

Archaeological and Biological Examination of The Bronze Pin Wreck (8MO1879) off Grassy Key, Monroe County, Florida: an Interim Report

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Principal participants included Debra Shefi, Dr. Roger Smith, and Daniel McClarnon of the Bureau of Archaeological Research (BAR); and Brenda Altmeier, Program Support Specialist for the Florida Keys National Marine Sanctuary (FKNMS). Valuable assistance for the project was provided by Dave Score, John Halas, and David Becker of the Florida Keys National Marine Sanctuary, and Dr. Tim Runyan from National Oceanic Atmospheric Administration's (NOAA) Maritime Heritage Program.



Figure 1. Project Team from left: Brenda Altmeier, Roger Smith, Dan McClarnon, and Debra Shefi.

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Introduction

Local Key Colony Beach residents Dr. Robert O. Stafford and Charles B. Collins, members of the Society for Ocean Studies, reported the wreck to Roger Smith in 1988. Stafford and Collins referred to the site as the Copper Pin Wreck and published their preliminary description and sketch diagram of the site in the Society's newsletter *Archipelago* (Vol. 3, No. 2, 1989). Robert Weller later reported the wreck in his 2001 permit (FKNMS-99-068) report to the Florida Keys National Marine Sanctuary calling it the Bronze Pin Wreck. Weller provided a location, a brief site description and a sketch diagram, but no follow-up survey was conducted on the site. The site was also included in the *Atlas of Maritime Heritage Resources, Florida Keys National Marine Sanctuary*, which was produced under contract for the Sanctuary by Dr. James J. Miller in 2006. In October of 2004 Bureau staff visited the site and confirmed the wreck had potential for further research.

The Bronze Pin Wreck, designated 8MO1879, is situated in the sand and seagrass flats on the northern edge of Hawk Channel and is characterized by coral encrusted ballast stones, remnants of iron frames, and the partially buried lower wooden hull of a 19th century sailing ship that ran aground. The wreck was subsequently salvaged by contemporary wreckers. Today, the site serves as an artificial reef supporting a large assortment of marine life. The project to survey and map the site was undertaken by BAR archaeologists between July 14th and August 4th, 2008.

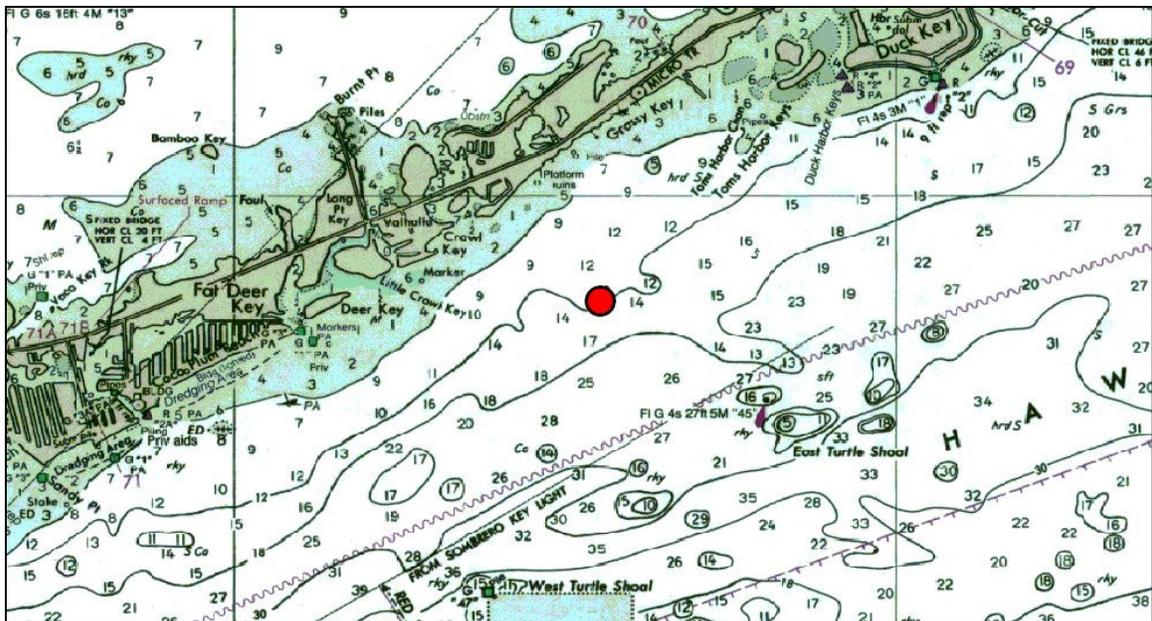


Figure 2. Location of Bronze Pin Wreck, 8MO1879. (Nautical Chart 11452, "Alligator Reef to Sombrero Key," U.S. Dept. of Commerce, NOAA, National Ocean Service Coast Survey, Dec. 4, 1999).

Research Design and Proposal

Given the cooperative relationship between staffs of FKNMS and BAR resulting from a 1988 Programmatic Agreement (between NOAA and the State of Florida for Historical Resource Management in the FKNMS), it was proposed that the two staffs continue to work together to record and assess known shipwrecks within the Sanctuary. The Research Design submitted to NOAA in 2007 briefly described the Bronze Pin Wreck and its current status. Photographs of the ship's surviving structure and site features were included. Cooperation was requested by Roger Smith to assemble staff from both agencies, consisting of a team of archaeologists to investigate, document, and study the remains of the shipwreck.

Site plans, cultural and natural inventories, underwater photographs, and videos would be utilized to assess the shipwreck and its management needs. Historical research both in the Florida Keys and the State Library of Florida would be conducted. Assessment data would be assembled to produce a report detailing the ship's history, overall condition, and suggestions for future research and minimizing visitor impact on cultural and natural features.

The following timeline of objectives and tasks was proposed:

Objective 1: Initiate project (October – December 2007)

Task 1: Assemble team members

Task 2: Secure field accommodations and travel arrangements

Objective 2: Conduct historical research (January – June 2008)

Task 1: Conduct oral interviews with local informants

Task 2: Document the history of the Bronze Pin Wreck

Objective 3: Inspect and assess the Bronze Pin Wreck (July – August 2008)

Task 1: Relocate the vessel and establish a temporary mooring system onsite

Task 2: Survey and document features of the sunken ship

Task 3: Create a site plan from data collected

Objective 4: Assemble historical and archaeological data (May – September 2008)

Task 1: Assemble historical information

Task 2: Discuss management strategies for protecting site

Objective 5: Prepare, print, and disseminate report on findings (September – December 2008)

Task 1: Write final report

Task 2: Print final report

Task 3: Update Florida State Master Site File and Maritime Heritage Resource Inventory of the FKNMS

Task 4: Deliver copies of report to interested parties

Bronze Pin Wreck Project

A plan of action for 20 days of fieldwork from July 14 to August 4, 2008 called for assembling a team of researchers consisting of Debra Shefi, Roger Smith, and Dan McClarnon of BAR, and Brenda Altmeier of FKNMS. The team gathered at a house located in Key Colony, just east of Marathon. The house, serving as field headquarters, was located alongside a canal, allowing the team to dock their work boats at headquarters. Survey equipment, including two state boats (R/V *Workhorse* & R/V *Scout*), accompanied the state team and diving gear was supplied by both agencies. Accommodations and air fills were provided by funds from NOAA's Maritime Heritage Program.



Figure 3. Field headquarters and work boats, R/V *Scout* and R/V *Workhorse*.

Fieldwork

Diving operations

Diving operations were planned and supervised each day by the Bureau's Dive Safety Officer. A dive briefing was provided daily, which included the day's objectives, dive schedules, safety and hazard information, emergency plan, and any additional information required by NOAA Diving Standards and Procedures. All standard NOAA operating procedures were met. Safety equipment, including first aid and oxygen was carried by both boats, as well as NOAA's Emergency Dive Management Plan and emergency contact information.

Each day R/V *Workhorse* (21-ft. Offshore) and R/V *Scout* (18-ft. Angler) traveled in company to the location of the Bronze Pin Wreck site and moored to a temporary mooring ball installed for the project. Once on site, diving operations consisting of buddy teams using open-circuit SCUBA proceeded from the two vessels. A dive log was

maintained throughout the project for all divers. Because the depth of the site is less than 30 feet, decompression limits were not applicable. Divers had approximately 46 hours of total bottom time during the period of the project; a full day of fieldwork included two dives on site.

Mapping

Archaeologists laid a baseline along the centerline of the site. This method remains the primary tool for documenting structural elements and orienting divers to certain areas of the shipwreck site. A survey tape in decimal feet was used for the baseline which extended along the longitudinal axis of the site and beyond the visible wreck remains in order to encompass the entire shipwreck assemblage. The baseline measured 172 feet in length and was tied to iron stakes placed along an axis of 130° magnetic north; each end of the baseline served as a datum point. The zero point of the baseline tape was established more than 15 feet seaward of the farthest protruding structural element in order to incorporate shipwreck scatter. Measurements using 90° offsets were taken at 20-foot intervals along the baseline to reconstruct the outermost edges of the site in plan view. Similar measurements using 90° offsets were also taken to reconstruct the outermost edges of the sand and seagrass beds.

Archaeologists used trilateration to map the iron frames and then recorded the exposed shipwreck timbers in relation to the baseline. Exposed remains of the site were



drawn by hand on Mylar® and were recorded by feature type and then transposed onto the overall site plan. Drawn to a scale of 40:1, the plan depicts the exposed ship timbers, iron frames, ballast, and other material. Detailed feature drawings of the stern and Frame 4 are also included at a scale of approximately 10:1 (see Appendix 1).

Figure 4. Archaeologist mapping ship structure.

Metal detector survey

Two metal detector surveys were conducted on site. One survey was conducted around the periphery of the hull remains in search of buried iron frames and/or iron frames masked by growing coral and concretions. Pin flags were used to mark locations of targets registered during the metal detector survey. The second survey was conducted to provide archaeologists with the overall length and breadth of the vessel. Pin flags were used to mark the outer most points along the centerline of the vessel as well as the widest

points across the center of the site. Archaeologists measured the distance and bearing of the pin flags between the two datum points.

Photographic recording

The site was recorded using extensive digital still photography and digital video. Plan view photos, profile photos, work shots both above and below water, and marine life photos were taken. Still and video photographers included State and Federal staff.

Marine Life Survey

Brenda Altmeier of FKNMS examined the wreck site to create a species inventory of pelagic and resident marine life located on site (see Appendix 2). The diversity and variety of species throughout the site demonstrates the synergetic relationship between the cultural resources and the natural resources. Many of the vertebrates were juveniles using the shipwreck as a nursery.

Site Description

The Bronze Pin Wreck is approximately one mile off Grassy Key in the Middle Florida Keys. The site has an average depth of 14 feet and is located in the intermediate shallows of Hawk Channel. The Bronze Pin Wreck lies in a shallow sand pocket and is approximately 130 feet long by 30 feet wide, oriented in a northwest/southeast direction. The pocket is surrounded by a variety of seagrasses including Manatee and Turtle Grass. The bottom sediments are composed of coral cobbles, shell hash, and carbonate sand. Visibility is influenced by tidal currents and weather; this time of year the site is exposed to prevailing winds from the southeast to southwest.

Site Features

The Bronze Pin Wreck is oriented southeast by northwest (130° magnetic north) with the bow pointing seaward. The majority of the site lies buried under sand and ballast. Copper-alloy fasteners, rectangular iron reinforcing frames, and a vertical section of the standing rigging are the most prominent features on the site. The “Bronze Pin” was named after the exposed copper-alloy fasteners; due to their composition, these fasteners tend not to attract concretions. The iron reinforcing frames range in size from less than 2 feet to more than 6 feet in length. Two of these frames stand perpendicular to the sand. Other features recorded include concreted iron fasteners, ceiling and hull planking, wooden frames, and a hawsepipe. Also exposed are portions of the bow and stern. In addition, concretions, ballast, large corals, and copper sheathing were recorded.

Architecture and Other Features

Stern

The eroded, worm-eaten wood exposed in the stern portion of the site cannot definitively be labeled the keelson; it is possible that this is deadwood between the keel and the missing sternpost. Hand fanning was used to further expose the structural remains but, without key elements such as the sternpost, rudder fittings, or additional elements of the stern assembly it is difficult to tell exactly what portion of the stern remains. For the purpose of this report the wooden remains will be referred to as the keelson.

The stern, as well as the remains of the ship, runs at 130° magnetic north. Although there was no evidence of a sternpost, the exposed section revealed four narrowing tail frames on the starboard side, set at an acute angle, bolted to the keelson. Between the keelson and tail frames are ceiling planks fastened down with alternating pairs of iron and copper-alloy bolts. Due to the deterioration, no sided-thickness or molded-heights could be determined.

Additionally, there are two cut-outs in the stern section around two of the copper-alloy bolts, which may indicate a re-fitting of the vessel in which the copper-alloy fasteners were added alongside the iron fittings. Just forward of the exposed wood are additional iron fasteners in line with those of the stern. These fasteners are surrounded by a number of concreted ballast conglomerates.

Bow

A series of copper-alloy bolts and iron bolts associated with remnants of wooden cant frames suggest that the southeast area of the site represents the bow. In the bow, along the port side, there are five wooden frames partially exposed. The forward three frames are clearly rising steeply. Additionally, the forward two frames are compass timbers, with the center grain of the tree still visible. These two frames do not have any space between them but are separated by an aggregate filling. Also in the bow is a thin, flat metal wedge between the ceiling planking and the frames. Additional features include a square nail hole, a tool mark in the frame near the square nail hole, and loose, disarticulated iron fasteners.



Figure 6. Image of fasteners and wooden frames looking from the bow towards the stern.



Figure 5. View looking from the stern towards the bow.

In addition to the frames there are two wooden parallel planks exposed in the bow, one ceiling and one which may be the sister keelson. There is also evidence of wood running down the centerline of the vessel but it is badly deteriorated and therefore difficult to discern if this is in fact the keelson.

Also in the bow is a vertical, spire-like section of encrusted wire-ropes, 12 feet in height from the base of the scour pit up to 7 feet below the surface of the water. Based on its location this may be a portion of the standing rigging associated with the bowsprit such as a head stay or martingale. The martingale was a part of the standing rigging that strengthened the bowsprit and jib boom against the force of the head stays.



Figure 7. Standing rigging and view of bow.

Iron Frames



Figure 8. Starboard side frame.

There are the remains of twelve iron reinforcing frames: five frames on the port side, six on the starboard side, and a dislodged iron frame located on the edge of the sand pocket. The frames appear to have been inserted sometime after the ship was built and fastened to existing wooden frames and futtocks with heavy copper-alloy bolts. These frames extend from the floor up to the turn of the bilge to reinforce the ship below the waterline.

Spaced approximately 10 feet apart on both port and starboard, the frames average 3 inches in molded-height and between 4 and 6 inches in sided-thickness. All are heavily encrusted with hard and soft corals. Two of the frames have been displaced from their original position, one lying flat on the seabed, Frame 1, and the second being the dislodged frame lying approximately 28 feet away. Exposed

frames measure in length from 18 inches to 82 inches.

The dislodged frame lying along the edge of the sand pocket was found with a rope tied around it, as if purposely removed. This may be the sixth frame from the port side, suggesting that there were six iron-reinforcing frames on each side of the vessel.

Frames 4 and 5 appear to be turtle scratching stations. Frame 4, which is located on the port side, is 78 inches in length, and has remnants of three copper-alloy fasteners spaced approximately 20 inches apart along its length. The underside of the frame has prominent, concave shapes worn into the iron as well as exposed, worn copper-alloy bolts, which show obvious signs of wear from sea turtles rubbing their dorsal carapaces against the structure to remove parasites. This activity has exposed wooden ceiling planks and frames below the iron frame and the copper-alloy pins associated with these timbers have also been worn down by turtles rubbing their plastron against the pins and

ballast stones. Frame 5, which is 72 inches in length, also shows extreme wear on its underside from turtle scratching activities.



Figure 9. (left) Port side frame showing evidence of turtle scratching. (right) Copper-alloy fastener rubbed down as a result of turtle scratching.

Iron Knee



Figure 10. Iron reinforcing knee.

An iron reinforcing knee was noted on the starboard side between Frame 8 and Frames 6 and 7 (Frames 6 and 7 are part of the same broken frame). The iron reinforcing knee has similar sided and molded dimensions to the iron frames, 3 inches molded and 4 inches sided, and is also fastened with copper-alloy bolts.

This is the only knee located on site and appears to be a hanging knee that became displaced from the hull. No lodging knees were visible.

Hawsepipe

An oblong object, located midships, is believed to be an in-deck hawsepipe with the following dimensions: the outer diameter of the pipe is 1 foot, 4 ½ inches by 1 foot, 6 inches across and 7 inches deep. The hawsepipe only has one lip which is 3 inches in width and 1 inch in depth. Based on the location of the hawsepipe at midships, it may indicate that this was an internal-deck hawsepipe as opposed to a more commonly found gunnel hawsepipe located in the bow.



Figure 11. Hawsepipe.

Floor Frames



Figure 12. Frames under Frame 4, along port side.

The floor frames, where they can be measured, are consistently 10 inches in sided-thickness and 10 inches in molded-height. They tend to be tightly spaced throughout, with space ranging from no space to 2 inches. Floor frames are found in the bow along the port side, in the stern on the port side, and on both the port and starboard midships.

Planking

Ceiling planking is observed in the stern, midships, and in the bow. It appears to be 2 inches thick throughout and is 10 inches wide at midships. Hull planking is located along the port and starboard sides, each measuring 3 inches thick.

Copper Sheathing

On the starboard side, between Frames 9 and 11, a run of copper-alloy sheathing was observed fastened to the hull planking. The sheathing was initially thought to be lead due to its grey color however, after careful examination it appears to be copper-alloy, and its placement and extent suggest that the entire ship may have been sheathed below the waterline as opposed to isolated patches.



Figure 13. Hull sheathing and sheathing tack.

Fasteners



Figure 14. Planking nail.

The ship was fastened with a combination of wooden, copper-alloy, and iron fasteners. The wooden floor frames were fastened with iron drift bolts and copper-alloy bolts, each 1 ¼ inches in diameter. The ceiling planking was fastened with square-shaped, square-headed planking bolts and copper-alloy bolts. Treenails were found throughout the ship. Some of the copper-alloy fasteners in the bow show evidence of a clenched ring around the shank of the bolt which would act as a stopper when the bolt was placed through the wood. Other fasteners in the bow, called rivets, also have a collar on the opposite end from the clenched ring. The rivets are essentially driftbolts with clenched rings on both ends. The copper-alloy sheathing nails are round



Figure 15. Copper-alloy pins located in the bow.

in cross section and have flat heads. Copper-alloy square dump bolts are longer than the sheathing nails, which may have been used to hold together elements of the superstructure of the vessel. An iron wood screw was located in the stern, which suggests it was also part of the upperworks superstructure.

The copper-alloy bolts appear to have been added after the ship was built because there is no consistent pattern in relation to the iron fasteners throughout the ship. A sample of fasteners was removed from the site for further analysis and documentation (See Appendix 3).

Artifacts

During investigations of the Bronze Pin Wreck, archaeologists located a pottery sherd amongst the ballast in the stern. Additional artifacts recovered include a sample of fasteners (discussed above) and a sample of what is thought to be early Muntz metal. The muntz metal was recovered from the base of Frame 10 and photographed. Further analysis will be conducted by a metallurgist to determine the composition of the metal.

Ballast

The ballast is distributed throughout the ship. Smaller ballast is found loosely across the site as well as larger stones which are found in concentrated clumps around areas that have iron fasteners. There are also large cut ballast stones, but nothing larger than one person can handle.

Ballast forward of midships appears to have been moved from the centerline to either side. This could be a result of modern day salvage activity. There is also a large scatter of ballast throughout the seagrass along the aft port side of the site. It is generally fist-sized ballast which may have been dispersed during a storm surge. The amount of ballast in the ship reinforces the notion that it was a sailing ship.



Figure 16. Sample of ballast from midships.

Researchers took 21 ballast samples to Guy “Harley” Means of the Florida Geological Survey for analysis and possible identification. The majority of the sample is a type of metamorphic rock, with both high and low grade rocks. The metamorphic rock types include chlorite, gneiss, slate, quartzite, and basalts. There are also igneous rocks, silica from within an igneous rock and an ultramorphic, intrusive igneous rock. Means notes that the samples did not include any sedimentary rock. The high concentration of metamorphic rock suggests that much of this ballast came from glacial area, perhaps the Great Lakes, Piedmont, or Appalachia.

Intrusive Material

A number of intrusive objects were found on site: a cinder block aft of midships; two lobster pot ballast slabs, one port side, amidships and the second in the seagrass midships; lobster pot polypropylene line throughout the site; monofilament fishing line throughout the site; fishing leaders located throughout the ballast; and a wheel hub in the seagrass.



0 Feet 8
 Bronze Pin Wreck
 SMO1879
 Florida Bureau of Archaeological Research
 July 2008

Interpretation

Historical Context

Nineteenth-Century Florida Keys

Prior to the transfer of Florida to the United States, the Florida Keys were home to a mix of international fisherman and wreckers who recognized the area for its fishing, turtling, and wrecking potentials.¹ The majority of these people were Bahamians but New England fisherman began to realize the vast opportunities that lay south and thus extended their winter fisheries to the Carolina's and Florida's coasts.² The fishing industry in the Keys was a cost-effective commodity and thus, began to draw more and more attention. To supplement their incomes, many fishermen turned to wrecking; the opportunity to salvage in the Keys was frequent and often proved to be more lucrative than fishing.

Shortly after the U.S. obtained Florida, Americans began to complain to the government "that the Keys had become the resort of wreckers [Bahamians] and pirates," and as a result, in 1821, the United States established an official wrecking station in Key West to monitor and regulate activities in the area.³ Due to it's proximity to the Cuban markets, the abundant fishing in the area, and the opportunity for wrecking, Key West became a rapidly developing settlement. Many American families began migrating down to the Upper and Lower Keys to participate in the lucrative business of wrecking and local fishing; the Middle Keys remained the least populated area. To rival the vast competition in Key West, development began to extend towards the Upper Keys and other islands closer to where a large majority of shipwrecks occurred.

Following the Civil War, the Florida Keys were in a period of transition; commercial traffic increased, passenger freighters increased, sponge collecting and cigar making increased, the Overseas Railroad was introduced, and construction began to boom. The railroad allowed for increased accessibility to the area, a rapid development of a new, local culture, and with it an increase in population. The sponge industry, which gained popularity in the mid-Nineteenth century, eventually supplanted wrecking in economic value in the Keys.⁴ The construction of lighthouses throughout the Florida Keys also assisted in the decrease of wrecked vessels along the reef, resulting in a decline in the wrecking industry over the decades following the war.⁵

Bronze Pin Wreck

During the late 19th century, a wooden sailing boat re-enforced with iron frames, copper-alloy pins, and copper went aground, either in foul weather or at night along the

¹ John Viele. 2001. *The Florida Keys Volume 3: The Wreckers*, Sarasota, Fla. Pineapple Press: 25.

² Ibid.

³ Ibid.

⁴ Janus Research, "A Cultural Resource Assessment Survey of US 1/SR 5 Corridor Turn Lanes and Intersection Improvements on Little Duck Key, Knight Key/Marathon, Long KeKey/Marathon, Long Key, and the City of Layton," St. Petersburg, FL, May 2002. 153.

⁵ Viele. 168 – 171.

northern edge of Hawk Channel, approximately one mile offshore of Grassy Key in the Middle Florida Keys.

Archaeologists place the sinking of the vessel during the 19th century because of a Grooved Brain Coral, 103 cm in diameter, growing over a conglomerate of ballast. These coral heads grow at approximately 1 cm per year, suggesting the site is at least 100 years old.

Due to the warm, shallow waters in the Middle Keys, the superstructure and upper works deteriorated. Most likely, the ship quickly disintegrated as shipworms ate the wood and the remainder of the vessel was impacted by the high dynamic environment. Although the upper works are no longer present, portions of the lower hull are accessible. The exposed structure in the stern contains cut-outs in the wood suggesting that the vessel was re-fitted with the copper-alloy bolts. Additionally, there is no consistent pattern between the iron fasteners and copper-alloy bolts – in the stern the two types of fasteners are paired together but at midships copper-alloy bolts are paired together. This inconsistent pattern suggests that copper-alloy bolts were inserted in areas that needed reinforcement.

Due to the lack of artifacts located on site it is difficult to determine what kind of cargo the sailing ship carried. The vessel's close proximity to shore, and location in shallow water, allowed contemporary and modern wreckers to thoroughly salvage the site, leaving very little behind.

Using an underwater metal detector, archaeologists followed a line of ferrous material beneath the sand to help determine the overall dimensions of the vessel. The ship appears to have been 130 feet long and at least 30 feet in beam, making it a long, narrow sailing ship, possibly carrying a shipment of copper rolls. Local resident, Dave Maimon of Key Colony, refers to this site as the "Copper Wreck," stating that in the past large rolls of copper, similar in size to contemporary hay barrels, were observed on site. The only existing copper on site other than the sheathing is a mashed, 1 foot by ½ foot section of copper, just outboard of the wreck remains.

How the ship was rigged cannot yet be determined because no mast steps were found and no running rigging components, such as chainplates, eyebolts, or deadeyes, were located. The only rigging observed was a piece of standing rigging in the bow. The wire-rope stands perpendicular to the seafloor, and is buried more than 5 feet below the surface of the substrate.

As for the identity of the Bronze Pin Wreck, a database recently compiled by Dr. Jim Miller from existing historical sources of ship groundings and losses in the Florida Keys was consulted.⁶ It contains listings for vessels that grounded or wrecked at and near Grassy Key but it does not list the name of the vessels; they remain unknown.⁷ Additional research is ongoing to determine the origins and identity of the ship.

⁶ James J. Miller. 2007. *Atlas of Maritime Heritage Resources: Florida Keys National Marine Sanctuary*, Tallahassee, James J. Miller, PhD, LLC.

⁷ Personal correspondence with Jim Miller, former State Archaeologist, 10 August 2008.

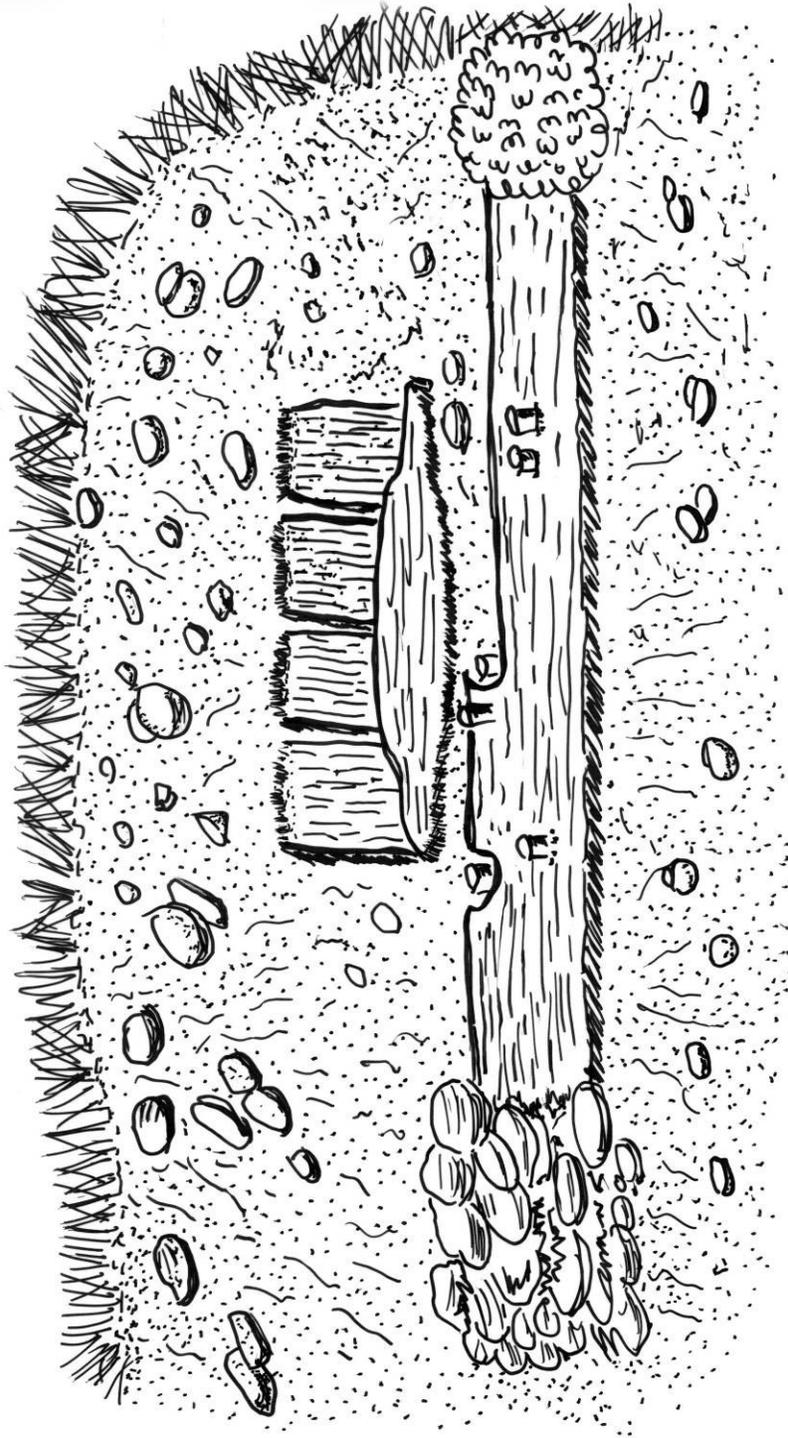
Recommendations

This report provides the results of an archaeological and biological examination of the Bronze Pin Wreck. The Bronze Pin Wreck represents a long, narrow composite-built or re-fitted ship that wrecked in the Florida Keys during the 19th century. Currently the majority of the lower wooden hull remains buried beneath the sand, but in its shallow-water environment is susceptible to exposure due to seasonal storms. It is recommended that the site be visited periodically by staff of the Florida Keys National Marine Sanctuary to monitor its condition and record any changes to its situation. Should a significant degree of wood hull become exposed or damage to the iron frames becomes apparent, planning for mitigation activities to prevent further damage should be undertaken immediately. Without appropriate measures for resource management, this site could become lost to time and nature.

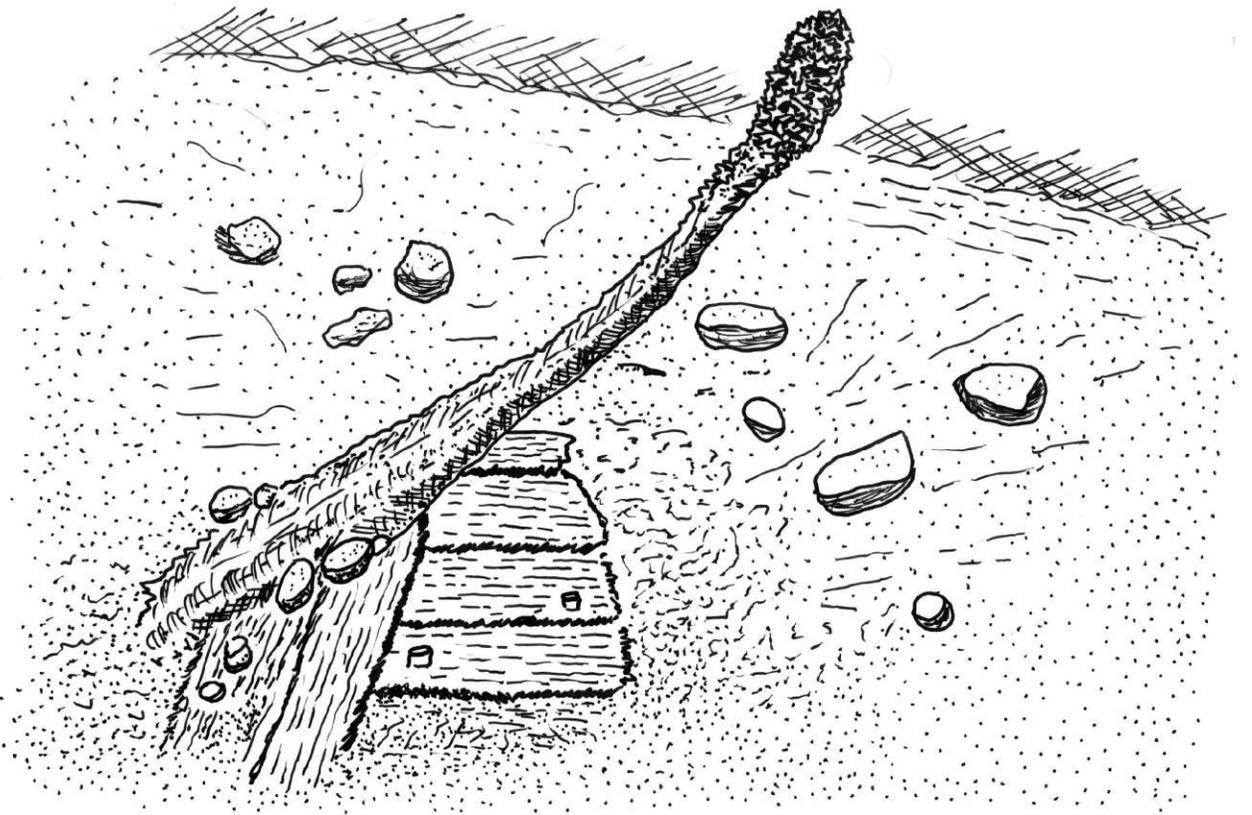
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Appendix 1
Site Drawings



View of stern looking towards the seagrass.



View of Frame 4 from the bow towards the stern.

Appendix 2 Biological Inventory

FISH

Bar Jack *Caranx ruber*
Bluestriped Grunt *Haemulon sciurus*
French Angelfish *Pomacanthus arcuatus*
Gag Grouper *Mycteroperca microlepis*
Gray Angelfish *Pomacanthus arcuatus*
Gray Snapper *Lutjanus griseus*
Gray Triggerfish *Balistes capriscus*
Great Barracuda *Sphyrna barracuda*
Green Moray *Gymnothorax funebris*
Highhat *Equetus acuminatus*
Hogfish *Lachnolaimus maximus*
Jolthead Porgy *Calamus bajonado*
Marbled Grouper *Bpinephelus inermis*
Neon Goby *Gobiosoma oceanops*
Nurse Shark *Ginglymostoma cirratum*
Ocean Surgeonfish *Acanthurus bahianus*
Pearl Blenny *Entomacrodus nigricans*
Porkfish *Anisotremus virginicus*
Rainbow Parrotfish *Scarus guacamaia*
Red Grouper *Epinephelus morio*
Rock Hind *Epinephelus adscensionis*
Sargassum Swimming Crab *Portunus sayi*
Schoolmaster Snapper *Lutjanus mahogoni*
Smallmouth Grunt *Haemulon chrysargyreum*
Southern Stingray *Dasyatis americana*
Spanish Grunt (Juvenile) *Haemulon macrostomum*
Spotted Moray *Gymnothorax moringa*
Spotted Scorpionfish *Scorpaena plumieri*
Striped Grunt *Haemulon striatum*
Yellow Stingray *Urolophus jamaicensis*



Gray Angelfish.



Nurse shark.

CRUSTACEANS

Arrow Crab *Stenorhynchus seticornis*
Banded Coral Shrimp *Stenopus hispidus*
Brittle Star (*Species Undetermined*)
Caribbean Reef Octopus *Octopus Briareus*
Christmas Tree Worm *Spirobranchus giganteus*
Florida Spiny Lobster *Panulirus argus*
Frons Oyster *Lopha frons*
Medusa Worm *Loimia medusa*

Pederson's Cleaning Shrimp *Periclimenes pedersoni*
Scaly-Tailed Mantis *Lysiosquilla scabricauda*
Sea Urchin (*Species Undetermined*)
Variegated Feather Duster *Bispira variegata*

CORAL

Corkscrew Anemone *Bartholomea annulata*
Giant Caribbean Anemone *Condylactis gigantean*
Great Star Coral *Montastrea cavernosa*
Grooved Brain Coral *Diploria labyrinthiformis*
Lumpy Porites *Porites asteroides*
Massive Starlet Coral *Siderastrea siderea*
Mustard Hill Coral *Porites astreoides*
Sea Plume *Pseudopterogorgia sp.*
Shallow-Water Starlet Coral *Siderastrea radians*
Star Coral *Montastrea annularis*
Symmetrical Brain Coral *Diplora strigosa*



103 cm Grooved Brain Coral (coral grows approximately 1 cm per year).

SPONGES

Black Ball Sponge *Ircinia strobilina*
Burgundy sponge *Amphemedon compressa*
Orange Encrusting Sponge *Diplastrella sp.*
Stinking Vase Sponge *Ircinia campana*

MARINE PLANTS

Flat-Top Bristle Brush *Penicillus pyriformis*
Green Alga *Avrainvilla sp.*
Large Leaf Watercress Alga *Halimeda discoidea*
Manatee Grass *Syringodium filiforme*
Neptune's Shaving Brush *Penicillus capitatus*
Turtle Grass *Thalassia testudinum*



Corkscrew Anemone, Pederson's cleaning shrimp, and Arrow Crab.

Appendix 3 Fasteners

Fasteners recovered include: a copper-alloy driftbolt, an iron driftbolt, a dump bolt, two iron nails, a screw, and a copper-alloy sheathing nail.



Fasteners from left: Copper-alloy driftbolt, iron driftbolt, dump bolt, iron nail, iron nail, screw, copper-alloy sheathing nail.



Copper-alloy Driftbolt.

Driftbolts were the largest, most durable fasteners located on the wreck site. This type of bolt would have been placed through the keelson into the keel. It would also be used as an extra-strong joint throughout the ship. The copper-alloy ring or washer is referred to as a clench ring, which helped to hold the bolt in place.



Iron Driftbolt.

Similar to the copper-alloy driftbolt, iron driftbolts were driven into an augured hole, not directly into the wood. Often these iron fasteners were hammered over clenched rings for additional support. The head and tip of the fastener were traditionally shaped by hammer.⁸

⁸ David L. Stone. 1993. *The Wreck Diver's Guide to Sailing Ship Artifacts of the 19th Century*. Underwater Archaeological Society of British Columbia: 33-35.



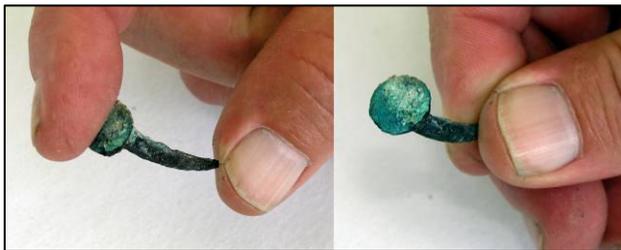
The dump bolt was driven into the wood for additional stability in conjunction with fasteners that extended through the planks into the frames. The dump bolt did not go through the full timber.

Dump bolt.



Iron nails, approximately 1½ to 2 inches in length, were the most abundant nails on the ship.

Iron nails.



Copper-alloy sheathing nails were used to secure the copper sheathing to the hull.

Copper-alloy Sheathing Nail.