware jugs that bear foreign pottery or company marks most frequently manufactured in Denmark, England, Germany and Sweden.

The third stoneware vessel recovered from Site BA02 is a Type 10 English jar with a so-called Bristol glaze that was the original artifact snagged in a fisherman's net that led to the discovery of the shipwreck. It bears the incised stamp of 'Pearson & Co., Whittington Moor Potteries, near Chesterfield', which was established around 1810. The jar's form of glaze was first developed in Bristol, England, in 1835. Bristol-glazed wares are commonly reported in bottle form from American archaeological sites, although the glaze also occurs on stoneware crocks, jars and other utilitarian items.



Fig. 65. Detail of some of the clay tobacco pipes recovered from Site BA02.



Fig. 66. A Type 1 ribbed clay tobacco pipe.



Fig. 67. A Type 2 'TD'-embossed clay tobacco pipe.

8. Clay Tobacco Pipes

The surface of the Jacksonville 'Blue China' shipwreck contained a widely scattered cargo of 63 clay tobacco pipes from which a sample of 16 examples was recovered in two different styles: 13 examples of Type 1 ribbed (also referred to as fluted or cockled) featuring raised vertical lines extending along the bowl and three Type 2 embossed with the letters 'TD' on the back of the pipe bowl (facing the smoker) and otherwise entirely undecorated (Figs. 52, 65-67). The pipes were produced in different two-part molds (pers. comm. Byron Sudbury, 6 November 2009) and all are made from white clay.

The individual examples within the ribbed Type 1 pipe are subtly distinct from each other (Fig. 66). Even though they are essentially typologically comparable, several appear to have been produced in different molds, although probably in the same workshop. Use of multiple molds in a single factory was not uncommon for larger pipe manufacturers (pers. comm. Byron Sudbury, 6 November 2009). The origins of all the pipes remain uncertain due to the pervasive imitation in production that occurred across Europe and America. Comparative excavated examples and historical evidence suggest that they are most likely exports from Britain or Germany, whose pipes made a strong appearance in the United States after 1845, although the Netherlands, Scotland and even America cannot be ruled out.

One of the 'TD'-embossed pipes stands out from the other examples and with the flat trimmed rim of the pipe bowl appears to be of British manufacture (Fig. 67). If indeed British, the pipe is likely to have been made from white ball clay (pers. comm. Byron Sudbury, 6 November 2009 and 4 December 2009), deposits of which are indigenous to Dorset and Devonshire in southwest England. Ball clay was largely used in England, which was a major exporter in the mid-19th century. Although kaolin clay was also available in Britain, with notable sources near Glasgow in Scotland, it was typically reserved for better quality pipes, while ball clay was more common in pipe manufacture (Byron Sudbury, 2006: 27). Given this identification, it is logical to assume that all of the remaining 'TD' pipes come from the same British source.

The emergence of white clay pipes with the initials 'TD' dates back over 200 years and has been correlated possibly with the London pipe maker Thomas Dormer who, along with his sons, produced pipes from the mid-1750s until about 1780. Decades later, 'TD'-marked pipes came to stand for a generic style and not for the actual pipe maker. The initials themselves became a trademark used to denote a certain 'brand' (Cotter *et al.*, 1993: 422; Walker, 1996: 86). Today they represent a major diagnostic



Fig. 68. A variety of glass bottles from Site BA02.

decorative attribute, having been excavated throughout America in contexts dating from the mid-18th century into the early 20th century.

The pipe assemblage from Site BA02 is clearly cargo. The material is highly scattered across the wreck in a zone extending from the northernmost flank in Area E, through Areas B, F and G. Two main clusters occur to the north, with Area B containing 39 pipes (33 in Area B1) and 11 pipes in Area E (six in Area E3). A single Type 1 ribbed pipe bowl observed embedded within the concreted top surface of a large keg in Area E (K6) may reflect their source of stowage. A separate subsequent article examines the site's clay smoking pipes in greater detail.

9. Glass Wares

Two large concentrations of glass products define the Jacksonville 'Blue China' wreck and account for a total of 259 cargo wares visible on the surface of the pre-disturbance site photomosaic (excluding the glass window panes: see Section 10 below). An extensive concentration is clustered

in the vicinity of its presumed original stowage point in the bows, perceptibly solely within the northern half of Area A (Figs. 5, 6, 53). A more numerous cluster is more widely scattered across the eastern and western flanks of the stern in Area B (Fig. 7). A total of 193 dark glass spirits bottles (including 65 in Area A and 115 in Area B), 18 clear and aquamarine glass bottles and 44 glass tumblers are visible on the surface of the site. The glass cargo includes table and bar wares and individual lamp parts, all of which are American products.

Without incorporating company makers' marks, attributing the Site BA02 glassware to any particular factory is largely impossible, with the exception of a few distinctive patterned examples. All of the glass assemblage is indicative of the two decades between the 1840s and 1860 at the latest, based on shape, form and color. Many of the bottles appear to be pontiled, an attribute that supports this timeframe: pontil scars became uncommon as the 1860s progressed and largely disappeared by the late 1860s or early 1870s as various 'snap case' tools dominated the task of grasping hot bottles for finishing lips. The below descriptions summarize



Fig. 69. A glass salt cellar and variety of glass bottles from Site BA02: Type 9 eight-sided spice or condiment bottles (small variety) (row 1); Type 5 tapered vial-like medicine bottles (row 2); Type 4 rectangular embossed Sand's Sarsaparilla bottles (row 3); Type 9 eight-sided spice or condiment bottles (large variety) (row 4); Type 6 green glass cologne bottles and Type 3 sauce or utilitarian aquamarine bottles (back row). The singular Type 8 cobalt blue 12-paneled cologne bottle is featured in the center of the back row.

the more detailed treatment of the glasswares available in *OME Papers 22*.

The representative sample of glassware recovered from Site BA02 consists of spirits/liquor bottles, a single mineral water bottle, sauce/utilitarian bottles, patent medicine bottles (two different forms), cologne bottles (three types) and condiment/spice bottles (two varieties). None of the bottles' paper or foil labels have survived and just one bottle type incorporates an embossment indicative of the manufacturer. Apart from the sides of two possible wooden packing crates south of Area B, no crates preserve the stenciled names of any companies, the bottled products within or the name of the merchant consignee to whom the goods were being shipped.

A. Glass Bottles

The six Type 1 long-necked spirits bottles recovered represent the largest glass cargo consignment in Areas A and B on the wreck (193 examples visible on the site photomosaic), are dark olive green in color, and often referred to as 'black glass' (Figs. 14, 23). All were found empty without their cork stoppers in place. They are representative of a common liquor/spirits bottle type with bodies that are

round in cross-section and whose cylindrical shape evolved generally from wider and squatter to narrower and taller as time progressed (McKearin and Wilson, 1978: 205, 207). This bottle form is generally associated with a variety of liquors ranging from rum to whiskey and brandy and was even commonly used for wine. The bottles' round bodies, an inherently strong shape, are composed of thick glass suited to both maritime trade and typical reuse. The Site BA02 collection displays strong parallels with wares believed to have held brandy excavated from the Hoff Store, which collapsed into San Francisco Bay during the 'Fifth Great Fire' that ravaged the city on 3-4 May 1851 (McDougall, 1990: 58, 60).

A single Type 2 dark olive green mineral water bottle recovered from the wreck, with a relatively heavy and squat body, is typical of mineral water containers designed to survive the rigors of high-pressure bottling, as well as extensive post-bottling handling, again partly due to the tradition of bottle reuse. Such 'black glass' was also especially functional for reducing exposure to heat and light. Often referred to as a 'Saratoga' bottle, this distinctive style was used by hundreds of different 19th-century companies that bottled mineral water, including a large number operating out of Saratoga Springs, New York. The form continued in



Fig. 70. A Type 6 green glass cologne bottle; Type 9 eight-sided spice or condiment bottle (small variety); Type 4 rectangular embossed Sand's Sarsaparilla medicine bottle; Type 3 aquamarine sauce or utilitarian bottle; Type 7 flint glass cologne bottle with a central plume motif; Type 9 eight-sided spice or condiment bottle (large variety); and a Type 5 tapered vial-like medicine bottle (left to right).

use from the earliest bottles made in the 1820s and 1830s until the end of the 19th century (McKearin, 1978: 238).

Two Type 3 sauce/utilitarian bottles, free-blown and light aquamarine in color (Figs. 69-71), were recovered in two slightly different sizes (H. 20.7cm and 21.6cm). This bottle form was also frequently used for any number of products, particularly patent medicines and especially Florida Water cologne. Without any identifying features, including an embossment or paper label, confirming the bottles' contents is not possible. However, long-necked, narrow-mouthed bottles such as these two examples are commonly associated with liquid food products, such as oils and sauces and other non-solid condiments produced by a host of different companies operating in the mid-19th century (pers. comm. Bill Lindsey, 28 January 2010).

Four Type 4 rectangular aquamarine-colored patent medicine bottles are embossed with the company and product name 'SAND'S SARSAPARILLA // NEW YORK' and seem to represent the earliest variant in this production line, which first appeared in the 1840s (Figs. 69, 70). Illustrations depicted in advertisements of 1848

and later feature a slightly modified version with embossed lettering that reads 'SAND'S SARSAPARILLA // GENUINE // NEWYORK' (Fike, 198: 220; *The Gazette of the Union*, 1849: 83). It is possible that both embossed variants were manufactured simultaneously, appearing on the market with some overlap for a period of time.

Abraham and David Sands established their business in New York City in 1836 (Holcombe, 1979: 450) and Sand's Sarsaparilla started to be produced around 1839, as documented in the Sands *Family Recipe & Medical Almanac* published in 1853. Advertisements of 1842 listed their retail and wholesale druggist business as based at several locations under a number of different family names: A.B. & D. Sands Druggists, David Sands & Co., and A.B. Sands & Co. The first two companies apparently served as retail outlets; the latter for the company's wholesale/retail and export business. By 1863 the separate companies were merged as A.B. Sands & Co. Various family members managed the business until it was sold to W.H. Schieffelin & Co. in March 1875 (Fike, 1987: 179).

The wreck's glassware assemblage includes an additional



Fig. 71. A Type 3 aquamarine sauce or utilitarian bottle; Type 9 eight-sided spice or condiment bottle (large variety); Type 6 green glass cologne bottle and a Type 8 cobalt blue 12-paneled cologne bottle (left to right).



Fig. 72. Two glass oil lamp globes and a lamp font and base from the north of Site BA02.



Fig. 73. The two varieties of glass tumblers from Site BA02.

seven Type 5 cylindrical, tapered vial-like medicine bottles, aquamarine in color (Figs. 69, 70). The distinctive bottle shape with a narrow neck and mouth was ideal for the pouring of liquids and was probably an American knock-off imitation of the enormously popular Godfrey's Cordial and Dalby's Carminative. Both of English origins, these soothing syrups were among the many remedies touted for various ailments afflicting infants and young children.

Two Type 6 non-embossed transparent green glass Cologne bottles (with their neck tops broken off) appear to be free-blown wares, possibly with some dip molding utilized to rough out the basic body shape (Figs. 69-71). These bottles are identical to examples discovered in a foundation trench in New Orleans' French Quarter dated to between 1830 and 1850 (pers. comm. Bill Lindsey, 26 January, 2010). Another similar, yet molded variety, dated to the 1880s or 1890s, bears the embossed name 'Lundborg', a prominent 19th-century American perfumer with an establishment in New York City. This bottle type was also used for a number of other products, such as balsam, oil, medicines and liquors like Rosolio (Van den Bossche, 2001: 220).

Included among the cologne bottles recovered from Site BA02 was an additional Type 7 mold-blown, clear glass example possibly made from a higher quality flint (lead) glass produced in the United States between the 1820s and 1860s (McKearin and Wilson, 1987: 11; Fig. 70). The characteristics of a central plume motif date this particular variety from the 1830s to 1865 (McKearin and Wilson, 1978: 396-7). The Jacksonville 'Blue China' cargo also included a stunning Type 8 cobalt blue 12-paneled glass bottle of a style typically associated with cologne or toilet water. The example with its pontiled base dates from approximately the 1830s to the late 1850s and is commonly attributed to the Boston & Sandwich Glass Company, although the type was also produced by a number of glass companies of the era (pers. comm. Bill Lindsey, 2 December 2010; McKearin and Wilson, 1978: 386, 406).

Finally, nine Type 9 spice or condiment bottles were recovered from the wreck site in two different sizes (four larger examples and five smaller) and with slightly different body forms (Figs. 69-71). This bottle type represents the dominant style used for various spices as well as other condiments during the mid to latter half of the 19th century. The unusual eight-sided bottle shape originated in the 1850s or possibly in the late 1840s. The original shape and design, which was subsequently imitated, is believed to have been produced by the J.W. Hunnewell Co. of Boston, Massachusetts (Zumwalt, 1980: 253). The excavation of similar condiment bottles from San Francisco's Hoff Store

site is useful in interpreting the Site BA02 examples. The Hoff Store culinary bottles, also recovered in two different sizes, have been identified as containing ground black pepper, suggesting the type of condiment once stored in the bottles recovered from the Jacksonville 'Blue China' shipwreck.

B. Glass Tumblers

Ten short, clear-paneled or fluted bar tumblers (H. 8.7cm and Diam. 8.3cm) recovered from Site BA02 are representative of the more common glassware items produced in great quantities in the 19th century (Figs. 54, 73). The fluted/paneled pattern was apparently manufactured in a number of different styles, as noted by the different factory designations: French flute, reverse flute, gill flute, pillar flute, column, edge flute and so on (Chipman, 1932: 155). The wreck's glass tumblers considerably post-date 1827, when Deming Jarves, using an iron mold, is credited with having produced the first pressed glass water tumbler at the Boston & Sandwich Glass Company in Massachusetts, which he founded in 1826 (Williams, 1922: 9).

The wreck's particular style of glass tumbler form broadly dates from 1845-75 and could have been manufactured in any number of American glass factories producing bar and table wares. An especially likely candidate, however, is one of the New England glass factories, quite possibly the Boston & Sandwich Glass Company itself or its competitor, the New England Glass Company (Spillman, 2006: 16). The Site BA02 examples are believed to be cargo items: the 44 examples visible on the photomosaic are far too numerous for a small crew of around five or less, and five tumblers were also found nested inside ceramic jugs, where they appear to have been packed for maximum spatial efficiency during shipping (Tolson *et al.*, 2008: 172).

Five smooth-sided, pale green bar tumblers (H. 8.7cm, Diam. 6.6cm) were among the recovered glasswares and are again common varieties that were manufactured in quantity in the mid-19th century, notably from 1845-75. Unlike the clear tumblers, these mold-pressed forms appear to feature pontil marks on their bases.

C. Oil Lamps

Site BA02 contained two lamp globes and two fonts at the northern limits of the wreck, some 1-2m north of keg K1 in Area B (Fig. 72). One example is a heavy clear glass lamp pressed in the 'Circle and Ellipse' pattern, with a pressed hexagonal base, which dates from 1840-60 (font H. 16.5cm, Diam. 16.0cm, base H. 21.5cm, Diam. 11.4cm). Similar lamps were produced by the Boston & Sandwich Glass Company and the Pittsburgh firm of McKee and Brothers. The latter featured the lamp in its

1859-60 catalog, noting that a dozen could be purchased with a whale oil burner for \$4.00 and with a fluid burner at \$4.66 per dozen (Barlow and Kaiser, 1989: 90). This object was plausibly shipped as cargo because a shipboard lamp would have been gimbaled and rigidly mounted.

In addition to the above fonts, the possibility that the ship lost at Site BA02 was carrying a small consignment of lamp parts is supported by the discovery of two additional spherical-shaped lamp globes, also typical of mid-19th century production. Both globes were probably mold-blown and sufficiently generic to have been manufactured by any number of glasshouses processing lighting accessories, including the Boston & Sandwich Glass Company, which began kerosene lamp manufacture in the 1850s. By 1867, most glass factories in the United States were involved in the manufacture of glass lighting devices. The business had become so immense that many glass houses were completely devoted to lamp globes, others to lamp shades and yet more produced just the chimneys (Barlow and Kaiser, 1989: 153, 156; pers. comm. Dorothy Hogan-Schofield, 8 February 2010).

The Second lamp globe is ruby red. No burners or chimneys were found on the site, while lamp stems and brass joint connectors were also conspicuously absent. This raises the possibility that the ship was transporting separate lamp components as cargo, a pattern that was quite common at a time when glass factories specialized in the production of separate glass parts – globes, fonts and bases – for the lamp industry, providing employment for hundreds of workers (Barlow and Kaiser, 1989: 155; pers. comm. Jane Spillman, 2006).

D. Beehive Salt Cellar

A single pale opalescent blue pressed glass salt cellar (H. 5.0cm, base 7.7 x 5.0cm; Figs. 34, 69) dating from approximately 1835-60 is attributable to the Boston & Sandwich Glass Company, where fragments have been excavated on the site of the former company factory, indicating that large quantities were manufactured there. This is one of the earliest salt dish forms pressed by the company. The artifact was recovered from shallow surface sediments 20cm northeast of large keg K6.

10. Building Materials: Window Glass & White Lead

In addition to the primary cargo of ceramics and glass bottles, the vessel wrecked at Site BA02 was also transporting building materials. A series of 28 small wooden kegs (16.8 x 16.8cm and 21 x 17.8cm) is located exclusively west of the keel in Areas A and D, which corresponds with the



Fig. 74. Detail of stacked glass window panes in Area D, with crushed wooden kegs in the background.



Fig. 75. Glass window panes in Area D, with a blue cologne bottle and a lead ingot in the foreground and wooden kegs in the background.

ship's starboard side (Figs. 6, 9, 14, 30). Both Area D2 and F contain discrete concentrations of stacked rectangular window glass pane (each 29.8 x 25.1cm; Figs. 9, 11, 30, 31, 53, 74-75).

Although it is not feasible to identify the specific manufacturer of the wreck's window glass because all companies essentially produced virtually the same product, generically the panes were probably cylinder glass, which had been widely adopted in the United States by the 19th century (pers. comm. Jane Spillman, 30 November 2010). At this time America had begun to play a significant role in glass production. Various improvements were underway in the manufacture of flat glass, notably due to its increased use in architecture and commercial and housing construction.

A number of glass houses existed in upstate New York, where over 40 of these businesses were established between the beginning of the 19th century and the 1870s, with at least half of the factories engaged commercially in the manufacture of window glass or bottles, and some produc-

ing both. While some of the ventures remained in existence for just a short period of time, a number of the glass establishments operated with varying degrees of success for decades, often under different ownership and management (McKearin and McKearin, 1941: 171).

One such New York establishment producing window glass was the Durhamville Glass Works established in Oneida County in 1845. This factory changed hands several times and in 1895 was acquired by the American Window Glass Company of Pittsburgh, which then closed down the firm (McKearin, 1941: 605). Another contemporary New York establishment producing window glass was the Union Glass Company of Cleveland, which began operations in 1852. Various firms owned the factory until 1899 (McKearin and McKearin, 1941: 608). An earlier New York glass house producing window panes was the Woodstock Glass Manufactory established in 1811, which may have been taken over by the New York Crown and Cylinder Glass Co. before 1836. The latter is also believed to have also purchased a second Woodstock glass house, the Ulster Glass Factory. In 1836 the New York Crown and Cylinder Glass Co. is credited as having employed 50 hands and was making 1,500 boxes of window glass per month. This firm is probably the one remaining factory reported from Woodstock in the 1855 NY State Census (McKearin and McKearin, 1941: 590).

Pittsburgh was also home to many factories manufacturing window glass: 13 glass works in 1837 of which six produced flint glass and the remainder manufactured green and window glass to the value of \$700,000 (Thurston, 1876: 129). Included among the early 19th-century Pittsburgh glass ventures dealing in window glass was the Sligo Glass Works established in 1819 by Frederick Lorenz, Sr., but by 1841 operated by William McCully & Co. The factory is believed to have closed down sometime after 1886 (McKearin and McKearin, 1941: 594).

Also listed among the Pittsburgh glass ventures was the window glass house established by Charles Ihmsen in 1814 and by 1836 operated by C. Ihmsen & Co., which erected a vial and bottle factory as well. At this time the factory is reported as possessing eight blowers at the window glass factory, each with an assistant, producing 5,500 boxes of window glass yearly (McKearin and McKearin, 1941: 593). Twenty years later in 1857, Pittsburgh would boast 33 glass factories of which 24 produced window glass (Thurston, 1876: 129).

The breadth of window glass production in both Pennsylvania and New York is highlighted by the quantity of rail shipments in 1863 and 1864. Over 9,000 boxes of window glass were shipped from Pennsylvania, followed by New York with just over 2,000 boxes. While statistics

for shipments by boat are not readily available, they are considered to have equaled shipments by rail (Thurston, 1876: 130).

New Jersey also housed many glass factories that produced window glass, including John H. Scott's glass house founded in Estelville, Atlantic County, in 1825. Under changing ownership the factory remained active until about 1877 (McKearin and McKearin, 1941: 597). Contemporary with the Estelville establishment was the Jackson Glass Works of Waterford Township, Camden County, set up in 1827 by Thomas H. Richards. The factory manufactured principally window glass until the 1850s, when it added other glass wares to its production line. The Jackson Glass Works was destroyed by fire in 1877 (McKearin and McKearin, 1941: 598). Camden County was also home to a glass works erected by Coffin & Hay on Cooper's Creek in 1850 that again produced largely window glass and was known as the Sasockson Glass Works (Van Hoeson, 1973: 137).

Among the New Jersey glass houses manufacturing window glass was the establishment launched by William Coffin Sr. and Jonathan Haines in 1817 in Hammonton, Atlantic County. Operated over the years by a number of Coffin family members, the factory shut down in 1857 due to the depression of the late 1850s. In addition to his other ventures, William Coffin Sr. also established with his partner son the Winslow Glass Works, again located in Camden County. The factory operated under a number of different names from 1831 until 1859, when business ceased (McKearin and McKearin, 1941: 594, 600).

Camden County was home to yet another glass house, the Waterford Glass Works launched in 1824 and specializing in window glass. Established by Coffin's former partner Jonathan Haines, the company underwent a series of different ownerships after Haines's death in 1828, and was later reorganized into separate factories in 1870. A decade later the factories were closed (McKearin and McKearin, 1941: 597).

The window panes found at Site BA02 were likely cylinder glass. The cylinder method of glass production was prevalent in the US and permitted the manufacture of up to 6-7ft long cylinders of glass – larger than previous methods (Dodsworth, 2003: 20). Cylinder glass served as the technological bridge between the small wavy panes of crown glass and the wider and optically clear plate glass form (Bock, 1988: 37). As a consequence, the large cylinder-glass window pane replaced the former multi-paned shop windows with their imposing wooden grids. This larger unobstructed Victorian window enabled greater light to penetrate stores and served as an extra enticement to shoppers – a marketing bonus for the hordes of new

retailers opening up shops in commercial spaces (Bock, 1988: 36). Courtesy of expanding lines of factory-produced goods, the small city store was quickly becoming a large retail outlet in the early 19th century and general stores were replacing the older frontier trading posts. Coincident with these developments, between 1830 and 1860 the size of the panes used in glass windows increased significantly.

Window glass panes were among the many articles sold by 19th-century wholesale pharmaceutical houses, several of which were based in Buffalo, Chicago and St. Louis. Yet the principal wholesale druggist houses were centered in New York, Boston and Philadelphia, whose overall sales allegedly amounted to \$2 million dollars annually in the mid-1800s (Bell, 1856-57: 413). In addition to the traditional diversity of drugs, perfumery, brushes, toilet articles and patent medicines sold in drugstores, these wholesale businesses maintained large stocks of building materials, including immense piles of window glass and thousands of kegs of white lead, and putty alongside a variety of paints and oils.

The technique for packing window panes is summarized in an excerpt from the *Pharmaceutical Journal and Transactions* of 1856-57 (Bell, 1856-57: 413), which helps reconstruct the structure in which the Jacksonville 'Blue China' ship's glass window panes may have been shipped originally:

"Every imaginable size of glass is put up in wooden boxes by the glasshouses in Pittsburg and New York, from 6 X 7 to 52 X 40, fifty panes in a box – the window glass not coming in huge crates, as in England, but is cut to the desired sizes at the glass works."

The *Pharmaceutical Journal and Transactions* further acknowledged that window glass was an article of very large consumption. In addition to glass panes, white lead in oil stored in 25lb kegs was also essential to the building construction "from the fact that most of the houses in America are built of wood, and in a new country like this, are built in immense numbers" (Bell, 1856-57: 413).

Based on this source it is quite plausible that the intended objective of the white lead discovered at wreck Site BA02 was for use in construction. In liquid form mixed with linseed oil, lead was coated on buildings "to liven them up and save them from decay" (cf. *The Farm Journal*, 1910: 100). White lead was also a vital component in the manufacture of different cement-like putties, which were again indispensable to the 19th-century housing industry and commercial construction (Hopkins, 1913: 325).

The juxtaposition of both products on a single wreck is not unexpected. Records of shipments to New Orleans



Fig. 76. Cupreous and glass compass BC-05-00020-ML (Diam. 4.0cm). Bar codes are used by the Odyssey conservation lab in accordance with company protocol to track all data relating to an artifact from site name and context to conservation history.



Fig. 77. Cupreous and glass compass BC-05-00208-UN (Diam. 4.0cm).



Fig. 78. Compass BC-05-00208-UN in situ between the legs of a concreted tripod in Area E1.

from the 'Interior' between 1 September 1849 and 31 August 1850 reveal that 4,887 boxes of window panes reached the Crescent City, as well as 5,979 kegs of white lead, 631 kegs of lead bars and 415,400 lead pigs (De Bow, 1851: 448). In the year ending 31 August 1851, New Orleans consignments from the 'Interior' comprised 16,428 boxes of window glass valued at \$82,140, and 325,505 lead pigs, 629 kegs and boxes of lead, plus 1,930 kegs of white lead worth respectively \$1,041,616, \$12,580 and \$13,510 (De Bow, 1852: 147).

11. Miscellaneous Ship's Fittings, Navigational Material & Domestic Assemblage

A relatively low volume of metallic and miscellaneous artifacts of different types and compositions was observed and recovered on Site BA02, including ship's fittings, navigation equipment, raw materials and musket shot. The metallic navigational equipment, limited to the northern surface of the site at the stern, included two disc-shaped lidded bronze containers found in Area E1 within the legs of a concreted tripod, presumably used for surveying or astronomy (Fig. 78). One remains sealed, while the opening of the second example during conservation verified that both artifacts are hand-held compasses (Figs. 76-77). BC-05-00020-ML is a circular cupreous housing composed of a flat lid with a screw thread that connects the object to its base, which features a convex underside. Within is a compass with a central glass mount and a north crosshair at center (lid H. 0.55cm, Diam. 4.0cm, Th. 0.12cm; base H. 1.1cm, Diam. 3.6cm, glass compass Diam. 3.05cm, north crosshair Diam. 0.6cm; weight 34gr). BC-05-00208-UN is a sealed compass (total H. 1.5cm, lid Diam. 4.0cm, base Diam. 3.7cm, base

slightly convex with two concentric circles incised onto it and a central aperture (0.2mm Diam., weight 36gr).

Within the center of the legs of the same tripod in Area E1 a cupreous single-draw refracting telescope was recovered (BC-05-00031-NL: preserved L. 24.2cm, external draw Diam. 4.0cm, weight 431gr). Located at the northern, stern end of the ship's remains in the vicinity of the former main cabin, this object would have most likely belonged to the captain (Fig. 79). The recovered object includes the eye end and about half of the interior portion of the telescope including the erecting lens (Figs. 81-83). The half of the tube below the erecting lens and the end containing the objective lens are missing. The eyepiece housing (L. 6.4cm, max Diam. 3.5cm, Diam. 3.15cm at the glass eyepiece, max Th. 3.8cm) is pierced with a central glass eyepiece with a 1.55cm-wide central aperture. From here the eyepiece housing broadens through a series of three bands to a 5.8cm wide flange. Inserted into the eyepiece housing is an extremely thinly sheathed cupreous draw, 0.47mm thick, overlying the core draw. The telescope is believed to date from 1820-40. While this 20-year timeframe predates most of the other artifacts discovered at Site BA02, it is a form of instrument that commonly continued in use over a long period of time, with some 19th-century telescopes still in use during World War II (pers. comm. Jeanne Willoz-Egnor, 17 December 2010).

X-rays of the Site BA02 telescope have not revealed any maker's name or mark, but has demonstrated that the two glass elements occupy about one-quarter of the object at each end (Fig. 83). They also revealed a small sliding cover to protect the eye lens and a small knob that would have been used to slide the cover on and off the eyepiece (pers. comm. Jeanne Willoz-Egnor, 17 December 2010). When recovered, the telescope was covered with its original protective wooden tube (Figs. 80-81). A two-draw telescope from the early 19th-century 'Mardi Gras' shipwreck in the Gulf of Mexico, probably manufactured by 'T Harris & Son of London', retains its wooden tube and is very similar typologically (Ford *et al.*, 2010: 91).

One fragment of a sextant sun shield was recovered (BC-05-00009-NL), composed of three cupreous square frame holders attached to a hinge. Inserted into each frame is one green-colored glass, blue (?) and red lens that enabled them to operate as filters individually or in combination (Figs. 84-86). The sextant navigational instrument was invented by John Hadley in 1731, originally as an octant with an arc of 1/8th of a circle, which was enlarged by Captain Campbell in 1757 to 1/6th (Potter, 1972: 63). The objects dimensions are: total artifact L. 6.8cm, rectangular frames 3.36 x 3.34cm, Th. 0.30cm, with a central circular aperture Diam. 2.9cm, hinge L. 2.4cm,

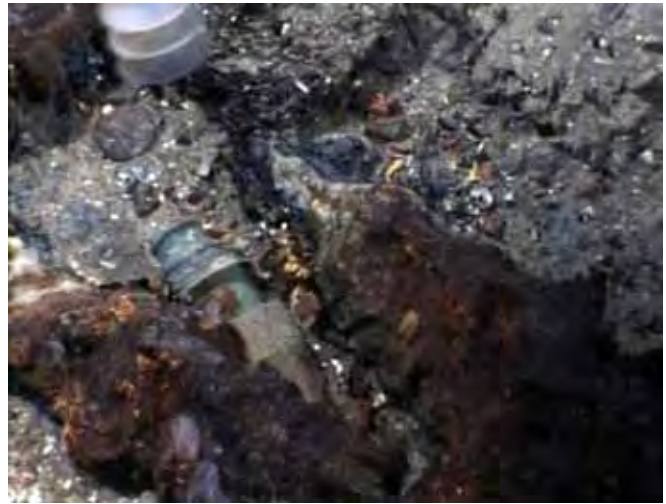


Fig. 79. Telescope BC-05-00031-NL in situ between the legs of a concreted tripod in Area E1.

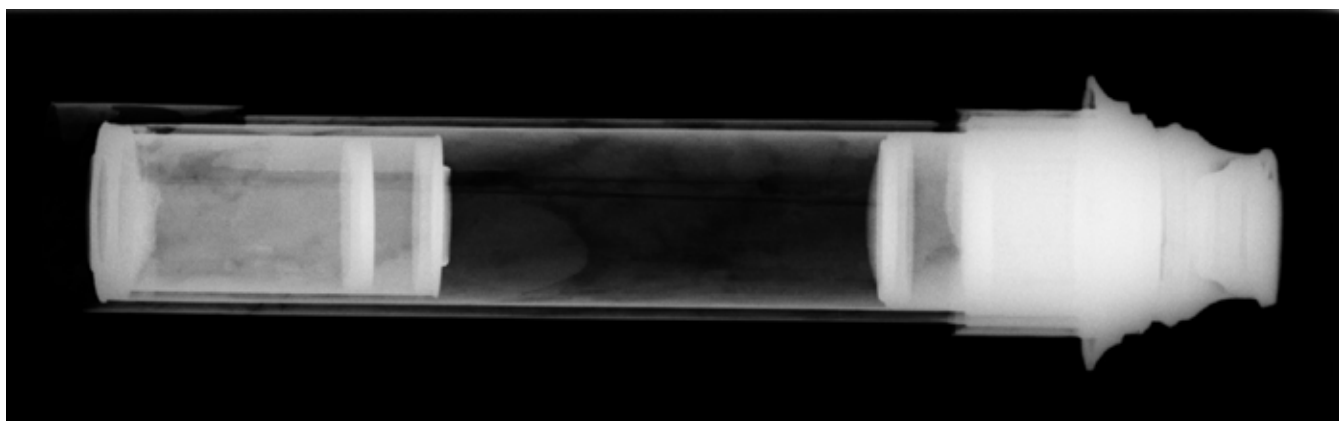


Fig. 80. Telescope BC-05-00031-NL being recovered by the ROV Zeus' limpet suction device. Note the preserved wooden tube.

hinge Th. 0.5 leading to a round rivet 0.67cm Diam. with a central pin 0.34cm wide, circular glass lenses Diam. 2.8cm, Th. 0.18cm. Like the telescope above, the sun shield was found in the stern section of the wreck on the northeast edge of the large keg K6.

A brass plaque from a hanging spring-loaded scale used for weighing (BC-05-00210-ML) consists of the section of a curved front section and upper sides with two rivet holes preserved along the better preserved outer edge (Fig. 87). An inscription runs widthwise along the head of the plaque in capital letters and reads in two lines 'WAR-RANTIED AND MADE BY' with 'MORTON &' (for Morton & Bremner of New York) stamped in a semi-circular curve on the left side before the plaque breaks away (plaque fragment L. 15.0cm, W. 4.1cm, Th. 0.11mm, rivet Diam. 0.45cm; Fig. 88).

The spring scale apparatus with which this artifact



Figs. 81-83. One-draw cupreous telescope BC-05-00031-NL before and after conservation and in x-ray (L. 24.2cm).

was once associated is perhaps the simplest form of weighing instrument known. It simply consisted of a spring fixed at one end with a hook used to suspend the object being weighed at the other and functioned on the tendency of stretched or compressed metal to return to its original position when the load is removed. This concept is derived from Hooke's Law of 1660, which states that the distortion of a metal is proportionate to the load applied. The practical application of Hooke's Law was first put into practice in 1696, when Jacques Ozman produced a 'balance' using the change in length of a coiled spring under load to indicate weight (Graham, 2003: 30).

Later innovations produced a spring balance consisting of a metal tube with a load hook attached to the bottom containing a spring-loaded, graduated bar. As the load was increased, compressing the spring, a greater length of the bar was exposed and the weight could be read from it. Several variations of this design followed, which was a popular and convenient form of weighing used for trade and in households alike. The basic design continued in production until 1960 (Graham, 2003: 30).

Colonel Andrew Augustus Bremner and Major Thomas Morton, both formerly of the Seventh Regiment National Guard, State of New York, were engaged in the manufacture of spring balances and fancy steel goods from 1841 to 1854 (Clark, 1890: 336; Swinton, 2009: 8). According to the *New York Mercantile Union Business Directory 1850-51*, Morton and Bremner were located at 61 Elizabeth Street in New York City. However, by May 1852 the address for their Spring Balance and Steel Manufactory was 389, 391, 393 First Avenue, where it was subsequently destroyed by fire (6 May 1852; *New York Daily Times*).

Following Bremner's retirement in 1854 (Clark, 1980: 226-7; Swinton, 2009: 8), the business continued

under Thomas Morton, as clarified in an advertisement in *Scientific American* of 24 September 1859, which offered "Improved Spring balances capable of sustaining from 8 ounces to 1,000 pounds each, suitable for post-office scales, butchers, icemen, grocers, fruit and flower dealers; also much used by leather inspectors....made to order and offered for sale by the manufacturer, Thos. Morton (late Morton & Bremner), 212 Pearl Street, New York".

The discovery on Site BA02 of the remains of the front plaque from a Morton & Bremner spring scale suggests usage aboard the vessel for weighing grocery or other cargo upon receipt or delivery. Its New York place of manufacture further supports the ceramic evidence pointing to this city as the ship's home port. Additionally, the dates in which Morton & Bremner worked together, and subsequently parted ways, significantly narrows down the wreck's date to between the years *c.* 1851 and 1854/5.

Notably also originating in New York are ten identical thin lead bar ingots with rounded edges recovered from a single cluster on the northwest central flank of Area G on Site BA02 (Figs. 42, 55, 89-91). This point of deposition coincides with the easternmost spread of glass window panes and small wooden kegs containing white lead, suggesting original storage in Area D on the starboard side of the ship alongside the building materials. All of the ingots are bent and some display curved horizontal sides. As well as being uniform in shape, the dimensions are relatively consistent. On average, the ingots measure 27.0-28.1cm long and are 1.9-2.1cm wide maximum. The inscription bands are similarly regularized at 23.5-25.8cm long and 1.05-1.2cm wide. The bar thickness, however, does vary overall from 0.49-0.98cm, resulting in weight differentials ranging from 253-358gr. Three exceed 300gr, while seven

Inv. No.	Length (cm)	Max Width (cm)	Thickness (cm)	Inscription Band Length (cm)	Inscription Band Max Width (cm)	Weight (gr)
BC-05-00029-LD	27.9	1.9	0.63-0.74	23.7	1.05	286
BC-05-00030-LD	27.0	1.97	0.55-0.8	24.2	1.1	260
BC-05-00212-LD	28.0	2.0	0.63-0.94	23.5	1.15	338
BC-05-00213-LD	28.0	1.95	0.64-0.86	23.8	1.1	307
BC-05-00214-LD	28.1	1.98	0.49-0.78	24.0	1.1	253
BC-05-00215-LD	27.8	2.1	0.51-0.71	25.8	1.1	265
BC-05-00216-LD	27.8	2.0	0.49-0.81	23.7	1.15	277
BC-05-00217-LD	27.7	1.95	0.58-0.79	25.7	1.1	270
BC-05-00218-LD	28.1	2.0	0.67-0.98	23.7	1.1	358
BC-05-00219-LD	28.0	2.1	0.51-0.64	23.6	1.2	280

Table 1. Relative dimensions of lead ingots recovered from Site BA02.



Fig. 84. Fragments of a cupreous and glass sextant sun shield from Area E2 (BC-05-00009-NL; total L. 6.8cm).



Figs. 85-86. Sextant sun shield BC-05-00009-NL being recovered from Area E2 by the ROV Zeus' limpet suction device.

cluster tightly between 253-286gr (Table 1).

Each ingot bears on its upper horizontal surface the mold-impressed name of 'James McCullough. N-Y' (Figs. 90-91). James McCullough was the President of McCullough's Shot and Lead Company, which in 1856 was located at 159 Front Street in New York City. An advertisement in the *New York Times* of 25 October 1856 confirms that McCullough was selling miscellaneous lead products, including bar lead (Wilson, 1857: 518). The company was well known as a major supplier to the Ordnance Department of the Union Army during the American Civil War. Multiple orders of buckshot, elongated balls and round balls of lead were requested from the company by Major Thornton and Captain Crispin of the Ordnance Department between 1861 and 1864. Demand declined after the Civil War and in 1875 McCullough's Lead Company went bankrupt. A second advertisement published in the *New York Times* on 17 March 1875 announced an auction sale for all of the company's goods and machinery (pers. comm. James Blackmon, 11 October 2005).

In light of the absence of any additional clusters, the ingots recovered in a single deposit from the Jacksonville 'Blue China' wreck are best interpreted as domestic assemblage, not due to the minimal differences in dimensions, but because BC-05-00030-LD is sliced off at its left end and possibly burnt at the right end, suggesting shipboard use. A cluster of lead shot was identified at the western edge of Area D in association with remains of a large crushed keg, from which a sample of 38 examples was recovered (Diam. 0.88cm, weight 2.7gr), all representing 30-caliber projectiles (Figs. 92-93). This class of artifact could also have been procured from McCullough's Shot and Lead Company. Extensive spreads of several hundreds of additional pieces of lead shot were observed on the eastern edge of Area D and western Area F overlying hardpan where the hull remains had completely decomposed. Musket shot seemingly shipped in some of the site's large wooden kegs reinforced with iron hoops appears to have been an additional component of the Jacksonville 'Blue China' shipwreck's composite cargo.

The varied ship's fittings include a single robust bronze strap hinge (BC-05-00364-CO; Fig. 94) recorded on the northeast edge of keg K6 in Area E, probably a miscellaneous element of the ship's structure rather than part of a wooden chest reinforce. It is composed of two unequal lengths of bronze, chamfered on all of the outer edges, rotating on a central hinge. The hinge was attached to an object or structure at an angle of about 120°. The longer section is punctuated by four centrally set holes and the shorter length by three holes, one staggered (hinge total L. 32.7cm,

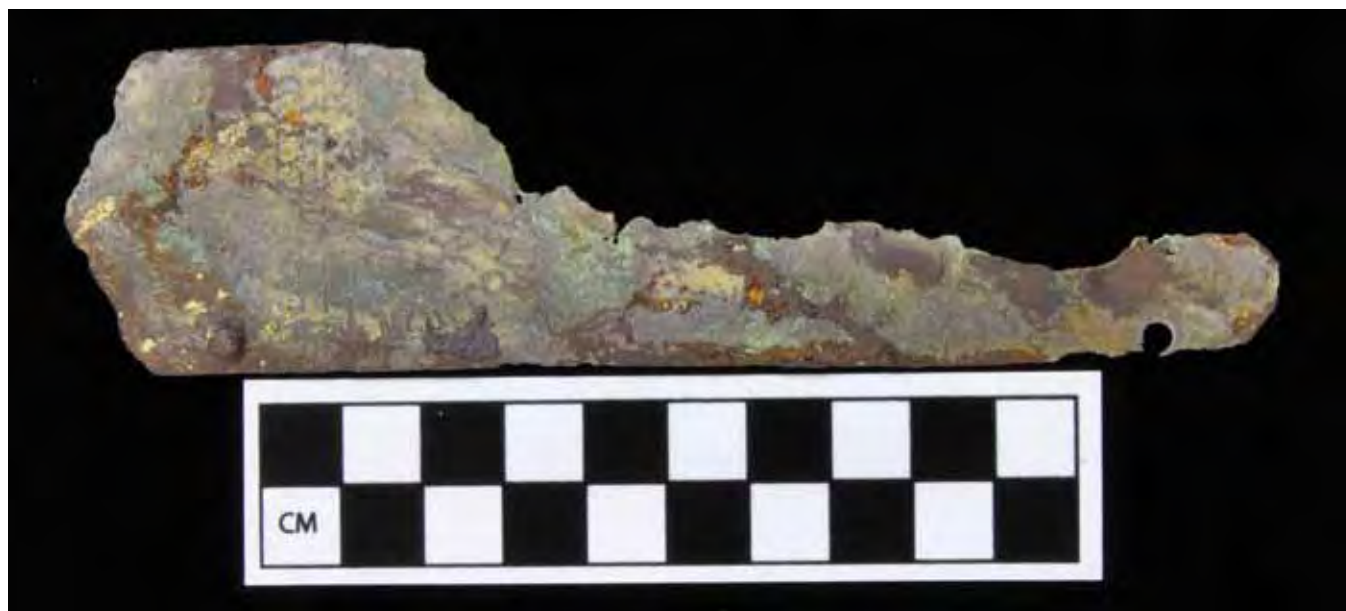


Fig. 87. Brass plaque BC-05-00210-ML from the front of a spring-loaded hanging 'Morton & Bremner' scale (L. 15.0cm).

W. at end 3.5cm, Th. 0.75cm max, hinge W. 3.7cm and Th. 1.38cm with central pin 0.8cm Th., weight 494gr, nail hole heads Diam. 1.2cm and their shaft Th. 0.65cm).

Three cupreous thimble rings with diameters of 7.6-9.0cm that probably served to reinforce the ship's rigging, mooring lines or the corners of sails (Tryckare, 1963: 104) were recovered from the wreck, including one example associated with a well preserved section of rope and canvas (Figs. 43, 95-99). Their measurements are: BC-05-00354-CO, external Diam. 9.0cm, internal Diam. 6.3cm, W. 2.9cm, Th. 0.41cm, weight 294gr; BC-05-00008-CO, external Diam. 8.2cm, internal Diam. 5.8cm, W. 2.7cm, Th. 0.33cm, weight 222gr; BC-05-00209-CO, with fibrous strands of rope/canvas still attached to the outer edge, total artifact Diam. 10.3 x 9.2cm, external thimble Diam. 7.6cm, internal Diam. 5.4cm, rope/canvas Th. 1.7cm, W. 3.0cm, Th. 0.47cm, weight 236gr.

A three-spoked iron wheel fragment of unknown function originates from a wheel or handle once equipped with six spokes (Fig. 100). Other structural finds include a bronze/brass bearing (BC-05-00211-BS; L. 10.8 x 9.9cm, weight 480gr; Fig. 101) composed of wood and cupreous metal that appears to have once been inserted within a wooden plank. A 4.2cm-wide and 0.9cm Th. central cupreous ring with six cylindrical bearings at its center, each 1.2cm wide, is pierced latitudinally with three circular holes, 0.24cm wide. To the outer ring edge into which the bearings are recessed is attached a second ring, Diam. 5.8cm, Th. 0.6cm. Along the artifact's outer edge is a section of wood, Th. 2.1cm, which displays scour marks from friction on both sides. The wood's outer edge is



Fig. 88. Detail of brass plaque BC-05-00210-ML from a weighing scale inscribed "WARRANTIED AND MADE BY MORTON &..." for Morton & Bremner of New York (L. 15.0cm).



Fig. 89. A cluster of ten lead bar ingots from Site BA02 (L. 27.0-28.1cm).



Fig. 90. Detail of a 'James McCullough. N-Y' inscription on a lead ingot.



Fig. 91. Lead bar ingot BC-05-00030-LD bearing the mold-impressed name of 'James McCullough. N-Y' (L. 27.0cm).

riddled with worm holes, 0.2cm wide, and sections of calcareous marine borer shells, 0.19cm wide.

Two heavily degraded mushroom-shaped composite wood/iron hatch rollers were recovered from the southern end of the wreck, 1.5m southeast of the concentration of shell-edged earthenware in Area A (Figs. 6, 44). The original cap survives in place on just one example. Each is pierced with a square hole extending along the central axis from the base to the bottom of the cap. BC-05-00403-SF is 22.7cm long and 17.7cm wide at its single preserved end, with a diameter midway down its length of 7.7cm (Fig. 103). Its central square shaft is 3.2cm wide and lined with a 0.25cm-thick veneer of iron. Four circular nail holes on the base of the preserved end measure 0.5cm in diameter and are set 3.4cm inward of the outer edge. Circular friction marks caused by repetitive rotation are visible at this end.

Just one end of roller BC-05-00402-SF remains intact

and both its central barrel and opposite end are heavily degraded (Fig. 102). It measures 23.4cm long and has a diameter of 17.6cm at the intact end. The central square shaft running vertically down the middle of the roller is 3.4cm wide with a 0.33cm iron interior lining. The four nails staggered 3.7cm inwards of the base edge each measure 0.8cm in diameter. Concentric friction marks caused by repetitive rotation are again present on the base.

Both hatch rollers originally may have had an iron core or may have been lined with iron sheet. These objects resemble capstan barrels, but incorporate no obvious holes for capstan bars and have subsequently been identified as hatch rollers (pers. comm. John Broadwater, 1 December 2006). The *Oxford Companion to Ships and the Sea* (1976: 378) defines such objects used on cargo ships as "pivoted in sections which allow the covers to be rolled back, folding together in cantilever fashion at either end of the hatch opening".

The rollers are associated with a heavily degraded composite wood and graphitized iron hatch roller base (BC-05-00169-ML), 19.2 x 18.9cm and Th. 1.8cm and a central aperture 2.9 x 2.9cm, which consists of a wooden core with an iron outer sheathing and is characterized by 16 angled sprockets set 2.4-2.6cm apart (center to center distances). Four symmetrically set circular nail holes are positioned 4.5cm inward of the roller edge, each 0.8cm wide and with a central shaft 0.55cm thick (Fig. 104).

A wood/iron composite hawse pipe (BC-05-00404-SF) consists of a 26.8cm-long section of corroded iron pipe with an asymmetrical lip at one end (presumably the outboard one) mounted through wood (inner pipe Diam. 10.2cm). The preserved circular end is 24.0cm wide, its rim 1.8cm high and 2.0cm thick and the hawse pipe 1.1cm thick (Figs. 105-106). A single circular hole on its edge measures 2.2cm in diameter. Corrosion products from the iron have leached into the wood and preserved the sections closest to the iron. The inner diameter of the pipe, inside which survives a section of iron wire cable, provides an approximation of the maximum size anchor cable used for the vessel.

Apart from the hull remains and two hatch rollers, the organic material observed on the surface of the wreck is restricted to two leather shoe soles with heels, one located 1.2m northwest of keg K8 on the western extreme of the site and the second (BC-05-00006-LR) recorded and recovered 0.9m southeast of the grindstone at the southern, starboard end of the wreck. The heel on the recovered example lacks evidence of any wear, suggesting it had never been worn and conceivably may be a part of a deteriorated larger cargo (Figs. 107-111). While the sole and heel of the shoe are relatively well-preserved, little remains of the uppers, making it difficult to determine the precise style of footwear; yet it appears to have been a man's shoe. The heel of the shoe is made of stacked leather and the top piece is held in place with cut nails and wooden pegs across the breast (pers. comm. Valentine Povinelli, 22 December 2010).

The rounded heel tapers inwards before broadening to a maximum width at its three-quarter length and terminating at a squared off toe. In profile from the side the shoe is gently rounded (L. 26.3cm, squared toe W. 4.5cm, max W. 8.8cm, W. at heel 7.1cm, max H. 5.3cm, Th. of sole 1.15cm, H. of heel 1.9cm). Sets of dual fastening holes, elliptical in shape, 0.18 x 0.13cm, are drilled around the sole's edge.

This single square-toed shoe features a pegged sole, a fabrication method by which the sole was attached using wooden pegs instead of by stitching. The technique of pegging new soles in this manner made its appearance in



Fig. 92. The sea bottom covered with lead musket shot west of Area D on Site BA02, alongside a cupreous hatch roller base.



Fig. 93. Lead musket shot after recovery from Site BA02.

the United States by 1815 (Bryant, 1897). By 1830 hand pegging was the dominant construction for cheap US shoes (pers. comm. Valentine Povinelli, 13 December 2010). Two decades later this design was no longer accomplished by hand following the invention of the pegging machine by A.C. Gallahue in 1851 (and subsequently improved by Townsend and Sturtevant of Boston). The evenness of the pegging apparent on the recovered shoe suggests the sole was pegged by machine.

The steam-powered pegging machine was used extensively throughout the country and greatly increased



Fig. 94. Bronze strap hinge BC-05-00364-CO from the northeast edge of keg K6 in Area E (L. 32.7cm).



Fig. 95. A thimble ring in situ on Site BA02.



Fig. 96. Thimble ring BC-05-00209-CO in situ alongside wood, concreted iron and canvas, possibly identifiable as a fragment of the ship's sail.

Fig. 97 (top right). Cupreous thimble ring BC-05-00209-CO, with fibrous strands of rope/canvas attached (Diam. 10.3 x 9.2cm).

Fig. 98 (middle right). Cupreous thimble ring BC-05-00354-CO (Diam. 9.0cm).

Fig. 99 (bottom right). Cupreous thimble ring BC-05-00008-CO (Diam. 8.2cm).



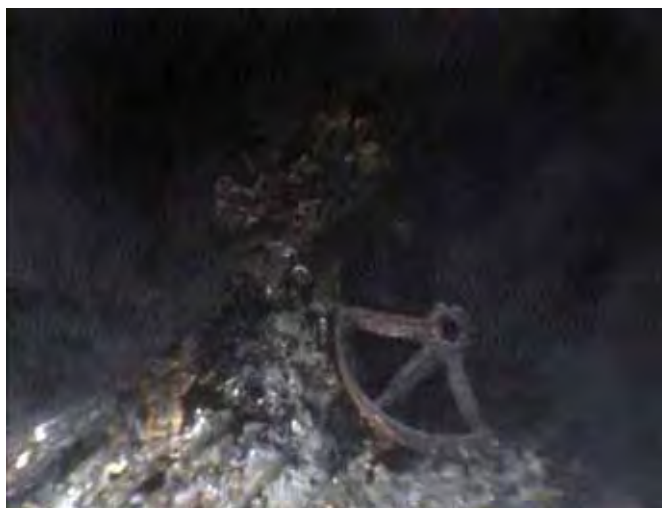


Fig. 100. A spoked iron wheel fragment from a wheel or handle once equipped with six spokes.



Fig. 101. Wood and cupreous bearing BC-05-00211-BS (L. 10.8 x 9.9cm).



Fig. 102. Composite wood/iron hatch roller BC-05-00402-SF from the bow area of the wreck (L. 23.4cm).



Fig. 103. Composite wood/iron hatch roller BC-05-00403-SF (L. 22.7cm).



Fig. 104. Wood and graphitized iron hatch roller base BC-05-00169-ML (Diam. 19.2 x 18.9cm).



Figs. 105-106. Wood/iron composite hawse pipe BC-05-00404-SF (L. 26.8cm).





Figs. 107-111. Leather shoe BC-05-00006-LR from the starboard bow of the wreck (L. 26.3cm).

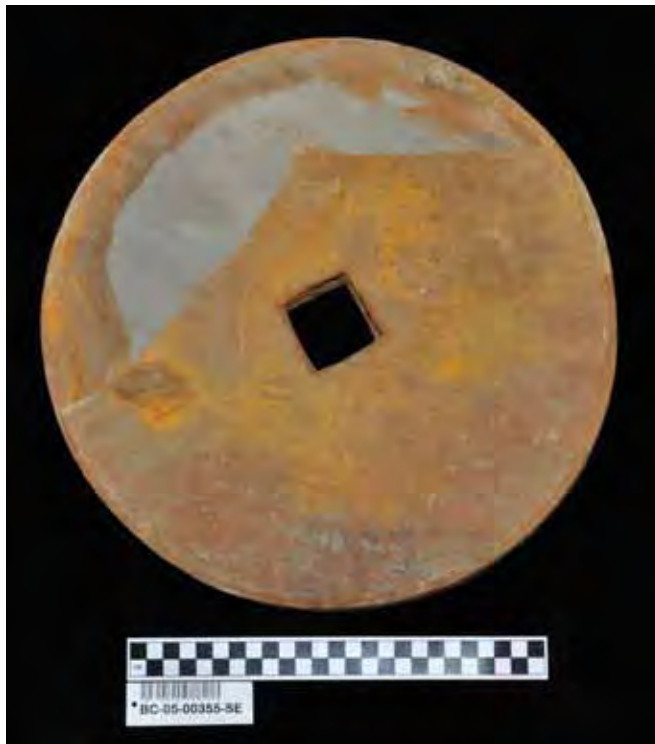


Fig. 112. Grindstone BC-05-00355-SE from the starboard bow of the wreck (Diam. 33.5cm).

the quality and production of pegged shoes. According to Brocket (1882: 220), "It would punch the holes, cut off and shape the peg, and drive them at the rate of 14 per second, and would peg two pair of women's shoes a minute, putting in two rows of pegs if required". By 1872 about 1,700 of these machines were in use across America, largely employed by manufacturers whose predominant convict labor made vast quantities of cheap, but neat looking products. Even for the finest examples, pegged shoes were not the choice of those who were 'delicately reared' (Brocket, 1882: 220).

The sole of the shoe bears an unidentifiable stamp. Some civilian shoes of the era featured hash marks on the sole to indicate size, and during the Civil War contractors and depots stamped their identification mark inside the quarters of the shoe (pers. comm. Valentine Povinelli, 22 December 2010). The purpose of this particular stamp from this time is not apparent.

The square toe of the Jacksonville 'Blue China' wreck's shoe was a recurring style enjoyed over many centuries (pers. comm. Valentine Povinelli, 22 December 2010) as referenced by John F. Watson (1779-1860), a Philadelphia antiquarian and amateur historian best known as the author of *Annals of Philadelphia*. In the 1857 edition, Watson stated that "I came into the world as the first generation of square toed boots were going out of it; and my feet are, at

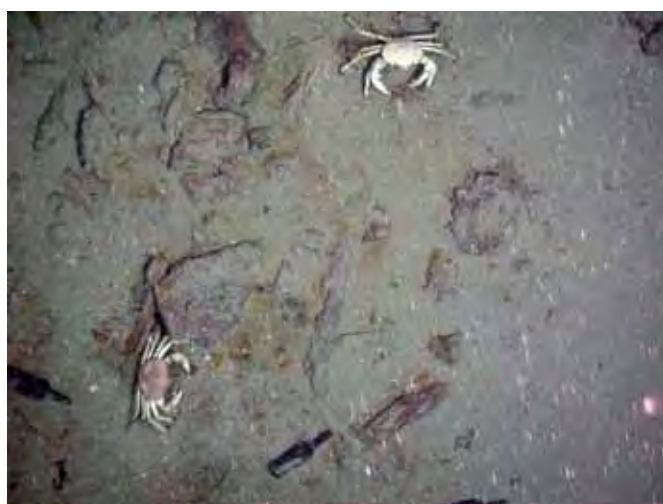
this moment, after an interval of -- years, no matter how many, incased in a pair of square toes No. 2" (Watson, 1884: 199).

Finally, a grindstone (BC-05-00355-SE: Diam. 33.5cm, Th. 6.4cm) with chamfered edges and a square aperture cut through the center for mounting on a rotating axis, 4.7 x 4.5cm, and probably used by the ship's carpenter or boson for sharpening tools, was recovered from the aft section of the shipwreck, just northeast of Area A (Figs. 5, 6, 16, 41, 112). The medium is very coarse and one-quarter of the front side is delaminated and has broken away. Chisel marks are visible across the entire outer edge, with blade widths of 0.3cm. The stone composition has been identified by Prof. Jeffrey Ryan from the Geology Department at the University of South Florida (pers. comm. 9 November 2009) as highly quartzitic sandstone. All of the grains are similar in size, which makes the surface highly homogeneous. The rock most probably originates on the west flank of the Appalachian Mountains between New York and Alabama.

12. Site Impacts

While the principal objective of this report has been to supply documentation related to the archaeological materials recovered from the Jacksonville 'Blue China' shipwreck, it also presents strong evidence for the impacts that trawling can cause wrecks. In this case it is impossible to understand the site formation fully without assessing the scale and character of the fishing impacts. This statement of factual documentation is in no way a comment about the ethics and economics, or a criticism, of the fishing industry, which serves a vital role within society. Without the interest, skilled observations and off-shore dedication of fisherman Woody Moore, Site BA02 and the knowledge it contains would never have been accessed. A cooperative reporting scheme rewarding fishermen for reporting and avoiding wreck sites would be a significant move toward protecting deep-ocean shipwrecks and underwater cultural heritage.

The 2005 rescue archaeology conducted on Site BA02 identified a significant amount of impacts inflicted by trawl nets dragged across the wreckage, most obviously visible in the form of at least four parallel furrows cut across the eastern length of the site from north to south (Fig. 119). These have cleared sterile paths through the cargo, leaving behind single straight lines of cleared ceramic wares, all that survive of cargo swept aside by trawl doors and net chains. Little of the original contexts observed in 2003 remained untouched in 2005. Substantial cargo had been smashed and scattered and the ship's structure flattened (Figs. 4, 40,



Figs. 113-114. Rock crab on the surface of Site BA02.

47-52, 118). Only a few relatively deep crevices amongst the hull preserved some stratigraphy below the surface of the sea floor. Limited test excavations revealed that, for the most part, only a single layer of artifacts survives on the site above the hull structure.

Discussions with fisherman Woody Moore (pers. comm., 29 March and 29 September 2010), whose initial inadvertent recovery in his nets of a 'Bristol-glazed' stoneware jar brought the wreck to Odyssey's attention, have revealed the scale of regional fishing. Working out of the port of Savannah, Georgia, he estimates that pottery has been trawled off the wreck for the last 35-40 years and that around four boats of 22.5-30m length regularly fish these waters year round. These fishermen specialize exclusively in red shrimp, which are most abundantly found around the 160-fathom (293m) line depth contour. Over the years Mr. Moore has routinely encountered the rims of abundant ceramic sherds and intact vessels, mostly dishes with blue designs (see British shell-edged earthenware Type 1 in Section 7 above), snagged in his nets at the end of a net drag through the area.

Woody Moore operates out of a twin shrimp trawler, deploying four nets of 16.7m-length each and 113kg; two on the starboard side and two on the port side. Each seam net is equipped with a tickler chain weighing 11.3kg (one tickler per net). The two trawl doors at the head of each net are 2.4m long, 1m wide and weigh 181kg. 'Hangs' or snags caused by his gear becoming caught are not uncommon. As the loss of a net is no small financial matter to commercial fishermen, the careful plotting of such locations is a professional necessity. Over his years of fishing the area around Site BA02, Mr. Moore has established the nature of such hangs (including piles of pipes, sunken aircraft and modern rubbish) by inspecting material recovered in nets. His skill and experience have enabled him to distinguish between airplanes and ships and even between old wooden and modern metallic ship remains.

The nature of layback towing complicates the determination of the exact location of such subsea obstacles. Anything hit by the trawl gear may not be noted until the nets are recovered at the end of a multi-mile long line and found to contain debris. In the event of a 'hard hang', where it is impossible to free the net loose from a seabed obstacle, the required strategy is to stop the ship and recover the trawl. In such a case it is possible to establish the exact location of the hang. Usually, however, only the general area containing a hang is known.

Over the years that the Jacksonville 'Blue China' wreck area has been fished, shrimp trawling gear has undergone major changes that included alterations in rigging. The twin trawl uses four small trawls (two from each outrigger) instead of one larger trawl on each outrigger. This rigging configuration is more efficient and produces greater catches than the double-rigged configuration, but requires extra rigging of an additional bridle and a dummy door, sled or bullet between the paired trawls. The additional rigging can create tangling and handling problems (Watson *et al.*, 1984: 3). Twin-rigged trawls have the advantage that a vessel using four small trawls, rather than two large ones, can tow more total trawl headrope length with the same horsepower. Data on the energy efficiency of shrimp trawl designs indicate that twin trawls sweep a larger total area per gallon of fuel than double rigged trawls (Watson *et al.*, 1984: 8).

The shrimp industry emerged off Florida in 1906, when Solicito Salvador first rigged his boats based in Fernandina, Florida, with otter trawl nets, which enabled his daily shrimp catch to increase tenfold. By 1921 the Salvador Fish Company was shipping shrimp as far away as Los Angeles, Canada and Denmark. By about 1950 most of the potential fishing grounds in the waters adjacent to

Shrimp Type	Year	Weight (lb)	Value (\$)
White	2008	3,947,691	9,361,853
Rock	2008	1,875,093	3,950,897
Brown	2008	641,538	1,265,756
Pink	2008	496,376	622,195
Dendrobranchiata	2008	316,706	1,343,279
Royal Red	2008	321,648	627,720
White	1998	2,891,407	8,370,921
Rock	1998	2,199,487	3,001,833
Brown	1998	551,209	1,475,059
Pink	1998	724,125	1,340,149
Dendrobranchiata	1998	439,402	1,311,932
Royal Red	1998	82,291	250,331
White	1988	2,590,546	7,480,369
Rock	1988	2,679,801	1,630,564
Brown	1988	546,000	1,327,858
Pink	1988	134,870	408,379
Dendrobranchiata	1988	0	0
Royal Red	1988	0	0

Table 2. Relative volumes and values of royal red shrimp in relation to other varieties landed in Florida's East Coast in 2008, 1998 and 1988 (as tabulated from the Fisheries Statistics Division of the National Marine Fisheries Service website).

the southeastern United States had been discovered, after which the US shrimp fleet expanded its operations to the east coast of Mexico and into the western Caribbean Sea (Gillett, 2008: 9-10).

Fishermen have been working in the offshore zone in which wreck Site BA02 is located since the early 1960s, although Mr. Moore only starting visiting these grounds in 1977. Since then no drop in yields has been observed: apparently this is not an overfished location (Table 2). In fact, in recent years Mr. Moore has been taking greater catches, which may be explained by improvements in equipment rather than by species population growth. There are currently no quotas in place for this offshore zone and none scheduled for the near future.

The deep-sea fisheries of the southeast United States are rich in rock shrimp and royal red shrimp found in soft bottom environments, primarily fine to medium grain sand made of shell, although both constitute a very small catch compared to other sectors of the overall shrimp fishery (Table 2). The rock shrimp (*Sicyonia brevirostris*) is named after its characteristically tough, rock-like exoskeleton and can

be fished year round, but its biological range is restricted to depths in the continental shelf of 25-65m (Harrould-Kolieb, 2007: 1-4). Site BA02 lies beyond these parameters.

The royal red shrimp (*Hymenopenaeus robustus* or *Pleoticus robustus*) is a deep-sea shrimp known for its sweet, juicy flesh and striking red color, popular today as 'sweet shrimp' used in sushi and Asian cuisine. The fishery for royal red shrimp serves a niche market, representing a very small proportion of the overall shrimp industry in southeast America (Table 2). The typical habitat for this shrimp includes sediments transported offshore by the Mississippi and other rivers emptying into the sea and forming blue/black compositions of sand, silt, mud and a more gritty white calcareous mud. Royal red shrimp larvae are carried north by the Gulf stream to settle into adulthood along the Atlantic Coast within a biological range extending along the continental shelf from 180-730m, with peak concentrations found between 250-475m, precisely within the depth of Site BA02. In the southeastern USA the core habitat areas are located off Florida and the northeastern Gulf of Mexico.

Royal red shrimp are harvested by trawl boats dragging four nets that typically leave port for three weeks at a time. Fishermen perceive the royal red shrimp fishery as a more difficult working environment requiring greater investment and specialization that presents higher risks (Harrould-Kolieb, 2007: 6-9). Figures for the period 1978-2004 reveal that 200,000lb of royal red shrimp from the Gulf of Mexico were landed in 1978 and peaked in 1994 at 600,000lb. Catches from the waters of the South Atlantic are far smaller, starting at 240,000lb in 1989 and peaking at 350,000lb in 2000 (Harrould-Kolieb, 2007: 8, fig. 2.2). More specifically, in 2008 321,648lb of red shrimp were landed in Florida with a value of just \$627,720 compared to just 82,291lb in 1998 worth \$250,331 (Table 2). This data, plus the fact that no red shrimp were landed in 1988, reflect the relatively late emergence and development of specialism on this species.

In terms of value, shrimp is the second most important fishery in the United States after the crab, with the average American consuming 1.9kg edible weight of shrimp a year. The combined landings for the US domestic shrimp fisheries have been about 140,000 tons annually in recent years, valued at a catch value of \$425 million (Gillett, 2008: 1, 17, 34). Shrimp fishing is exceptional in the amount of controversy it has generated. A recent UN Fishing and Agriculture Organization study revealed that tropical shrimp trawl fisheries generally have high discard rates, which account for over 27% of total estimated discards in all the marine fisheries of the world, amounting to some 1.8 million tonnes per year. Shrimpers are continually working to improve the waste of bycatch.

The general impacts of trawl gear on sea bottoms are well known. Demersal otter trawls are the primary fishing gear that have been employed in the US shrimp industry since at least the early 1950s and are rigged with standard loop chains with a spread of 2.4 x 1.0m alongside chain doors (Watson *et al.*, 1984: 1, 5). This fishing method has the potential to reduce or degrade structural components and habitat complexity by removing or damaging epifauna, smoothing bedforms (which reduces bottom heterogeneity) and removing structure-producing organisms. Trawling may change the distribution and size of sedimentary particles, increase water column turbidity, suppress growth of primary producers and alter nutrient cycling. The magnitude of trawling disturbance is highly variable and its ecological effects depend on the site-specific characteristics of the local ecosystem, such as bottom type, water depth community type and gear type, as well as the intensity and duration of trawling and natural disturbances (Gillett, 2008: 303-304).



Fig. 115. Vermillion snapper (*Rhomboplites aurorubens*) on the surface of Area A on Site BA02.



Fig. 116. Vermillion snapper (*Rhomboplites aurorubens*) on the surface of a large keel on Site BA02.



Fig. 117. A conger eel hiding beneath the possible stem structure of Area A on Site BA02.

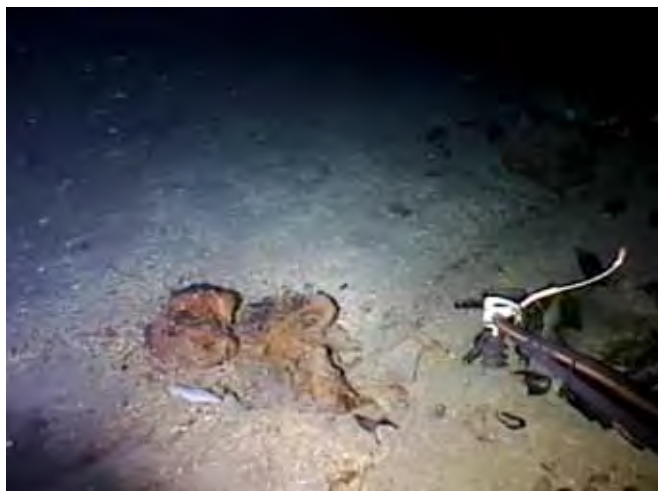


Fig. 118. A crushed keg located between kegs K3 and K4 in Area B.



Fig. 119. Lines of ceramics apparently cleared by trawl doors running north/south across Area G on Site BA02.

The specific impacts on wrecks located off United States as a whole, and within the nearshore and offshore fishing grounds of Florida and Georgia, are undocumented. The data from Site BA02 offer a clearer understanding of the nature of the effects such equipment may cause. The evidence of trawl impacts to Site BA02 can be summarized as including:

1. Exploitation of this area of seabed as a fishing ground for red shrimp since the early 1960s.
2. Oral testimony, combined with physical evidence in the form of snagged ceramic sherds from single fragments to an intact jar, for site impacts since 1977.
3. Site BA02's wreck formation displays a disproportionate balance of cargo across the site, which cannot be an accurate reflection of original stowage. Compared to the

dense concentration of glass bottles and ceramics in Area A, cushioned on three sides from impacts, the remainder of the site has been heavily flattened, artifacts have been scattered and some kegs crushed.

4. The above point is substantiated by the presence of lines of ceramics juxtaposed alongside lines devoid of any artifacts, reflecting the geography of inflicted damage and small zones cleared between trawl doors. Smashed pots ground down into sherds and completely crushed wooden kegs characterize the southeastern quadrant of Site BA02. Anchor A1, broken along the lower shank, may have been dragged and fractured from its original context related to being lashed on the portside bow.
5. The differences in levels of artifact and structural preservation between 2003 and 2005 reflect an accelerated level of site impact.

13. Anatomy of an East Coast American Coastal Trader

The ship wrecked at Site BA02 can be solidly dated to the mid-19th century, certainly within the decade spanning 1850-60. The absence of wire rigging is indicative of a pre-Civil War timeframe anteceding 1861. This vessel was thus not a blockade runner. The lack of cannon and the presence of a large cargo of ceramics are indicative of a merchant vessel. The visible remains of the keel for 17.6m and planking across a breadth of 2.5m on the starboard side suggest a minimum keel length of 18m, while the anchor size favors a capacity of 100 tons or less, making the vessel an unlikely candidate for a transatlantic trader.

The ship was outward-bound with a mixed cargo consisting of various British ceramics stowed alongside glass bottles filled with American liquor, condiments, patent medicines and colognes, as well as with glass window panes and two types of wooden kegs, some perhaps containing musket shot, tobacco pipes and maybe leather shoes. It is realistic to assume that an additional organic cargo, now perished, originally accompanied these goods. The nature of this cargo is indicative of a modest coastal trader of North American origin originating in a port along the Northern Atlantic seaboard. Both the lead ingots and spring balance plaque bear inscriptions reflecting manufacture in New York, which best fits the profile of the Site BA02 ship's home port and final point of departure (see Section 15 below for the controlling role of New York in mid-19th century East Coast trade).

The British ceramic wares would have been shipped initially to New York before being loaded onto the Site BA02 vessel alongside local products to head to the South.

Since America pursued a protectionist policy in its coastal trading, whereby President James Monroe's Navigation Act of 1 March 1817 permanently excluded foreign vessels from participating in coastal cabotage, and which later evolved to ban foreign ships from trading between the US and its offshore possessions and territories (Forsyth, 1989: 5; Morris, 1973: 17), the American origin of the vessel lost at Site BA02 may be judged to be secure.

Rather than being rigged with a square sail suited to generating tremendous driving force for a vessel crossing oceans, the Jacksonville 'Blue China' coastal trader probably featured a fore-and-aft rig, which was far better suited to the localized varying breezes, the need for maneuverability along the shore, and perhaps amongst the islands of the Caribbean, and the necessity to sail against various inshore currents and the powerful Gulf Stream.

Henry Hall's famous *Report on the Ship-Building Industry of the United States* of 1882 confirms that fore-and-aft rigged schooners were preferred for coasting because fewer sailors were required to handle a vessel, which could be worked in and out of harbors and along rivers more easily than a square-rigged craft. Since this form of craft could sail closer into the wind, trips were generally quicker (MacGregor, 2003: 69-72). These vessels could be sailed by a skipper and just two to three crew members, resulting in low operating costs (Chapelle, 1935: 258; MacGregor, 2003: 72-73). One working rule favored the use on schooners of two men per mast, plus the captain, but often with fewer personnel on smaller vessels (Morris, 1973: 119).

By 1800 the schooner had become the basic coastal cargo carrier in America, and from around 1825 New England and New York merchants preferred schooners



Fig. 120. The 91-ton Mary Langdon schooner built at Rockland, Maine, in 1845 and rebuilt in 1860 is probably close to the lines and origins of the Site BA02 ship.
Photo: Maine Maritime Museum, Bath, Maine (Capt. W.J. Lewis Parker Photograph Collection).

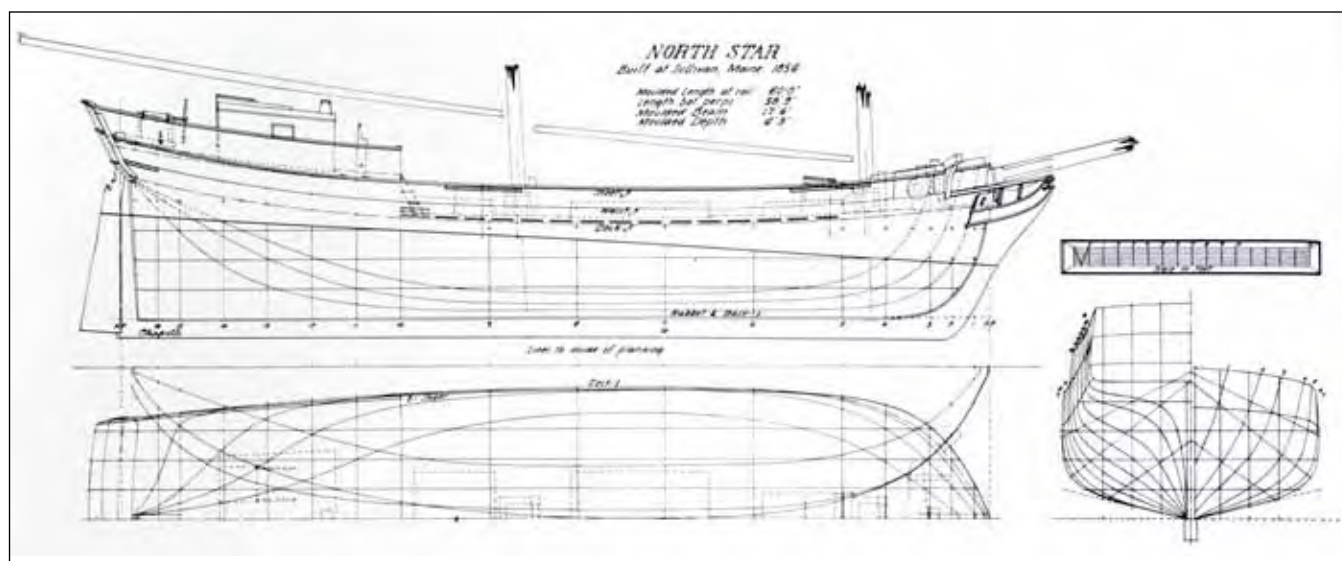
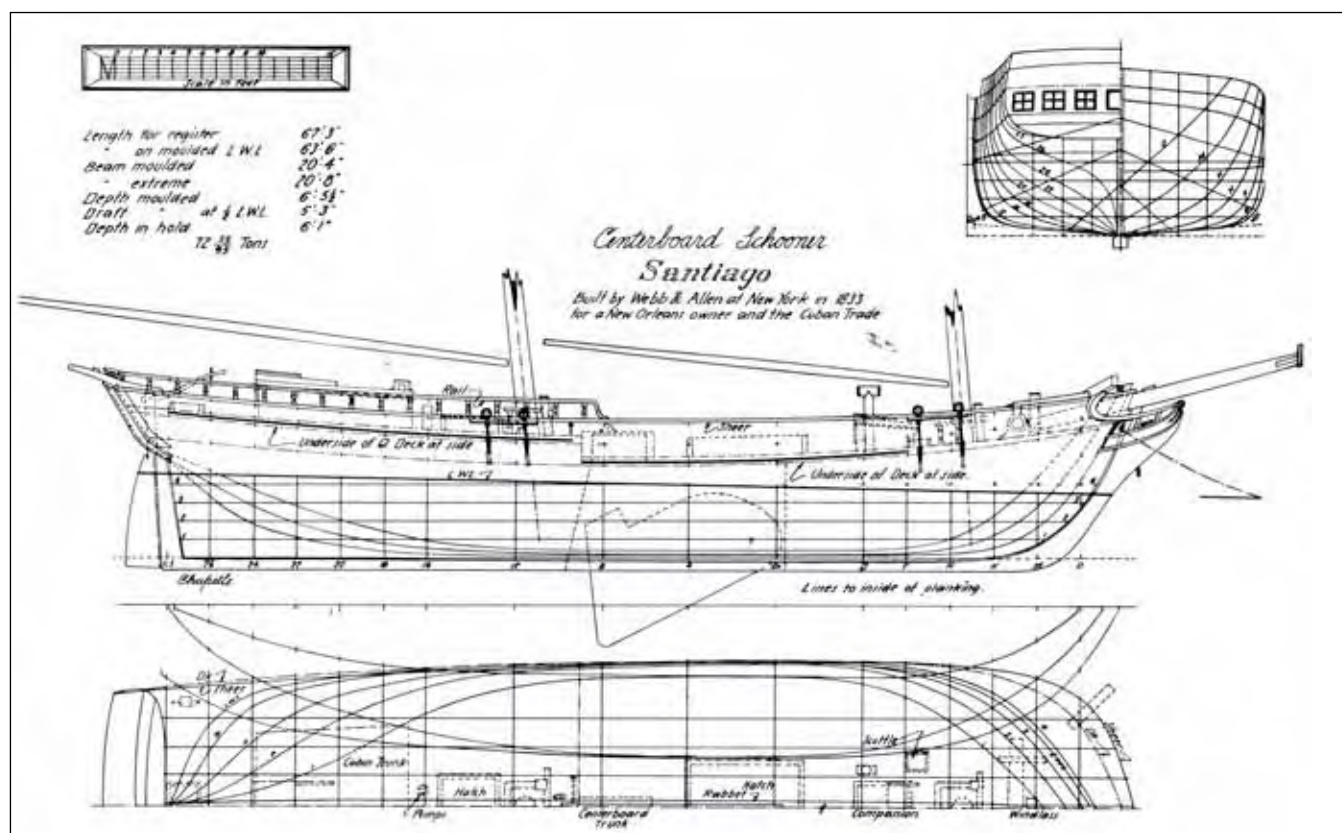


Fig. 121. Lines of the two-masted schooner North Star built at Sullivan, Maine, in 1856 (from Chapelle, 1960: 76).

American schooners were renowned for their ‘flush deck’ or ‘hurricane deck’ construction form, a term that referred to a vessel where “the weather, or upper, deck ran unbroken from the bow to the stern” (Parker, 1960: 52). The after accommodation on such vessels consisted of a large stern deckhouse that spread across almost the entire deck width, leaving just a narrow passage on either side at the same level as the poop. Unlike British schooners, which carried the after accommodation below the main deck, this arrangement preserved valuable cargo space. The main cabin, or afterhouse, was half sunk into the deck abaft the spanker mast and forward of the wheel. During the period of the Jacksonville ‘Blue China’ ship’s life, crew berths were located in the bows, below deck in a forecabin.

A companionway would have provided access to the crew's quarters: merely bunks, benches and a table, with the sailors expected to bring their own mattresses and blankets on board. The skipper would have taken his meals in the after cabin, and in bad weather the cook would have had an acrobatic time balancing the food during his traverse from the forecabin to the stern. Fitting out the captain's after cabin would have been dependent on the tastes of the owner and master, but might be "fitted out with paneled hardwood and decorated in the style of fashionable quarters ashore. A large coal stove provided heat for the whole space, which consisted of the saloon for sitting around and for officers' meals, rooms for master, mates and cook, a bathroom of sorts, and a pantry containing the smaller items of the ship's stores and usually provided with a sink for cleaning up" (Parker, 1960: 59).

The coasting schooner as used in America up to c. 1850 can be typically characterized as “a rather full-ended two-master, like the packets that ran between Maine ports



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and Boston. Most of them were fore-and-afters, but a great many of the Maine-built schooners were fore-topsail rigged. There were some sharp-lined coasters, particularly in the South. After 1860 the 'Essex model' became common, differing from the 'Bankers' of that particular model only in deck-plan" (Chapelle, 1935: 258). Vessels of this type frequently featured high hatch coamings and were commonly loaded until the main deck was virtually awash. Figureheads were rare and the bow was more likely to be decorated with a billet head and trailboards. The typical stern featured an old round tuck with wide upper and lower transoms, a style that gradually changed as the two-master evolved, first to a flat raking transom with a round tuck and subsequently with a short counter, a raking transom, curved athwart-ship and usually elliptical on New England vessels (Morris, 1973: 19-20).

After the War of 1812, Southern shipbuilders were more inclined to use oak and cedar, whereas oak, hatch-matack, pine and spruce was favored in the north. Hard pine was also imported northward, with the long leaf pine of Georgia and Florida considered the optimum medium. Mid-19th century schooners were most commonly built with trunnels for fastenings, which explains the absence of masses of concreted nails on Site BA02. Around 1861 a schooner cost about \$70 per ton to build (Morris, 1973: 63-5).

Purely fore-and-aft schooners were rare in Britain and in much of northern Europe on commercial craft, whereas in

the United States the opposite was the case after the 1850s, when square sails became a rare exception, particularly on the East Coast. The most common rig was a fore and aft foresail and a main with two headsails (the fore-staysail or jumbo and jib), with gaff topsails on the fore and main (Morris, 1973: 19). This pattern is typified by the *Mary Langdon* of 91 tons built at Rockland, Maine, in 1845 and rebuilt in 1860, which had two large deckhouses, a boat on the stern davits, a wooden balustrade as far forward as the fore rigging because the deck was level with the main rail, and 'lazy jacks' on the mainsail to prevent the sail spilling on to the deck when being lowered (Fig. 120). Such American schooners were broader in proportion to their length, the *Mary Langdon* having a length of 22m that was equal to only 3.5 breadths. This feature seems to be shared by the Site BA02 ship, for which available data reveal a keel length of some 17.6m and starboard planking across a breadth of 2.5m. A total beam of around 5.0m seems to fit the smaller variety of this class of craft (Table 3).

Based on combined historical and archaeological evidence, the following picture can be drawn for the Jacksonville 'Blue China' merchant vessel (cf. Figs. 120-122):

- Approximately 100 tons.
- A two-masted fore-and-aft schooner rig; no square topsails.
- Possibly fitted with a centerboard.
- A small boat rigged on davits across the stern.

Name	Date	Build Location	Area of Operation & Cargo	Length (ft)	Beam (ft)	Depth (ft)
<i>Lucy</i> (coaster)	1852	Sargentville, ME	New England coasting trade (lumber south, manufactures back north)	85 (moulded, at main rail)	23.29	7.15
<i>Wakeag</i> (coaster)	1855	Trenton, ME	Coastal & West Indian trade	102 (moulded, at rail)	25.29 (extreme)	8.46 (in hold)
<i>J.W. Hale</i> (coaster)	1855	Brooklin, ME	Coastal lumber trade; marine stores out of Florida, manufactured goods south	87 (moulded, at rail)	23.0 (moulded)	7.5 (moulded)
<i>North Star</i> (coaster)	1856	Sullivan, ME	Coastal lumber trade	60 (moulded, at rail)	17.5 (moulded)	6.25 (moulded)
<i>R.B. Sumner</i> (coaster)	1858	Newburyport, MA	General coastal freighting; packet on Boston-Newburyport route	84.25 (moulded, at rail)	21.17 (moulded)	8.33 (moulded)
<i>Aaron</i> (coaster)	1858	Lubec, ME	West Indian & coastal trade (incl. salt fish)	108.75 (moulded, at rail)	32.83 (moulded)	14.42 (moulded)
<i>Charmer</i> (packet, 116 tons)	c. 1860	Newburyport, MA	Passengers & light freight on Boston-Newburyport route	81 (moulded, at rail)	22.5 (moulded)	7.67 (moulded)
Unknown (coaster)	1860	Newburyport, MA	Possibly in coal trade	106 (moulded, at rail)	24.0 (moulded)	10 (moulded)
<i>E. Closson</i> (coaster, 135.37 tons)	1860	Sedgwick, ME	Coastal lumber trade	95.5 (between perpendiculars)	26.29 (extreme)	8.92 (in hold)

Table 3. A list of coastal schooners of comparable form as the Site BA02 ship (data from Chapelle, 1960: 75-9).

- Manned by a skipper and a crew of two to four.
- American registry, probably from New York.
- Not a bulk carrier.

Chapelle's *The National Watercraft Collection* (1960: 75-9) provides data from builders' half-models used to construct a number of two-masted schooners that were contemporary with the Jacksonville 'Blue China' trader and furnishes an additional understanding of its probable type (cf. Figs. 120-122). Ships with comparable lines are listed in Table 3 and indicate that lengths varied from 18-32m, widths from 5.2-7.9m and depths of 1.9-4.3m.

14. The Wreck Event & Great Storm of 1854

Historical sources dated to 1854, the midpoint of the period of interest for the Jacksonville 'Blue China' wreck, confirm that shipwrecks were common in the waters of the North Atlantic and down the East Coast of the United States all the way into the Gulf of Mexico. Approximately 90 American ocean-going sailing ships sank in the dangerous waters of the Bahamas, Cape Hatteras, Nantucket Shoals, Cape Cod, Cape Sable and Cape Race each year. Statistically, an average of one out of six American sailing packets went down during their long years of service, and these top rate vessels were judged to be safer than the regular coastal traders, which were not always well maintained and were often staffed by inexperienced mariners. The casualty rate for these vessels, particularly those engaged in the immigrant trade, was much higher. Seafaring was even more hazardous for men than ships. Sailors risked crippling injury or death as part of their daily routine, for which they typically received \$12 a month (Shaw, 2002: 4, 87, 50).

Data published in the *New York Times* (26 January 1854), based on reports of marine disasters accumulated in New York, Boston, Philadelphia, Baltimore and Norfolk, reveal a more precise picture of the great hazards of East Coast shipping in the 1850s. In the year between 1 July 1850 and 1 July 1851, some 50 ships, 59 brigs, 190 schooners, 20 steamers and nine sloops were lost alongside 318 lives. These figures exclude lakes and rivers, where a further 118 vessels were wrecked with 695 lives. Some 313 (75%) of the above total craft were lost by tempest, 45 by fire, 34 by collision, 48 by snagging/beaching and two through explosions. Insurance claims reveal that the average individual value of these wrecked vessels was \$9,745.

The specific reason for the loss of the Jacksonville 'Blue China' trader is unverifiable, but in the absence of any indications of fire, explosion, catastrophic hull failure or collision, it is likely that the ship was overcome by condi-

tions of wind and wave, resulting in loss by foundering. Using software and historical information produced by the National Oceanic and Atmospheric Administration (NOAA), the major storm tracks that passed through the area of Site BA02 during the decade of interest, 1850-60, can be plotted and examined using NOAA's Historical Hurricane Tracks database.

The character of the surviving cargo on the wreck is indicative of a southern trading voyage from the vessel's home port, probably New York. In fact, the bow of the wreck points southward, but because of the confused climatic-induced gyrations that must have taken place during the ship's final minutes this may be nothing more than purely coincidental and symbolic today.

The extreme climatic episodes that struck the area of Site BA02 in the period of interest (Table 4) ranged from tropical storms (TS) through to full-blown hurricanes of categories 1, 2 and 3 (H1, H2, H3). Such storms are defined as having maximum sustained surface winds as follows:

- Tropical Storm: 34-64 knots/39-73 miles per hour inclusive.
- Category 1 Hurricane: 64-82 knots/74-95 miles per hour inclusive.
- Category 2 Hurricane: 83-95 knots/96-110 miles per hour inclusive.
- Category 3 Hurricane: 96-113 knots/111-130 miles per hour inclusive.

Between 1851 and 1860, 11 major storm and hurricane episodes are registered as having struck the area of Site BA02 (Table 4). In light of current dating criteria for the wreck, notably a transfer-printed plate bearing the maker's mark 'STONE WARE / B H & Co' (for Beech, Hancock & Co.), which was produced between 1851 and 1855, and a plaque from a Morton & Bremner spring-loaded scale, which provides a *terminus ante quem* for its manufacture before Bremner retired from business in 1854, the hurricane of 7-9 September 1854 emerges as the most plausible cause of the Site BA02's ship's loss. While the scale could easily have remained in circulation for years after this date, it would be unexpected for an old stock British product to be sold to the middle class South and its clamor for the latest and most affordable British Staffordshire wares.

1854 was renowned amongst the insurance agents of New York as the "black year" for its high record of casualties. The New York Atlantic Mutual Insurance Company's preserved 'disaster books' reveal that some of the city's largest ships took big hits. The greatest loss was the *Franklin* of the Havre Line that ran ashore on Long Island, enforcing a payout of \$20,000 on the hull and \$176,000

Year	Date	Wind Speed (Knots)	Category
1851	24 August	50-90	TS-H2
1852	27 August	40	TS
1852	11-13 September	50-70	TS-H1
1852	9-10 October	50-90	TS-H2
1853	19-22 October	70-90	H1-H2
1854	7-9 September	60-110 (938-950 MB Pressure)	TS-H3
1856	31 August - 1 September	50-90	TS-H2
1858	14-15 September	50-80	TS-H1
1859	18 October	40	TS
1859	28 October	70-80	H1
1860	13-14 August	40-50	TS

Table 4. A list of the principal storms that struck the area around shipwreck Site BA02 between 1851 and 1860, based on NOAA's Historical Hurricane Tracks database.

for the \$472,000 cargo, part of which was salvaged. Three lost ocean-sailing packets, the Red Star Line's *Waterloo*, the London Swallowtail Line's *Prince Albert* and the Black Baller Line's *Montezuma* (lost at sea, abandoned at sea and wrecked on Long Island) were insured by the company at \$7,000, \$30,000 and \$43,000 respectively. Altogether, the Atlantic Mutual Insurance Co. losses for 1854 totaled \$4.5 million (Albion, 1970: 273-4).

The loss of these top end vessels was just the thin edge of a long list of horrors. In reality, 1854 was the culmination of appalling weather and casualties that characterized the end of the previous winter's shipping, of which the wrecking of the New York steamer the *San Francisco* on 25 December 1853 was especially dramatic. The detailed account of an anonymous female survivor in the *New York Times* of 18 January 1854, who was eventually saved by the *Kilby*, merits lengthy reproduction to provide a comparative understanding of the horrific experience that ships' passengers and crews alike experienced during the next year's even more ferocious hurricane:

"We sailed, as you know, on the 22d December... I soon made acquaintances among the lady passengers. We sat together in the saloon and talked of Christmas, and how we should spend it... I, for one, never thought of danger in the voyage... Our ship seemed too noble, too strong for such a contingency... And even on the morning of the 24th December, when the wind throughout the night had been blowing a gale, when our engine had stopped working, and our foremast was carried away, I could not realize the danger we were in... In less than an hour afterwards, when I was in the cabin, a deafening crash, not so much like the falling of houses as the crushing them in from the roof downwards, as

you might crush a pile of pill-boxes, sent the blood away from my heart, and left me so utterly petrified that I had no power even to sink upon the ground.

Then I felt that our fate was decided. I heard the commencement of screams that were stifled by the choking waves, and at the same moment the water came rushing into the cabin, as if the vessel's sides had cleaved, and she had already begun to sink. Then my friend, there was indeed horror on that ship. The confusion, the wailing, the praying, the groans of agony from the maimed and bruised, the shrieks from the ladies in their berths – all the tragedy, in its entirety and its details, will live in my memory forever, – is burnt into my brain, – can never perish while I have life, and "memory holds its seat." I think insanity would not obliterate it, – I think I might forget home, relatives, friends and all that is or was dear to me, – my father's and my husband's names, and the sweet faces of my children, and still retain a lively recollection of that scene.

This was when the upper saloon was swept away by the force of one tremendous wave, that was afterwards described to me as literally an enormous mountain of water. Nearly one hundred and fifty human beings, mostly troops, including, as you know, COL. WASHINGTON, MAJOR TAYLOR and lady, Capt. FIELD, and Lieut. SMITH, were swept overboard. When I recovered myself after my momentary paralysis, I made an effort to reach the deck, but a sudden convulsion of the ship – I can call it by no other name, it was so like the shudder of a human being in mortal agony – threw me with violence on the floor, and left me for some minutes senseless. When my consciousness returned I was nearly covered with water that had poured in from above, and inundated the cabin.

Somebody assisted to raise me up, and then I saw faces – faces only – grouped around me, as in a nightmare dream – faces so frightful from the overpowering awe that had seized

them, that I almost imagined them to be the phantom-faces of shuddering ghosts... Some of the soldiers' wives filled the ship with screams... In our part of the ship there was ejaculated prayers, sighs, half-suppressed lamentations, but no shrieks... We prayed during that night. I never knew what prayer was before. In the darkness – for we had no lights for several hours – prayers as sincere as were ever uttered by human lips or framed by human hearts, ascended to the Throne Eternal.

In the same was Christmas Day, which was also Sunday, was spent... The sunrise of that morning was splendid. The sky was unclouded, though the cold was intense, and the sea was heaving in a terrible manner. Anything more beautiful than the snowy crests of those huge waves as they shone in the sun, I cannot imagine. Our ship was lifted by them and let fall, like a dead giant. She had no longer any resemblance to a "thing of life." She was a cumbrous corpse upon the waters, without vitality or will."

The *New York Times* captures the geographic scope of this storm and its damage in graphic detail. The year opened with a report of 4 January 1854, confirming that:

"We continue to receive accounts of marine disasters in the late gale, and it is feared that further accounts, to come from Cape Cod, will show a large loss of life... A gentleman from Provincetown on Saturday says there are vessels ashore on all parts of the Cape... Parts of wrecks are all the time drifting ashore of vessels that must have been swamped in the gale, and whose crews doubtless perished. There has never been known such distress on the shores of Cape Cod."

The *New York Times* of 7 January 1854 dedicated substantial space to the subsequent outpouring of sorrow:

"The land is filled with mourning. The disasters at sea with which the papers have been crowded, and under which the telegraphic wires have staggered, for the past fortnight are fraught with more miseries than at first appear. In the centres of commerce, after the first shudder of sympathy is over, the value of the lost property is the remembered thing. But out along the sea-coast, and farther back into the country than would be supposed, are families sorrowing perpetually over the news that nestles in among our mail and marine items... Lost ships, men clinging to floating spars, dashed over by cruel waves, and uttering shrieks of despair – all are presented to the ears of the desolate, who from one brief text – a "marine disaster" – are left to deduce endless chapters of domestic and heartbreaking misery. The past month and this are likely to be remembered as epochs of fresh sorrow around thousands of firesides for many years to come."

If the fate of the *San Francisco* provides the most graphic account of the human drama felt by crew and passengers caught in the midst of an almighty storm during the pe-

riod of the Site BA02's ship's loss, then an account from Newport of the *Moselle* in the *New York Times* of 5 January 1854 provides a closer image of the final hours of the same type of craft as the Jacksonville 'Blue China' ship. "An awful scene was witnessed this morning by SETH C. BATEMAN, Esq. from the shore of his farm", announced the newspaper, before continuing that "At about daylight he discovered a schooner between Brenten's Reef and the small reef, water-logged, and at the mercy of the sea, which was making a clear breach over her. The crew, four in number, were in the rigging." The schooner then heavily struck the rocks and turned over on her beam ends before she was broken into fragments by another wave, after which:

"The men were thrown into the water, and there caught at the fragments... Two others were near together on the spars, when one, losing his hold, caught by the other, who tried to disengage himself, but before he could do so they both went down. The fourth had a fearful struggle with death. He was on the spars, and was repeatedly washed off, but managed to get on again, bruised, crushed as the fragments were washed against him, and Mr. BATEMAN could hear him groan as he received blow after blow, but no aid could be extended to him, and finally his strength failed and he shared the fate of his companions. The shore is strewn with the remains of the wreck..."

February witnessed little relief from the appalling weather. A letter written from the breakwater at Philadelphia on 23 February described how "the storm of Monday night was the severest ever known, and was accompanied with terrific thunder and lightning. The beach is strewn with wrecks. Thirteen vessels are ashore within view of the Breakwater..." (*New York Times*, 24 February 1854).

Progressing to September 1854, the suggested month of the Site BA02 ship's loss, the *New York Times* was awash with reports of damage at land and sea alike. The epicenter of a great storm heavily struck Savannah, Georgia. Far out to sea off this town, on 7 September the steamer *Star of the South* battled a slow moving major hurricane for five days. One of its passengers reported later how, "As far out as the eye could see, a perfectly white mountainous sea presented itself, while the wind moaned and whistled with awful fury". The storm shredded the sails and on 8 September the waves cracked the rudder and water reached and extinguished the boilers. The steamer only reached Charleston in a "crippled condition" through the coolness and seamanship of its captain (Fraser, 2009: 121-22).

The brig *Mary Ann* capsized in the same storm far off Savannah, but another heavy sea fortunately turned her upright. Eventually the wind shredded her sails off Georgia, brought down the mainmast and again capsized the brig.

Insured for \$6,000, the ship was a total write off. Caught in the same waters, the crew of the brig *Alice* described the scene as a “perfect hurricane”, while the schooner *Angenett*, loaded with timber and again sailing off Savannah, was forced to cut away its masts. The nearby schooner *Edward Kidder* lost its mainsail and everything movable on deck, and the schooner *Dirigo*, again loaded with lumber, was caught by the hurricane at 5pm on 8 September, which washed the crew’s food and water overboard before the masts were cut away and the hold filled with water. The dismasted schooner drifted helplessly northwards for six days before being rescued.

Off the Charleston bar another schooner, the *Mary D. Scull* of Philadelphia, loaded with merchandise for the shops of Charleston, was slammed by northeast winds on 7 September and fought the storm for 36 hours stripped of its sails, with smashed bulwarks and a holed hull (Fraser, 2009: 122, 124).

The same stories resonated across the seas of North Carolina and all the ‘Low Country’, where the waters were filled with wreckage and ships floating bottom up. US Navy lieutenant W.A. Bartlett of the steamer *Atlantic* would record that “Twenty-one years of trials incident to a sea life, I have not met before a gale of greater severity, and in no instance have I known the wind to blow a hurricane gale for so many consecutive hours.” Captain G.P. Adams of the schooner *Aid* also survived the hurricane in the open seas and described it as “the heaviest sea ever experienced during the 25 years he has been at sea” (Fraser, 2009: 123).

The bark *Harvest* incoming from Liverpool was caught in the September hurricane as it traveled east-northeast, which at latitude 40°20’ and longitude 68°30’ blew away its fore and main topsails and fore-topmast staysail, as a result of which “the ship breached to, shipping a tremendous sea, sweeping the deck of water casks and everything movable, and shifting cargo. In the height of the hurricane, blew away foresail, spanker, spencer, and foretop gallant sail out of the gaskets. Thirteen steerage passengers were washed overboard...” (*New York Times*, 18 September 1854).

The coastal towns of Georgia also took the full force of the hurricane, as revealed in a report filed from Savannah on 9 September (*New York Times*, 13 September 1854):

“...a terrific hurricane, exceeding in violence and the amount of property destroyed anything we have ever witnessed, is sweeping over Savannah from the Northeast. It is appalling to look out upon the streets and listen to the rushing, roaring, beating limbs of trees, pieces of slate and tin and boards, upon its mighty wings, as if they were lighter than chaff... Looking from the upper story of the Republican Buildings, we find that the whole of Hutchinson’s Island opposite the

city is submerged, and that the rice fields above and below, both on the Georgia and Carolina sides, as far as the eye can reach, are completely inundated... The loss from the destruction of the Rice and Sea Island Cotton crops, in Georgia and South Carolina, must be immense. Indeed, it can only be estimated at millions!”

On 12 September reports of a 48-hour storm were dispatched from Charleston, where all the wharves had been damaged, with estimated repair costs of \$250,000 (around \$5.2 million in modern value, cf. Fraser, 2009: 128), and warehouses and stores flooded. “We are called up to record one of the severest and most destructive storms that has been felt at our port for many years”, wrote a local reporter in the *New York Times* (12 September 1854). “In duration, violence, and amount of damage, we can, indeed, compare the visitation which has just passed over, with nothing that has occurred since the memorable gale of 1804 – of which, by a strange coincidence, the present was the semi-centennial anniversary.”

Reports suggest that the hurricane’s winds varied from the southeast to northeast and northwest. Jacksonville, Florida, the closest landfall to wreck Site BA02, is reported as having just been brushed by the storm’s northeastern gales before the full force of the storm made land between Brunswick and Savannah. The hurricane of September 1854 crossed the coast of Georgia at an angle as it began its slow curvature north-northeast along a track parallel to the coastline (Fraser, 2009: 131).

A combination of the above data with information from the 1831 version of Francis Beaufort’s scale permits the climatic conditions deteriorating during the fateful period when the Jacksonville ‘Blue China’ ship was lost off the Florida/Georgia coast to be reconstructed. As the ship headed south any experienced member of the crew would have recognized from the clouds and the shifting winds the approach of foul weather. If equipped with a barometer, the falling pressure would have been further evidence of an impending storm. The crew members would have busied themselves lashing down any loose equipment, double checking that the hatches were secured and putting extra lashings on the boat or boats in the stern davits and on deck. Perhaps they would have wolfed down a last hot meal before extinguishing the stoves in the forecabin galley and the after cabin, a precaution against fire due to the pitching of the vessel that was soon to come.

The crew would have verified that the pumps were clear and functioning. With a pure fore-and-aft rig (without square topsails), as the weather deteriorated the increasing wind would have forced the crew to take in the topsails, jibs and spanker. Afterwards, the fore and mainsails would have been reefed: the heads of the sails would have been

lowered and the slack material bundled up and lashed to the booms, effectively reducing the sail area. Thus, when the ship was in the troughs of the sea as the waves ran high, these sails would have gone slack as the wind was blocked. Upon rising to the crest the ship would have been exposed to the full force of the storm and the gear subjected to a sudden and heavy strain. Smaller schooners commonly carried a storm trysail, used when the mizzen was furled to aid in keeping the ship's head to the sea in stormy conditions (Parker, 1960: 57, 61).

Even under the best of conditions wooden hulls leak, working in a seaway that tends to bend and flex, causing seams between planks to open. In extreme cases the caulking washes out, causing increased water to flow into the hull through the resulting gaps. The Jacksonville 'Blue China' trader would have had no steam pumps, so the small crew would have been at the hand pumps (probably brake pumps) continuously to keep the rising water level down.

Site BA02 lies within the flow of the Gulf Stream, so a strong northerly wind would have pushed against the 2.5-knot flow of the northward-moving current. Even in isolation, such a wind of 30 knots or more would build up steep 4.5-6m high seas. As the winds reached gale force, even without the effect of the Gulf Stream, waves would have built up further to heights of 6-9m. The entire surface of the ocean would have turned a frothy white as thick streaks of foam were ripped from the waves and blown downwind. If the sails had not already been reefed, it would have been suicidal for the crew to venture onto deck in an attempt to secure them. The only distress signal available to the small ship would have been to hoist the American flag upside-down, an international signal of distress – but at this stage this would have been a final act of despair. As the wind reached speeds of 56-63 knots only the storm trysail would have held up as the waves began reaching mountainous heights of 9-13.5m. The Jacksonville 'Blue China' trader would have been completely hidden in the troughs of monster waves. In such deep waters, the presence of the anchors was meaningless. They remained strung to the bows, unused.

With the winds reaching hurricane force, the ensign on the Jacksonville 'Blue China' trader would have been shredded. The storm trysail, if still in place, would have exploded into fragments with a sound like a cannon shot. Even the furled sails might have been torn loose and whipped to pieces. The completely white sea would have been convulsed by 13m-high waves, the air so filled with foam and spray that it would have been difficult to discern the air/water interface. At this point survival on deck would have been impossible and the pumps would have been abandoned. No hope remained of controlling

the direction of the ship and the only recourse would have been to run before the wind under bare poles. The master compass was probably smashed by this time, and even if not the wild gyrations of the vessel would have overcome the gimbel mechanism, making the direction impossible to read. At best the crew could have hoped of being driven to shore, which afforded at least a slim chance of survival.

By this time the ship's small boat could have been smashed to splinters in its davits, leaving only one on deck remaining if that too had not been destroyed by the pounding waves. This would have been scant comfort, however, because launching it would have been out of the question. The best that could be hoped for would have been to cut it loose as the ship went down and for the crew to cling on or lash themselves to it. At this final point in the ship's life, the men might have found themselves trapped in the gyre that, according to local folklore, characterizes this part of the ocean.

The terror that goes through a ship's crew in its final minutes can be well imagined from the above historical accounts, but these were written by fortunate survivors. The utter sadness of loss of hope is aptly laid bare in an account of August 1872 in the North Atlantic. When the schooner *Lancaster* sighted that month a dismantled derelict, the *Glenalvon*, its crew found on board several skeletons and an open Bible lying face downward in the cabin alongside a loaded revolver and a bottle, which contained a note reading "Jesus guide this to some helpers! Merciful God, don't let us perish!" (Morris, 1973: 106). As with the fate of the Jacksonville 'Blue China' ship, the Blue God had other malicious intentions.

15. Conclusion: the Port of New York

The collective data for the Jacksonville 'Blue China' shipwreck points towards the presence of a relatively modest 20m-long schooner of 100 tons or less specializing in coastal trade along the East Coast of America (cf. Figs. 120-122). The grindstone, a stoneware jug, the Morton and Bremner spring-loaded scale and McCullough lead ingots provide guiding evidence to define the vessel as originating in New York and having commenced its final voyage in or after 1851 and before 1855. This chronology coincides with the artifact dating scheme (Table 5). The vessel's New York origin is further supported by the fact that by the 1850s the bulk of Staffordshire pottery exports was handled by New York ceramic importers and dealers, who controlled the distribution network for the internal American trade.

The ship was transporting a diverse cargo of British

Artifact	Origins	Date
Grindstone	Appalachian Mountains: New York to Alabama	----
Sand's Sarsaparilla glass bottles	New York, America	1840s
Type 8 salt-glazed stoneware jug	New York/ Pennsylvania, America	1850-60
Morton & Bremner spring-loaded scale	New York, America	1851-54
McCullough lead ingots	New York, America	----
Type 2 dipped whitewares	Staffordshire, Britain	1850-60
Type 3 painted whitewares	Staffordshire, Britain	c. 1845-55
Type 7 transfer- printed plate	Staffordshire, Britain	1850+
Type 7 transfer- printed soup plate	Staffordshire, Britain	1851-55

Table 5. A list of the artifacts from Site BA02 with the tightest dates and reflections of the ship's origin.

ceramic dining and toilet wares, largely manufactured in Staffordshire, and which would have been exported via Liverpool, presumably to New York. In this bustling North Atlantic port they were purchased, possibly through the city's infamous dockside auctions, for trade inland and to the South. Added to the pottery shipment was a consignment of American beverages, medicinal products, condiments and cologne packaged in glass bottles, plus glass tumblers, glass lamps and building materials in the form of glass window panes and kegs holding white lead. Most ships carried some form of organic cargo, whose character in this case can only be a matter of speculation (see Table 6 for a cross-section of the most valuable New York exports of 1860). A few wooden crates of lead musket balls and tobacco pipes were slotted in amongst the overflowing merchandise as the small schooner headed towards the South, the cotton and tobacco-growing center of America.

Although the storms of late December 1853 were notoriously harsh on shipping, a small schooner is unlikely to have risked such notorious seasonal seas. Rather, the great storm of 7-9 September 1854, a category three hurricane associated with 110-knot winds (126 mph), emerges as the most likely cause of the Jacksonville 'Blue China' ship's demise. The wreck's location off the border of northern Florida and southern Georgia fits perfectly the profile of this killer storm, which hit the coast of Georgia from the east-northeast on 7 September and peaked the following day as the full force of the gale made land between Brunswick and Savannah, Georgia, and began its slow curvature north-northeast along a track parallel to the coastline.

Contemporary accounts report that Jacksonville itself

largely escaped the hurricane. Brunswick is situated some 107km north of Jacksonville, which fits with the storm's southern-moving track. The steamer *Star of the South* fought the hurricane for five days and the schooner *Mary D. Scull* battled the elements for 36 hours. The Jacksonville 'Blue China' schooner, stripped of sails and masts, could easily have been propelled to the current wreck's location by the northern storm.

Alternatively, it is possible that far out to sea the hurricane was more malicious than along the shore. Although the storm peaked at Charleston and Savannah, the damage to North Carolina was also extensive and a similar trail of destruction would not be unexpected to the south. Under these circumstances, and some 70 nautical miles offshore, it would have been beyond a miracle if any of the small crew of around five people survived. Lieutenant Matthew Fontaine Maury's newly published *Wind and Current Chart of the North Atlantic* of 1847 (Laing, 1974: 199) would have been an idle tool in these climatic circumstances.

The destination of the Jacksonville 'Blue China' ship is not obvious. Both Savannah and Charleston were major cotton ports at the time and each exported respectively \$4 million and \$11 million worth of goods in 1854. Another candidate for the Jacksonville 'Blue China' ship's intended port of call was New Orleans in the northern Gulf of Mexico, which exported \$60 million of goods in return for \$14 million of imports in 1854 (Albion, 1970: 390, 402; cf. Cunningham Dobson and Gerth, 2010 for commerce in New Orleans c. 1865).

To what extent all three of these Southern ports were

functioning in light of the outbreak of yellow fever at the end of August 1854, which provoked widespread panic, is unclear, especially since contemporary sources described it as so highly contagious that the people of Augusta and the neighboring villages had taken to “camping it out in the open fields” according to the *New York Times*. Around 25 September 1854, 32 people died from the disease in two days in Charleston and by 29 September New Orleans had been hit by 110 deaths in three days (with 500 cases overall). Reports from 30 September listed seven dead in Savannah in a day, including the doctor (*New York Times*, 27, 29 and 30 September 1854). The extent of the social meltdown is described in a letter from Savannah published in the *New York Times* on 27 September:

“Age nor condition afford security against the disease, and people that are acclimated are carried off by it, in common with the rest of the victims. But what shall I say of Savannah? Out of sixteen thousand people, there remains but *two thousand* – the rest have either fled or are dead. The deaths in this poor devoted city are, on an average, fifty per diem; and when you understand that bread is wanting, (the bakers have

all died,) and that the Mayor of Savannah has called upon the neighboring town to send five hundred loaves of bread a day – and that the cars bring fifty coffins a day, as none can be had – you will then have some idea of affairs. In Charleston it’s not quite so bad, but bad enough.”

In a second scenario it would seem reasonable to question whether the Site BA02 schooner may have been sailing alternatively for the Southern ports after the 7-9 September hurricane had struck, when new window panes, white lead used for paint and to plug leaking window frames and, of course, pottery to replace damaged dining wares would have been in high demand. However, no storm episodes are listed for the second half of the month.

The emergence of a deep-sea fishing fleet off Georgia and Florida in the 1970s probably saw the wreck being impacted by bottom gear for the first time. The extent of natural deterioration caused by time and tide previously cannot be quantified. Since then pottery has been raised in fishermen’s nets over the last 35-40 years. All but the southwestern quadrant of the wreck (Area A) has been heavily impacted, especially the eastern, port side of the



Fig. 123. A bird's eye view of the port of New York from the Battery, looking south, published by Currier & Ives, 1872.
Photo: Eno Collection, Miriam and Ira D. Wallach Division of Art, Prints and Photographs, the New York Public Library, Astor, Lenox and Tilden Foundations.

ship, where the ceramic cargo is widely scattered and linear furrow lines are present.

In one sense this form of impact is synonymous with the burrowing actions of moles and rabbits on land sites that simultaneously damage, yet expose, new sites of archaeological significance for the first time. Few shipwrecks are static, but rather are subjected to varying degrees of continuous impacts from natural degradation by currents, dredging for gravel and sands and the oil and gas industry, at one extreme characterized by the 19th-century 'Mica' wreck in the Gulf of Mexico, which was unwittingly cut in half in 2001 by a 20cm-diameter ExxonMobil Corporation pipeline (Jones, 2004).

Site BA02 is a unique type of shipwreck. A wide cross-section of sea craft has been identified and recorded off the East and Gulf coasts of America, including: remains of Spanish galleons of 1559, 1622 and 1733 off Emanuel Point and the Florida Keys (Mathewson, 1986; McKinnon, 2007; Smith *et al.*, 1998); the early 18th-century wreck of the pirate ship *Queen Anne's Revenge* off Beaufort Inlet, North Carolina (Lawrence, 2007); the deep-sea SS *Republic* steamer wreck of 1865 off Georgia; the early 19th-century 'Mica' wreck schooner and possible armed 'Mardi Gras' privateer shipwreck of c. 1820, both in the Gulf of Mexico (Jones, 2004; Ford *et al.*, 2010: 95); and various regional early modern and modern vessels off Dog Island, northwest Florida (Meide *et al.*, 1999). More recently, the wreck of a two-masted 19th-century brig that sailed between New York and the Caribbean was recovered from the foundations of the World Trade Center in New York (Lobell, 2010).

None of these sea craft typify or reflect the most common form of coastal trade conducted by schooners between New York and the Southern ports of Savannah, Charleston and New Orleans that were the economic life force of New York. These lesser schooners that carried everything from coal cargos worth just \$1,000 to consignments of tea, spices and other exotic imports insured for \$200,000 have been termed a "neglected virgin subject" (Albion, 1970: 122-23). The small schooner of around 100 tons in fact was the favorite instrument for coastal trips of moderate length of about 300km: of 2,869 ship arrivals in New York in 1835, 2,521 were schooners. In 1860 New York built 372 schooners of 75-150-ton range (as well as 289 sloops and canal boats, 264 steam vessels, 141 ships, 36 brigs) that formed the rank and file of lesser coastal runs from Maine to North Carolina and on to the Caribbean and Spanish Main (Albion, 1970: 124, 305). The wreck at Site BA02 currently stands as the sole archaeological representative of this voluminous mercantile operator. It is also the only cargo of British ceramics and American glass wares



Fig. 124. View along the docks of New York City, 1800s, from Harper's Weekly: A Journal of Civilization. Photo: Picture Collection, the Branch Libraries, the New York Public Library, Astor, Lenox and Tilden Foundations.

found on any schooner off the United States.

Following the end of the Napoleonic War in 1812, the US evolved from national adolescence to nationhood during the ensuing 50 years. The decade of peace from 1815-25 cemented New York's status as the preeminent American seaport. The city's position at the heart of US maritime trade grew rapidly through a series of social and economic developments strongly grounded in the 1820s: the appearance of packet lines, the rise of the 'cotton triangle', the opening of the Erie Canal, growth in immigration and the California Gold Rush.

The establishment of timetabled packet lines between America and Britain created the foundations of a long-term, long-distance trade mechanism. The Black Ball Line was founded in October 1817 between New York and Liverpool, which was followed in January 1822 by Byrnes, Trimble and Company's expansion of its flour trade business to set up the Red Star Line with monthly sailings between the same two destinations. Thaddeus Phelps & Company's Swallowtail Line soon expanded the healthy competition (La Guardia, 1941: 142-3, 148-9). These early packets were modest ships of around 257 tons and 28m in length (Albion, 1970: 40-41).

Once the packet line service was bedded in as a reliable



Fig. 125. View along South Street, New York, from Harper's Weekly: A Journal of Civilization, 1878.
Photo: Picture Collection, the New York Public Library, Astor, Lenox and Tilden Foundations.

and constant feature of eastern American travel, New York found itself in the perfect position to play middleman in the 'cotton triangle' (Fig. 123). Southern cotton cultivated in abundance in Charleston, Savannah and New Orleans was first shipped to New York before being loaded to England (La Guardia, 1941: 150-1). Prior to the completion of the railroad system shortly before the American Civil War, coastal craft offered merchants the only means of moving their goods in quantity between the North and South (Bauer, 1979: 44).

It has been observed that women's bell skirts with voluminous underpinnings were literally a style that launched a thousand ships. Never before had American female society demanded greater volumes of cloth. The average woman's dress in 1855 required some 30 yards of material, while petticoats and other garments underneath brought the total per woman to a staggering 100 yards (eight times the amount needed in 1800 and sufficient to clothe 14 women in the 1920s). In a rather convoluted and economically embedded manner, Southern cotton was shipped raw first to New York, exported to Britain and then imported in

finished form back to America. By 1860, \$85 million of the total of \$125 million woolen and cotton goods imported annually into America derived from Britain and mainly Liverpool, compared to just \$900,000 per annum of silk imports from China (Albion, 1970: 58).

The early autumn to late spring (October to April) cotton season made the southward sea lane from Sandy Hook past Hatteras to the cotton ports second in importance only to the Atlantic shuttle. New York's total coastwise trade in 1835 – comprising 2,869 arrivals of 302,000 tons a day, almost 10 vessels a day – almost equaled that of its two chief city rivals combined.

New York's economy received an enormous boost in 1825 with the opening of the artificial Erie Canal (the total length from Buffalo to Albany was 226km, where it fed into the Hudson River), which linked New York with Lake Erie, Lake Ontario and the fertile hinterland (Bauer, 1979: 47). The canal allowed the western counties centered on Rochester to replace the Hudson Valley as the center of the flour industry. The stimulus to New York's economy was dramatic. In the immediate wake of the canal's opening, 500

Product	Value (Million \$)	Product	Value (Million \$)
Specie & bullion	50.3	Staves	1.3
Cotton	12.4	Skins	1.3
Cotton goods	5.9	& furs	
Flour	6.6	Indian corn	1.1
Iron & related products	3.2	Oil cake	1.1
Tobacco	2.6	Rice	1.0
Naval stores	2.7	Drugs/medicine	0.8
Wheat	2.3	Lumber	0.8
Lard	2.0	Manufacturers of wood	0.7
Whale oil	2.0	Butter	0.7
Beef	1.8	Furniture	0.5
Pork	1.6	Spirits	0.5
Hams & bacon	1.5	Rye/oats	0.4
Cheese	1.4	Livestock	0.3
Copper/brass	1.4	Raw hides	0.2

Table 6. A list of New York exports by value in descending order compiled from the *Reports on Commerce and Navigation for 1860* (from Albion, 1970: 401).

new mercantile establishments set up business in the first few months of the year, and the April edition of the *Gazette* carried 1,115 new advertisements. By the end of 1825, 12 banks and 13 marine insurance companies representing an aggregate investment of \$23 million had been established. New York shipyards were filled with more orders than they could meet and the overflow trade passed to Boston, Philadelphia, New Bedford and Gloucester (La Guardia, 1941: 151). Where 218,000 tons of goods were carried along the canal in 1825, by 1850 the amount had mushroomed to 3,076,617 tons. Vessels shipping cash crops to New York returned with myriad imports from Europe, China and Latin America, creating an explosion of small stores and consumers in the western interior (Albion, 1970: 85-91).

New York had become the center of mercantile America and once gold was discovered in California in autumn 1848, a starry-eyed multitude crowded its docks (Figs. 123-125). By March 1849 more than 150 ships carrying 11,000 passengers had left for California, with a total of 775 vessels by the end of the year. Again the shipyards of New York were overstretched, which enabled Maine, with its shipyards perched on the edge of forests, to wrench leadership in the regional ship construction industry away from New York. Whereas New York had 44,104 tons of ships in construction that year, Maine's yards had 82,256 tons in production (LaGuardia, 1941: 166-68). With New York focusing on larger craft and Maine specializing in smaller vessels, it was probably in the latter region that the Site BA02 ship was most likely constructed.

New York was also infamously the landfall of choice for any aspiring mid-19th century speculator, large or small, and of 5.4 million immigrants that arrived in the United States from 1819-60, 3.7 million entered at New York. In 1854, the peak year of movement, the city received 327,000 immigrants (including 177,000 Germans, 82,000 Irish, and 36,000 people from England, Scotland and Wales), almost three-quarters of the national total (Albion, 1970: 337-38).

By the mid-19th century, New York stood second only to London in the tonnage of shipping it handled, and New York vessels exceeded the combined tonnage of Boston, Philadelphia, Baltimore and New Orleans. The city's 1,377,000 tons of registered vessels manned by 60,000 people carried 52% of the nation's combined imports and exports and had 33% of its registered tonnage. The *Reports on Commerce and Navigation* for 1854 demonstrate that of total US exports amounting to \$275 million, New York City handled \$122 million. Of \$304 million US imports, the city's ships carried \$195 million of its value (Albion, 1970: 54-58, 95, 123, 267, 390-91, 398). The types and total values of New York imports and exports are presented in Tables 6-7.

The original source of this virtual maritime empire was New York's geographical position as an outstanding natural harbor with 481km of protected waterfront. One arm was formed by the outer shore of Long Island, stretching eastward 65km from Coney Island to Montauk Point. The opposite arm was the New Jersey coast, extending

Product	Value (Million \$)	Product	Value (Million \$)
Woolen goods	34	Furs	1.7
Silk goods	30.7	Glass	1.7
Cotton goods	22.6	Clothing	1.5
Sugar	20.7	Lead	1.6
Iron/steel	12.3	Molasses	1.6
Linen/flax	8.6	Hats/bonnets	1.5
Coffee	8.5	Jewelry/gems	1.5
Tea	8.3	Raw silk	1.3
Raw hides/skins	6.9	Rubber	1.3
Leather goods	4.5	Soda	1.3
Tin	4.5	Rags	1.0
Lace	3.5	Linseed	0.8
Spirits	3.4	Indigo	0.6
Tobacco	3.3	Spices	0.6
Wine	2.9	Hemp	0.5
Clocks/watches	2.6	Copper	0.4
Chinaware	2.4	Salt	0.3
Fruit	2.4	Gunny	0.2
Raw wool	2.4	Saltpetre	0.1
Specie/bullion	2.3		

Table 7. A list of New York imports by value in descending order compiled from the Reports on Commerce and Navigation for 1860 (from Albion, 1970: 401).

68km from Sandy Hook to Cape May. The main sea lane to Europe ran along the former, while the latter was skirted by shipping for the Southern and Caribbean ports (Albion, 1970: 16).

By 1840 the city possessed 60 wharves on the East River and 53 on the Hudson (Figs. 124-125). Data from a single day in spring 1836 reveal that 921 vessels were moored up East River and only 320 in the Hudson, the latter largely consisting of small schooners and sloops (Albion, 1970: 221-22). For all its mercantile wealth, port facilities for handling the increased trade were inadequate. The 1.8km-long stretch of wooden piers in lower Manhattan was rotting and sand and silt drifting into the slips between docks. In 1836 Mayor Lawrence bemoaned the “decaying timbers around our wharves and bulkheads that cause spread of disease” (La Guardia, 1941: 2, 155). The old docks in the East River at Coenties Slip, Old Slip, Coffee House Slip, Fly Market Slip, Burling Slip and Peck Slip caused a Glasgow printer to refer to New York in 1823 as an “overgrown sea-port village” (Albion, 1970: 220):

“The slips run up a considerable way in the center of the buildings, as it were in the middle of the streets; and being built or faced up with logs of trees cut to the requisite length, allow free ingress and egress to the water, and being com-

pletely out of the current of the stream or tide, are little else than stagnant receptacles of city filth; while the top of the wharves exhibits one continuous mass of clotted nuisance, composed of dust, tea, oil, molasses, &c, where revel countless swarms of offensive flies.”

In a letter to a visiting foreigner in 1824, Fenimore Cooper, the author of *The Last of the Mohicans*, had explained (Albion, 1970: 220) that:

“The time has not yet come for the formation of permanent quays in the harbor of New York. Wood is still too cheap, and labor too dear... All the wharves of New York are of very simple construction – A frame of hewn logs is filled with loose stone, and covered with a surface of trodden earth... the whole of the seven miles of water which fronts the city, is lined with similar constructions... [forming] a succession of little basins, which are sometimes large enough to admit thirty or forty sail, though often much smaller.”

The shrewd reasons for the conditions of the docks were partly a result of low mooring rates in New York, which seem to have been a deliberate strategy geared towards attracting ever-increasing shipping. In the *New York Times* of 13 January 1854 a ship and wharf owner explained the unfair criticism he received thus:

“Complaints are made by shipmasters of our bad wharves, shoal-waters, encroachments upon the harbor, &c; but they do not consider that the earnings of our Wharves in this City are so small that we cannot pay for excavating the mud and sediment constantly washing from our streets into and filling up our slips. It is well known that there is no charge here upon articles of merchandise landed upon our docks and wharves, and that a vessel of say 100 tons pays in New-York 62½ cents per day wharfage, with an addition of 12½ cents per days for every fifty tons; whereas if she takes a cargo of 500 barrels flour to Providence, or to any other Eastern or Southern seaport, and lands it upon the wharves there, she pays \$15, or 3 cents per barrel. No doubt the low rates of wharfage here help to promote business; but is it necessary that our rates of wharfage should be kept so ruinously low as to compel us to let them rot and go to ruin, while our slips become shoals upon which vessels dare not venture.”

By the mid-1850s most docks were 60-90m long and covered with pine planking that needed replacing every four or five years, largely due to horses hoisting cargo wearing out the wood. ‘Wharfingers’ estimated a normal pier to have a life span of 30 years and that new repairs cost about \$15,000, a third to a quarter of the original construction’s value. Many wharves were leased by the city to private individuals, who charged mooring costs of 75 cents a day for vessels of 100 tons. In 1852 the total gross rentals of the city’s piers, wharves and bulkheads came to \$127,000 and repairs to \$37,000 (Albion, 1970: 222-23).

The scale of business derived from New York’s maritime trade in the first half of the 19th century is laid bear by the fact that the city’s Custom House was the principal source of revenue for the Federal Government, which collected enough duties in 1828 to cover the entire running expenses of the national government. By 1843 the Custom House had 503 members of staff with total salaries of \$489,000. In downtown New York in 1852 Wall Street was already the focus of monetary operations (including marine insurance), Broadway was a promenade of beauty and fashion, and the principal shipping houses were clustered along South Street on the East River, where the counting-houses stood strikingly opposite the piers, from where ships’ bowsprits stretched well across the cobbled street (Fig. 125).

Doggett’s *New York Business Directory* of 1846 listed 31 “general merchants”, 51 “importing and commission merchants”, 138 “shipping and commission merchants” and eight “shipping and importing merchants” as based on South Street. Nearly 60 different fields of importation were listed in this directory, including more than 100 importers of dry goods and allied commodities, 89 in wines and liquors, 86 in hardware and cutlery, 69 in coffee,

and 53 in china, glass and earthenware. By 1860 New York was credited as containing an astounding 21,677 resident merchants, a rather liberal definition that included country storekeepers (Albion, 1970: 224, 266, 270, 275).

Such was the bustling world of the small schooner that met its fate in the greatest hurricane of the generation. 1854 was a year of seemingly apocalyptic winds of change. Already wracked by a great outbreak of yellow fever across the entire South, the category three hurricane of 7-9 September 1854 destroyed the rice and cotton crops and left the towns with little means of economic respite. The South was also on the verge of a new revolution, the railroad, which was offering cut-price tickets to willing passengers. The great age of the East Coast schooner was on the verge of extinction. The humble remains of a small ship of this class at Site BA02, the Jacksonville ‘Blue China’ wreck discovered by Odyssey Marine Exploration, is a physical reminder of a time and place that made New York the great metropolis it is today.

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Notes

1. See: http://sofia.usgs.gov/publications/maps/florida_geology/intro.html.
2. See: US Geological Survey GLORIA Mapping Program, US EEZ Atlantic Continental Margin GLORIA: <http://coastalmap.marine.usgs.gov/gloria/eastcst/geology.html>.

Bibliography

Albion, R.G., *The Rise of New York Port (1815-1860)* (Newton Abbot, 1970).
 Barlow, R.E. and Kaiser, J.E., *The Glass Industry in Sandwich. Volume 2* (Barlow-Kaiser Publishing Company, Inc. 1989).
 Bauer, K.J., 'The Golden Age'. In R.A. Kilmarx (ed.), *America's Maritime Legacy: A History of the U.S.*

Merchant Marine and Shipbuilding Industry Since Colonial Times (Boulder, 1979), 27-65.
 Bell, E., *Pharmaceutical Journal and Transactions Volume XVI, 1856-57* (London, 1857).
 Blacker, J.F., *Nineteenth-century English Ceramic Art* (Boston, 1911).
 Bock, G., 'Glass Notes', *Old House Journal* (July/August 1988), 35-43.
 Bowditch, N., *Bowditch Explains How to Select, Use, and Maintain the Marine Sextant, Adapted from American Practical Navigator* (New York, 1976).
 Brocket, L.P. (ed.), *Our Country's Wealth and Influence* (Hartford, 1882).
 Bryant, S., *Shoe & Leather Trade of the Last Hundred Years* (Boston, 1891).
 Carpentier, D. and Rickard, J., 'Slip Decoration in the Age of Industrialization'. In R. Hunter (ed.), *Ceramics in America* (Chipstone Foundation, Milwaukee, 2001), 115-34.
 Chapelle, H.I., *The History of American Sailing Ships* (New York, 1935).
 Chapelle, H.I., *The National Watercraft Collection* (Washington, 1960).
 Chapelle, H.I., *The Search for Speed Under Sail 1700-1855* (New York, 1967).
 Chipman, F.W., *The Romance of Old Sandwich Glass* (Boston, 1932).
 Clark, E., *History of the Seventh Regiment of N.Y. 1806-1889* (New York, 1890).
 Cotter, J.L., Roberts, D.G. and Parrington, M., *The Buried Past. An Archaeological History of Philadelphia* (University of Pennsylvania, 1993).
 Cunningham Dobson, N. and Gerth, E., 'The Shipwreck of the SS *Republic* (1865). Experimental Deep-Sea Archaeology. Part 2: Cargo'. In G. Stemm and S. Kingsley (eds.), *Oceans Odyssey. Deep-Sea Shipwrecks in the English Channel, Straits of Gibraltar & Atlantic Ocean* (Oxford, 2010), 25-68.
 Cunningham Dobson, N., Gerth, E. and Winckler, L., 'The Shipwreck of the SS *Republic* (1865). Experimental Deep-Sea Archaeology. Part 1: Fieldwork & Site History'. In G. Stemm and S. Kingsley (eds.), *Oceans Odyssey. Deep-Sea Shipwrecks in the English Channel, Straits of Gibraltar & Atlantic Ocean* (Oxford, 2010), 1-24.
 De Bow, J.D.B., *De Bow's Review of the Southern and Western States, Vol. X* (New Orleans, 1851).
 De Bow, J.D.B., *Industrial Resources, Etc, of the Southern and Western States, Vol. 2* (New Orleans, 1852).
 Dodsworth, R., *Glass and Glassmaking* (Princes Risborough, 2003).

- Ewins, N., "Supplying the Present Wants of Our Yankee Cousins...". *Staffordshire Ceramics and the American Market 1775-1880* (Journal of Ceramic History 15, Stoke-on-Trent City Museum and Art Gallery, 1997).
- Fike, R.E., *The Bottle Book: a Comprehensive Guide to Historic, Embossed Medicine Bottles* (Salt Lake City, 1987).
- Ford, B., Borgens, A. and Hitchcock, B., 'The 'Mardi Gras' Shipwreck: Results of a Deep-Water Excavation, Gulf of Mexico, USA', *International Journal of Nautical Archaeology* 39.1 (2010), 76-98.
- Forsyth, C.J., *The American Merchant Seaman and his Industry: Struggle and Stigma* (London, 1989).
- Gillett, R., *Global Study of Shrimp Fisheries* (Fisheries Technical Paper 475, Food & Agriculture Organization of the United Nations, Rome, 2008).
- Godden, G. A., *Godden's Guide to Ironstone, Stone & Granite Wares* (Woodbridge, Suffolk, 1999).
- Graham, J.T., *Scales and Balances* (Princes Risborough, 2003).
- Hawley, G., *Treasure in a Cornfield* (Kansas, 1998).
- Holcombe, H.W., *Patent Medicine Tax Stamps* (Lawrence, MS, 1979).
- Hopkins, A.A. (ed.), *The Scientific American Cyclopedia of Formulas* (New York, 1913).
- Hunter, R.R. and Miller, G.L., 'English Shell-Edged Earthenware', *The Magazine Antiques* 145.3 (1994), 432-43.
- Hunter, R. and Miller, G., 'Suitable for Framing: Decorated Shell-Edge Earthenware', *Early American Life* (August 2008), 8-19.
- Jervis, W.P., *A Pottery Primer* (New York, 1911).
- Jones, T.N., *The Mica Shipwreck: Deepwater Nautical Archaeology in the Gulf of Mexico* (MA Thesis, Texas A&M University, 2004).
- Kennett, J., *Marine Geology* (Prentice Hall, 1982).
- La Guardia, F.H., *A Maritime History of New York* (New York, 1941).
- Laing, A., *Seafaring America* (New York, 1974).
- Lawrence, R.W., *Archaeological Investigations at Beaufort Inlet: A Summary of Submerged Cultural Resource Surveys and Investigations at Beaufort Inlet, North Carolina* (Underwater Archaeology Branch, Department of Cultural Resources, State of North Carolina, 2007).
- Lobell, J.A., 'The Hidden History of New York's Harbor', *Archaeology* 63.6 (2010): <http://www.archaeology.org/1011/etc/wtc.html>.
- MacGregor, D.R., *The Schooner: its Design and Development from 1600 to the Present* (London, 2003).
- Marx, R.F., *Shipwrecks of the Western Hemisphere: 1492-1825* (New York, 1975).
- Mathewson, R.D., *Treasure of the Atocha* (London, 1986).
- McDougall, D.P., 'The Bottles of the Hoff Store Site'. In A.G. Pastron and E.M. Hattori (eds.), *The Hoff Store Site and Gold Rush Merchandise in San Francisco, California* (Society for Historical Archaeology, Special Publication Series, No. 7, 1990).
- McKearin, G.S. and McKearin, H., *American Glass* (New York, 1941).
- McKearin, H. and Wilson, K., *American Bottles and Flasks and their Ancestry* (New York, 1978).
- McKinnon, J., 'Creating a Shipwreck Trail: Documenting the 1733 Spanish Plate Fleet Wrecks'. In J.H. Jameson and D.A. Scott-Ireton (eds.), *Out of the Blue. Public Interpretation of Maritime Cultural Resources* (New York, 2007), 85-94.
- Meide, C., McClean, J.A. and Wiser, E., *Dog Island Shipwreck Survey 1999: Report of Historical and Archaeological Investigations* (Florida State University, 1999).
- Miall, A.D., Balkwill, H.R. and McCracken, J., 'The Atlantic Margin Basins of North America'. In A.D. Miall (ed.), *The Sedimentary Basins of the United States and Canada* (Oxford, 2008), 473-504.
- Miller, G., 'Classification and Economic Scaling of Nineteenth-century Ceramics'. In M. Beaudry (ed.), *Documentary Archaeology in the New World* (University of Cambridge, 1988), 172-83.
- Miller, G., 'A Revised Set of CC Index Values for Classification and Economic Scaling of English Ceramics from 1787 to 1880'. In D.R. Brauner (ed.), *Approaches to Material Culture Research for Historical Archaeologists* (Society for Historical Archaeology, United States, 2000), 86-110.
- Morris, P.C., *American Sailing Coasters of the North Atlantic* (Chardon, 1973).
- Murphy, L.E. and Jonsson, R.W., 'Environmental Factors Affecting Vessel Casualties and Site Preservation'. In L. Murphy (ed.), *Dry Tortugas National Park Submerged Cultural Resources Assessment* (National Park Service Submerged Cultural Resources Unit, Santa Fe, 1993), 96-110.
- Parker, J.P., *Sails of the Maritimes* (Slough, 1960).
- Potter, J.S., *The Treasure Diver's Guide* (New York, 1972).
- Pratt, R.M. and Heezen, B.C., 'Topography of the Blake Plateau', *Deep Sea Research and Oceanographic Abstracts* 11.5 (1964), 721-28.
- Richardson, J., *The Young Sea Officer's Sheet Anchor: Or a Key to the Leading of Rigging, and to Practical Seaman-ship* (unabridged reproduction of 2nd edition by Darcy Lever, New York, 1998).
- Rickard, J., *Mocha and Related Dipped Wares, 1770-1939* (University Press of New England, 2006).

- Shaw, D.W., *The Sea Shall Embrace Them: the Tragic Story of the Steamship Arctic* (New York, 2002).
- Sheridan, R.E., 'The Passive Margin of the U.S.A.', *Episodes* 10.4 (1987), 254-58.
- Smith, R.C., Bratten, J.R., Cozzi, J.C. and Plaskett, K., *The Emanuel Point Ship. Archaeological Investigations 1997-1998* (University of West Florida, 1998).
- Spillman, J., 'Sunken Treasure: the SS Republic', *The Glass Bulletin Club of the National American Glass Club* 204 (2006), 13-17.
- Stiles, M.L., Harrould-Kolieb, E., Faure, P., Ylitalo-Ward, H. and Hirshfield, M.F., *Deep Sea Trawl Fisheries of the Southeast US and Gulf of Mexico: Rock Shrimp, Royal Red Shrimp, Calico Scallops* (Oceana, 2007).
- Swinton, W., *History of the Seventh Regiment, National Guard, State of New York, during the War of the Rebellion (Vol. 7)* (Memphis, 2009).
- Sudbury, J.B., 'White Clay Pipes from the Old Connellsville Dump, 36 fa 140', *Historic Clay Tobacco Pipe Studies* 1 (2006), 23-28.
- Thurston, G.H., *Pittsburgh and Allegheny in the Centennial Year* (Pittsburgh, 1976).
- Tolson, H., Gerth, E. and Cunningham Dobson, N., 'Ceramics from the "Blue China" Wreck'. In R. Hunter (ed.), *Ceramics in America* (Chipstone Foundation, Milwaukee, 2008), 162-83.
- Tomlinson, C., (ed.), *Cyclopaedia of Useful Arts, Mechanical and Chemical, Manufactures, Mining, and Engineering, in Three Volumes, Volume I* (London, 1854).
- Tryckare, T., *The Lore of Ships* (New York, 1963).
- Van den Bossche, W., *Antique Glass Bottles: their History and Evolution (1500-1850)* (Woodbridge, 2001).
- Van Hoeson, W.H., *Crafts and Craftsmen of New Jersey* (New Jersey, 1973).
- Walker, I.C., 'TD Pipes – a Preliminary Study', *Archaeological Society Quarterly Bulletin* 20.4 (1966), 86-102.
- Walter, J.F., *Low Country Hurricanes. Three Centuries of Storms at Sea and Ashore* (University of Georgia Press, 2006).
- Watson, J.F., *Annals of Philadelphia, and Pennsylvania in the Olden Time* (Philadelphia, 1884).
- Watson, J.W., Workman, I.K., Taylor, C.W. and Serra, A.F., *Configurations and Relative Efficiencies of Shrimp Trawls Employed in Southeastern United States Waters* (NOAA Technical Report NMFS 3, 1984).
- Williams, L.W., *Sandwich Glass* (Bridgeton, Connecticut, 1922).
- Wilson, H., *Trow's New York City Directory for the Year Ending May 1, 1857* (New York, 1857).
- Zumwalt, B., *Ketchup, Pickles, Sauces: 19th Century Food in Glass* (Fulton, 1980).