
The INA Quarterly



THE INA QUARTERLY



Winter 2001

Volume 28 • No. 4



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On the cover: Ships at anchor below Mount Brasil in Angra Bay. The shipwreck designated "Angra D" was probably anchored in this position before the storm that wrecked it in front of the Customs House ("Alfandega") at the head of the bay. From a topographical print by Jan Huyghen Van Linschoten, circa 1589.

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The Home Page for INA is at <http://www.NAUTICALARCHAEOLOGY.org>.

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The *INA Quarterly* was formerly the *INA Newsletter* (vols. 1-18).

Editor: Christine A. Powell

The Shipwrecks of Angra Bay,

2000-2001

Kevin J. Crisman and Caterina Garcia

It was but one of over one hundred ships that wrecked in the region of Angra Bay (fig. 1). We do not yet know its name or the precise date of the sinking, but we do know that it was lost sometime in the late sixteenth or early seventeenth century. We can say with certainty that it was regarded by its owners as a particularly fine ship. The hull was large for the time, in the range of four or five hundred tons, and measured about thirty-five meters in length and nine meters in breadth. Its structure was assembled principally of high quality oak, carefully fashioned with broadax, adze, and saw, and amply fastened in the Iberian style with large numbers of wrought iron spikes and bolts. The dimensions of the individual timbers were substantial, and the bottom of the ship was heavily reinforced inside with a series of transverse riders that added much to the integrity of the hull. Below the waterline, the planking was entirely sheathed with thin sheets of lead, a covering that protected the timbers from the depredations of wood-eating *teredo* worms, but at a cost that was, for the time, incredibly expensive. This was no ordinary ship.

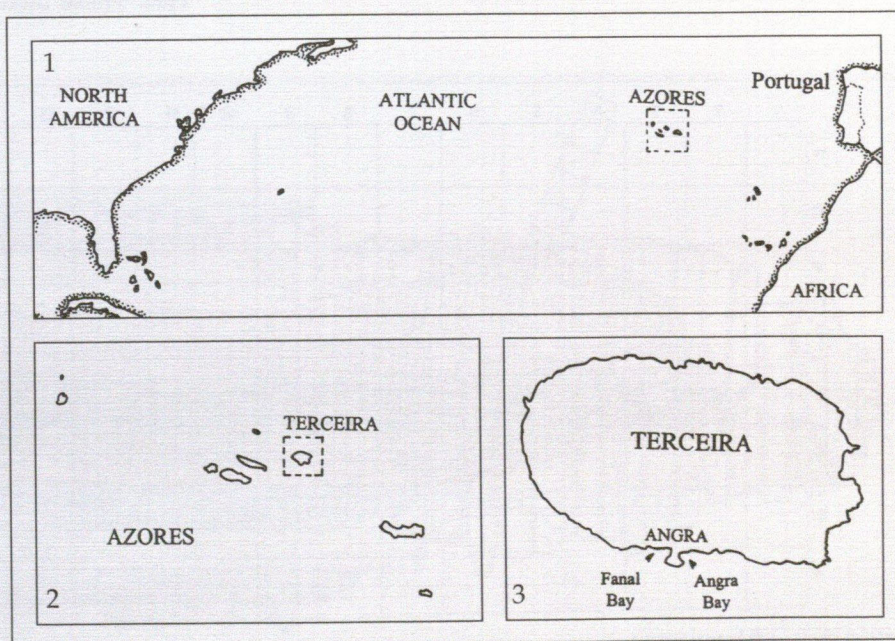
We do not know if the ship's owners were from Portugal or Spain, or indeed from somewhere else, but one important clue, puddles of mercury in the hold, tells us that the vessel had sailed between Spain and the Americas. The Spanish New World empire had a voracious appetite for mercury, which was used to extract silver from its ore, and shiploads of the liquid metal were sent across the Atlantic to the mines of Mexico and Peru. The ship in Angra Bay made at least one such voyage in its lifetime.

We may not know the ship's name or the date of its sinking, but the circumstances of its loss can easily be guessed. Located on the southern coast of Terceira Island in the Azores, Angra Bay was a strategic mid-Atlantic way point for fleets of Portuguese and Spanish ships returning home to Europe, their holds filled with metals, spices, dyes, textiles, porcelains, and exotic commodities from the Americas and Far East. As a haven for sea-weary ships, the bay's protection could be illusory, however, for it was terribly vulnerable to sudden shifts of wind and rapidly-building waves that could entrap unwary sailors in their slow and unhandy

vessels. Residents of the city of Angra overlooking the bay still call southeastern winds *carpinteiros* ("carpenter's winds") because they once provided woodworking shops in town with fresh supplies of oak and pine from smashed hulls.

Our ship was probably riding at anchor in the lee of Mont Brasil, the volcanic cone that protects the bay from the prevailing western wind. The crew may have been exhausted after a long voyage, and possibly many were ashore; in any event, they failed to pay heed to the changing direction of the wind, which shifted to the south or southeast and began to increase. Those on board had two options: attempt to ride out the gale and pray the anchors held, or cut their cables and try to beat out of the narrow bay before conditions became too extreme. Whichever choice they made, the gale won. The vessel was driven helplessly onto the shelving sand seabed below the town, and there it was pounded hard until the seams opened and the hold filled with water.

Did the upperworks hold together or break up in the waves? Did the crew perish or survive? We do not know, but we can be certain that every effort was made to recover the cargo when the storm had passed. The relatively shallow depth of the bay at this location (seven meters) permitted salvage of guns, anchors, and other ma-



Map: E. Heinold

Fig. 1. The North Atlantic (1), the Azores (2), and Terceira Island (3).



Photo: K. Crisman

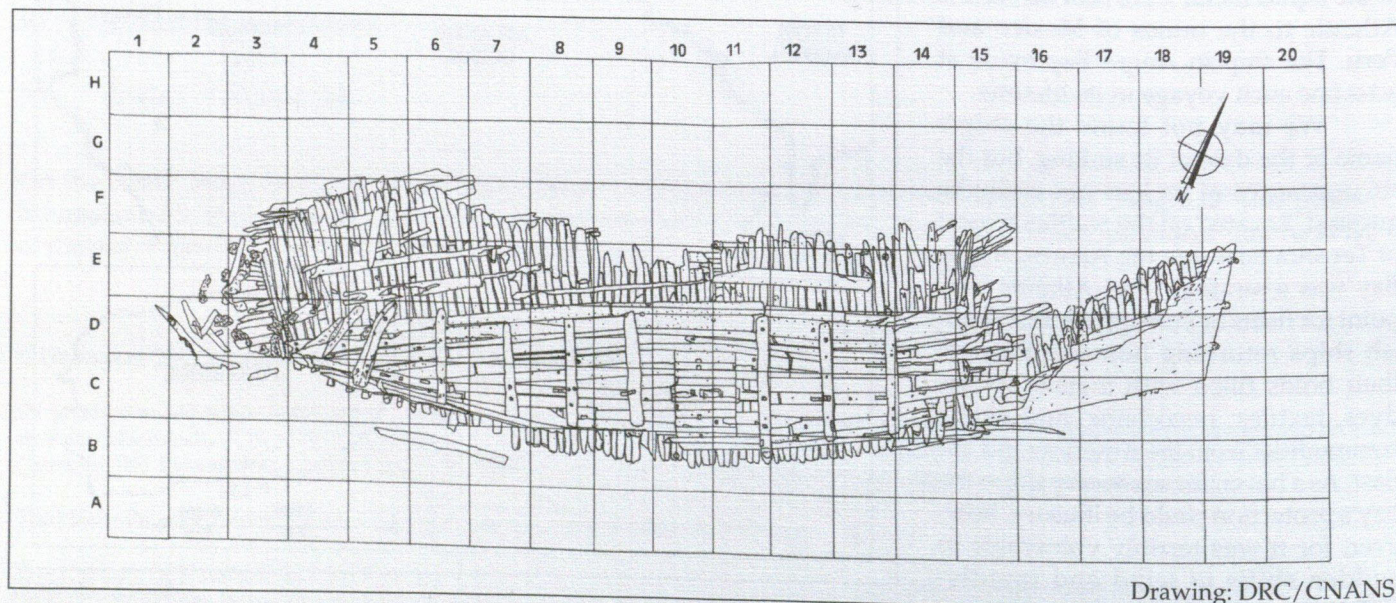
Fig. 2. Angra Bay and the city of Angra do Heroísmo, Terceira Island, Azores, showing the new breakwater and yacht basin. The wrecks known as "Angra C" and "Angra D" were located in a spot that is now beneath the middle of the breakwater.

materials from the wreck. Held fast to the bottom by a pile of ballast stones, the bottom and lower starboard side of the hull were abandoned, and rapidly disappeared beneath two meters of coarse sand. A few decades later another wooden ship, perhaps Dutch in origin, fetched up nearby, although in a much more fragmentary condition. Still later, about two centuries afterwards, *Run'Her*, a blockade runner carrying a cargo of electric sea mines to the Confederacy in 1865, ran aground in front of the city of Angra. It then broke up, scattering fragments of iron plate and a boiler around the inner bay. Only at the very end of the twentieth century did the existence of these wrecks become

known to archaeologists who could conduct a scientific investigation of them.

Emergency Intervention in Angra Bay, 1997–1998

In the mid-1990s, harbor authorities proposed the construction of a new marina in front of the city of Angra do Heroísmo, a facility that would require the construction of a long and substantial stone and concrete-tetrapod breakwater on the bottom of the inner bay (fig. 2). Concerned about possible damage to shipwrecks or archaeological features on the bottom of the bay, an intensive survey effort was organized by regional and national agencies. These included the Azorian Government's Direcção



Drawing: DRC/CNANS

Fig. 3. Plan view of Angra D. Evidence suggests that this wreck dates to around 1600 and was probably built in Spain or Portugal.

Regional da Cultura (DRC), the national Instituto Português do Património Arquitectónico e Arqueológico (IPPAR) and IPPAR's marine archaeology arm, the Centro Nacional de Arqueologia Náutica e Subaquática (CNANS). Survey work began in 1996 and continued through 1997, with the participation of archaeologists and oceanographers from the Institute of Nautical Archaeology (INA) and Texas A&M University.

A variety of survey tools and techniques were tested, including sonars, a magnetometer, and a sub-bottom profiler (see *INA Quarterly* 25.2, 3–11). These produced geological data on the bottom of the bay, but in the end the most reliable means of finding archaeological sites proved to be the old time- and labor-intensive standby: dredging a series of closely-spaced test pits in the sand bottom. Besides turning up scattered artifacts and debris, archaeologists located three wrecks in the path of the proposed breakwater. The first was the well-preserved, lead-sheathed Iberian ship of the late sixteenth or early seventeenth century, which was designated "Angra D" (fig. 3). The second was the less-complete wooden wreck of possible Dutch origin called "Angra C" (fig. 4). The third, Confederate blockade runner *Run'Her*, was judged to be too broken up to warrant further study, but the preliminary examinations of Angra C and D suggested that they were worthy of excavation, recording, and removal if construction proceeded on the breakwater.

As it turned out, work on the marina *did* proceed and with little prior warning from the construction supervisors. Archaeologists and preservation authorities managed to halt the work temporarily, but in March 1998 they were faced with the daunting task of pulling together, in a

matter of days, a team from Europe and North America with all the necessary excavation and diving equipment. Under the supervision of Dr. Francisco Alves, Director of CNANS, divers quickly but systematically uncovered Angra C and D, removing ballast stones and artifacts. Angra C seems to have been very thoroughly salvaged after sinking, and its hull and ballast pile yielded only a small collection of material, including a copper cauldron, shoe soles, ceramic sherds, and a decorated pipe stem. The pipe stem proved to be one of best indicators of the date of Angra C, for it closely matched Dutch types from the second half of the seventeenth century.

Angra D had both a larger ballast pile and a more extensive collection of artifacts. Various types of containers found within the hull included a copper pitcher, two complete wooden buckets, wicker baskets, and barrel staves and heads. Elements of the ship's equipment and weaponry were also discovered, including a two-sheave block, fragments of rope and cable, cannon shot (four of iron and one of stone), three triangular gunpowder flasks, a portion of a wooden musket stock, and lead musket shot. The divers recovered hundreds of ceramic fragments from glazed and unglazed containers (two olive jar rim fragments bore the "IHS" stamp of the Jesuit order), and there were also a number of Ming dynasty porcelain sherds. The ceramics and other artifacts all pointed to a late sixteenth- or early seventeenth-century date for Angra D.

Abundant faunal remains indicated that Angra D's crew enjoyed a varied diet of beef, pork, mutton, chicken, and fish. Other types of faunal remains, namely many rat bones and cockroach exoskeletons, showed that vermin had infested the vessel. Finally, there was the mercury, which

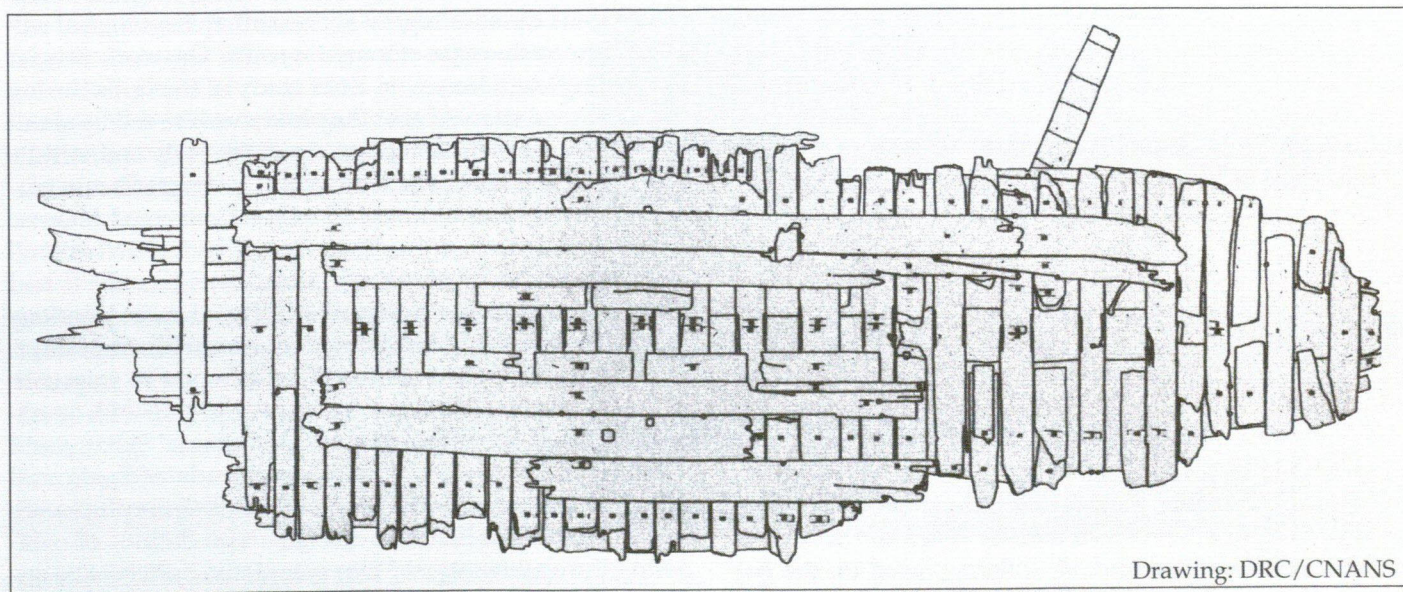


Fig. 4. Plan view of Angra C. Evidence suggests that this wreck may be from the later seventeenth century and may be Dutch.



Photo: P. Monteiro

Fig. 5 (above). Archaeologists tracing timbers during the salvage excavations of Angra C and D.

Fig. 6 (right). The DRC diving headquarters building at Porto Pipas, Angra. We worked in the shadow of S. Sebastião, one of the earliest forts built to defend the bay.

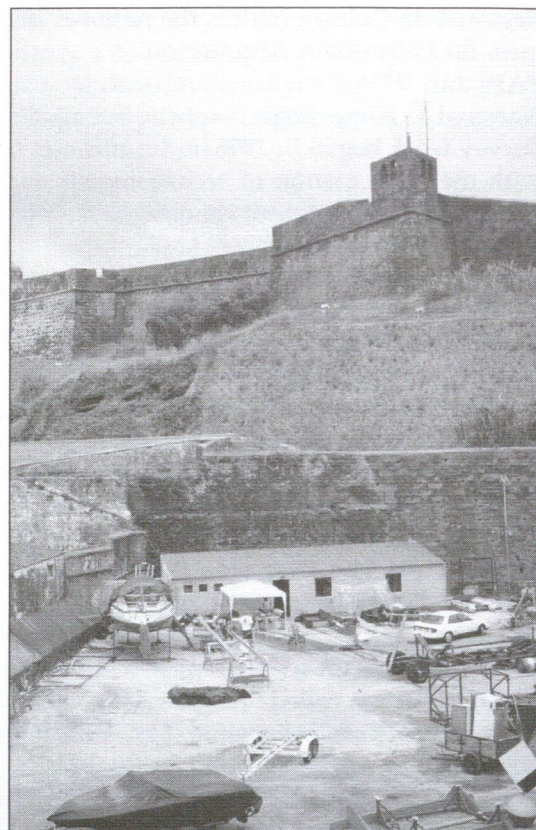


Photo: E. Phaneuf

must have leaked out of its containers at a great rate during shipment. Over 150 milliliters were collected with syringes, while other globules of the metal were gobbled up by the hungry fish that constantly circled the excavations.

When the two wrecks had been cleaned of sand, ballast, and artifacts, one-to-one tracings were made of interior ceiling and frame surfaces onto large sheets of clear plastic (fig. 5). Basic measurements and frame curvatures were also taken. Work on the marina was scheduled to resume shortly, however, and there was no time to carry out any kind of detailed study of the timbers or the techniques used to assemble the hull. Recovery and conservation of the timbers was too expensive an option to be considered, and the plan was simply to pick up the wrecks and move them out of the construction zone. Peter Waddell of Parks Canada assisted the CNANS team with the disassembly process. He shared the tools and techniques he and his colleagues developed during their excavation and disassembly of the Basque whaling ship sunk at Red Bay, Labrador. Angra C and D were disassembled piece-by-piece and transported about six hundred meters across the bay. The timbers were stacked on three steel pallets sunk at a depth of seventeen meters. When the hulls were entirely disassembled and all timbers placed on the pallets, each was sealed over with several hundred sand-filled plastic feed sacks to slow deterioration and *teredo* infesta-

tion. The excavation, disassembly, and removal of the two wrecks was completed in less than four months.

Documentation of Angra C and D, The 2000 Season

Considering the difficult circumstances and time constraints, the 1998 salvage excavation of Angra C and D can be considered a highly successful archaeological salvage of two otherwise-doomed wrecks. The work was far from completed, however. Brief study of the hulls during their removal showed that they had much to tell us about design and construction practices of the early and middle seventeenth century. The Iberian wreck, Angra D, was particularly intriguing because so much of it survived, because it was the only known example of an all-lead-sheathed hull discovered with its sheathing intact, and because it had features (such as the riders) that differed from previous archaeological examples of sixteenth-century Iberian ships. Was Angra D representative of new trends in ship construction, or was it merely a well-financed ship with heavier-than-usual scantlings and reinforcement? What could it tell us about the ships, fleets, and trade of Spain and Portugal during a time when their maritime empires were facing financial difficulties and the depredations of competing European nations? Our questions could best be answered by further investigation of the timbers cached on the bottom of the bay.



Photo: K. Crisman

Fig. 7. Archaeologist Erik Phaneuf records a plank from *Angra C* with offset measurements and sketches.

In 1999 we reviewed the excavation data, examined the timber caches, and organized an intensive program of study for the summer of 2000. The plan originally envisioned lifting each timber to the surface and bringing it back to the diving headquarters building at Porto Pipas (*Angra's* shipping terminal) for intensive recording (fig. 6). This would have given us the most detailed look at the construction, but we lacked a barge and crane for moving large numbers of timbers, and there were additional limitations of time and personnel. We instead elected to uncover two of the submerged pallets in 2000 (one containing all of *Angra C's* remains, the other one containing half of *Angra D's* structure), arrange the timbers in rows on the sea floor, and record them in this location. Under the circumstances this was the best approach for completing as much as possible with the available time and resources.

The 2000 season on the *Angra* wrecks got underway on July 2, when the seven members of the INA team, consisting of Kevin Crisman and six Texas A&M University students and alumni (five from the Nautical Archaeology Graduate Program) flew to Terceira. There we joined Caterina Garcia and three other representatives of DRC/CNANS. The first week was spent familiarizing the crew with the site, preparing lift bags, slings, and diving equipment, and lift-bagging the heavy sandbags from the two timber caches.

With the stacks of timbers exposed, we could begin a busy daily routine that alternated lift-bagging timbers and recording, boat-tending over the site, tank filling and equipment maintenance, and recopying of the underwater notes into scale views of each timber.

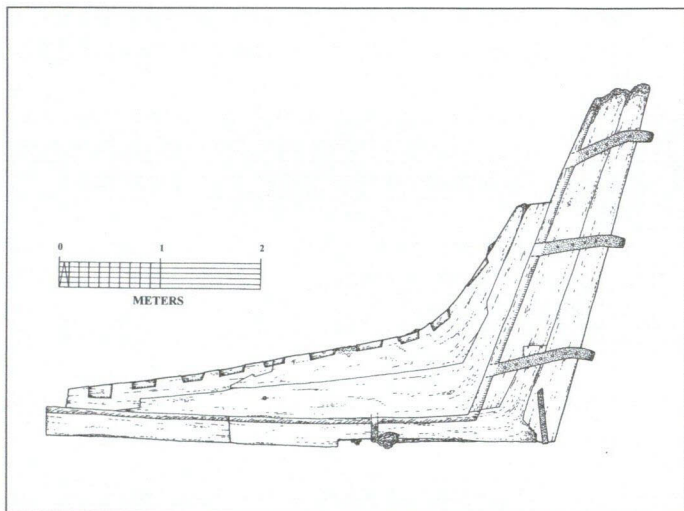
We employed a number of techniques for getting the information we needed, all of them fairly basic. Some timbers were recorded by overlaying large plastic sheets and tracing shapes and features with grease pencils. The information on the tracings was then transferred back at our headquarters to one-to-ten scale drawings. This technique provided accurate results, and worked well on smaller, curved timbers such as the Y-frames at the stern. The disadvantage was that the plastic sheets were sometimes difficult to manage underwater due to the currents that flow through the bay. We also used another method, in which a tape-measure baseline was tightly stretched over the length of a timber and offset measurements were

taken at selected intervals (figs. 7–8). Our tables of offsets and measured sketches of the timbers were later converted into one-to-ten scale drawings. This was a fast and reasonably accurate way to measure long and uncomplicated timbers such as planks and futtocks. The documentation process was rounded out by collecting samples of wood from each piece for identification of the species of trees used in construction, and by taking color photographs of each timber.



Photo: K. Crisman

Fig. 8. INA-TAMU archaeologists Julie Polzer (left) and Brian Jordan (right) record the top of the *Angra D* sternpost.



Drawing: B. Jordan

Fig. 9. The stern assembly was perhaps the most interesting portion of the *Angra D* wreck.

The most challenging and in many ways the most interesting task we had before us in 2000 was the disassembly and study of the *Angra D*'s stern (fig. 9). This five-meter-long structure, which comprised the after end of the keel, the heel timber and stern knee, two sternposts, and Y-frames and planking, had been cut from the rest of the hull and removed intact during the 1998 salvage excavation. The assembly was wonderfully preserved, and is one of the best known examples from an Iberian vessel of the late sixteenth or early seventeenth century. It bears some resemblance to the lower stern timbers recovered from the wreck of *San Esteban*, a Spanish *nao* lost off Padre Island, Texas in 1554.

The deteriorated state of the iron spikes that held part of the stern assembly together made the initial disassembly quite easy. The portside planking and all of the Y-frames were carefully extracted from the structure for recording, and the ragged remnants of the lead sheathing were removed from the keel and sternposts to reveal the ship's heel in profile. The oak timbers of the stern were carefully shaped and tightly fastened together with iron bolts into what was obviously a very solid mass of wood. The top of the knee was notched to fit the base of every Y-frame. Of particular interest was the large triangular projection or "skeg" at the after end of the knee or "heel" that joined the keel and main sternpost. A skeg is designed to protect the forward edge of the rudder in the event of grounding, but in this case a second, or outer, sternpost was fastened atop the skeg, negating any protective function it may have had. The outer post may have been a later addition, perhaps added as part of a repair or to strengthen the original sternpost. A filler piece fastened to the bottom of the heel by a pair of iron straps looked as if it may have been a repair added after a grounding incident.

Also recorded in 2000 were three keelson timbers that provided vital reinforcement to the hull. The ship's builder deeply notched the underside of the keelson to fit over the frame tops, and the three separate elements were hook-scarfed end-to-end, a combination of features that required extra assembly time and effort, but added to the overall longitudinal strength of the ship. The central keelson timber had the expanded section for the mainmast step common to nearly every sixteenth-century Iberian wreck yet examined by archaeologists. More unusual were the ten large, curved oaken riders that crossed over the keelson to provide lateral support to the hull. These are known from only one other wreck of the period, the English carrack *Mary Rose*, built in 1509 and sunk in 1545. The riders on *Mary Rose* were added to support the weight of many guns on the topsides, and their presence on *Angra D* may be a sign that this vessel, too, was designed to be heavily armed.

The *Angra C* and *D* hull studies wrapped up on August 8 after five busy but very fruitful weeks of operations. We lost a number of days to weather during the 2000 field season—strong winds and high seas from the south or southeast and heavy rain—but summertime inclement weather in the Azores luckily never seems to last more than a day or two at a stretch. The diving went well, too, and over the course of over four hundred dives we were able to accomplish nearly everything we had set out to do. Intensive recording of the principal timbers of *Angra C* (the possible Dutch wreck) was completed in this season, permitting reconstruction work to proceed. We also completed our work on the first of the two timber caches from *Angra D*, and acquired detailed drawings, dimensions, and photographs of the intact stern assembly, the keelson, riders, frame floors and futtocks, and planking.

In the Sea of Jellyfish: *Angra D*, the 2001 Season

Our principal objective for the 2001 season was the study of the remaining *Angra D* material cached atop the second pallet. This sandbag-covered pile was large, and contained not only the three keel timbers but the majority of frame floors and many futtocks as well. We decided to work with a larger recording team this year, not only to ease the exhausting daily schedule of boat tending and diving for each individual, but to provide more graduate and undergraduate archaeology students with shipwreck recording experience. The 2001 INA-DRC project, again directed by Crisman and Garcia, had a team that included eight Nautical Archaeology graduates from Texas A&M University, six undergraduate students from Portuguese universities, and project assistant Cristina Lima.

The field crew assembled on Terceira and work was underway by July 3. The experience we gained the previous year made the planning and logistics for this season straightforward. For example, we found in 2000 that the removal of the sandbags took up time at the beginning of

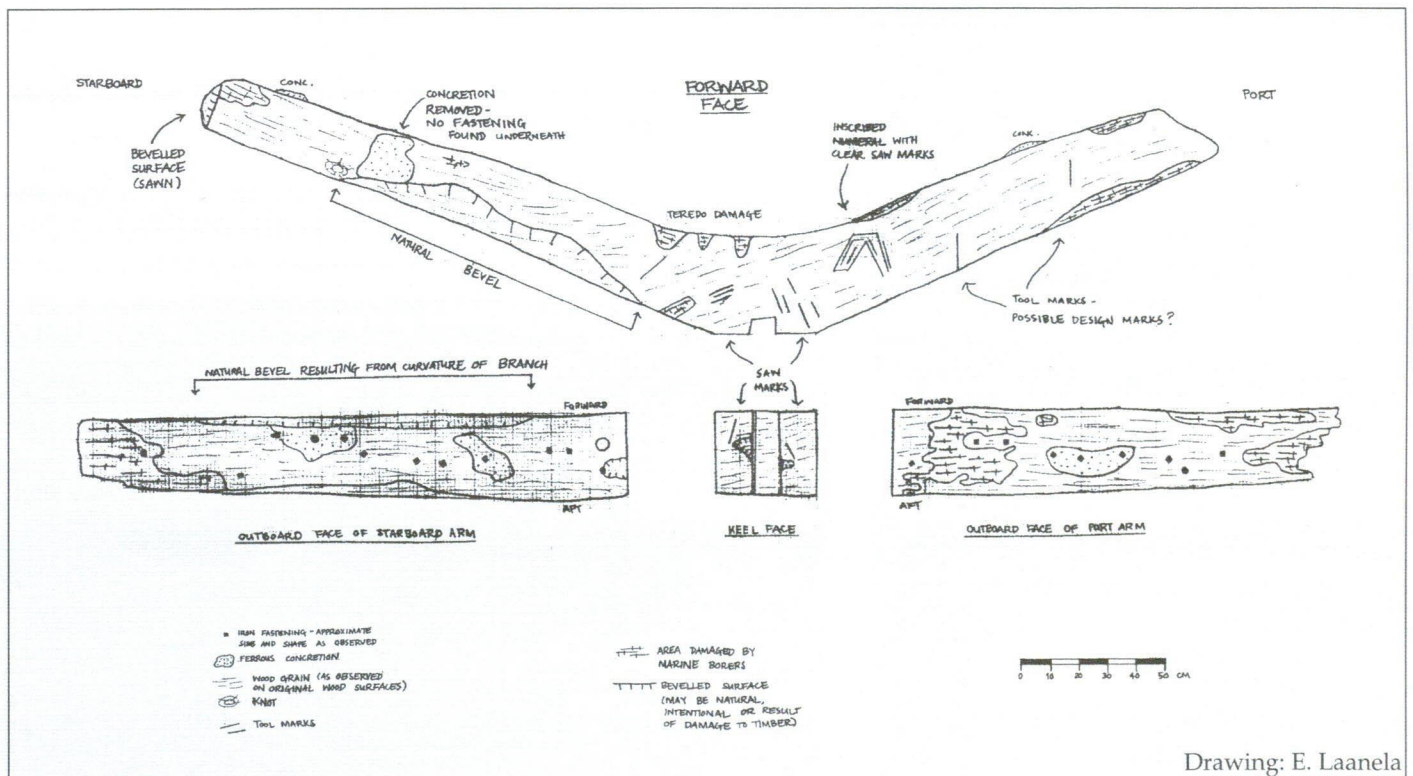
the project that might have been used more profitably for recording. Consequently, Garcia and Lima organized a group of local volunteer divers in 2001 to remove the majority of sandbags from the Angra D timber cache the weekend before we started. After a brief training and orientation period we could go right to lifting timbers from the pile and recording. The measuring procedures used in 2001 were the same as those used earlier: we either traced the timbers on sheets of clear plastic or took offsets from a baseline tape, and subsequently transferred all of this information into one-to-ten scale drawings.

We were particularly eager to investigate the keel timbers this year, and were pleased to find them at the top of the pile (although moving them off the cache was a challenging operation that required three large-capacity lift bags and the coordinated work of several divers). The dimensions of these oaken pieces were substantial, thirty centimeters moulded and approximately twenty-five to thirty-five centimeters sided. The recording process turned up several curious features: according to the excavators working on the wreck in 1998, the keel was originally entirely lead sheathed on its top, sides, and bottom. Although much of this sheathing was damaged by oxidation and by the disassembly and removal of the hull, substantial remnants were still evident in 2001. The owners of the ship were obviously willing to spend a large sum of money on

lead to protect the hull from the depredations of *teredo* worms. Textile impressions on the inner surfaces of the lead plates show that some type of fabric was laid down between the timbers and the sheathing. The reasons for including the textile are not clear at this time, but further research may provide us with answers.

A second curious feature noted on the keel timbers was the method that was used to attach the floors. The builders did not fasten the frame elements with spikes or bolts driven from above, but instead cut shallow, angled notches in the sides of the keel below the rabbet, and then drove large iron spikes *upwards*, diagonally through the keel into the undersides of the floors. The effort required to drive these spikes must have been herculean. Each floor was fastened by a pair of spikes, one from each side of the keel. Most of the floors were held in place by the spikes and nothing more, although a few floors were also transfixed by bolts extending down from the keelson. The shipwrights must have had a good reason for using this fastening method, but it is not yet apparent to us. Again, we will likely gain a better understanding of their approach to shipbuilding as the research and reconstruction proceed.

The timber cache yielded numerous planks and futtocks, but we concentrated on measuring the many floor timbers stacked in its center (fig. 10). These varied from relatively short to quite long, and from only slightly curved



Drawing: E. Laanela

Fig. 10. Floor timber 31 from Angra D.

to nearly V-shaped (depending upon their location in the hull). According to the 1998 excavation records, the hull had a total of fifteen pre-assembled frames amidships, which consisted of the midship frame and seven frame sets forward and aft. The floors and futtocks of these frames were attached to one another with dovetail joints and iron spikes. The grain of the wood usually followed the curve of the timber, and in only a few instances – mostly in the steeply-rising floors from the ends of the hull – did we observe part of the curved exterior tree surface. In all, it looked as if the builders had access to good-quality wood, particularly oak, for assembling this ship.

We had extraordinarily good luck with the equipment and weather in 2001. Despite the hard use of sixteen to eighteen dives per day, the inflatable boat and its outboard engine ran smoothly and the air compressor filled tanks from morning until night with nary a complaint. Aside from minor malfunctions such as blown o-rings, leaky valves, and balky dive computers, our huge array of personal equipment kept functioning. The Azores experienced unusually dry, settled weather conditions this year, with week after week of warm, sunny days and calm sea conditions. The conditions beneath the surface varied with the tides, but the water temperature was reasonably warm and the visibility was often quite good.

All was not idyllic, however, for the seas around the Azores experienced an infestation of jellyfish which local divers and fishermen described as atypical and possibly related to the fine weather conditions. These jellyfish were about ten centimeters in diameter, pink, and trailed long skeins of tentacles that oozed with a potent toxin. They concentrated in the uppermost five meters of water and travelled in schools. Wet suits provided protection against the tentacles, but in the first two weeks of the project, before we learned to be more vigilant during ascents and descents, several of the field crew received nasty stings on their exposed hands and lips. We later discovered that a shot of compressed air released under marauding jellyfish sent them rocketing to the surface and out of our path, and this became the favored method of self-defense while hanging at the decompression stop.

The 2001 project wrapped up on August 10. Over the course of five and one-half weeks we carried out over five hundred dives on the second Angra D timber pile and prepared scale drawings of over one hundred timbers (figs. 11–12). We recorded everything extracted from the pile with photographs and video footage, and collected dozens of wood samples. The fieldwork portion of the Angra D study is finished for now, and the laboratory and library part of the project is just beginning (fig. 13). Much work lies ahead before we can



Photo: K. Crisman

Fig. 11 (left). INA-TAMU archaeologist Brian Jordan records details of the sternposts and one of the iron gudgeons from Angra D.

Fig. 12 (below). INA-TAMU archaeologists Erika Laanela (foreground) and Sara Brigadier (background) record Y-frames from the wreck of Angra D.

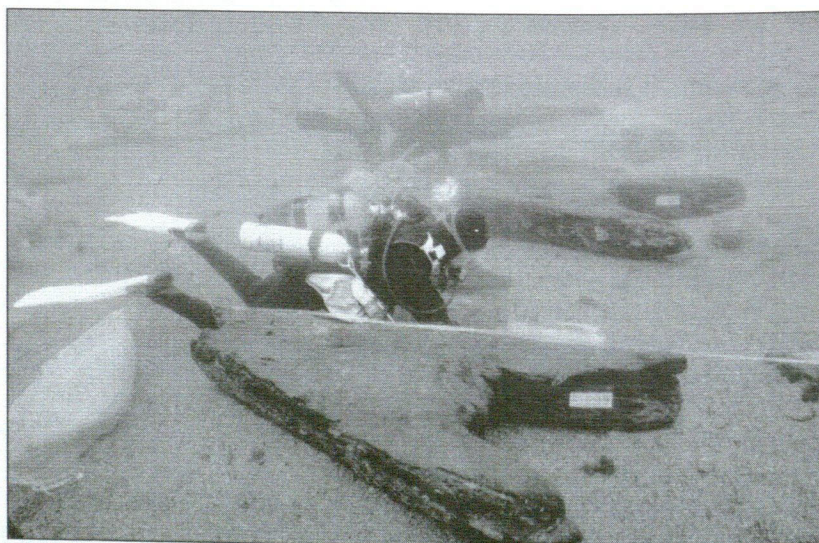


Photo: K. Crisman

begin to bring this forgotten ship back to life through written analyses, lines drawings, construction plans, and (possibly) models. It has told us much already about the state of European ship design and shipbuilding practices around the turn of the seventeenth century. Few wrecks from the first half of that century have been archaeologically studied and even fewer published. Angra D is already helping us to fill in a large piece of the puzzle.

Acknowledgments: The joint Institute of Nautical Archaeology—Direcção Regional da Cultura —Centro Nacional de Arqueologia Náutica e Subaquática study of the shipwrecks of Angra Bay owes much to the support of the sponsoring institutions and their directors. The late Sylvia Baird and the late Frank Darden of INA are especially remembered for encouragement of the research in the Azores. We also wish to thank the members of the INA Board of Directors and their families who traveled to the Azores in July of 2001 (see 26–27, this issue). Board member Alex Nason treated the field crew to a delightful dinner at the Quinto do Martelo Restaurant that will not soon be forgotten. Paulo Monteiro contributed much to the initial study of Angra D. Finally, we wish to recognize and thank the field crew who worked so hard to make the 2000 and 2001 projects so productive. ☞



Photo: K. Crisman

Fig. 13. *Tiago Fraga, a 2001 project member, records a mast step buttress timber at Porto Pipas.*

News & Notes

Texas Museum Exhibits La Salle Materials

A tribute to nautical archaeology is almost the first thing to greet visitors to the spectacular new Bob Bullock Texas History Museum near the Capitol Building in Austin. The ground floor rotunda is filled with a display dedicated to the La Salle expedition. Most of the artifacts and photographs come from the excavation of the French flagship *La Belle*. INA Director of Texas Operations Barto Arnold led the early stages of the discovery of this historic landmark, and many students and graduates of the Nautical Archaeology Program at Texas A&M University participated in the excavation. Because the wreck was safely buried in the sediments of Matagorda Bay for over three centuries, the ship and its artifacts were in a remarkable state of preservation. To keep them that way, they had to be desalinated, dried, and conserved with state-of-the-art techniques. The conservation laboratories associated with the Nautical Archaeology Program have provided that treatment. The items on display at the Bob Bullock Museum give silent testimony to their work, as most of the artifacts now look as if they were from the twentieth century, not the seventeenth. The interpretive displays explain how the La Salle excavation is providing invaluable information about the first European settlement on the Texas coast. This should allow visitors to appreciate the impact of nautical archaeology on our knowledge of the past. ☞

Denbigh Machinery on Display

Moody Gardens in Galveston, Texas, has been devoting considerable attention to underwater exploration lately. The Discovery Pyramid is hosting "Deep Sea Treasures," a hands-on traveling exhibit, from August 18, 2001, through January 6, 2002. Included is a section on the Confederate blockade runner *Denbigh*, which INA has been exploring and excavating in Galveston Bay. Director of Texas Operations Barto Arnold is the Principal Investigator and Project Director. An eight-foot, 550-pound connecting rod from the steam engine is on display, along with the vessel's superheater. Arnold notes that these parts contributed to *Denbigh's* superior speed, which helped the ship complete twenty-six trips when most runners averaged only four before capture. The ship was the last to leave Mobile before that port fell and one of the last two runners to enter the Port of Galveston. The exhibit uses computers, robots, and other new technology to provide an interactive view of the ocean and nautical archaeology. Moody Gardens has several other attractions of related interest to complement the "Deep Sea Treasures" exhibit and the Aquarium. "Into the Deep," a documentary on undersea life, is showing at North America's first IMAX® 3D theatre (along with a 2D film on dolphins). Even the IMAX Ride-film at Moody Gardens has "Sea Trek," an underwater virtual reality experience. ☞

A Question Now Answered: "Who Owns Sunken Spanish Shipwrecks?"

James A. Goold, INA General Counsel

From the start of the Age of Discovery through the end of the Colonial Era, more than a thousand Spanish Royal vessels were lost in the Caribbean and Atlantic. Popular estimates—invariably inflated—put the value of their cargoes at fifty billion, one hundred billion, or even three hundred billion dollars. There is probably no one in the United States who grew up without hearing stories about sunken Spanish treasure. Most of us relished the dream that "finders keepers" can lead to instant wealth for anyone lucky enough to find a Spanish shipwreck. Few realize that the reality is far different: for the majority of sunken Spanish ships, the "treasures" obtained by salvors consist of funds lost by investors who were seduced by the romance of treasure hunting.

An Object Lesson: The Molasses Reef Wreck

My first involvement with Spain's lost ships began as INA Counsel in 1982, when a Spanish ship armed with cannon and other weapons manufactured using pre-1500 technology was found on Molasses Reef in the Turks and Caicos Islands (fig. 1). Treasure hunters soon descended on the site

and made claims, eagerly carried by U.S. television shows, that the ship was Columbus' *Pinta*. Plans were announced to break the wreck into pieces to be sold at five dollars per chunk, coupled with threats to bring suit against INA or anyone else who interfered. Fortunately, the British Government recognized the importance of the site and gave instructions that it should only be excavated by qualified archaeologists (fig. 2). An INA team, of which I was a member, proceeded to the reef, only to find that a significant portion of the site had already been blasted apart by treasure hunters. Worse destruction awaited: the most visible signs of the main wreck area were brightly colored detonation wires drilled into coral heads near the ballast pile.

Although the Molasses Reef Wreck is thought to be the earliest Iberian ship found so far in the New World, the claim that it was *Pinta* has not been confirmed. The odds are against it: From 1492 to 1520 alone, at least 110 Spanish ships were lost in the New World. However, regardless of what ship it was, the saga of the Molasses Reef Wreck epitomized the modern day history of sunken Spanish ships in several ways. First, an irreplaceable historic

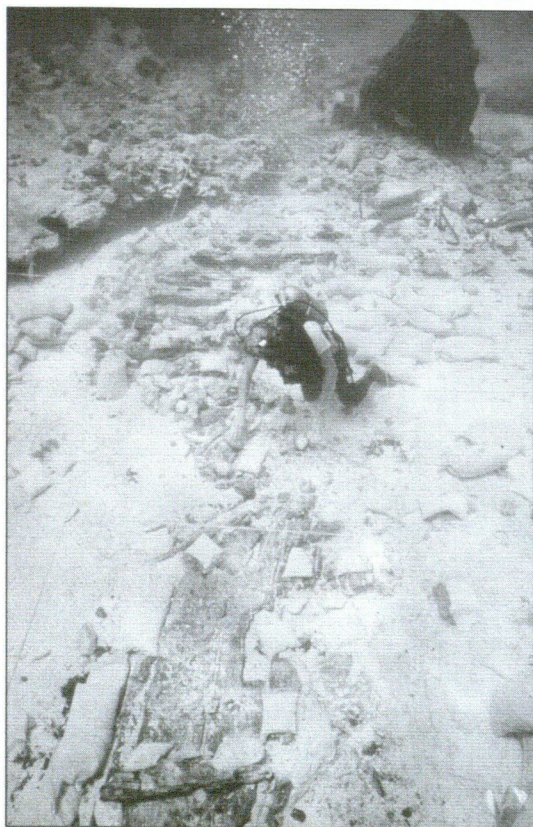


Fig. 1. The Molasses Reef Wreck is significant as possibly the oldest European vessel yet found in the New World.

Fig. 2. Molasses Reef project team members "walk" a cannon to the lifting area.



Photos: INA

site was partially destroyed because it was taken for granted by treasure hunters that they could mine the site for objects of commercial value. Second, even though the ship was virtually certain to have been the property of the Kingdom of Spain, so far as I am aware Spain was not notified of the discovery or consulted about what should be done with the remains of one of its most significant early ships.

The Abandoned Shipwreck Act

Concerns about destruction of historic shipwrecks in U.S. waters led to enactment by the United States Congress in 1987 of the Abandoned Shipwreck Act (ASA). Under that Act, the federal government gave state governments ownership of shipwrecks that are (1) within three miles of land; (2) have been "abandoned;" and (3) are sufficiently old that they have become embedded in the seabed or are eligible for listing on the National Register of Historic Places. At the time, the Act was hailed as a major achievement in the protection of shipwrecks in the United States waters from looting. It was assumed that there would be little difficulty determining which ships were "abandoned" and, as such, the property of the states. Other ships, which had not been abandoned, would remain the property of the original shipowner or the insurance company that acquired ownership by paying a claim on the loss. It was also assumed that the states would take active responsibility for those shipwrecks that became their property and would put in place programs to protect shipwrecks with archaeological or historic significance.

If there is one thing on which archaeologists and treasure hunters might agree, it is that the ASA has *not* put an end to disputes over ownership of historic shipwrecks. One reason lies in the fact that the Act does not expressly define what "abandoned" means. When the crew leaves a sinking ship, that does not mean it has been legally abandoned by the owner. Under admiralty law, the owner retains title to the wreck, which includes the right to decide whether to permit salvage. How then, can it become abandoned? Does this mean that the owner of the ship declared that it has given up any rights to the ship? On the other hand, does "abandonment" occur if the owner simply did not try to salvage the ship during the decades or centuries after it sank?

Long before the ASA, however, the legal principle had developed that warships and other government vessels are sovereign property of their nation and are not abandoned except by official government act. These principles of international law and diplomatic relations no doubt go back to the Roman era, if not earlier. It is understood that a ship (or airplane) owned by a nation remains the property of that nation wherever it may be located, and whether it is afloat or sunken, unless it was captured in time of war. Important principles of national sovereignty underlie this concept. We were all recently reminded of this when a United

States intelligence plane made an emergency landing in China.

Ownership can also affect important humanitarian values. In many (if not most) cases, sunken sovereign ships such as naval vessels are the gravesites of military personnel who died in the service of their country. Among civilized peoples, it is unacceptable to disturb the gravesite without the consent of that nation. This concept is most easily grasped with respect to modern naval vessels. When a U.S. Navy vessel sinks, even the most ardent treasure hunters usually understand that it remains the property of the U.S. government, and that it may not be disturbed without Navy permission. However, salvors often forget that this principle is not limited to modern warships, and that it applies to vessels of other nations as well. The royal vessels of Spain, France, Great Britain, and other countries were—and still remain—sovereign property of those nations just as much as U.S. Navy vessels are U.S. property.

After the Molasses Reef Wreck, my legal work on admiralty matters focused on ships of more recent vintage such as *Queen Elizabeth 2*, supertankers, and container ships... most of which had not sunk. In 1997, however, the United States Supreme Court agreed to hear a case, *Deep Sea Research, Inc. v. California*, involving whether the privately owned paddlewheel steamer *Brother Jonathan*, which sank a few miles off Northern California in the nineteenth century, had been abandoned according to the ASA. The case was expected to produce a definitive ruling on the meaning of "abandonment" in the Act. Therefore, I agreed to represent the National Historic Trust for Historic Preservation and other major archaeological groups with an interest in the principles at stake. As it turned out, the Supreme Court decided the case on grounds that did not spell out what "abandonment" means, either for privately owned or sovereign vessels. I did not know it at the time, but a far more significant engagement lay ahead: representing Spain to uphold its sovereign rights with respect to sunken vessels.

The Landmark *Juno* and *La Galga* Litigation

Without consulting Spain, the Commonwealth of Virginia issued a permit under the ASA to a commercial salvage firm. Sea Hunt, Inc. was licensed to remove artifacts from two Spanish Royal Navy Frigates, *La Galga* and *Juno*, lost off Virginia in 1750 and 1802, respectively. On learning of the permit, the Embassy of Spain issued Diplomatic Notes. These protested that the ships had not been abandoned, but were military gravesites that should not be disturbed without Spain's consent.

Litigation soon followed when Sea Hunt and Virginia ignored Spain's concerns and filed suit in federal court in Norfolk, Virginia. They claimed that the ships had been abandoned by Spain, simply by the passage of time since their sinking, and therefore had become the property of Virginia

under the ASA. In a major policy development reflecting growing recognition of the need to protect historic shipwrecks, the Government of Spain decided to appear in the U.S. court—a decision not lightly taken by any foreign government. Spain's position focused on two key principles: (1) the vessels had not been abandoned and remained national property; and (2) no salvage activities can be conducted on Spain's vessels without authorization by Spain.

La Galga

As with virtually all shipwrecks, behind each of these is an interesting and poignant history. *La Galga* was a fifty-gun frigate built in 1732 and assigned to Spain's Caribbean Fleet, where it served in the little known War of Jenkins' Ear between Spain and Great Britain. In August 1750, *La Galga* was assigned to escort a convoy of seven cargo ships from Havana to Spain. On board *La Galga* were a company of Spanish Royal Marines, a number of Dutch and British military prisoners arrested in the Caribbean for various infractions who were being transported to Spain for trial, and a shipment of mahogany and other supplies for the King of Spain. The Captain of *La Galga* was an Irishman, Daniel Mahoney ("Huoni" in Spanish), serving the King of Spain. On the northbound Gulf Stream leg of the trip, the fleet was overtaken by a hurricane and shattered: five or six of the ships in the convoy sank or were driven ashore. *La Galga* grounded on shoals about a mile off Assateague Island, very near the border between Virginia and Maryland. Most of the prisoners and crew reached shore and much of the stranded wreck remained above water for the next month or two.

From late August through October 1750, Captain Huoni remained at the wreck site, futilely trying to protect it from looting by the locals. The Colonial Archives of Virginia contain increasingly desperate correspondence from the captain pleading for the Virginia Sheriff to come to the site and protect it, but none of his pleas appear to have been answered. The next documentary evidence is a late October 1750 letter by Captain Huoni to the Governor of Maryland. He reported that one of the locals had finally told him, presumably after everything of value had been stripped from *La Galga*, that the wreck lay off Maryland, not Virginia, and Captain Huoni ought to direct his pleas for assistance to Annapolis. The Governor of Maryland wrote back pledging help, but it was too late. A second storm had shattered the ship and driven the remains into the seabed. Local lore has it that coins from *La Galga* and pieces of her timbers still turn up on shore after storms. Interestingly, *La Galga* is also often said to be the source of the famous wild ponies of Chincoteague.

Juno

Juno was a thirty-four-gun frigate built in 1789 at the start of the Napoleonic Wars. Over the next decade,

she was involved in extensive combat duty, principally in the Caribbean. In January 1802, during a hiatus in Spain's participation in the war, *Juno* left Vera Cruz bound for Cadiz with a Royal Treasury shipment on board, but she was forced by storm damage to put in at Puerto Rico for eight months. While *Juno* was laid up in the shipyard, the funds were offloaded and transferred to another ship, *Asia*, that continued on to Cadiz.

After *Juno's* repairs were completed in October 1802, it was assigned to serve as a troopship and sailed for Cadiz. It carried the soldiers of the Third Battalion of the Regiment of Africa and their families, home to Spain from extended duty in the Caribbean, a total of 432 people.

Like *La Galga*, *Juno* ran into a hurricane off the U.S. Atlantic coast. On the fifth day of the storm, an American schooner, *La Favorita*, sighted the foundering *Juno* and began efforts to rescue the passengers, which the crew had abandoned. Seven people were transferred to *La Favorita* before the ships were driven apart by heavy seas. When last seen by *La Favorita* on October 28, 1802, *Juno* was awash and her main deck was crowded with women and children facing imminent death. *La Favorita* lost sight of *Juno* in fog and the 425 people on board vanished. For the next six months, Spain's Consul General in Boston canvassed United States ports seeking information about *Juno's* fate, but there were neither survivors nor any sightings of wreckage.

As often happens with Spanish ships, *Juno* became transformed over time into a legendary "lost treasure galleon." Just before litigation started, one treasure hunting firm opened a website to announce to potential investors that it had found *Juno* and posted photographic "proof," consisting of a picture of a length of anchor chain. The chain was readily identifiable as having been manufactured in New England long after *Juno* sank. All reliable information indicates that the contents of *Juno* consist not of "treasure," but the remains and personal effects of the 425 people who went down with the ship.

The Litigation Begins

Once the *Juno/La Galga* litigation began, it quickly became an international test case. Spain, Great Britain, the United States, and other nations sought to maintain ownership of their long-lost sovereign vessels and to prevent unauthorized disturbance of underwater military gravesites. The United States Departments of State, Defense, and Justice provided strong submissions on the military and foreign policy interests of the United States. The remains of Spanish vessels and the gravesites of victims of a Spanish maritime disaster should receive the same protection that the United States Government expects from other nations. There are sixteen thousand or more sunken U.S. Navy ships and aircraft around the world; these carried tens of thousands of lost U.S. military personnel.

Before long, Great Britain also became involved in the litigation. A critical issue developed when Sea Hunt and Virginia claimed that Spain had abandoned *La Galga* in the 1763 Treaty of Peace between Spain, France, Great Britain, and Portugal that ended the Seven Years War. In the Treaty, Spain ceded to Great Britain all Spanish territory "on the continent" of North America east of the Mississippi in exchange for the return to Spain of Cuba, which Britain invaded in 1762. On learning of the importance of the 1763 Treaty in the case, the British Government issued a Diplomatic Note agreeing with Spain that the Treaty had not affected the status of shipwrecks and applied only to land, not to offshore areas. The concept of a three-mile offshore area as part of national territory did not arise until 1793. Prior to then, the "cannon shot rule" was generally recognized. Nations were understood to have the right to keep hostile vessels from coming within a cannon shot distance of their territory, but not to have territorial ownership of that area.

The 1763 Treaty also contained a significant provision concerning moveable Royal property, as opposed to land. A little known provision expressly reserved to the King of Spain "the power to cause all the effects that may belong to him to be brought away [from North America] whether it be artillery or other things." In other words, Spain retained its rights to all Royal "effects" (i.e., moveable property) located in North America. Extensive documentation from the Royal Navy Archives and other sources also showed that over the centuries since 1750 Spain had never stricken *Juno* or *La Galga* from the rolls of the Spanish Navy. Under Spanish law, just like U.S. law, Spanish national property can only be abandoned by an express act authorized by national legislation.

The Court of Appeals Decision

On July 21, 2000, the United States Court of Appeals for the Fourth Circuit issued a sweeping and historic (in every sense of the word) decision affirming that the ships had *not* been abandoned and upholding Spain's rights to its Royal vessels. As an initial matter, the court construed the terms of the 1902 Treaty of Peace and Friendship between Spain and the United States, the treaty which ended the Spanish-American War. This remains in force as the basic treaty defining the relationship between our nations. The Court held that Spanish shipwrecked vessels are entitled to the same protection under our laws as U.S. government ships. Because Spain has never abandoned *Juno*, *La Galga*, or other Royal vessels, U.S. courts must protect them equally with U.S. Navy vessels. On a more general level, the court also ruled that under international law, the U.S. will provide sunken vessels of other nations, particularly those that are gravesites, with the same protection that the U.S. expects those nations to provide U.S. vessels and gravesites.

The court also affirmed that the understandings of Spain and Great Britain concerning their 1763 Treaty were correct interpretations entitled to respect by the U.S. courts. Additionally, because the King of Spain's right to remove Royal "effects" from North America contained no expiration date (unlike virtually every other provision in the Treaty, which contained specific deadlines for North America, Canada, India, and much of the rest of the world to change hands), that right remains in effect. In short, *Juno* and *La Galga* are not abandoned. They remain the property of Spain just as they were when they sank.

After upholding Spain's ownership of *Juno* and *La Galga*, the court went on to affirm that Spain also had the right to prohibit any salvage of artifacts by Sea Hunt. This right was recognized as a prerogative of Spain as owner of the ships, as well as out of respect for Spain's right to leave a military gravesite undisturbed. Because Sea Hunt knew that the wrecks had been Spanish and had not obtained Spain's consent to remove artifacts, Sea Hunt had acted at its peril. It was ordered to return to Spain's possession all artifacts it had taken from the ships.

Sea Hunt and Virginia, supported by an array of treasure-hunting organizations, then petitioned the Supreme Court to reverse the court of appeals' decision. While the petitions to the Supreme Court were pending, the United States also took an important step to formalize its support of the principles at stake in the litigation. On January 19, 2001, the White House issued a Presidential Statement on United States Policy for the Protection of Sunken Warships, affirming the United States commitment to protection of sunken sovereign vessels of all nations. On February 20, 2001, the Supreme Court rejected the petitions of Virginia and the treasure hunters, making the court of appeals' decision final. I thought the Supreme Court's ruling put an end to the litigation; unfortunately, I was too optimistic. Faced with a final order to turn over to Spain all artifacts taken from *Juno* and *La Galga*, Sea Hunt refused, claiming that the artifacts might have come from other ships. Further court proceedings followed, culminating in a court order that Sea Hunt turn over to Spain all artifacts it had recovered. Moreover, it was to provide Spain with the exact coordinates where it recovered anything.

The artifacts include two Spanish Navy anchors and several hundred small objects. There are Spanish coins with dates consistent with both ships, as well as small military items such as officers' tunic buttons, and other miscellany. On March 16, 2001 the small artifacts were delivered to the Spanish Embassy in Washington and the anchors were placed at the Assateague National Park Seashore facility of the U.S. Park Service. The conservation needs of the artifacts are being determined, and arrangements for museum display are being made. Spain is planning surveys of the sites to determine the condition of *Juno* and *La Galga* and assess whether further steps should be taken.

Since the litigation returning the *Juno* and *La Galga*, with their lost soldiers and sailors, to Spanish custody took place in Norfolk, it was all the more fitting that the final leg of their latter day saga began there. On April 27, the *Castilla*, a 13,000 ton Spanish Navy helicopter carrier, attack transport, and command ship, sailed from NATO Base Norfolk. Aboard were numerous dignitaries (and my wife Dabney, daughter Catherine, and me) to conduct a commemoration at sea in honor of the lost soldiers, sailors, and passengers of *Juno* and *La Galga*. Two hundred fifty-one, and one hundred ninety-nine, years after the sinkings, the Kingdom of Spain accorded full military honors to its lost soldiers and sailors.

Future Implications

From the start of the case, there have been almost daily inquiries from the media, archeologists, treasure hunters, and others asking what the long-range implications of the *Juno* and *La Galga* litigation will be for nautical archeology and for treasure hunting. In the Spanish media, the

litigation quickly took on a high profile as a welcome step to protect Spanish sovereignty and the shared cultural heritage of Spain and the Americas. Media interest in the U.S., on the other hand, has tended to focus on the precedent as a threat to treasure hunting. The case is likely to have similar impact on the preservation of other shipwrecks, such as British, French, and Dutch naval and government vessels.

For obvious reasons, I have refrained from public statements about possible future lawsuits or diplomatic activity with respect to Spanish ships. I will say, however, that the litigation and its outcome should be particularly welcome to the archaeological community and for historic preservation in general. We have made it clear that Spain's purpose is not to prevent study and recovery by appropriate institutions of the cultural heritage represented by its sovereign vessels. Rather, Spain seeks to establish a framework in which cooperative programs concerning Spanish shipwrecks can be conducted for the benefit of the public.

Acknowledgments: I use this opportunity to thank David Beltran, Counsellor for Juridical Affairs; Rafael Conde, Deputy Chief of Mission; and Ambassadors Oyarzabal and Ruperes of the Embassy of Spain for their guidance and support. Admiral Gonzalez Aller Hier and Admiral Tafalla of the Royal Navy of Spain took an understandably strong interest in protecting the gravesites of their predecessors. I also thank Capt. Ashley Roach, Esq., of the U.S. Department of State; Barbara O'Malley and Richard Olderman of the U.S. Department of Justice; and Marion McQuaide of the Royal Navy (U.K.) Historical Office. Finally, I thank His Majesty King Juan Carlos I for his Decree of December 13, 1999, appointing me a Commander in the Order of Queen Isabella. ✍

Suggested Reading

Sea Hunt, Inc. and Commonwealth of Virginia v. Kingdom of Spain, <http://laws.findlaw.com/4th/992035p.html>



The Spanish Ambassador thanks the author for his assistance in protecting Spanish navel shipwrecks in United States waters.

The "Archaeology" of Fifteenth-Century Manuscripts on Shipbuilding

John McManamon, S.J., INA Research Associate

Armando Petrucci of the Scuola Normale in Pisa once observed that codicology and paleography comprise an "archaeology of the book." Those disciplines focus their methods of study on the material remains of written culture: codicologists treat a codex's constituent elements and paleographers treat the script on its pages. The genius of Petrucci's analogy can quickly be illustrated by reference to stratigraphy. A codex contains characters written down at various moments in its existence, often in differing historical scripts. Careful analysis of those "layers of handwriting" becomes a privileged tes-

timony to the history of its use. Petrucci's analogy can be carried one step further, for there are significant parallels between the work of a paleographer and that of a nautical archaeologist. The book comprises a sort of hull, a mobile container built by a group of skilled artisans. What is written within the book comprises its cargo, moved about for a variety of reasons, among which figure commerce. We still speak today of the "book trade." We can appreciate the promising possibilities of these analogies by examining a small group of codices of interest to readers of this *Quarterly*: fifteenth-century manuscripts on shipbuilding.

Florence, Biblioteca Nazionale Centrale, cod. Magl. XIX.7

Anonymous, *Libro di Marineria*

In Venetian, on paper; written sometime between 1475 and 1525 in Italy; 210 X 156 mm.; 131 folios; pen and ink drawings with rubrics; two hands; late one-sixth parchment binding covered by ivory marbled paper.

In the nineteenth century, Admiral Jal made this codex famous when he labeled it "Fabrica di Galere" and transcribed portions of its texts. The title in the codex itself, which means "A Handbook on Seafaring," is actually fairer to the contents.

The container: the codex is small in format, making it easy to store or carry. It is assembled from paper with three different watermarks that help to date the book. The handwriting has minimal embellishments, generally over-size initials that sometimes violate the left-hand margin. The codex is also embellished with pen and ink drawings accompanied by rubrics. That means that the scribe submitted the work to an illustrator for the drawings. These do not appear to be traced; there are no prickings or impressions in dry point. They illustrate mathematical lengths and ship construction.

There is a distinct difference in handwriting styles as one moves through the codex. The first four fascicles (leaflets bound together into a codex) are written in a Humanist cursive hand of high quality. The scribe was attentive to details: strokes are upright, the margins by and large are respected, and a template was placed beneath the page to align the characters. The style changes at the beginning of the fifth fascicle. The hand is still Humanist cursive, but the writing becomes more cursive, inclining conspicuously to the right. Though continuing to use a template, the scribe now shows less respect for the margin. Specific characters are inscribed in a way that differs from the earlier writing.

Although one scribe may have written the entire codex, changing his style briefly in mid-stream and later

returning to his more formal, upright cursive script, it is more likely that a second scribe wrote the fifth fascicle and a portion of the sixth. The attention to detail and the upright ductus of Scribe A suggest that he was a professional copyist. Why then would he pass along his responsibilities to Scribe B and later take the book back to finish it himself? There is no obvious answer, though one could envision a case where he was simply too busy with a variety of commissions and needed temporary assistance. Things would be simpler had the change in hands begun at the beginning of a fascicle (as it does) and ended at the end of a fascicle (which it does not). The question of two hands in the codex becomes more intriguing when one examines the contents and their relationship to the handwriting.

The cargo: the forward portion of the codex has a coherent block of material on the building and outfitting of a series of Venetian vessels (the Atlantic great galley, the Mediterranean great galley, the light galley, the lateen-rigged round ship, and the square-rigged round ship). The nomenclature used for these vessels in the codex seems anachronistic: "the galley of Flanders" or "the galley of Romania." The exposition is at times confused. The discussion of the galley of Romania is interrupted by a treatise on cutting sails, the explanation for building a light galley begins in mid-sentence, the illustrator stopped working at fol. 33v and left blank spaces until fol. 48v, and folios are at times left blank at the conclusion of the discussion of a given ship type. Moreover, the material recorded deals not only with building vessels but with their masts, yards, shrouds, rudders, and anchors. In the case of shrouds, ex-

PLICIT mention is made of the methods used in the Venetian Arsenal.

Amidships, the material in fascicle 5, where the change of hands apparently occurs, is introduced by the illustration of a round ship. Scribe B then recorded information on estimating the displacement of vessels, on a balinger built by those "living in the West," and on the outfitting of vessels in general. That lengthy disquisition on outfitting is continued by Scribe A, who went back to work on fol. 65 in the midst of a discussion of cutting sails. The correspondence between the work of Scribe B and the discussion of the balinger built by "quelli de ponente" is significant. The balinger is the only non-Venetian vessel discussed in the manuscript, and the discussion is structured according to the proportional relationships utilized to project Venetian hulls. Could Scribe B have had some supplementary information unavailable to Scribe A?

In the stern of the codex, more materials on shipbuilding were entered. Vessel types discussed earlier, such as the galleys of Flanders and Romania and the light galley, are treated again with some variation, new smaller types of oared vessels such as *fuste* are introduced for the first time, and mention is made of a vessel designed by a specific shipwright, a light galley that Theodoros Baxon designed and Thomas Chaxios completed after the master's death. Born on the island of Rhodes, Baxon was so admired for his skill in constructing light galleys that he was hired by the Arsenal in Venice. Early in the fifteenth century, the Arsenal paid him a salary that caused envy among his Venetian competitors. Around the time of Baxon's death in 1407, the Venetian government made the extraordinary decision to conserve as models eight hulls he had built. They were entered into a competition for hull design in 1425 and were still in existence in 1431. The manuscript conserves a verbal description of a hull designed by Baxon, using mathematical lengths and proportions to hand on the complex shape.

In addition to matters of shipbuilding, the last portion of the Magliabecchiano codex preserves information on the quantities and prices of materials needed for that craft (timber, iron, etc.), a recipe for gunpowder, a brief explanation of the tides in the Venetian lagoon, and a lengthy treatise on the art of cutting sails. In that last treatise on sails, over twenty different methods are compiled for comparison. One especially proficient approach is at-

tributed to a Venetian, Marco Zen. Likewise, there are two other references to methods followed in the Venetian Arsenal for building oared vessels called "falcons" and for assembling oars.

Stratigraphy, Provenance, and Significance: the scribe(s) copied materials from existing sources. They drew primarily upon Venetian source materials, derived in general from methods followed at the Arsenal. Theodoros Baxon earned a place of recognition for hull design, as did Marco Zen for sail cutting. The scribes also included source material from "those in the West," and that material on a balinger explains hull construction using the same system of lengths and proportions in use at Venice. The suspicion that Scribe A and Scribe B were professional copyists is further supported by the fact that each made corrections in the manuscript. They both went back and checked their work against the original sources. The codex was never completed, as the missing illustrations indicate, and it has suffered little wear and tear through the ages, suggesting that it quickly found a safe place in the commissioner's personal library or writing desk.

A second manuscript copy of the same material is presently preserved in the Austrian National Library in Vienna. That copy was once in the possession of the Foscarini family of Venice. The fact that two copies of the same material exist suggests that the texts were conceived as a book for circulation. Physically, the book shares some elements with typical vernacular codices of the late fifteenth century: the small format, the use of paper as the material component, and the use of Humanist cursive as the script. There is an effort to enhance the material value of the little book in the upright ductus of Scribe A's writing and in the employment of a professional illustrator. In fact, text and illustrations work together to make the book comprehensible.

We still must inquire about the individual who commissioned the copying of the book. Logically, he was someone interested in the building and outfitting of a variety of vessels. We might also be curious about the genesis of the earlier compilation that was eventually copied into the Florence and Vienna manuscripts. Frederic Lane has argued that the original materials were gathered by someone associated with the Arsenal itself, perhaps the "admiral" whose primary responsibilities lay in outfitting vessels built and laid up in that shipyard. Other codices conveying the same texts shed further light on these questions.

Greenwich, National Maritime Museum, cod. NVT.19

Anonymous, Ragioni antique spettanti all'arte del mare et fabriche de vasselli

In Venetian, on paper; written from 1470 to 1561 in Venice; 416 X 275 mm.; 67 folios; text, numerical tables, and drawings in pen and ink and in colored wash; eight hands; late eighteenth-century binding of parchment over pasteboards.

The container: the codex is large in format and awkward to move from place to place. It is assembled from paper with two watermarks. The graphic elements of the

codex are notable for their high quality; the hands drawn to demonstrate mathematical calculations are superior to hands in other codices. When rendering the historical car-

racks *Masorba* and *Scoribuca*, the illustrator consulted the talented Venetian artist Gentile Bellini for advice on obtaining the appropriate blue tone for the sea (fig. 1).

Among the eight hands identified in the codex, Scribe B is the one who commissioned the book in the first place. He paid Scribe C to copy texts on shipbuilding, and that scribe set to work on December 27, 1470. He also paid two other scribes to copy texts, and they used a traditional "Laus Deo" invocation to begin their work. The commissioner, Scribe B, then utilized the remaining space in the book to record matters of personal interest. Around 1500, he bequeathed the book to a member of the De Milliis family of Venice, to which he probably belonged. References in the codex to the De Milliis make it clear that they were involved in the maritime business and naval defense of Venice. Domenico de Milliis died at the battle of Zonchio in 1499 while serving on a galley commanded by Vincenzo Polani. This folio codex was thus the prized possession of the De Milliis, whose members used it as a family journal and a reference work.

The cargo: as the various hands demonstrate, the core of the codex is a compilation from other sources. The context for this material would appear to be business and war at sea. There are texts that illuminate various facets of contemporary navigation: portolans describing the coastlines, charts for the position of the stars and sun and moon, lists of months that are unlucky for sailors, discussions of tidal action, and accounts of the results of lead soundings. Much of this information is contained in other fifteenth-century codices, and some of it was copied as early as 1380 in the Zibaldone Da Canal now conserved in New Haven. The codex also carried information on shipbuilding culled from previous sources. In fact, it has materials found in the Florence and Vienna codices, including the reference to the light galley designed by Theodoros Baxon.

Once the commissioner had his basic reference materials, he updated them periodically with information that came into his possession. On the subject of shipbuilding, he wrote down cases of quality design, of contracted design, and of personal design. His codex betrays a subtle new tendency to highlight the person of the shipwright, who emerges as an acknowledged master within a guild of licensed artisans regularly employed by the Venetian Arsenal. The designs are made intelligible by the interaction of verbal and graphic information.

The title assigned to this collection supplies an important clue to mentality: "ragioni antique" means "ancient methods." Much as Italian Renaissance humanists and artists claimed to find their inspiration in ancient methods of public speaking and canons of representation, so a ship designer of the late fifteenth century claims to provide prescriptions for shipbuilding in keeping with the tenets of ancient practice. To

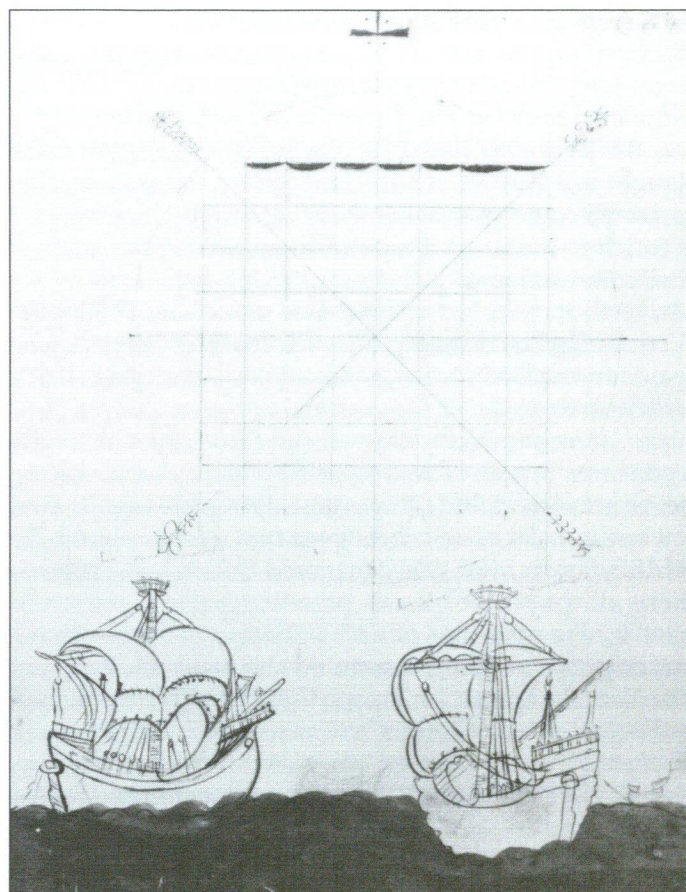


Fig. 1. National Maritime Museum cod. NVT.19, fol. 64. The depiction of the carracks *Masorba* and *Scoribuca*. By permission of the National Maritime Museum, Greenwich.

this day, we do not know how "ancient" those prescriptions really are. The earliest probable material evidence for the use of such prescriptions in the construction of a vessel is supplied by the Serçe Limanı wreck from the eleventh century. Some scholars have argued that such principles are implicit in the hull remains of the Roman barges from Lake Nemi and the architectural teachings of Vitruvius. The claim to revive ancient practice in the Renaissance was not always accurate. Humanists felt that they had revived Roman script, calling it "antiqua," when they had actually revived the Carolingian minuscule script used in the oldest manuscripts of classical texts they could readily find.

The choice of the word "ragioni" is even more indicative. In Venetian and Italian, "ragioni" can refer to the act of calculating and to proportion. When the texts discuss shipbuilding, they often relate one part of a vessel to another (*per rason de l'alttro*). Standard mathematical training for Italian merchants during the Renaissance often reduced problems to the "Rule of Three": two is to four as eight is to an unknown (2:4::8:X). Students were taught to think proportionally

in order to arrive at a correct answer. Ultimately, though, *ragione* and its variants derive from the Latin term *ratio*. In addition to its mathematical connotations, *ratio* also refers to the theory or the principles of a given art. Every *ars* had a *ratio*, a set of rules that can be taught to a learner of sufficient ability. By grasping the principles and practicing them repeatedly, one became proficient in the art. Shipbuilding, then, in the mind of the commissioner of this manuscript, was such an *ars* and had its own set of teachable principles. When the Venetian government hired Theodoros Baxon in 1403, they paid him explicitly to teach "the art of shipbuilding" (*l'arte della marangonia*).

Stratigraphy, Provenance, and Significance: this folio codex was conceived as a repository for copies of existing texts, grew to include important data added by its first owner, passed as an inheritance to a member of the De Milliis family, and was conserved through the generations down to 1561 as an organic heirloom personalized by the notations of each subsequent owner. In the seventeenth century, it entered the massive library of the Venetian patrician Iacopo Soranzo. The Jesuit book collector—Matteo Luigi Canonici—purchased the book in the eighteenth century, and his heirs sold it to the Reverend Walter Sneyd in the nineteenth century. Having

reached the British Isles, the codex was eventually purchased for the National Maritime Museum by James Caird in 1934.

This is not a practical book that would be easy to carry around for ready reference. It would occupy a fixed place in a library and generally need to be consulted there. The common materials found in this and other codices of the period point to a shared culture of maritime activity among a group of Venetian bourgeoisie. As reflected in the surviving codices, their interests in seafaring might extend to shipbuilding, but that was not necessarily the case. This particular codex has a marked interest in specific designs for vessels. The design of Baxon for a light galley was a clear watershed. Among other ship carpenters, the manuscript explicitly mentions Baxon's nephew Nicola Palopano, Giorgio di Giovanni, and Nicolò Vitturi. The commissioner of the codex had direct contact with shipwrights working in the Arsenal; he acknowledges that Andrea Rizo built a vessel for him. He was confident enough to attempt to draw his own master-frame for a galley, and he was likewise confident enough to rate another design for a light galley as virtually flawless (*perfetissima raxon*; fig. 2). He was proud to number shipbuilding among the crafts (*artes*) with its own ancient methods.

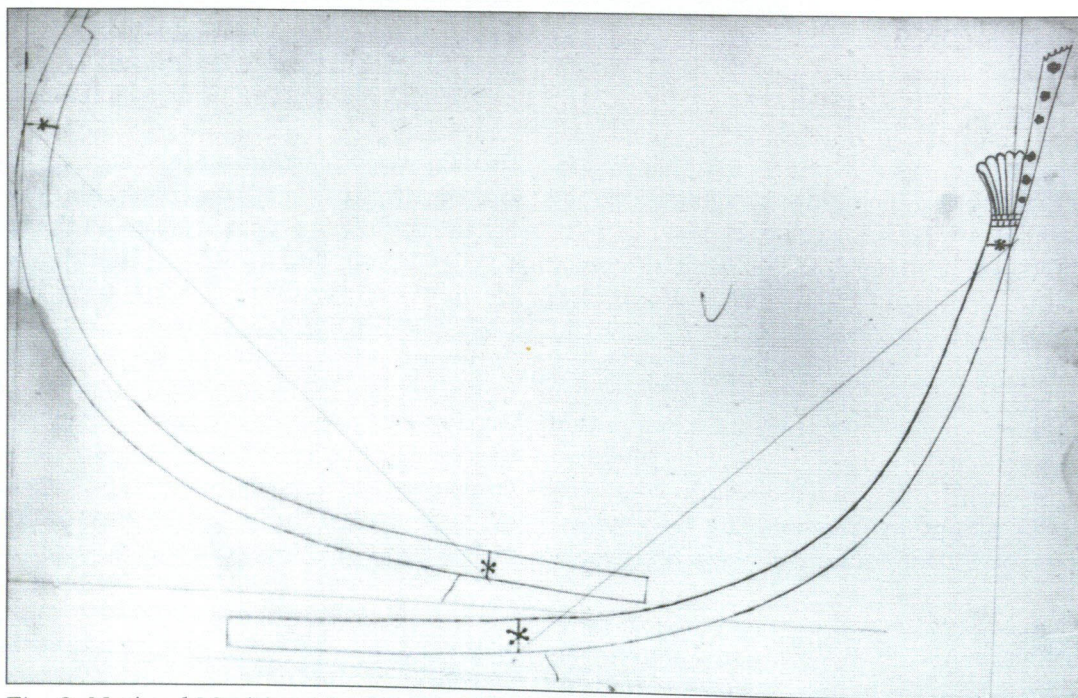


Fig. 2. National Maritime Museum cod. NVT.19, fol. 50v. The posts for a light galley which the original owner of the codex rated sublime artistry. By permission of the National Maritime Museum, Greenwich.

Zorzi of Modon, *Zibaldone*

In Venetian, on paper; written from 1444 to 1449 in Venice and aboard Venetian vessels; 213 X 144 mm.; 64 folios; pen and ink drawings; three hands; original binding in paper that now forms part of a composite codex.

The container: we return to a codex of small format that is put together from a consistent lot of paper with a single watermark. The codex has drawings, perhaps by the author himself, and it was written primarily by its commissioner and owner, Zorzi Trombetta of Modon, who played the trumpet on board Venetian vessels. Zorzi first used the book as a small compendium for music; the initial musical entries were copied by two different scribes. He then turned the rest of the volume into a "hodgepodge book" (*zibaldone*) indicative of his personal interests and activities.

The cargo: in the forward part of the codex, one finds a compendium of music, late medieval *rondeaux* in old French and Italian. It was a logical place to begin for one who earned his living by playing the trumpet, both in an official capacity on board ship and in freelance fashion at events such as weddings. Zorzi may have bought the book with music already written into it by Scribe A and then had a second scribe add a few more pieces. More likely, he

had Scribe A copy some music when he bought the book and later had Scribe B add a few more pieces.

The majority of the codex is filled with texts that reflect Zorzi's eclectic interests. He included mathematical problems that would keep his bookkeeping and business skills sharp. The problems were most likely copied from a previous compilation because, in one instance, Zorzi wrote down incorrect figures in the problem but still managed to arrive at the correct solution. He devoted many pages to matters of "military engineering" such as the bridging of streams and the launching of projectiles. The author included texts related to matters of health, from stopping nosebleeds to exploiting rosemary. Finally, he included a good deal of material on seafaring. He has a section on the cutting of sails, which is similar to the instructions in the Magliabechiano and *Ragioni* codices as well as further codices now preserved in Venice and Padua. If Zorzi was working from the same source as the others, he enjoyed rewording his source and rectifying its figures. He also has a number of

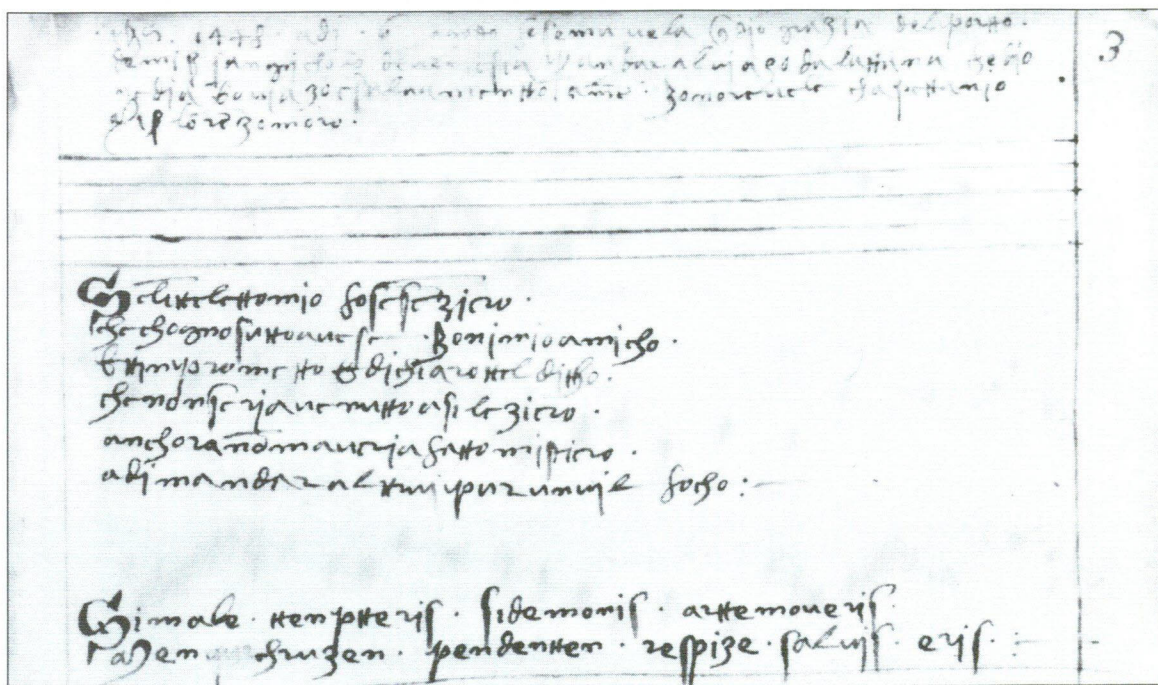


Fig. 3. British Library cod. Cotton Titus A. 26, fol. 3. A note in the hand of Zorzi Trombetta of Modon indicating that he served on a vessel commanded by Lorenzo Moro in 1448 ("1448 a di 6 agosto fesemu vela con dio grazia del porto de miser fangicholo de venesia per andar al viazo da la ttana che dio ne dia bon viazo e salvamentto amen. Honorevole chapettanio miser lorenzo moro.") By permission of the British Library, London.

guidelines related to the building of vessels which are culled from earlier sources and reworded in his characteristic way.

When traveling as a herald on Venetian ships, Zorzi took his book along and added notes as he went. This is the first time we have evidence that a book designed to be mobile moved a great distance and the first time we have a compilation of materials on seafaring sailing on board ship. Supplied with music he might need, Zorzi also had space in the little volume to keep his accounts for business conducted along the way. He had access to a wine supplier in Modon, perhaps a family vineyard, and, when traveling a route through his hometown, he took orders for the wine from passengers and fellow crew members such as Gerardo the piper. He once worked on a ship commanded by Lorenzo Moro that departed from Venice for Azov on the Black Sea in August 1448 (fig. 3). One of the vessels drawn into the little book is a round ship that displays the flags of the Moro family (fig. 4). As superstitious as most sailors through the ages, Zorzi insured himself against possible disaster by penning a few prayers and moral epigrams into his precious volume.

Stratigraphy, Provenance, and Significance: the book comprises a double layer of texts, beginning with the music that Zorzi commissioned from two scribes and continuing with the texts related to his personal interests. From 1446 to 1449, during at least three different voyages for

Venice, Zorzi scribbled a series of notes in leftover space. The little book made its journey to England within a century of Zorzi's death. It was bound with other manuscripts into a composite codex assembled by Sir Robert Cotton (1571–1631). The composite book passed to Cotton's heirs and was eventually willed to the British government in 1700. It survived a fire in 1731 with minimal damage and was moved into the British Museum in 1753.

The original little codex testifies to the active intellectual curiosity of a Venetian shipboard trumpeter. As Zorzi traveled on Venetian vessels, he became curious as to how they were built. In a Mercantile gothic script characteristic of the bourgeoisie of the later Middle Ages, Zorzi filled his book with information copied from several different sources and made the improvements he judged necessary in orthography and expression. Apparently, he copied the math without doing the math, getting the right sum from the wrong components. Similarly, he copied information on shipbuilding from the canonical source preserved in the Florence and *Ragioni* manuscripts, but he made what he deemed appropriate editorial changes in that material as well. It is not surprising, then, that this enterprising trumpeter of independent mind would proudly leave us a record of his supplementary earnings as he traveled, whether by marketing the wine produced in his native Greece or playing his music on ceremonial occasions.

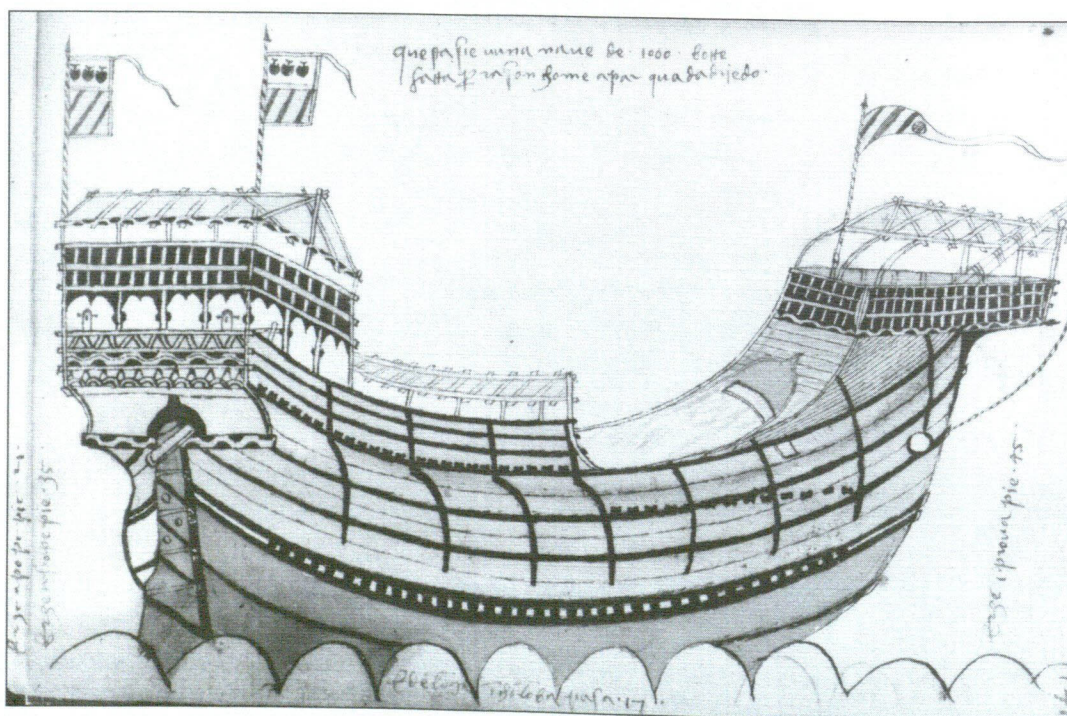


Fig. 4. *British Library cod. Cotton Titus A. 26, fol. 41. A merchant vessel of "1000 botte" that displays the standards of the Moro family of Venice. By permission of the British Library, London.*

"Utopia"

Michael of Rhodes, Zibaldone

In Venetian, on paper; written from 1434 to 1473 in Venice; ca. 195 X 140 mm.; 240 folios; drawings in pen and ink and in colored wash; autograph of Michael of Rhodes; original binding of green doeskin over woodboards.

The container: the codex is the smallest yet encountered and is once again assembled from paper. There are several clues to the efforts that Michael of Rhodes made to assure himself a quality product: the binding of doeskin was an expensive choice. Michael paid an illustrator to obtain the drawings that are richly colored in some instances, with rubrics to guide his work. There are even full-page representations of St. Christopher and a coat of arms, the latter toward the beginning of the material on shipbuilding. The arms display a large Gothic "M," that may be a clue to the provenance of the material (Mocenigo? Moro? Morosini? Michael?). Michael himself added design features which bespeak pride in his book and Greek heritage. He gave the codex typically Greek elements: mirroring page numbers, a +IHS+ invocation at the top of each page,

and a twisted rope design to separate entries. When all was complete, he added a table of contents and inserted one omitted entry at the end.

Michael's finished product influenced other collectors. When Pietro di Versi assembled his *Raxion di Marineri* at Venice from 1444 to 1445, he used Michael's codex as a source for texts and as a model for bookmaking, right down to the twisted ropes to separate entries (fig. 5). Michael's codex also served as a source and model for the initial materials on shipbuilding in the Magliabecchiano manuscript. The first folio describing the building of a light galley is torn out of Michael's book, and the Florence manuscript is deficient at that precise juncture. When Michael gives measurements by reference to the height of his pages, they are transferred into the Florentine codex by lines or boxes of

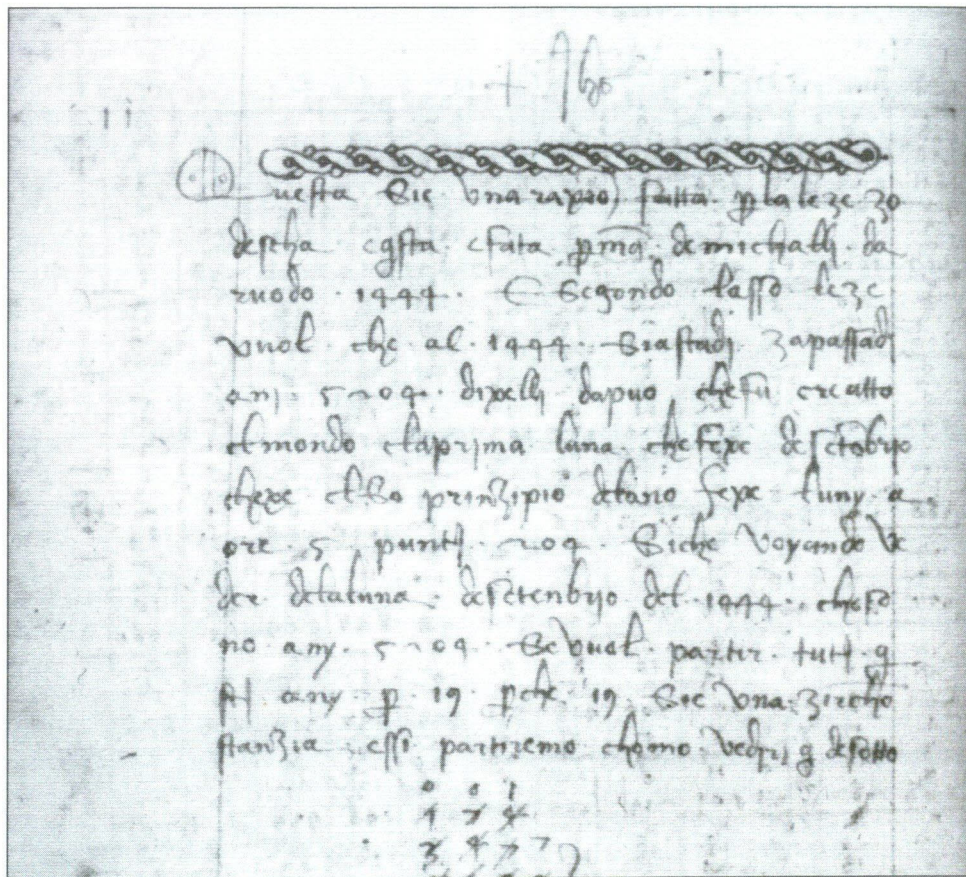


Fig. 5. Biblioteca Nazionale Marciana cod. Marc. ital. IV.170 (5379), fol. 17v. A folio from the manual of seafaring written by Pietro di Versi which has the IHS invocation, the twisted cord used to separate works, and a note acknowledging his dependence for this material on Michael of Rhodes ("Questa sie una raxion fatta per la leze zodescha e questa e fata per man de michalli da ruodo"). By permission of the Biblioteca, Venice.

the same length. Both codices are missing drawings of two types of round ships. The scribe in Florence copied his material directly from the codex of Michael of Rhodes or from an intermediate exemplar copied from that codex.

The cargo: as another in the series of hodgepodge books, the contents reflect the intellectual world of Michael himself. He has problems in commercial mathematics, at times related to trade in pepper and other spices. He has prayers to supplement the giant depiction of St. Christopher, all to ward off danger. He has astrological and astronomical tables, portolans and aids to navigation, regulations for shipboard life on Venetian galleys issued by Andrea Mocenigo in 1428, instructions for shipbuilding, and a journal about himself and his family with entries down to 1444. He used the book extensively as its stained and worn pages attest.

From the journal we learn that Michael rose through the ranks to prominence on the galleys of Venice. He began his career as a rower and reached the level of navigational adviser (*armirai*) to the fleet's captain. He served on the Serenissima's war galleys and was seriously wounded in 1431. He served on the Venetian merchant galleys as well, traveling to Flanders nine times, to London three times, to Alexandria twice, and to Azov, Trebizond, and Aigues Mortes one time each. He was twice a widower, and he lost a son who was serving on the fleet. Perhaps the proudest moment of his career came when he was chosen to sail on the galleys that carried Emperor John VIII Palaiologos from Constantinople to the reunion council at Ferrara in 1439. Two years earlier, Michael's fellow Rhodiot, Nicola Palopano, had won the commission to build those vessels over his Venetian rival, Bernardo di Bernardo. The ships were actually built by Nicola's son Giorgio after his father's untimely death.

The materials on shipbuilding in the codex of Michael of Rhodes were copied into the exemplars now

conserved in Florence and Vienna and influenced the common texts in the *Ragioni* and Zorzi of Modon manuscripts. Was Michael the author of those materials? Among arguments that might suggest he was, one could point to the fact that those specific texts are arranged in the same way as all the others in his little book. He used the pages of the book itself as a scale for specific measurements, and his text has readings preferable to those in the Magliabecchiano codex. However, there are also sound reasons to suspect that Michael was not the author. There are no corrections whatsoever in that part of the volume; if Michael wrote the work, he recorded it with perfect accuracy on his first try. Illustrations are missing at key points, and materials on shipbuilding are scattered in three places in the book. Most importantly, Michael's autobiography gives no indication that he had any training as a shipwright. He went from rower to officer and entrepreneur, and he concluded his active career working a steelyard, perhaps as a customs official for the government. He never mentions handling an adze.

Stratigraphy, Provenance, and Significance: the codex was a prized family possession of its writer, Michael of Rhodes. He began the work in 1434 and updated it year by year until his retirement from work with the steelyard in 1444. Little use was made of the space left over in the codex after that year. A few additional portolans were added by a second hand at the end of the codex, and notes and scribbles were scratched into it, the last of which conveys an inventory of household goods from 1473. The codex remained in Italy until the twentieth century, when it was in the possession of the Torinese professor Federico Patetta (1867–1945). On two different occasions, Sotheby's auctioned the codex. It is now in the hands of an unknown private collector ("Utopia"), begging to be collated with the other manuscripts preserving instructions on shipbuilding.

Conclusions

Our metaphorical excavations have revealed the diffusion of a series of manuscripts dedicated in part to matters of shipbuilding according to Venetian methods. The earliest compilation presently known was transcribed by Michael of Rhodes in 1434. The cluster of texts treats the building of five different types of hulls, the general outfitting of the vessels, the making of sails for a galley of Flanders, and the appropriate species of wood for that galley. In Michael's codex, the last two topics are separated from the treatment of the five vessels and their outfitting. Later copyists tried to integrate them into one work. The codices written after Michael's compilation had this original block of material and supplement it with further designs for the same type of vessel. Mauro Bondioli has carefully charted at least six different proposals for the

building of a light galley that he culled from these works. Among all of the designs, that by Theodoros Baxon seems a clear watershed. It is therefore reasonable to infer that Baxon's design stimulated the genesis of these texts, and they were articulated sometime between 1407 and 1434.

Sociologically, the commissioners of the works comprise a consistent group. We can probably identify a member of the De Milliis family, which belonged to the class of "original citizens" in Venice, one step below the patriciate on the social ladder. The individual who assembled the codex knew the history of shipbuilding in Venice, nurtured contacts with Arsenal shipwrights, and designed his own galley. We can certainly identify a trumpeter born in Modon by the name of Zorzi. He worked as a herald on Venetian ships and supplemented his income along the way by

dealing in Modonese wine. Among other interests, Zorzi was fascinated by military engineering and shipbuilding. We can certainly identify a seaman from Rhodes named Michael, whose career of service on Venetian ships eventually earned him an officer's rank. In 1434, when he worked on the merchant galleys traveling to Aigues Mortes, he took advantage of that short voyage to begin writing his family journal. Two qualities stand out in this little group: all are from the middle class and only one may have been a shipwright.

Why, then, do they collect texts on shipbuilding? The codices themselves supply material clues that may help to answer that question. The commissioners seem proud of that craft and its social worth, wishing to raise it to the status of an *ars*. Shipbuilding is worthy of written culture. A hull can be reduced to basic dimensions which generally have a proportional relationship to each other, e.g., the length must be six times the beam. The bourgeoisie of fifteenth-century Italy learned to think proportionally in their formal mathematical education. Shipbuilding is also worthy of graphic culture. Verbal description is clarified by the illustrations in the codices. Form followed function: to enhance the pedagogic purpose of the illustrations they were commissioned from professional illustrators. Even an artist of the ability of Gentile Bellini was consulted.

Shipbuilding, ultimately, is worthy of inclusion in a book. Most of the exemplars that survive reflect the general characteristics of the hodgepodge book popular with the bourgeoisie of the day. They are at the opposite end of the publishing scale from luxury manuscripts. Put together from paper rather than parchment or vellum, small rather than large in format, containers often for a Mercantile cursive script rather than a more formal book-hand, repositories for a variety of texts, and poorly bound, they formed a significant percentage of the small book collections kept by the middle class in their homes. The codices on shipbuilding differ in some ways from the traditional book of this character. We have already noted the effort for quality in the graphic elements of the book. At times, they have colored wash rather than mere pen and ink drawings; their compilers understood the value of illustrating a technical treatise. The *Ragioni* manuscript now in Greenwich is folio size, and the "Libro di Marineria" in Florence is written in a more formal Humanist cursive script. Like their commissioners, these codices seem to be serious social climbers.

The most pertinent of all questions, why reduce the art of shipbuilding to text at a given historical juncture, is still the most puzzling. From the perspective of ownership, these codices were the family treasures of the urban bourgeoisie, particularly those with involvement in the maritime activities of Venice. From the perspective of content, they are a repository for the rules of an *ars*, a skill with theoretical principles that can be communicated to a learner of sufficient talent. They might assist the preparation of a sufficient pool of skilled shipwrights for Venice's Arsenal. Demand in that workplace for skilled craftsmen was increasing in the fifteenth century as Venice expanded westward, opened new trade routes, and defended against the Turkish threat in the eastern Mediterranean. They might assist the work of Venetian government officials appointed to manage affairs in the Arsenal. Those officials would have a ready compendium of vessel types, a rough idea of materials needed to build each hull, and a sound checklist of the elements necessary to outfit the hull.

As Alvise Chiggiato suggests, the notebooks might demonstrate an individual's ability to build quality ships. A shipwright could show potential customers a summary list of previous designs and underline the unique characteristics of his design. And they might also serve the government of Venice in stimulating competition for better design among skilled shipwrights in her employ. William McNeill has demonstrated that Venice pioneered the business of war in the fifteenth century by contracting with mercenary entrepreneurs who bid for the right to fight land wars on behalf of the city. Similarly, the government made wars at sea a business, importing shipwrights from Rhodes to compete with Venetian shipwrights in designing light galleys for battle. By fostering such competition, the government sought to assure superior vessels at contained costs.

There are probably other reasons as well. Nonetheless, from an archaeological examination of a small group of books written in the fifteenth century in Italy, we do know that, for the first time in history, the process of building a ship was committed to paper. Beside the significant body of luxury codices on parchment copied for the libraries of Italy's wealthiest upper classes, a few little books on paper reveal the growing sense of worth that a sailor, a trumpeter, and others assigned to the shipwright's craft. It is a significant advance in consciousness that should be appreciated for its own sake.

Acknowledgements: I am most grateful to the Gladys Kriebel Delmas Foundation for funding my work in Venice and to the Institute of Nautical Archaeology for awarding me research associate status. While residing in that unique maritime city, I enjoyed the scholarly hospitality of Drs. Luigi Fozzati and Marco D'Agostino, the fraternal hospitality of Dino Faggion and the Jesuit community, the vast resources of the Biblioteca Nazionale Marciana, the wise counsel of Mauro Bondioli and Carlo Beltrame, and a most gratifying "welcome aboard" from the owners and staff of the contract firm IDRA. ☞

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An Azores Adventure

Alex Nason, INA Director

When I first learned about archaeology in elementary school, it sounded like tedious, time-consuming, highly academic work. This science and I seemed to have little in common. Then, when I watched *Indiana Jones and the Temple of Doom*, I realized there might be more to the discipline than meets the eye. After being on the Board of Directors of the Institute of Nautical Archaeology for about a decade now, I have come to the conclusion that "INA" really stands for "Interesting Never-ending Adventure." You would think that ten years' exposure to anything would rub off the novelty, but quite the contrary. I never cease to be amazed by the projects I visit, the people I meet, the countries to which I travel, and the diving... the incredible diving! My trip to the Azores this summer proved to be no exception to the rule. Although I have a hundred other important things to do at this moment, the ongoing efforts of "Team INA" compel me to drop everything else and take a moment to share my recent experience.

In my case, the trip to the Azores involved three flights, but since two of these were short puddle jumpers, I am already planning to do it again. It took one hour from Westchester, Connecticut, to Boston, then six hours from Boston to the Azorean island of São Miguel and another thirty-minute hop to the island of Terceira. I'll be the first to admit that my American Airlines Admirals' Club membership came in handy. (The bartender at the Boston Logan Airport club happened to be mar-

ried to a fellow whose family lives in the Azores. What a small world it really is!) Like many of you, I had not known that the Azores are a truly spectacular cluster of Portuguese volcanic islands situated between New York and Lisbon, pretty much right smack in the middle of the Atlantic Ocean, about eight hundred miles west of mainland Portugal.

We finally arrived at the Angra Hotel in downtown Terceira. I highly recommend the place. It has clean rooms, a beautiful garden, a great museum one block away, superb



Photo: A. Nason

Fig. 1. The "Running of the Bulls" was one of several colorful Terceiran customs that the visiting INA Directors witnessed.

food, and a staff with a "can-do" attitude. The town is small enough to walk-tour in one day. You feel you have just stepped back in time to the cobblestone streets... except for the air conditioning and other modern comforts. The simply delicious food rated a full ten out of ten. Everything was fresh, and there were many items I have never had before, like limpets and barnacles. Don't knock them if you haven't tried them! The meats from local farms and ranches were first rate, like the organic fruits and vegetables. I gained five pounds; need I say more? During our stay we had the distinct pleasure of dining at the Quinta Do Martello restaurant, a sort of museum, traditional dance and music theatre, restaurant, and resort rolled into one. I must have gained two pounds right there. One evening, we had the unforgettable pleasure of listening to the most beautiful sound in the world: the Gulbenkian Orchestra and Chorus singing in Terceira's acoustically perfect cathedral.

The landscapes are spectacular. Beautifully and carefully preserved, they feature pristine rolling hills and mountains, with lots of stone walls, animals, and friendly people. Tercierans harbor no hostilities toward the "Yankees," perhaps because they have been happily coexisting and intermarrying with U.S. Air Force base personnel for several decades. Being a semi-professional photographer, I immediately thought of returning with a group to spend a week shooting everything in sight. I went through eight rolls of film during my stay, with very few wasted shots.

Then there was "The Running of the Bulls" (fig. 1). I think they should call this "The running of the people being chased by bulls." I initially planned to skip this event and take a nap instead, but when I saw the eager look on fellow board member Toby Darden's, face, I decided to go along for the ride. Most college graduates opt for the high ground, but I decided that the only place I could get that "Kodak Moment" without a telephoto lens was right down there on the street. I suppose the two *cervezas* I bought from the street vendor minutes before might have had some influence on my decision. I had forgotten what having the fear of God put into me was like. The first homicidal bull out of the chute kindly reminded me. Needless to say, I survived.

Eventually, we all had an opportunity to dive on a well-preserved sixteenth-century wreck (fig. 2). Thoughts of Columbus and Vasco DeGama permeated the day. How convenient too—only two hundred yards from the dock at an easy

depth of fifty feet, protected by a bay, with water temperature a cool sixty-eight degrees, and good visibility. Kevin Crisman (our team leader and chief archaeologist) put together an incredible international team of excavators and conservators. All were champing at the bit to get down on the wreck and bring up the artifacts. His extraordinarily knowledgeable team was well organized and equipped. What a treat and honor it was to dive with them! It was also a pleasure to share the adventure with Jerome Hall, the president of INA, and a dozen other INA board members and staff. If you haven't joined the INA team (fig. 3), there has never been a better time. Even with more than a dozen projects all over the world, we have hardly begun to solve the mysteries of the past. I raise my glass to congratulate all of the teams and project leaders on a job well done this season! 🍷



Photo: A. Nason

Fig. 2. INA Directors preparing to dive on a well-preserved Shipwreck site



Photo: A. Nason

Fig. 3. INA Directors learned much from their visit with Azores Project principal investigator Kevin Crisman

Just Released

By Christine Powell

Sacred and Secular: Ancient Egyptian Ships and Boats
by Cheryl Ward

Boston: Archaeological Institute of America, 2000

ISBN 0-7872-7182-9, AIA Monographs, New Series 5, xiv + 164 pp, 77 illustrations, 16 tables, appendices, bibliography, index. Cloth. Price: \$77.75 per copy (AIA members \$66.00)

Long-term readers of the *INA Quarterly* will be very familiar with the work of Cheryl Ward, now on the faculty of Florida State University. This book, a development of her doctoral research in the Nautical Archaeology Program at Texas A&M, brings together almost everything known about the approximately twenty surviving ancient Egyptian hulls. These range from the Early Dynastic (ca. 2700 BCE) hulls at Abydos to the Late Period (ca. 450 BCE) boat found in the Cairo suburb of Mataria.

As one might expect, the author gives her most detailed coverage to the most completely excavated and reconstructed Egyptian vessels. These are the 4600-year-old Khufu I ship found beside the Great Pyramid at Giza and the four 3850-year-old boats from the funerary complex of Senwosret III at Dashur. Dr. Ward and Douglas Haldane (now Area Director of INA-Egypt) were the first to scientifically record the Dashur boats, beginning in 1983. These five complete vessels illustrate the remarkable continuity of Egyptian shipbuilding techniques over the period of more than two millennia separating the Abydos and Mataria boats. Indeed, many of the distinctive features of these vessels can be found in boat models from the Predynastic Period (ca. 4000 BCE) and in traditionally-built Egyptian watercraft even today.

Modern vessels are built frame-first; the supporting skeleton, which provides the strength, is covered with planking (or metal plating), which only provides watertightness. Ancient ships were built skin-first; the planking provided most of the strength, with any framing added later as reinforcement. Obviously, the weak points in this design are the joints between adjacent planks. These joints must not only be watertight, as in a modern vessel, but must also transmit all the stresses the hull carries during operation. Ancient vessels in the Mediterranean used pegged mortise and tenon joints to lock adjacent planks together. Egyptian vessels used a different design, with transverse hull lashing as the primary attachment. Rather than using long, straight planks, most Egyptian shipbuilders employed short, curved planks with joggles and unpegged tenons to prevent excessive movement. Only the late Mataria boat reflects the Mediterranean style of straight planks and pegged joints. However, the author warns that direct comparisons of Egyptian and Mediterranean techniques may be misleading, since we have no surviving seagoing ships from Egypt and no riverine craft from the Mediterranean area.

Pre-Roman Egypt did not have roads, so only the Nile held the kingdom together. Since boats and ships were indispensable to economic and political security, they were tightly regulated by the state. There is much evidence of the close connection between watercraft and the bureaucracy that controlled every aspect of ancient Egyptian society. Even labor gangs that built the pyramids were apparently divided into squads named after the quadrants of a boat. The book presents evidence that the design of boat planking was highly standardized, both so that vessels could be readily taken apart and reassembled, and so that scarce timber could be recycled into new boats, repairs for old boats, and various structural uses (such as ramps for temple construction). Egyptian conservatism and bureaucratic control maintained traditional shipbuilding techniques for millennia, preventing any innovations by individual creative shipbuilders.

Despite the title, *Sacred and Secular: Ancient Egyptian Ships and Boats* is not a comprehensive overview of ancient Egyptian shipbuilding. Cheryl Ward provides introductory chapters on historical context, natural resources, and tools, and a short concluding chapter, but the heart of the work is in the eight chapters describing the individual vessels. The author acknowledges that her primary interest is in the hulls as technological artifacts, not in their religious or social significance. Accordingly, there is very little discussion of the textual or iconographic evidence from ancient Egypt relating to watercraft, except insofar as it relates to the interpretation of these particular surviving examples. Within these limitations, however, this book is a valuable addition to the literature on ancient shipbuilding. ❧

Review

By Patricia Sibella

Construction navale, maritime et fluviale. Approches archologique, historique et ethnologique
Archaeonautica 14, 1998
ed. Patrice Pomey and Éric Rieth

E. Editions CNRS, Paris, 1999
ISBN: 2-271-05640-3, 335 pages, references, bibliography, paperback

Archaeonautica 14, published in 1999, consists of the proceedings of the Seventh International Symposium on Boat and Ship Archaeology, held July 19–22, 1994, at the Maritime Museum on Tatihou Island in Brittany, France. Its delayed publication is due to the uncertainty between 1995 and 1997 whether the series would continue.

The present proceedings are divided into four sections, gathering forty-three scientific papers given by fourteen delegates from as many different countries. To accommodate the international composition of the authors and their audience, each paper is presented with either a text or a summary in both French and English. French geography and history—particularly France's diverse and abundant fluvial and maritime heritage—inspired the two main topics of this meeting. On one hand, river and lakeside craft comprise an important part of the focus of the collection. On the other, papers cover the interaction between the Mediterranean world and the broader Atlantic/English Channel/North Sea region.

The first section of the proceedings includes fifteen papers, nearly all discussing archaeological finds of river craft, ranging in date from the Neolithic to the recent past. The diversity of the papers sheds new light on the development of boats specifically adapted to shallow water. The importance of internal transportation is illustrated by numerous discoveries, including the Neolithic dugouts of Paris-Bercy and Carolingian craft from Noyen-sur-Seine, as well as several larger assemblages from France, the United Kingdom, Denmark, and the former Soviet Union. River craft, although adapted to local geography, had a wide influence on the economy of societies and, consequently, on the development of shipbuilding.

The second section comprises seventeen papers, most of which are in English. These cover the inherent problems of naval shipbuilding as well as the evolution of solutions. The sustained historical importance of the Mediterranean world is emphasized through its relationship with the Atlantic, and the subsequent diffusion of technology. This section is also valuable for including recent discoveries, such as the Greek Archaic-period shipwrecks from Place Jules-Verne, and for summarizing older finds such as the Ma'agan Mikhael wreck. Some papers in this part present a blunt reality: many specific aspects of ancient naval construction remain unknown. Historical sources predominate over archaeology for illustrating medieval and modern vessels, such as the Genoese *cocha*, *Kadırga* from Istanbul, or seventeenth-century galleys. Additionally, some papers combine several approaches to illustrate different phases of vessel construction.

The third section includes five papers, and involves more ethnography. It is entirely dedicated to studying the European origin of craft found in North America, and concentrates on the methods used in this research. The fourth and last section is a miscellaneous collection of six papers on the most recent discoveries of global research.

As expected, given the outstanding scholars who edited this volume, the book is well organized and has an abundance of good illustrations and useful data. Nevertheless, the work is not perfect. One notes the absence of a credit (e.g., p. 139, 162, 313), a blurry illustration (p. 89), a poorly-drawn map (p. 104), or even the lack of an adequate map (see p. 14; not everyone knows where the Saone River is located!).

The combination of archaeological, historical, and ethnographic approaches was undoubtedly the keynote of the Seventh International Symposium on Boat and Ship Archaeology. One half-hidden goal was to promote naval archaeology as an autonomous discipline sufficiently independent to free itself from the supervision of underwater archaeology. The richness and diversity of the topics, the appearance of new research strategies, and the multiplicity of methodological approaches contributed to the success of this meeting. *Archaeonautica 14* should find a place on the shelf of every good research library. ❧

FROM THE PRESIDENT



A few years ago, I talked to a fifth-grade class about nautical archaeology. Those of you who have worked with children know just how demanding they can be about clarity of concept. Children have the ability to ask big questions, the type for which adults are often unprepared.

Our forty-minute class included "show-and-tell" artifacts and a young volunteer who donned a complete SCUBA outfit to demonstrate our bulky underwater "uniform." Then it was then time for the questions. I looked forward to simple ones like "Do you ever see sharks?" or "Are you ever scared?"

That day, however, the first question was, "What are the best and worst parts of being a nautical archaeologist?" I had never consciously given it any thought, so my quick response surprised even me: "That's easy! The worst part is never having enough time to do all your jobs. The best part is getting to travel in space (around the globe) and time (through the centuries)... and getting to do it all in a swimsuit!" As frivolous as my response seemed, it is the truth.

This issue of the *INA Quarterly* illustrates how nautical archaeology is one of the most rewarding endeavors imaginable. INA Directors Jim Goold and Alex Nason share their experiences in the professional and avocational realms of underwater discovery. Kevin Crisman tells us what it is like to extract information from beneath the sea in his ongoing fieldwork in the Azores. John McManamon takes us around the libraries of the world, carefully "excavating" data from manuscripts. All of us in INA are privileged to engage in work that is physically and mentally challenging, but filled with wonder, discovery, travel, adventure, and close friendships.

Thank you for your continued support of INA. I hope your New Year is also filled with wonder, discovery, and an agreeable amount of adventure, together with the good friends to make it all worthwhile.

Jerome Lynn Hall

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