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On the cover: Tommy Hailey of Northwestern University of Louisiana pilots his ultralight craft over the wreck site of the steamboat *Heroine* in Oklahoma's Red River. Photo: William Lees

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The *INA Quarterly* was formerly the *INA Newsletter* (vols. 1–18). Editor: Kirsten E. Jerch

News from the Red River: A Mid-Season Update on the Steamboat *Heroine*

Heather Brown and Kevin Crisman

Since 1999, researchers from the Institute of Nautical Archaeology have been studying the oldest example of a Mississippi River steamboat ever to undergo archaeological excavation. This vessel, called *Heroine*, was built in 1832 and enjoyed a lengthy career (for a Mississippi River steamer) running between Louisville, Kentucky and New Orleans. It was lost in the Red River in 1838 while carrying provisions to the U.S. Army garrison at Fort Towson in the "Indian Territory" (now Oklahoma). The boat began its final voyage at Vicksburg, Mississippi, and had successfully navigated several hundred miles up the tricky river channel, only to be fatally snagged on a submerged log a mere two miles (3.22 km) short of its destination.

The study of *Heroine* has been a joint project of INA, the Oklahoma Historical Society (OHS) and Texas A&M University (TAMU). During intensive excavations in 2003 and 2004, the boat's stern was fully documented, comprising 45 feet (13.72 m) of the ship's approximately 140-foot (42.67 m) length. The digging here yielded a collection of artifacts relating to the crew, passengers, cargo, and hull, and the steamboat's complete rudder was raised for study and eventual display by the OHS. The surviving paddlewheel machinery was also recorded, enabling TAMU Research Associate Glenn Grieco to begin work on a 1:10 working scale model of the propulsion system (see Grieco's article in this issue of *INA Quarterly*).

Fig. 1. *The joint OHS-TAMU-INA team set up the network of dredge hoses used to clear the river sediment from the wreck. Several feet of sand and accumulated tree branches needed to be cleared just to reach deck level in some areas. Photo: H. Brown*

Work on the wreck of the *Heroine* resumed in 2005 with a two-part study of the hull forward of the sidewheel axle. Our goal has been to clear the sand down to deck level as far forward as time and the river permit, documenting the deck structure and other features. The first phase of the project, a five-week TAMU field school in May and June, has been our most productive endeavor to date. Favored with excellent weather, low water and a hard-working team of archaeologists, not a day of diving was missed and the dredges ran nearly non-stop (fig. 1) as we worked our way up *Heroine*'s deck.

Three weeks into the project we reached amidships, and the course of our digging proceeded downward rather than forward. One factor in our decision to change directions was the discovery of two copper pipes at the top of the port side (we wanted to see what these pipes did). A second factor was intense curiosity about the structure of the cylinder timbers that once supported the piston and crank at the level of the main deck. The opportunity to learn more about the workings of the steamboat's machinery and assembly was simply too good to pass up.

Digging a trench across the hold amidships allowed us to measure internal stringers, frames, the keelson and a pair of sister keelsons, and to record a section across the hull. Beneath the cylinder timbers we discovered heavy vertical stanchions, wrought-iron rods, and diagonal cross-bracing that became standard in later designs. The copper pipes, it turned out, both exited the hull near the turn of the bilge and were probably used to supply the boilers with water.

Excitement ran high when a barrel head was found bearing the stencil "USA"(fig. 2), indicating the contents were intended for the U.S. Army. (According to Howard McKinnis of the OHS, it was not a common practice in the early 19th century to refer to the United States as "USA.") This barrel head was our first unequivocal proof that the steamboat was hauling government supplies up the Red River—which of course was *Heroine*'s mission when it was lost. This find was only the beginning of our barrel-related discoveries.

As the digging continued we were pleased to find a large cache of barrels that had survived in the hold. Some of the barrels were crushed or missing staves, but others were perfectly intact and still bound by their wooden hoops. Many appeared to lie in rows, as they were originally stowed by the crew. The outside dimensions of all the barrels were nearly uniform, but it was immediately obvious that two types were represented. The first had thin wooden staves, and was bound by only a few wooden hoops at the top and bottom. These barrels contained flour, and therefore did not have to be particularly strong or perfectly watertight. The second type had thicker staves, and was bound by rows of wooden hoops. These barrels were filled with salted pork in a brine solution, a commodity requiring heavily-built containers.

The heads of the pork barrels that we examined lacked obvious markings, but the flour barrel heads proved quite interesting. Besides several more examples of the "USA" stencil, at least two were branded "S FINE," indicating that they contained the high quality superfine flour stipulated in the government's contract. The carved or branded names "J. Phillips" and "W&R. Phares" may identify the merchants who supplied *Heroine*'s cargo. Research at the American Antiquarian Society in Worcester, Massachusetts, has already turned up one likely connection. Several of the flour barrel heads bore a small circular stencil in which the name "Armstrong" was legible. According to the 1837-1838 edition of the Cincinnati, Ohio directory, a James Armstrong was employed in the city as a flour inspector. This discovery reinforces other historical evidence that the provisions in *Heroine*'s hold were obtained in Cincinnati.

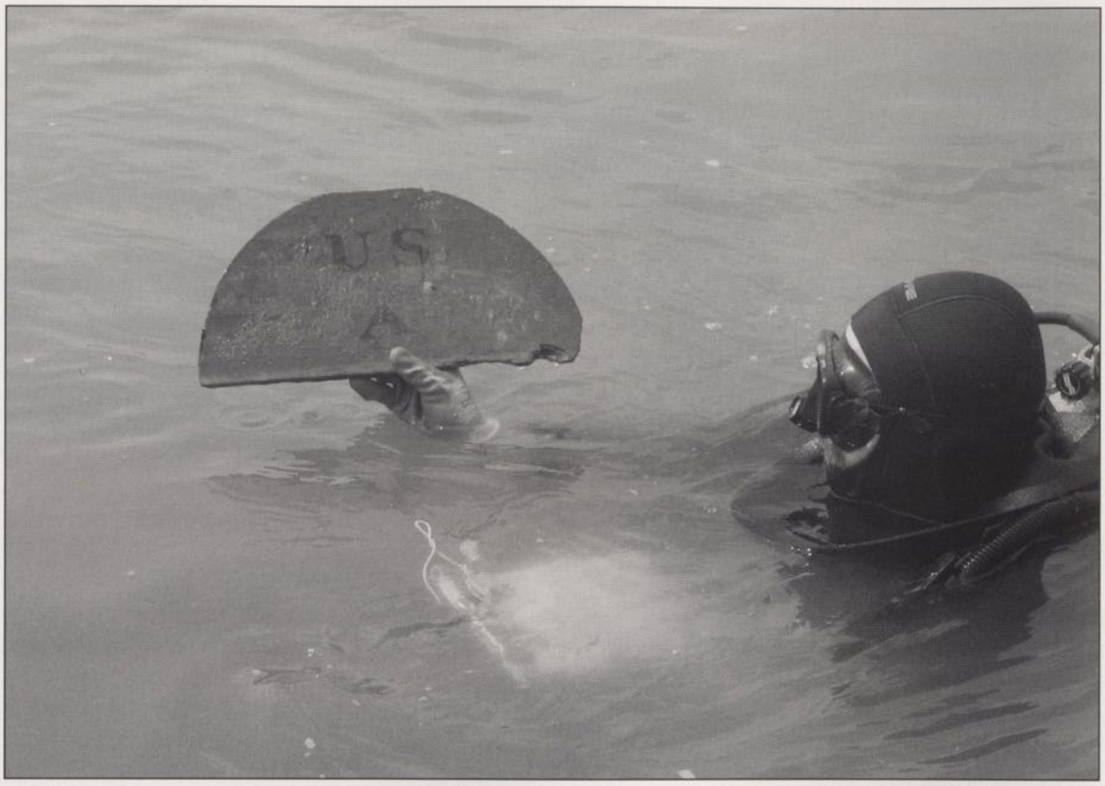


Fig. 2. *Principal investigator Kevin Crisman displays the barrel head bearing the stencil "USA," indicating its contents were intended for use by the U.S. Army. Photo: H. Brown*

We recovered the staves and heads of two crushed flour barrels, and also elected to raise, conserve, and study one intact pork barrel. TAMU Anthropology graduate student Jessi Halligan spent several days carefully digging around the selected barrel, tightly wrapping it in self-adhering "Ace" bandages as she went. The barrel was then removed in its entirety, with staves, heads and contents intact (fig. 3). Some of the fragile wooden hoops that once held the barrel together were even preserved in their original positions. The bung on the pork barrel had a metal cap and plug, the first example yet encountered on the wreck.

Fig. 3 (left). *John Davis of OHS and Nautical Archaeology Program graduate student Dan Walker haul a 167-year-old barrel of salted pork found on the wreck up the boat ramp. Considerable effort was put into preventing the barrel from breaking apart as it was removed from its supportive environment under water. Photo: H. Brown*

Fig. 4 (below). *Team members lower the smaller of two recovered iron flywheel fragments into its holding tank. The surviving portions of the wooden spokes were wrapped in wet towels to keep them from drying out during transport. Photo: H. Brown*

Other remarkable finds from the summer included two rim sections from the pair of massive iron flywheels at the center of the sidewheel axle (fig. 4). The sections had broken off during or slightly after the sinking and landed on the port side of the deck. One was nearly ten feet (3 m) in length, while the other was over six feet (1.8 m) and had two wooden spokes still attached. Their recovery posed some challenges to OHS logistical mastermind John Davis, for each rim weighed several hundred pounds. With the aid of heavy-duty lifting slings, a chain hoist and our pontoon barge, we were able to lift both pieces off the bottom and then deliver them safely on shore.

Our one other large-scale recovery project was the removal of a seven-foot (2.1 m) long section of the outboard main deck (the "guard") with railing, planking, molded guard plank, and deck beams. This piece, which still has red and black paint on its surfaces, will allow closer study of construction techniques, and after it is conserved will provide OHS museum visitors with a better sense of what the steamboat looked like.

The multitude of bricks that began to turn up on the very first week of digging in 2005 was completely unexpected (few bricks were found in 2003 and 2004). They emerged first from under the port guard aft of the paddlewheel, mostly in fragments and many noticeably charred on one side. We initially thought they were from the base of a galley stove in the stern, but their continued appearance forward of the paddlewheel has led to different hypotheses. It now

Fig. 5. *This painted iron box with a delicate orange floral motif was one of the few personal items found on the wreck during the summer. Surprisingly, it contained a cache of carpenter's nails, tacks and spikes. Photo: H. Brown*

seems likely that they either lined the fire boxes inside the boilers or were laid beneath the boilers to protect the wooden deck from catching fire. Several large iron sheets recovered in 2005, measuring approximately two feet (61 cm) square, may also have served as heat and spark shields around the boilers.

Barrels, flywheel pieces, bricks and sheets of iron illuminate the steamboat and its cargo, but it is the personal objects that reveal the crew and passengers. We found these types of artifacts, too, including the sole from a woman's shoe, a metal garment hook, and a brass straight pin. The most exciting of the personal finds was a small iron box recovered from under the port guard abaft the paddlewheel. The box, decorated in a style known as "tole," was painted black all over with orange flowers on the front (fig. 5). Speculation about its contents was rife among the field crew. Did it contain the steamboat's payroll, gambling tokens, or recipes for salted pork? The truth, revealed by the X-ray machine at TAMU's Conservation Research Laboratory, was more prosaic: the box was stuffed with spikes, nails, and tacks. Why, we now wonder, was the carpenter using this attractive little box for such a mundane purpose? With its delicate painting of flowers it was obviously intended to grace someone's household. Some questions in archaeology can never be adequately answered.

With the season only half complete at the time of writing, we are looking forward to continuing work in the fall of 2005. We plan to return in September and continue our excavation forward of amidships, and thereby find out much more about *Heroine*'s hull, machinery and cargo, as well as about the people who lived and worked aboard the steamboat when it navigated the rivers of the western frontier.

Acknowledgements: The work on *Heroine* has been supported by the contributions of many, many people, particularly among the faculty, staff, and students of the Institute of Nautical Archaeology, the Oklahoma Historical Society, and Texas A&M University. To all of you (and you know who you are), we extend many thanks. Funding for the project has been provided through the three above-named institutions, as well as by a federal grant administered by the Oklahoma Department of Transportation. *hgbrown@tamu.edu; kcrisman@tamu.edu*

Suggested Readings

Crisman, K.
2005 "The *Heroine* of the Red River," *INA Quarterly*, 32.2, 3-10

Crisman, K. and W. Lees
2003 "Beneath the Red River's Waters: The Oklahoma Stemboat Project, Part I," *INA Quarterly*, 30.2, 3-8

Grieco, G.
2005 "Modeling an Early Western River Steamboat Engine," *INA Quarterly*, 32.4, 7-11

Modeling an Early Western River Steamboat Engine

Glenn Grieco

In the early 19th century, marine steam transportation was in its infancy. The westward expansion of the United States necessitated more efficient transportation in order to supply the new settlements that were being established. Although the design of the engines used on western river steamboats was initially crude and inefficient, the technology used in them advanced quickly, and by the middle of the 19th century the science of steam engine design allowed for more efficient engines.

Prior to the introduction of the Bessemer process in 1855, which provided a method of producing steel in large quantities, amounts needed for the larger components of an engine such as the axles or piston rods were difficult to acquire. Unfortunately, the poor quality of the earlier engines is partly responsible for our lack of knowledge about them. Engineers resorted to cast iron for almost every part of the engine and boilers on board a steamboat. In addition to being extremely brittle, load-bearing surfaces would wear quickly. Iron axles in bronze bearings resulted in frictional forces that would have greatly limited the efficiency of the engines. It was also necessary to assemble the engines to very low tolerances. Because the vessels that were carrying the engines were designed to be very flexible to minimize damages caused by running onto snags and sandbars, the connections between engine linkages were intentionally designed to be loose or sloppy to allow for twists to the machinery that would bind tight connections. These earlier engines required constant maintenance and probably endless repairs. The brittle nature of iron also contributed to the common and catastrophic problem of steam boiler explosions. When an engine did fail or become unusable, the parts were often salvaged for use on other engines or for the iron itself, and due to this, there are no complete examples of these engines in existence today.

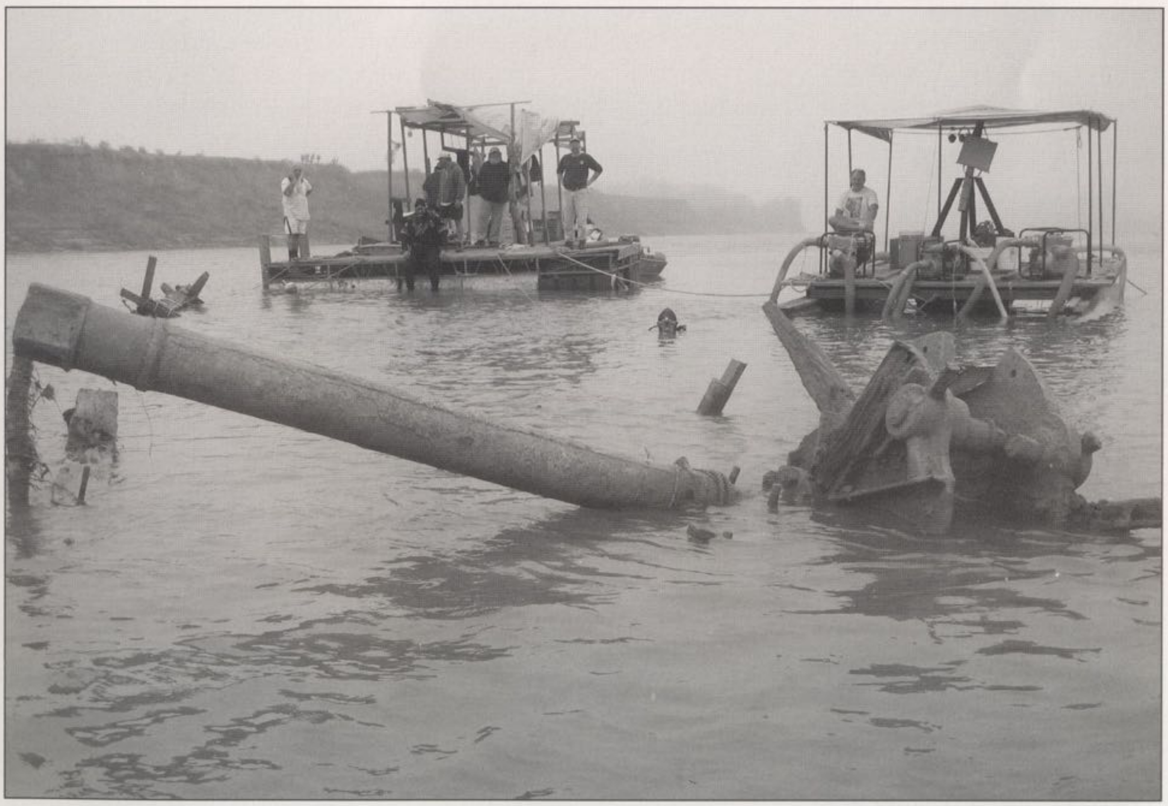


Fig. 1. Heroine's *starboard flywheel flange and axle protruding from the surface of the Red River. Photo: G. Grieco*

Recent excavations conducted by the Oklahoma Historical Society and the Institute of Nautical Archaeology are providing a unique and informative look at one of these early western river steamboat engines. *Heroine* was built in 1832 and ran onto a snag in the Red River in 1838. Although her single cylinder and valves were salvaged shortly after the accident, a large portion of the machinery was left aboard the wreck (fig. 1). Several field seasons directed by Dr. Kevin Crisman have provided a wealth of information about not only the design of the engine, but also about the state of disrepair of its mechanical parts. This information was used to create a 1:10 scale reconstruction of *Heroine*'s steam engine, flywheels and paddlewheels. Commissioned by the Oklahoma Historical Society, the model is one of four detailed models that will be on permanent display in the new Museum of History in Oklahoma City.

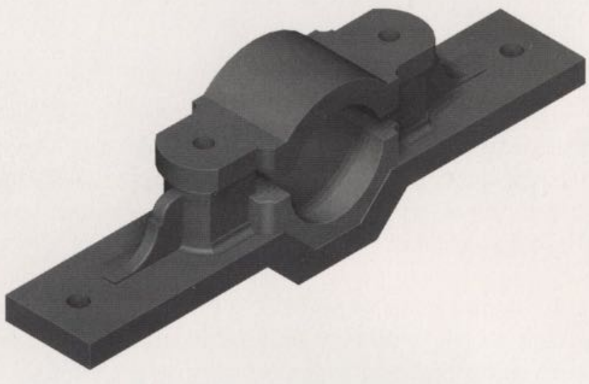


Fig. 2. *An example of one of the parts reconstructed in AutoCAD from data recorded by divers. This bearing would have been one of four that supported* Heroine's *two paddlewheels. Image: G. Grieco*

The first step in creating the model was to create a computerized reconstruction of the entire engine. Using data from the extant components of the machinery recorded by divers, a library of 3D AutoCAD drawings of each surviving part was created (fig. 2). These parts could then be reassembled in a virtual reconstruction of the entire engine (fig. 3). One advantage of utilizing this method was that it provided the ability to adjust for any deformation of the vessel's timbers that may have occurred over the last 165 years. This reconstruction of the surviving parts can provide a great deal of information about the parts that no longer exist on the wreck, as well. For example, the "throw" or diameter of the circle that was created by the crank pin as the flywheel turned was calculated at 57 inches, and this is always equal to the stroke of the cylinder of the engine. By comparing the stroke of this cylinder to a contemporary table of steam cylinder proportions, the bore of the cylinder was determined to have been about 18 to 20 inches.

Another example of how the 3D reconstruction provided additional information came from the analysis of a single surviving valve cam (fig. 4). It was not until after the curves of the cam were reproduced in AutoCAD that the importance of the part was realized. This type of cam, referred to as a "full stroke" cam, gives a good indication of the type of steam valves with which it was associated. The shape of the cam also indicated that the engine was of a relatively simple design that was utilized early in the evolution of sidewheel steam engines.

With the completion of the 3D computer model, it was then possible to take the virtual model apart and fabricate each component. As mentioned earlier, the majority of the engine components would have been cast from iron. For the scale model, however, it would have been difficult to reproduce the proper appearance of the parts with cast iron. Instead, it was decided to machine the parts from solid billets of brass and treat the parts to create the appearance of cast iron.

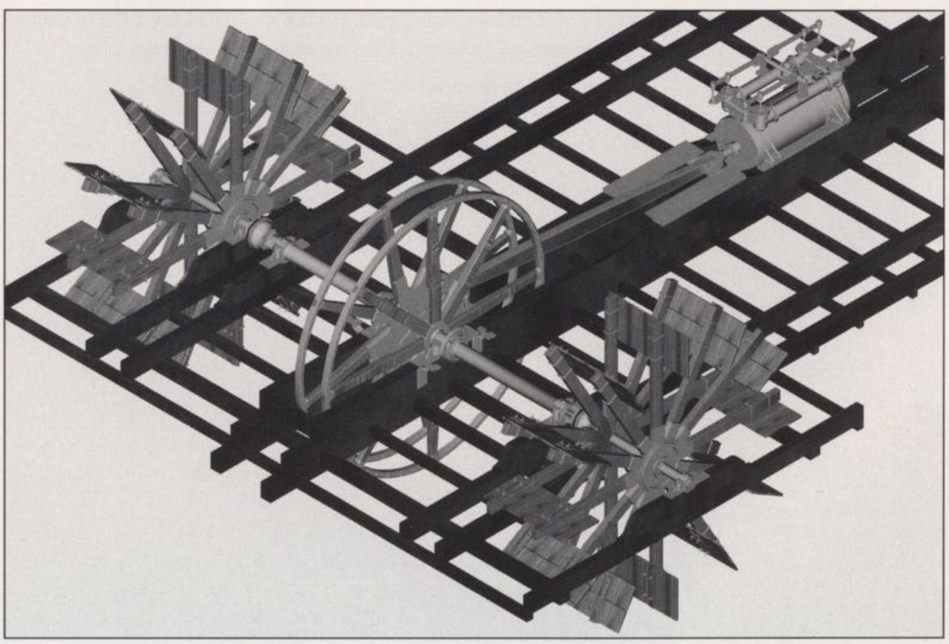


Fig. 3. *Rendered AutoCAD reconstruction of* Heroine's *engine, flywheels and paddlewheels. Image: G. Grieco*

Using a computer-aided manufacturing program called BobCAD v.20, toolpaths were created for each AutoCAD part drawing (fig. 5). These toolpaths are the machine codes that guide the mill in machining the complex contours of the part. The machining of each part was done on a small scale TAIG CNC mill (fig. 6), which is capable of machining the complex contours to an accuracy of 0.0002 inch.

study. That architects created the report certainly underscores the importance of their findings reflecting a dearth of trained archaeological professionals, and highlights the influence that these particular professionals had in the early years of sub-aquatic exploration in Argentina.

In 1985 the ICOMOS once again precipitated a positive step forward for underwater archaeology. During a seminar focused on "experimenting with and developing the discipline in a practical way," concerned professionals, including for the first time an archaeologist, created the Underwater Archaeological Working Group (GTAS). The group's name was later changed to the Underwater Heritage Working Group (GTPS) and was comprised of seven architects, two experienced divers and a museum curator. The GTPS expanded its work in various areas around the region and attempted to implement different archaeological techniques at several sites but still lacked the expertise of a trained underwater archaeologist. From 1987 to 1989 the group carried out survey work, mapping and photographing the wreck site of H.M.S. *Swift*, an English sloop-of-war located in Puerto Deseado, Santa Cruz in the Chubut Province. *Swift* is a highly important find, as the sloop-of-war from the late 18th century is a rare example of this type of ship and is in an excellent state of preservation.

In 1990 diver and architect Cristian Murray, a member of the GTPS team, recognized the deficiency in the team's composition, and journeyed to the National Institue of Anthropology (INAPL) to see if he could locate any interested archaeologists willing to donate their time and expertise towards the development of a unified archaeological aquatic program. Dolores Elkin was the archaeologist at INAPL that foresaw the possibilities of working under water. Dr. Elkin volunteered her time to help Murray and the group of architects to form professionally trained units of underwater archaeologists. One of Dr. Elkin's first suggestions was to postpone all work on H.M.S. *Swift* until the team was properly versed in underwater excavation techniques and the development of research designs based on sound, archaeologically-oriented, scientific principles. Her suggestion spoke to the importance of having a highly trained archaeologist in the fold. Dr. Elkin fully understood the risks of losing potentially important data from the *Swift* site when worked by an enthusiastic, but largely untrained team.

Underwater archaeology in the region received an added boost of recognition in 1994 when the national archaeology conferences of both Argentina and Uruguay included the topic in their programs for the first time and created an atmosphere for underwater archaeologists to share knowledge and converse on topics relevant to the field.

A year later Pilar Luna Erreguerena , sub-director of the Underwater Archaeology unit at the Instituto Nacional de Antropología e Historia (INAH), gave a series of lectures in Montevideo, Uruguay concerning underwater cultural heritage and the dangers this heritage faces from exploitation by unscrupulous treasure hunters. Dr. Elkin met Ms. Luna at the conference and they discussed the possibilities of creating an efficient and self-sustaining underwater archaeological program in Argentina. Ms. Luna then proceeded to Argentina to visit INAPL headquarters, where she spoke to resident archaeologists and archaeology students about the need to protect and study the cultural heritage submerged in Argentina's regional waters. The lectures attracted people interested in underwater cultural heritage from around the world and the open forum allowed the general public to become involved on a large scale for the first time.

The awareness that Ms. Luna conveyed of the very real risk of losing irreplaceable cultural heritage resources and the encouragement she offered the INAPL staff greatly affected the course of underwater archaeology in Argentina. After Ms. Luna's inspiring visit, INAPL Director Diana Rolandi suggested to Dr. Elkin that she create and direct an underwater archaeology program. Dr. Elkin readily accepted the job, and along with four former members of the Underwater Heritage Working Group, a professional diver and an archaeology student, the program was born in 1995. This small and highly motivated group from diverse backgrounds believed that the program was feasible despite budgetary, staffing and technological constraints and their unwavering dedication and intense motivation has made the PROAS-INAPL program one of the most respected in Latin America and, indeed, the world.

PROAS-INAPL continues to operate today, and the 2004 Valdés Peninsula survey is just one example of their projects. Since 1997 Dr. Elkin has also been the Scientific Director of the H.M.S. *Swift* project, jointly operated by PROAS-INAPL and the Puerto Deseado local museum in Santa Cruz Province, Southern Patagonia. The team has completed ten field seasons to date. They have excavated and conserved numerous artifacts, and created maps, photographic and video records, and naval architectural drawings. Their detailed work has allowed the archaeological community unprecedented access to knowledge concerning the smaller English warships employed by the British Royal Navy for exploration during the 18th century.

Valdés Peninsula Project 2004 survey objectives

The detailed research design for the Valdés project included the following objectives:

1. Perform a detailed investigation into the maritime history of the region including cartographic, written and photographic sources (when available) for the purpose of identification and analysis.

2. Compile wreck location and identification data gathered from area residents concentrating on information from fishermen, historians and sport and commercial shellfish scuba divers.

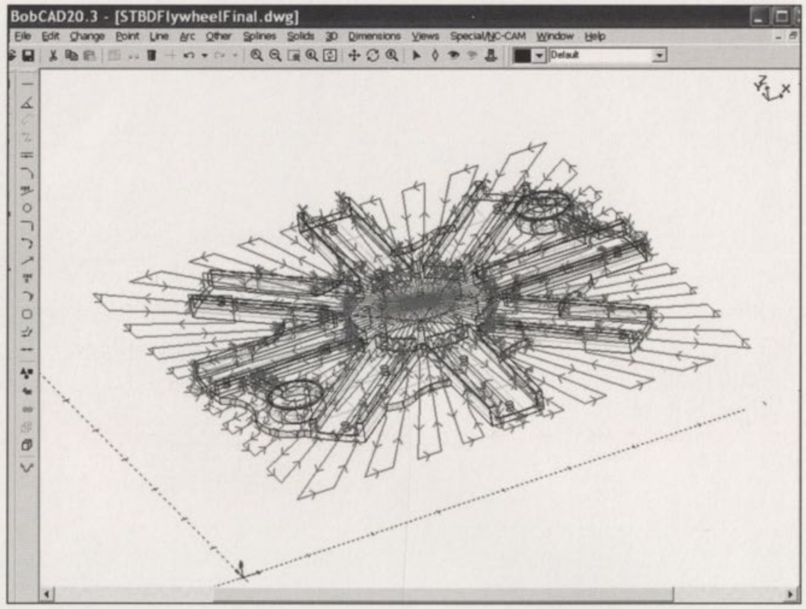


Fig. 5 (above). *Screen capture from BobCAD v.20, the computer-aided manufacturing program used to accurately reproduce the components of the model in scale. Image: G. Grieco*

Fig. 4 (below). *AutoCAD drawing of a full stroke cam found on the wreck. The geometry of this part can tell us much about the design of the steam engine associated with it. Drawing: G. Grieco*

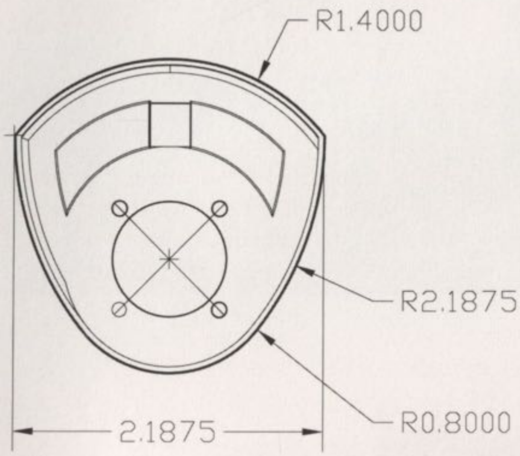
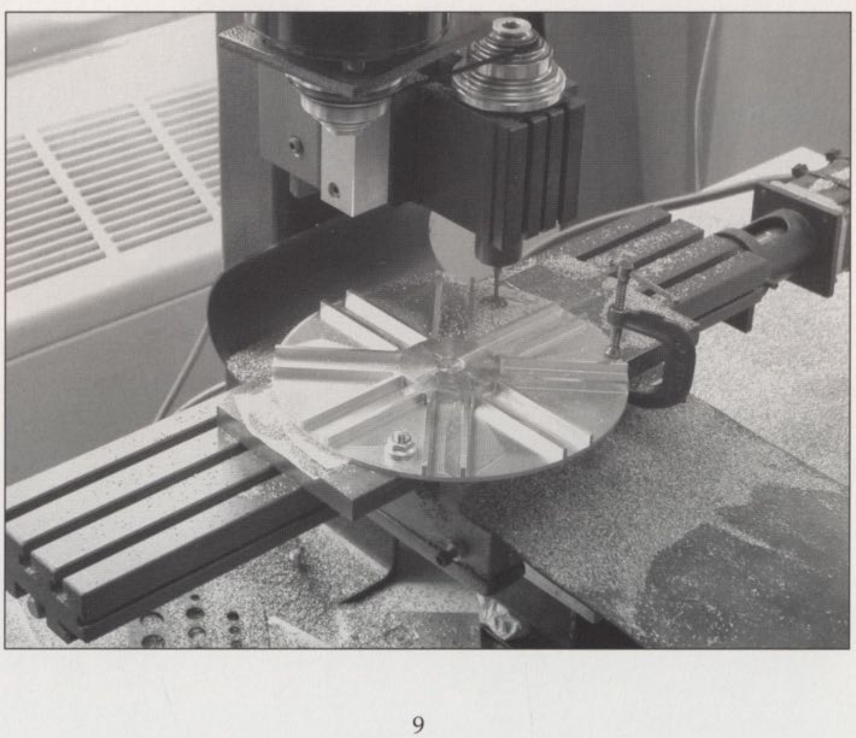


Fig. 6 (below). *Using a small CNC mill to machine one of* Heroine's *two flywheel flanges from a 12-pound brass billet. Photo: G. Grieco*



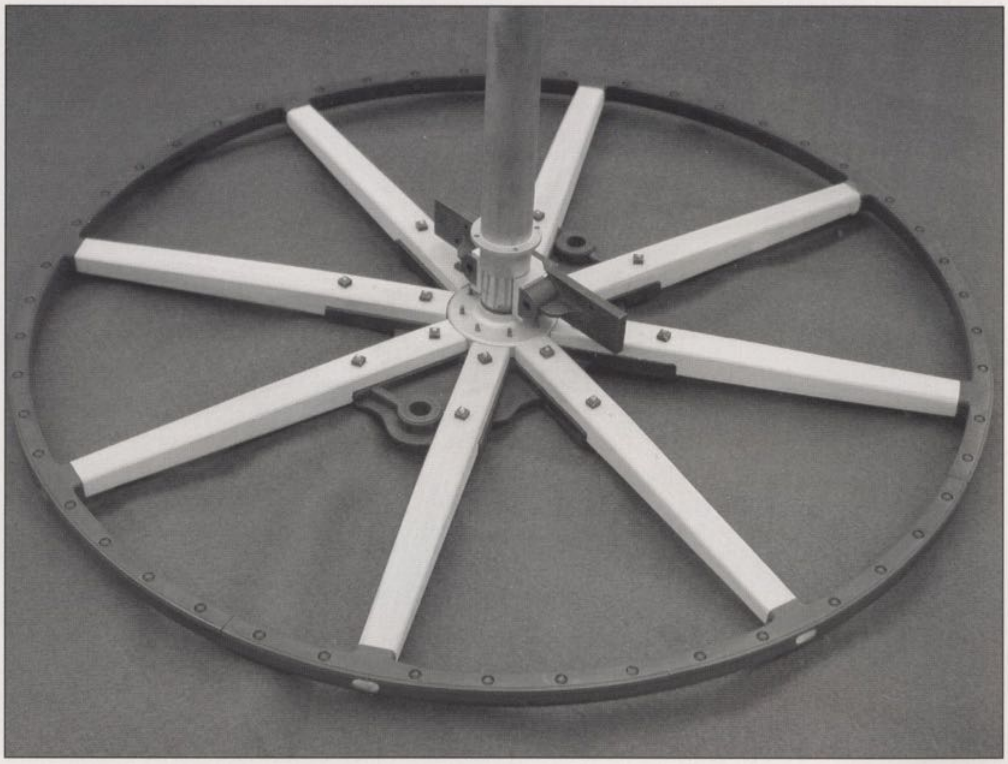


Fig. 7. *Completed starboard flywheel with spokes, rim and axle attached. Photo: G. Grieco*

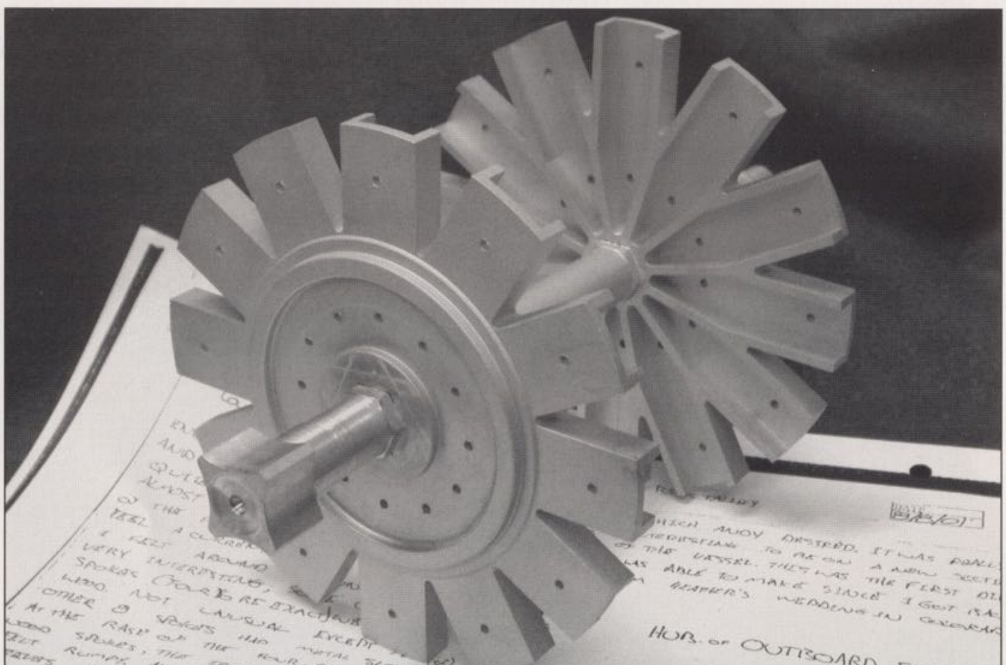


Fig. 8. *Completed paddlewheel flange/axle assembly prior to blackening. The sketch in the foreground shows the conditions of one of the paddlewheel flanges on the wreck. Photo: G. Grieco (sketch by Rick Talley)*

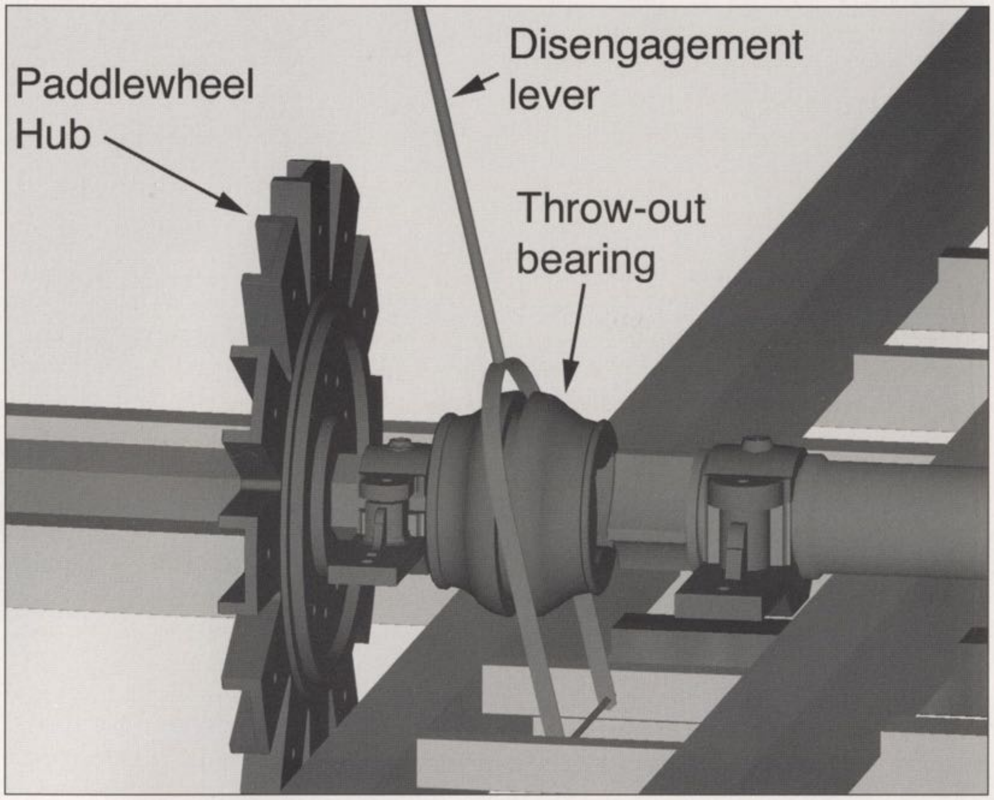


Fig. 9. *Reconstruction of the throw-out bearing assembly. Pins on the inside of the curved iron strap attached to the lever engage the notch in the throw-out bearing. Moving the lever in an outboard direction disengages the paddlewheels from the main axle. Image: G. Grieco*

Figure 7 shows the completed starboard flywheel assembly, axle and bearing block. Weighing in at over 1,000 pounds, the flange or hub on the original snapped in half, a testament to the incredible amount of force that must have been exerted on the engine as *Heroine* hit a snag. Figure 8 shows the unfinished paddlewheel flanges on their axle. The sketch in front is of one of the flanges found on the wreck. Many years of hard service on the rivers had broken off several of the channels that would have supported the spokes of the paddlewheel, necessitating a crudely fashioned iron strap to be bolted across the affected spokes in an attempt to provide some support. How this repair would have affected the balance of the paddlewheel can only be surmised, but a large number of wood and iron shims under the bearing that supported this paddlewheel may be evidence of its erratic motion.

Figure 9 illustrates an interesting construction feature that could have been used to protect the machinery in the event of running onto a sandbar or hitting a snag. The effect of stopping one of the paddlewheels while the engine was running would have been devastating, as the twisting forces along the brittle iron hubs and axles would have caused irreparable damage. A lever activated throw-out bearing could disengage the paddlewheel from the main axle, limiting the damage to just the paddlewheels. The throw-out bearings could also have been used to cut power to both paddlewheels to decelerate quickly or individually to maneuver in a tight turn.

New information recorded during summer 2005 has provided more valuable information about the deck and hull structure under the engine and paddlewheels. Heavy stanchions and bracing directly under the engines and flywheels were necessary to support the considerable weight of the iron castings. A rare glimpse into the construction of these early river steamers, it was decided to incorporate these structures into the finished model.

The 1:10 scale model is 44 inches wide, 48 inches long, and weighs nearly 300 pounds. Initially designed and intended to run on compressed air, the completed model is powered by a small, concealed electric motor due to maintenance concerns. The typical average speed for a sidewheel steamer's paddlewheels was about 20 revolutions per minute. Just as in the full size vessel, the simple bearings on the model will wear over time, so in order to minimize wear and facilitate the viewing of the motions of the machinery, the model will run at two revolutions per minute. It is interesting to note that what was one of the most important concerns for the vessel in 1832 is also one of our biggest considerations when building the model today.

In addition to the steam engine model, three other models have been constructed for the museum. A 1:10 scale section model of the hull, a detailed model of the stern and rudder of the vessel, and a 1:20 scale diorama of the wreck *in situ*. All models were displayed at the grand opening of the museum on November 5, 2005.

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2004 Shipwreck Survey of the Valdés Peninsula, Patagonia

J. Bradshaw Coombes, Jr.

The Atlantic coastal area of Patagonia (fig. 1) has been recognized as a major avenue of shipping traffic for centuries, beginning with early 16th-century European exploration and colonization, and commercial shipping in the area continues today. The Valdés Peninsula, home to the early 18th-century Spanish settlement of San Jose in the Chubut Province of Argentina, was the focal region of an underwater cultural heritage survey in 2004. The main objectives of the Valdés Peninsula Project were defined after preliminary information indicated that there were more than 20 known shipwrecks in the region and that these vessels represented a wide range of periods.

Fig. 1. *Map of Patagonia.*

The objectives of the project were to geographically pinpoint underwater sites that conformed to the definition of an underwater cultural heritage resource for the Valdés region, to determine the states of preservation of these sites, their dates and provenance, and to create a guideline that would help the cities and regions involved manage their submerged cultural resources. A main goal of the project has been to find ways to integrate these resources into tourism development in the Valdés region by bridging the gaps between community members, museums and cultural centers that are involved in the maritime history of the area, and divers, sailors, fishermen and their businesses.

The survey was conducted by Dolores Elkin, director of the Underwater Archaeology Program (Programa de Arqueologia Subacuatica, or PROAS) from the National Institute of Anthropology (Insituto Nacional de Antropologia y Pensamiento Latinoamericano, or INAPL) and her team of advanced students and specialists.

The interdisciplinary composition of Dr. Elkin's team includes members trained in nautical archaeology (including the author, a Ph.D. candidate in Texas A&M's Nautical Archaeology Program), naval architecture, architecture, regional historical studies, conservation of submerged artifacts, professional diving and management of submerged cultural resources for tourism and preservation.

The history of nautical archaeology in Argentina

Nautical archaeology is a relatively new field in Argentina and it is through the diligence and dedication of Dolores Elkin and her team at PROAS-INAPL that systematic, scientific and professional underwater archaeological work is now a respected and valuable science in Argentina.

The history of underwater investigation in Argentina begins in the hands of a group of interested architects and professional divers. This loosely knit group had no actual training in archaeology or underwater archaeological procedure but did possess an abiding interest in discovering and preserving the cultural heritage submerged in their regional waters. In 1970, the International Council of Monuments and Sites (ICOMOS) commissioned a report to analyze the status of underwater archaeological deposits and to outline the possible cultural heritage contained in these sites. After ten years of work, the Argentinean report, written in 1980 by a team of architects, noted a lack of archaeological professionals and a wide variety of prospective areas for

3. Perform investigative dives in selected areas both where shipwrecks are known to be located and also where there is a logically high expectation of finding them.

4. Map, record (by photograph and video) and measure the submerged cultural heritage resources while taking samples of the finds for further study.

5. Assess the state of the resource's preservation and the dangers presented by biofouling action and commercial ventures such as fishing, diving etc.

All of this data will be analyzed and the findings used to prepare a report detailing the precise location, historical background, environmental conditions, state of preservation and general site plan of the surveyed underwater cultural heritage sites. This information can hopefully be employed to create guidelines for the management of the region's underwater cultural heritage including the creation of site monuments and interpretation centers.

An integral part of the project is to identify and to generate interest in the benefits of protecting the region's underwater heritage. Museums and visitor centers may benefit from the incorporation of interpretive displays of recovered regional artifacts thereby increasing the tourist trade. Local arts and handicrafts could consider recovered cultural heritage artifacts for inspiration in designing new themes incorporating the adventures of maritime traffic. PROAS-INAPL will build on the foundation of the project report to create CDs, booklets, magazines and videotapes disseminating this information on a wider public scale to increase public awareness and interest in the submerged cultural heritage of the Valdés Peninsula in particular and underwater archaeology in general.

Fig. 2. *Map of the Valdés Peninsula.*

Survey of Golfo Nuevo

The 2004 survey was conducted from January 10 to 21 under the direction of Dr. Dolores Elkin. Standard operating procedure for the survey team involved splitting the larger diving survey team into two smaller groups that rotated their dive times. These two groups were then split into smaller components of two to three members per unit. Each unit was given a specific task to accomplish in their limited time underwater. The unit members were paired according to diving and archaeological experience, usually including a more experienced member of the team to oversee completion of the assigned tasks with those students perfecting their professions.

Fig. 3. Folías *with superstructure visible at low tide. Photo: J. Coombes, courtesy PROAS-INAPL*

Puerto Madryn

First, the group surveyed five vessels in the Puerto Madryn area, a coastal city situated on the Valdés Peninsula (fig. 2). The first survey site was approximately six kilometers along the southern shore of Golfo Nuevo (New Gulf). The first shipwreck, *Folías*, lies approximately 100 meters from the shore (fig. 3). At high tide only a small portion of the wreck is visible from shore but at low tide more of the vessel becomes exposed.

Fig. 4. *Project Director Dolores Elkin investigates* Folías' *propeller. Photo: J. Gilman, courtesy PROAS-INAPL*

Folías is a large steel fishing trawler, measuring approximately 60 meters from bow to stern, that caught fire in 1980. A photograph in Puerto Madryn depicts the large trawler stranded on the shoreline with smoke billowing from it and several local residents in the foreground. The ship is never fully exposed at low tide and these conditions have made the vessel an artificial reef that enhances local fishing and diving.

Lying on its port side, the vessel still has a large portion of its superstructure attached to the main deck with more remnants scattered nearby on the ocean floor. The large screw propeller is still attached while a large section of the starboard bow is missing. Several cables, machinery parts and scattered artifacts from the vessel litter the surrounding perimeter of the wreck site at a depth of about 10 to 12 meters at high tide and half that at low tide.

Measurements were taken, including the total length, width and beam of the vessel at midships, as well as the dimensions of the large screw propeller (fig. 4). Sample specimens of the different potentially damaging biofouling organisms living on the ship were gathered to help ascertain the long-term consequences of growth upon the vessel.

In the center of Golfo Nuevo, roughly half a kilometer offshore, lies the second site of the survey. The wreck of *Emma*, a Chilean *Goleta* or schooner, is historically significant because it was one of the vessels used by the explorer Sir Ernest Shackelton in his attempts to rescue the members of his marooned team, trapped in the Antarctic ice aboard the ill-fated *Endurance*.

On the first attempt high winds made locating the vessel nearly impossible. The winds in Golfo Nuevo are infamous among local ship captains for good reason. After the wind abated, the team located the vessel at a depth of 13 meters. The wreck, as Dr. Elkin had reported after diving it in October of 2003, had been extensively damaged by commercial traffic and storms in the area. Fishermen had placed several old tires directly in the wreck site and unassociated debris was also scattered around the site.

Despite the destruction, several timbers survived including what could be part of the keel or keelson. Samples, photos, drawings, measurements and site plans were generated for further analysis.

The team then turned its attention to two wrecks partially buried in the shoreline in the intertidal zone less than a kilometer from the center of town. The ships are known locally as the "Welsh" wrecks, possibly used by Welsh colonizers who still maintain a thriving community 70 kilometers away from Puerto Madryn. The exact origins of the ships have yet to be determined with certainty. There are extensive timbers buried in the wet sand of this area, all apparently still joined in the original skeletal framework of the crafts. One vessel is joined with large treenails and the visible structure includes several frames, all of a substantial thickness—indicating a relatively large size for a wooden vessel (fig. 5).

Of the other craft less is visible because it is more deeply buried in the sand, but it is also crafted of timber and there is evidence of iron nails. A large, possible anchor chain is also nearby. Of course, more extensive excavation is necessary to reveal more of the buried information pertaining to these ships, possibly utilizing a cofferdam to maintain site integrity during high tide.

A visit to the Ecocentro, or ecocenter of the region capped off the team's stay in Puerto Madryn. The Ecocentro contained several wonderful exhibits and interpretive displays of the area's wildlife and undoubtedly looms large in the future plans of managing the underwater cultural heritage investigated by Dr. Elkin's team.

Puerto Piramides

The team moved gear to the research support vessel *Ice Lady Patagonia* for the next phase of the survey. A short voyage across Golfo Nuevo left the team anchored outside the tiny town of Puerto Piramides. Here two professional divers and whale tour ship operators who had dived extensively in the region joined the team and added their knowledge of the site's exact location. The wreck in this region had been severely disturbed by the diver who had initially located its remnants, as the individual moved several of the artifacts to different locations.

The wreck site was situated in the northeast corner of Puerto Piramides' small bay within the larger gulf, approximately half a kilometer from the shore and at a depth of 16 meters. The survey team was blessed with two very calm days upon arrival and successfully carried out surveying, recording and sampling tasks despite the difficulty of the previously mentioned scattering of several of the artifacts. Within two days the wind increased and made diving the site a somewhat more difficult endeavor with choppy waves and decreased visibility. The wind on one occasion was sufficiently powerful to move the temporary buoy that had been stationed at the wreck site and send the inflatable boats tethered behind *Ice Lady Patagonia* careening wildly between the waves. Diving the wreck site had become untenable due to the conditions so the survey work at the Puerto Piramides site was temporarily halted.

Fig. 5. *"Welsh" vessel's timber frames* in situ. *Photo: J. Coombes, courtesy PROAS-INAPL*

Instead Dr. Elkin directed *Ice Lady Patagonia* to another site where a shipwrecked vessel was stranded on shore. Punta (or Point) Cormoranes is located on the coastline of Golfo Nuevo towards the mouth of the gulf, and is known to contain the remnants of *Maud*. The vessel was a large steamer and had come to rest on Punta Cormoranes several years ago. The entire upper decks and superstructure have eroded away leaving the skeletal frames, two boilers and parts of the electrical system of the lower hold. The transom containing the large screw propeller is present and still attached to the remaining components (fig. 6). The site was recorded, mapped and photographed, and the team made the return journey to Puerto Piramides.

Fig. 6. *The remains of* Maud *situated on Punta Cormoranes with the boiler housing and screw propeller to the right. Photo: J. Coombes, courtesy PROAS-INAPL*

The weather improved and a remote operated video camera or ROV was deployed at the Puerto Piramides site for the first time during the survey adding live stream video of a team member carrying out their prescribed tasks. Two bottles, possibly contemporaneous artifacts, were found at the site of a timber structural component (fig. 7). A large anchor and several large mounds of ballast stones were also located near the timbers but it could not be ascertained whether they had originated from the same ship.

Dedication to cultural stewardship

The stay in Puerto Piramides ended with Dr. Elkin giving a presentation at one of the dive shops to several interested members of the community including the local divers. The presentation is an example of the interaction that Dr. Elkin and the group at PROAS-INAPL have with the area's communities and reflects their dedication to sharing information that will help decrease intentional and unintentional damaging of wreck sites and the artifacts associated with these vessels.

In the ten days the survey was conducted, six wrecks were surveyed in both the Puerto Madryn and Puerto Piramides coastal areas of the Golfo Nuevo. The shipwrecks' remains were measured and mapped. Samples of structural components were collected, the sites were photographed and, in the case of the Puerto Piramides wreck, the survey procedure was taped by a remote operated video camera. Historical information was gathered throughout the region to aid in the further location of wreck sites and every effort was made to further communication between the professional underwater archaeologists of the PROAS-INAPL team and the regional communities.

Fig. 7. *The author investigates the possible keel timber at the Piramides site. Photo: T. Winton, courtesy PROAS-INAPL*

Dr. Elkin and the Valdés Peninsula survey team eloquently and passionately conveyed the message to these communities concerning the importance of the preservation of their underwater cultural heritage in the present and in the future. The certainty that more wrecks lie in the wind tossed waters of Golfo Nuevo and the resident's new knowledge of their vital role in the preservation of such sites makes further surveys and eventual excavations by the dynamic PROAS-INAPL team in the region a necessity. The world-renowned work by Dr. Elkin and her team on the H.M.S. *Swift* project and the continuing evolution of the PROAS-INAPL assures that historically significant information concerning maritime trade, naval architecture and the history of seafaring will not lie forgotten off the Atlantic coast of Patagonia.

Acknowledgements: I would like to thank Dr. Dolores Elkin, Director of PROAS-INAPL, for providing a wonderful opportunity, invaluable experience and hospitality, and the rest of the team for their professionalism, support and friendship. In addition to PROAS-INAPL, the National Research Council or CONICET, the Argentinean Coast Guard, local dive shops and private sponsors also supported the project by supplying diving and scientific equipment, logistical support and funding to the principal investigators. *b-rad@neo.tamu.edu* ❁

Suggested Readings

Elkin, D.

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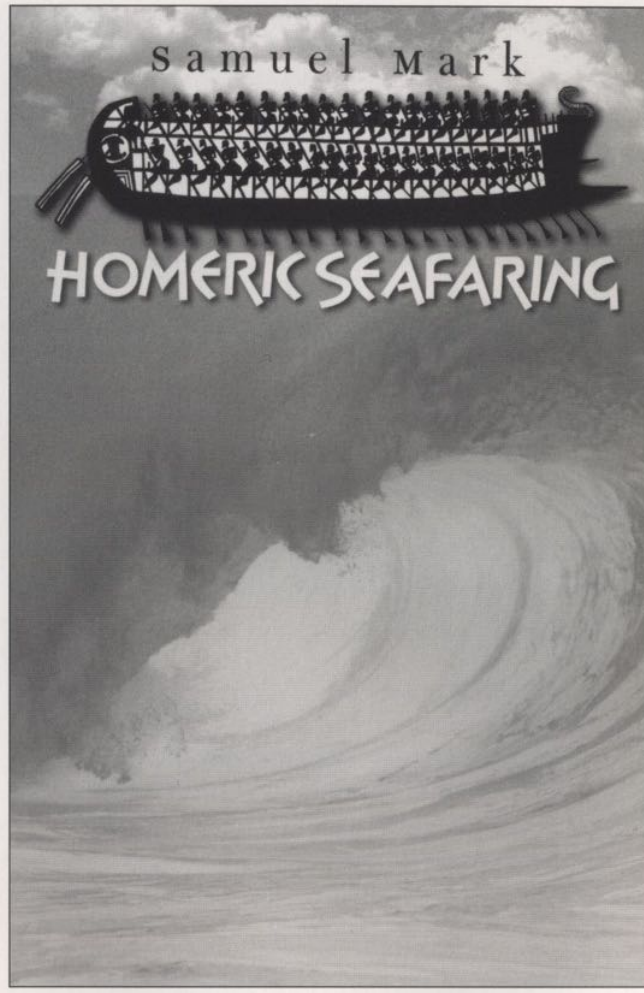

Homeric Seafaring
by Samuel Mark

Texas A&M University Press, College Station 2005
ISBN 1-58544-391-3, 257 pages, 67 black and white figures, glossary, bibliography, English index, Greek index, index of citations. Hardcover. Price: $60.00

Around 700 BC, a Greek poet named Homer set into writing two epic poems that would herald the age of western literature. The *Iliad* treats the struggles of Achaean and Trojan heroes toward the end of the decade-long siege at Troy. The *Odyssey*, a more personal tale, describes the voyages and misfortune of the Achaean hero Odysseus as he attempts to reach his home island of Ithaka after the fall of Troy. At several thousands of lines each, both poems vividly portray a world of kings and queens, gods and goddesses, monsters, and sea raiders. The *Odyssey* in particular teems with details on ancient seafaring, from navigation methods, to nautical terminology, to descriptions of ship construction. Scholars of ancient seafaring have mined these passages extensively for the past century in an attempt to arrive at a core set of nautical practices and traditions that reflect ancient reality. Samuel Mark's *Homeric Seafaring* is the latest contribution to the field and provides a substantial reassessment of long-held beliefs about Homeric ship construction and seafaring.

Mark begins with a discussion of the cultural context of the poems—a valuable start when dealing with the complex issue of the orality of the poems and theories of their transmission through time. He also tackles such difficult issues as the so-called Homeric question (whether Homer set the backdrop of his poems in the Late Bronze Age or in his own living memory in the archaic period) and the intricacies of Homeric nautical diction. The centerpiece of the book, however, is his treatment of Homeric ship construction (chapters 4 and 5). From an archaeological viewpoint, this is the book's most valuable contribution. Using the most recent evidence from Mediterranean shipwrecks, Mark lays out the argument that pegged mortise-and-tenon construction began as a Canaanite tradition, as early as the Late Bronze Age, whereas the Greek tradition of ship construction early on involved the use of dowels and lacings to edge-join planks. It was not until the late 6th century BC that Greek ship builders began to change over, slowly at first, to mortise-and-tenon joinery. This evolution in ship construction, Mark argues, was driven by the need for stiffer hulls and stronger planking seams to handle the smaller point loads of stacked amphoras. The need for stiffer and stronger hulls in warships designed for ram warfare also provided a stimulus for radical changes in Greek shipbuilding practices.

The remaining chapters deal with a variety of subjects related to ancient Mediterranean seafaring, both in the poems and in general. The ram, for example, is often thought to be an invention of the early 1st millennium BC based on its supposed appearance in the iconography of ships on Geometric pottery. Mark shows, however, that the iconography is too small and stylized to make this conclusion, and makes a good case for its appearance after Homer, that is, in the 7th century BC or later. A chapter on Homeric geography rounds out the book.

Mark's study is most illuminating not only in its review of all the available evidence on Homeric seafaring and the corpus of literature published about it, but also in its contribution of original and convincing ideas on the topic. With its extensive documentation, clear illustrations, useful glossary and indices, it is sure to become a valuable reference book for students of Homer and ancient seafaring.

-Dan Davis

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