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**On the cover:** A charming but not-quite-accurate Dutch print of Angra Bay, Terceira Island, Azores, dating to the late seventeenth century. Courtesy of Kevin Crisman.

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Editor: Christine A. Powell

# Crossroads of the North Atlantic: The 1996 and 1997 Angra Bay Shipwreck Surveys, Terceira Island, Azores.

by Kevin J. Crisman

## A Spanish Tragedy at Angra Bay

On October 10, 1589, residents of the island of Terceira in the Azores lined the hillsides and shores of the south coast to watch a desperate battle upon the sea. The protagonists were two ships, one a lumbering Spanish *nao* heavily laden with the riches of the Americas, including two hundred thousand ducats in gold, silver, and pearls; the other vessel was a small but handy English privateer that had been lurking about the island seeking prizes. The Spaniard mounted twelve cast guns and the Englishman only three, so the contest should have been one-sided. It was, but perhaps not in a way that the onlookers anticipated.

Among the Terceiran citizens who lined the shore to witness the action was a foreigner, a recently shipwrecked Dutchman named Jan Huygen Van Linschoten. The Spanish ship, Linschoten later wrote, "sayled close under the Island, so to get into the Roade." Outside the shelter of the bay and its gun batteries, however, the little English ship closed to within cannon range and commenced a lengthy battle. The governor of the Spanish forces occupying Terceira sent two boatloads of soldiers to bolster the hard-pressed crew of the *nao*,

...but before they could come at her, the English shippe had shot her under water, and we saw her sinke into the Sea, with all her sayles up, and not anything of her seen above the water. The Englishmen with their Boate saved the captain and about thirtie others with him, but not one pennie worth of the goods ... the rest of the men were drowned, which might be about fiftie persons, among the which were some fryers and women, which the Englishmen would not save. Those that they had saved they set on land: and then they sayled away.

The sinking of the Spanish ship that Linschoten described was one of many ship losses to war and storms that have taken place in and around the Bay of Angra on the southern shore of Terceira. This stretch of rugged shoreline is one of the most promising regions in the world today for maritime archaeology, for beneath its waters lie the remains of scores of ships dating from the mid-fifteenth century to the present day (fig. 1). Indeed, the potential of all the Azorian islands for post-Medieval shipwreck studies is immense, and is only now being realized through a collaborative effort by archaeologists from INA, the Azores, and mainland Portugal.

## The Azores and Terceira Island

My interest in pursuing research in the Azores began in early 1994 as the result of a telephone call from archaeologist Bruce Verhaaren of the Cultural Assessment Division at the Argonne National Laboratory in Illinois. Verhaaren was scheduled to fly to Lajes Field on Terceira Island (a U.S. and Portuguese Air Force base) to ensure that construction activity would not damage archaeological sites. His question for me was simple, but has had lasting repercussions: "What can you tell me about shipwrecks in the Azores?"

My knowledge of the Azores in 1994 was sketchy at best (fig. 2). I knew that they were a cluster of islands lying in the middle of the Atlantic Ocean, and frequent references to them in accounts of sailing voyages made it clear that they were a focal point for shipping in the North Atlantic. But shipwrecks? While surely there must have been many vessels lost around the islands, I could not recall ever reading or hearing of any shipwreck studies in the Azores.



Fig. 1. Angra Bay in the late sixteenth century, from a print by Jan Huygen Van Linschoten. Courtesy of the Museum of Angra.

Verhaaren's question intrigued me, especially since after many years of work on wrecks in North American lakes, I was interested in expanding my research to earlier, seagoing ships. I began reading everything available on Azorian history, geography, geology, and culture. The Azores, I learned, lie 1300 kilometers (800 mi.) west of Portugal and consist of a 320-kilometer-long (200 mi.) chain of islands created by immense volcanic mountains rising abruptly from the depths of the sea. They are terrestrial evidence of the 'Mid-Atlantic Rift', the great cleft created by the separation of continental plates. The islands are still geologically active, with periodic eruptions and earthquakes. Their volcanic composition, combined with a temperate but humid climate—plenty of rain here—has also made them extraordinarily green and fertile.

The Azores were discovered during the earliest years of Portugal's great age of exploration, in the late 1420s or 1430s, when Portuguese mariners returning from voyages down the African coast sighted the heavily-forested, unpeopled isles on the final leg of their journey home. The islands acquired their name, Açores, from the Portuguese word for the goshawks that inhabited their mountainsides. Colonization followed soon after discovery, with a combination of Portuguese and Flemish settlers seeking timber and farm land. During the first sixty years of their recorded his-

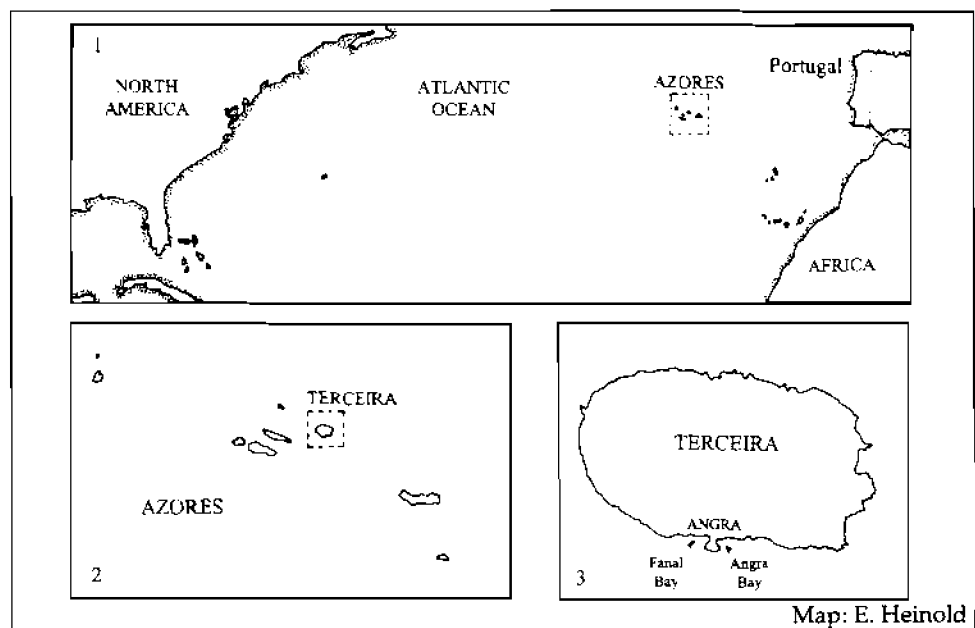


Fig. 2. The North Atlantic (1), the Azores (2), and Terceira Island (3).

tory the Azores constituted Europe's westernmost outpost, a collection of colonies at the very edge of the known world.

Two momentous voyages of discovery at the end of the fifteenth century profoundly changed the status of the Azores. The first was Columbus's voyage to the Americas in 1492 (he stopped at the Azorian island of Santa Maria on his way back to Spain in 1493); the second was Vasco da Gama's passage around Africa to India in 1497 (Da Gama also stopped in the Azores on the return voyage, where his brother Paulo died). The astounding expansion of European seafaring, colonization, and trade that followed these discoveries transformed the Azores into the crossroads of the North Atlantic. For Iberian mariners returning from the East and West Indies, the islands were a key landfall, a navigational reference point and a place to refresh after weeks or months of sailing. Over the next five hundred years ships of every size and purpose anchored off Azorian harbors, including little *carvelas* and *naos* of the Iberian explorers, massive Portuguese East Indiamen heavily laden with textiles, porcelains, spices, and luxury goods from Asia, Spanish galleons filled with precious metals and other commodities from the Americas, and merchant vessels from every maritime nation in Europe. The wealth passing through the islands attracted seafaring predators as well, privateers and pirates who infested Azorian waters and took an annual toll of merchantmen.



Photo: A. Lessmann

Fig. 3. Angra Bay and Mount Brasil from the Museum of Angra.

Throughout the first three hundred years of Azorian history the island of Terceira functioned as the center of government,

religion, and commerce. Terceira's early prominence among the islands can be largely ascribed to two natural harbors at the city of Angra do Heroísmo on the south coast (cover). Here a narrow peninsula, topped by an extinct volcano called Monte Brasil, extends out from the island at a right angle; to the east of Monte Brasil lies the principal harbor, Angra Bay (fig. 3), while to the west of the mountain lies the secondary anchorage of Fanal Bay. Angra Bay offers shipping protection from the prevailing west winds and a good bottom for anchoring. During Terceira's heyday as a port in the sixteenth and seventeenth centuries the bay was regularly filled with vessels engaged in trade, re-watering and re-victualing, and repairing. The bay was not entirely free of danger, however, for when the winds shifted to the southeast and blew with great strength, it became a cull de sac—a deathtrap—for sailing ships. So common were incidents of wrecking that Angrans referred to southeast winds as *carpinteiros* (carpenters winds), since the pieces of ships that washed ashore provided Terceiran carpenters with the wood they needed to build houses and furniture. Ship timbers can still be seen in the walls and ceilings of many Angran houses.

The potential of the Azores for shipwreck studies is impressive: Angra Bay and the waters off Terceira and the other islands are one of the great archaeological storehouses in the world today. In the spring of 1994 I made several attempts to get in contact with Azorian archaeologists and government officials to discuss shipwreck studies in the islands, but these efforts met with little success. At that time the Azores were the focus of an epic struggle between the small Portuguese maritime archaeology community and an army of foreign treasure hunters—mostly from the United States—who were lobbying for permission to mine the islands' shipwrecks. A law had been passed that permitted treasure hunting, and permits for survey and salvage were

about to be issued. Under these circumstances an American calling from out of the blue to ask about Azorian shipwrecks was sure to be regarded with suspicion.

In May of 1995 I received another phone call concerning the Azores, this one from reporter William Broad of the *New York Times*. Broad was preparing an article on the treasure hunting controversy in the Azores, and he wanted comments from someone at the Institute of Nautical Archaeology. He got the comments he needed, and I got something in return: the name and phone number of the Portuguese archaeologist leading the battle against the treasure hunters, Dr. Francisco Alves, then director of the National Archaeological Museum in Lisbon. Dr. Alves and I began a correspondence, and he directed me to an association of volunteer divers, historians, and archaeologists, the Grupo de Arqueologia Subaquática (GAS), which had formed at the Museum of Angra do Heroísmo to protect and study the region's maritime heritage. In October I flew to Terceira to meet with the group and discuss cooperative archaeological research.

Terceira proved to be even more beautiful than anticipated, with its multitude of volcanic peaks, stone-walled cow pastures, and rugged coastline; I was also awed by the strong connection with the past evident in Angra's cobblestoned streets, tile-roofed stone buildings, cathedrals, and harbor fortifications. The Museum of Angra is lodged in the ancient Franciscan cathedral and monastery that overlooks the town, surely a fitting location for an institution dedicated to Azorian history (fig. 4). It was here, beneath the floor of the cathedral, where Vasco da Gama buried his brother Paulo in 1499 on their return from that momentous voyage to India; the grounds of the museum also feature an impressive collection of bronze and iron guns salvaged from the sea in the 1960s and 1970s (fig. 5). My hosts in Angra proved to be a dedicated and knowledgeable group of individuals,

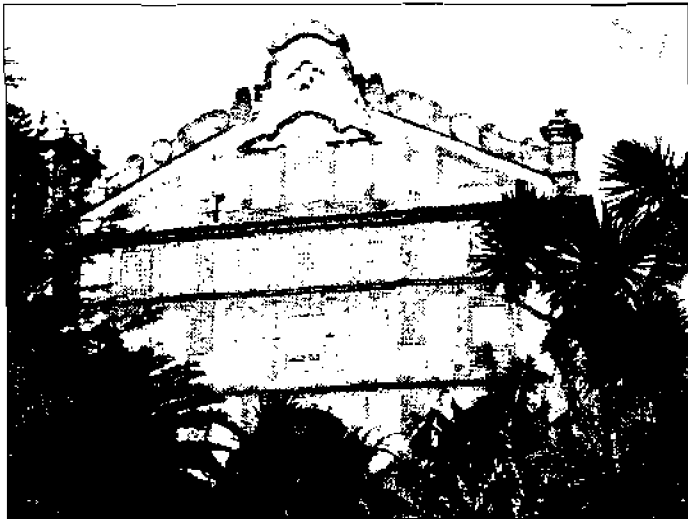


Photo: K. Crisman

Fig. 4. The Museum of Angra, located in the city's Franciscan cathedral and monastery.



Photo: K. Crisman

Fig. 5. Sixteenth-century bronze cannon—Portuguese, Spanish, French and English in origin—salvaged from Angra Bay.

and they certainly made me feel welcome. During my brief stay in 1995 we reviewed our many mutual interests and decided to begin a joint program of archival research, shipwreck surveys, and excavations that could provide an alternative to treasure hunting in the Azores. A subsequent meeting with Dr. Alves in Lisbon was similarly productive. Everyone agreed that the first order of business was to begin a survey of the Azores for shipwrecks.

### The 1996 Angra Bay Survey

Since the 1995 meeting all of us involved in the Azores endeavor have been climbing the slope of a steep learning curve. Dealing with the intricacies of logistics, funding, project personnel, and government bureaus has demanded much effort on the organizational level; learning about the diving environment, the topography and composition of the ocean floor, and the ever-changing sea conditions has certainly made the fieldwork challenging. Fortunately, many factors have worked to our favor. In late 1995 a change of national governments in Portugal led to a re-examination of treasure-hunting, and the controversial law was frozen and then repealed in 1997. Meanwhile, the INA portion of the research team was bolstered by the addition of my long-time colleague Arthur Cohn, Director of the Lake Champlain Maritime Museum and by Dr. William Bryant of the Texas A&M Oceanography Department. Funding for part of the survey project was provided by a Texas A&M Interdisciplinary Research Initiatives grant and by a very generous donation by INA member Sylvia Baird. Finally, plans for the construction of a marina on the Angra waterfront gave us our first opportunity to look under the water and test survey equipment, with part of the project costs covered by the Azorian harbor authority.

Research by the GAS team indicated that the innermost part of Angra Bay, the area slated for marina construction, was likely to contain ship wrecks (fig. 6). The seafloor here is characterized by a coarse sand bottom that is highly mobile. According to octopus-hunting diver Waldemar Reis, who has spent many hours in the waters off Terceira, shipwreck remains and other debris can be seen in the inner bay after heavy winter storms move sand into deeper water; within a few weeks, however, the sand shifts back and covers everything. Since sonars are generally ineffective for finding materials buried beneath sand, and we had doubts about how a magnetometer would function in this highly-magnetized volcanic environment, Dr. Bryant and I elected to use a sub-bottom profiler to get a better look at the sediments in the marina zone. Dr. Anne Rutledge of Texas A&M Oceanography joined us to operate the Datasonics Chirp II system leased for the project.

Fig. 6 (below). The inner bay at Angra, location of the proposed marina. The harbor's ancient landing, Porto Pipas, is in the foreground.

Fig. 7 (right). The Angra Harbor pilot boat Vouga surveying Angra Bay with a sub-bottom profiler in 1996.



Photo: K. Crisman

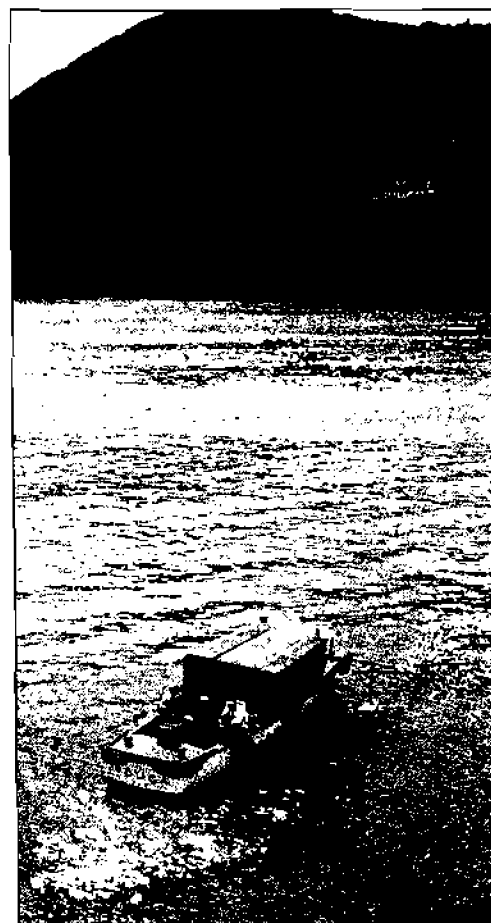


Photo: A. Lessmann

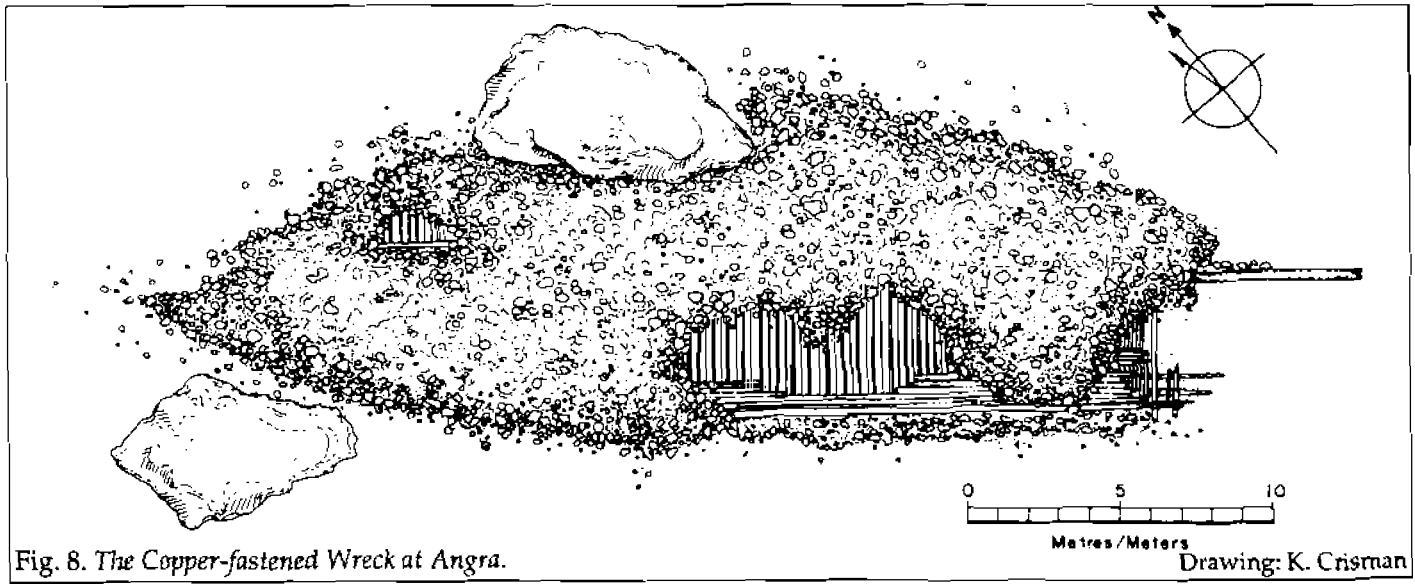


Fig. 8. The Copper-fastened Wreck at Angra.

INA's portion of the 1996 survey extended between September 13 and 24. The GAS-Angra Museum team secured the harbor pilot's boat *Vouga* for our primary survey vessel (fig. 7) and arranged for the use of work space in a building overlooking the waterfront. After getting the *Chirp II* cleared through the Terceiran customs office and rigging *Vouga* for its new career, Rutledge and Bryant ran a series of transects with the profiler across the inner harbor. Their records showed an average depth of one to two meters of sand overlying a sub-stratum of compacted sediments or outcropping bedrock. It was clear that in this dynamic, near-shore environment shipwreck remains or loose artifacts would likely have worked their way down through the shifting sand layer and settled on top of the denser layer beneath. A series of test pits in the inner bay subsequently confirmed that this was the case.

At the same time that the sub-bottom profiler survey was proceeding, GAS and INA divers investigated three wrecks protruding above the sand on the west side of the bay. The first wreck was 35 meters (115 feet) in length and evidently was once a large wooden vessel. The dimensions and condition of the wreck and the presence of copper-alloy fasteners together suggested a date sometime after the first quarter of the nineteenth century (fig. 8). The second wreck was mostly buried under a ballast mound, but the style of framing, the presence of lead sheathing, and a scatter of lead shot for small arms all hinted at a late sixteenth or early seventeenth century date. Lead hull sheathing was typical of Spanish and Portuguese ships built at this time. The third wreck was of the iron-hulled steamship *Lidador* (fig. 9), a 78.6-meter (258-foot), British-built vessel belonging to the Empresa

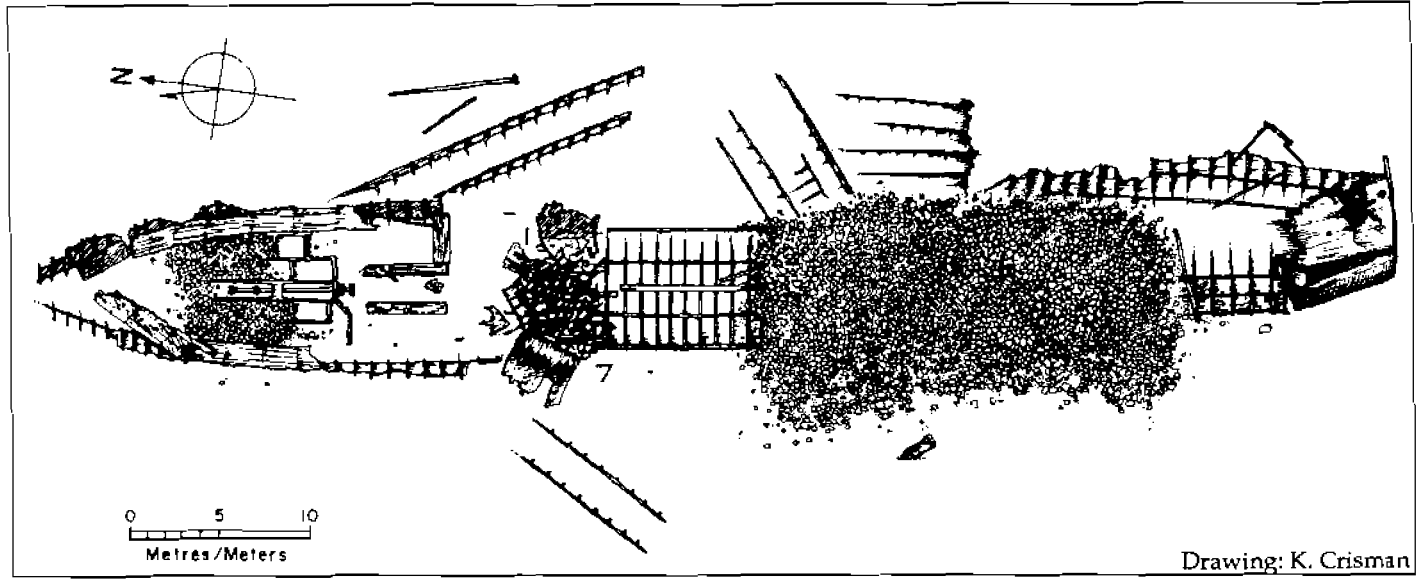


Fig. 9. The Brazilian steamship *Lidador*, another victim of Angra Bay that sank in 1878.

Transatlântica de Navegação (Transatlantic Navigation Company) and registered in Rio de Janeiro, Brazil. *Lidador* sank during a storm in February of 1878 and is now a picturesque mass of twisted iron plates, boiler fragments and stone ballast. All three of the sites would be well worth further study in the future.

The Texas A&M-INA team's time at Angra was all too brief in 1996, but nevertheless provided us with a tantalizing look at what we could expect to find in Azorian waters. After our departure the GAS team continued the survey of the inner bay under the direction of Paulo Monteiro and Catarina Garcia, and by systematic test-pitting of the marina zone turned up three more wrecks, two of them wooden and evidently of a fairly early date. The third wreck was more recent and had a curious history. This vessel was the Confederate blockade runner *Run'Her*, sunk late in the American Civil War in November of 1864. *Run'Her* was typical of late-war runners, built in Britain with a long and extremely lean iron hull and propelled at high speeds by powerful steam engines. She left England for Bermuda (and the Confederate states) carrying both the latest in undersea electrical mine technology and Confederate mine expert Hunter Davidson. During a stopover at Terceira *Run'Her* inexplicably ran aground and wrecked in broad daylight immediately below the customs house on the Angran waterfront. Part of the cargo was salvaged, but a storm that struck the island a short time after the wrecking broke up the hull and scattered its remains; part of one boiler and numerous iron fragments were evident during the GAS survey.

#### The 1997 Survey

The discoveries at Angra in 1996 and their implications for the construction of the marina are still being debated in the Azores, and at some time it may be necessary to renew the study of the wrecks in the inner bay. For 1997, however, we concentrated on our original plan: a wider survey for shipwrecks along the south coast of Terceira, particularly in Angra and Fanal Bays. This was to be accomplished by searching the sea bottom with high-resolution side-scan sonars (provided at no cost to the project by Marine Sonic Technology, Ltd and Jon B. Jolly, Inc) and by examining sonar targets with teams of divers. We also planned to test the effectiveness of both the magnetometer and a new type of sub-bottom profiler; precision navigation for the entire survey was provided by a differential GPS unit donated to INA by Trimble Navigation Corporation.

In late May of 1997 INA Board Chairman Gregory M. Cook, Nancy Cook (fig. 10) and I flew to Terceira for a week to meet with Professor José Álamo de Meneses, the Secretary of Education and Cultural Affairs for the Azorian Government, to discuss both the 1997 survey and long-term INA-Azorian cooperation in archaeological research and education. This also proved to be a good opportunity to work out many details of the survey with our colleagues at the

Museum of Angra and the GAS. This year's project participants included the same individuals and institutions that contributed to the 1996 work, and we were additionally supported by the Azorian Government's Direcção Regional dos Assuntos Culturais (DRAC), Dr. Luiz Fagundes Duarte, Director, which supplied partial funding and leased the University of Azores research vessel *Águas Vivas* for the sonar survey. Thanks to a cultural-scientific cooperation agreement between the Azorian Government and the United States Military Forces (the 'Lajes Agreement'), a trailer containing INA's inflatable boat, diving equipment, and survey instruments was flown to Terceira by U.S. Air National Guard units at no cost. During the survey we were also joined by Dr. Francisco Alves and Filipe Castro of the Centro Nacional de Arqueologia Náutica e Subaquática in Lisbon.

The 1997 survey, like most surveys, was a roller-coaster ride of triumphs and frustrations, all concentrated in days filled with intense activity. The INA-Texas A&M team arrived on Terceira between September 11 and 14, and spent the first few days retrieving the INA trailer from Lajes Field, unpacking equipment, and generally preparing to go to work. We had more time for preparation than we anticipated, due to tropical storm (ex-hurricane) Erika, which stalled in the mid-Atlantic, upwind of the Azores, and refused to move on. The harbor at Angra was a beehive of activity as fishermen hauled their boats out of the water in preparation for the storm. Erika finally drifted by the north coast of Terceira on September 15 and 16, roiling the seas and blasting the island with high winds and rain, but luckily causing no serious damage.

Fig. 10. INA Board Chairman Gregory Cook and Nancy Cook. The inter-island freighter *Fernao Magalhães*, wrecked in a storm on Christmas, 1996, lies upon the rocks in the background.



Photo: K. Crisman





Photo: K. Crisman

Fig. 11. Brett Phaneuf rigs the sonar provided by Marine Sonics, Inc. for deep towing.

The sonar survey finally got underway on September 17 and we began to search beneath the waters around Monte Brasil. For the first few days the seas proved rough and forced us to limit daily operations; that we were able to accomplish anything at all was largely due to the seamanship of Captain Paulo Martins and Frederico Cardigos of the R/V *Agua Viva*. During this time one of our two sonars malfunctioned, limiting the survey coverage. On the plus side, the Marine Sonics sonar operated by Brett Phaneuf (fig. 11) yielded dozens of magnificent images of the sea floor, including a near-photographic view of the steam-

er *Lidador* (fig. 12). The geology off Terceira was like nothing we had ever seen, with enormous linear volcanic-rock outcrops (which were, in fact, fault lines extending out from the island), fields of boulder-sized rocks, and wide expanses of coarse, heavily-rippled sand. The area was a geologist's dream, but the convoluted sea bed made our search for shipwrecks more challenging, for it was hard to differentiate possible ballast mounds from the fields of natural rock.

Unusual features noted in the sonar images were electronically 'tagged' and, after review of the sonar records each evening, the more promising targets were identified and buoyed the next morning for diver verification. The INA-GAS dive team, under the direction of Art Cohn, made over two dozen verification dives during the course of the survey (fig. 13). Most of the sonar targets proved to be ship-shaped geological features, although some may require further investigation to rule out the presence of ship remains. That Angra Bay experienced much maritime activity was evident from the enormous numbers of anchors encountered by divers, anchors of every size, type and period; most were evidently lost when they wedged in rock outcrops and could not be extracted. The sonar also revealed a scatter of wreckage on the flat sand bottom immediately east of Monte Brasil; divers inspecting this area found wooden ship timbers and pieces of modern, steel-hulled vessels, as well as quantities of nineteenth and twentieth century ceramics. No identifiable shipwreck site was encountered, however, and we strongly suspect that wrecks in this part of the bay are deeply buried under the sand, where they are likely to be well-preserved.

The tests of our proton magnetometer and a sub-bottom profiler during the survey of the outer bay gave back disappointing results. The magnetometer would be a most

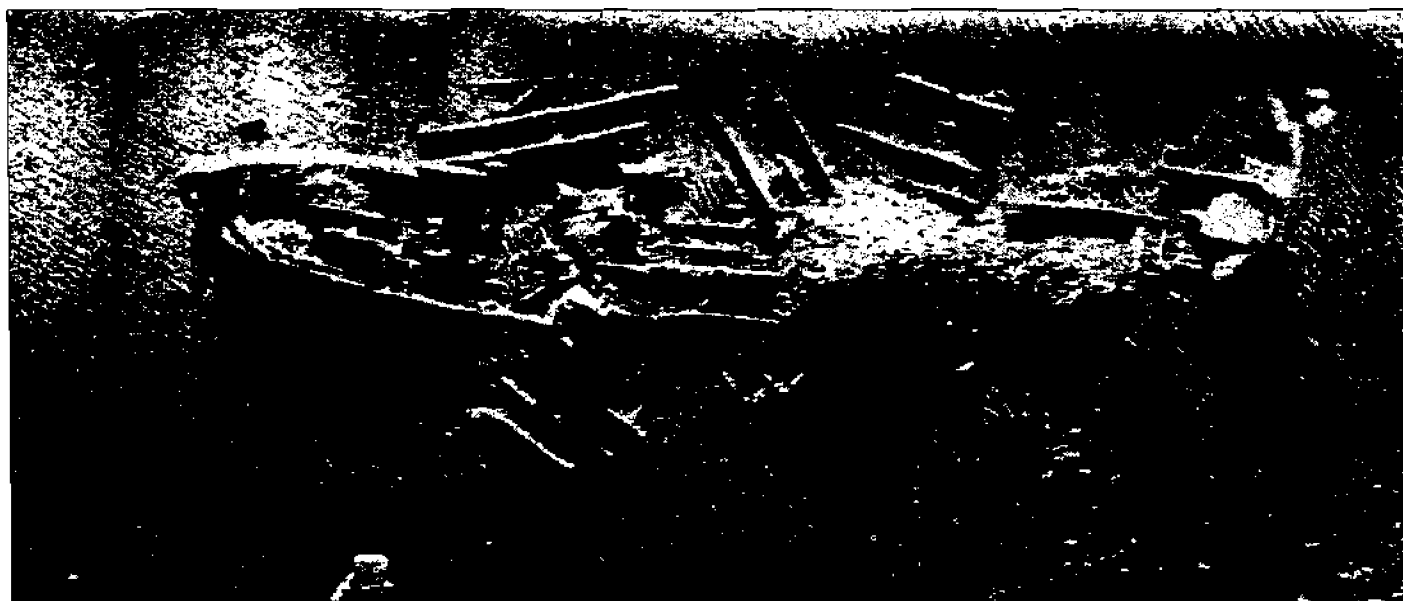


Fig. 12. Marine Sonics, Inc. high-resolution sonar image of the steamer *Lidador*. Courtesy of Brett Phaneuf and Marine Sonics,



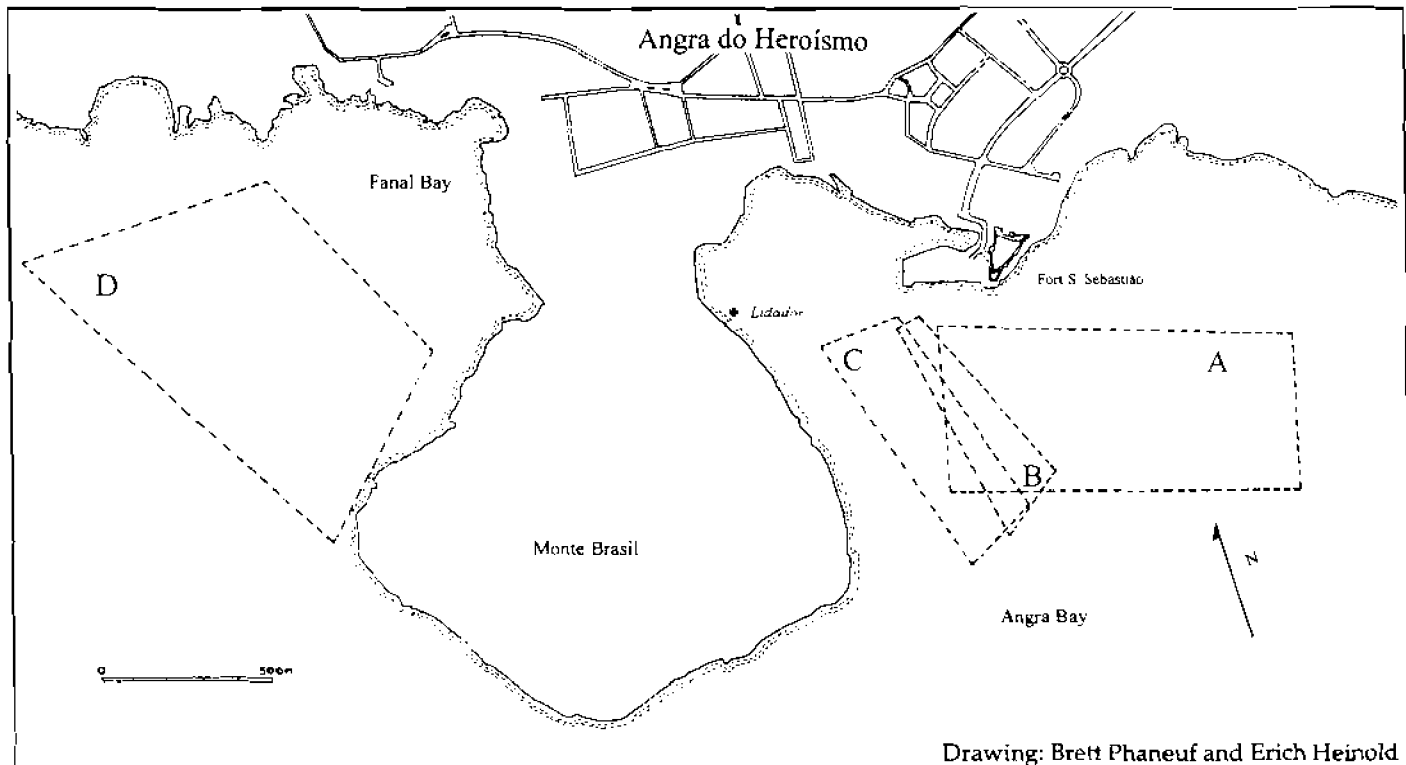
Photo: A. Lessmann

Fig. 13. Brian Jordan of the INA team and Catarina Garcia of the Portuguese National Center for Nautical and Underwater Archaeology (CNANS) record the remains of a wreck in Angra Bay.

useful tool for finding buried wrecks off Angra were it not for the fact that the background 'noise' of Terceira's magnetized volcanic bedrock overwhelms these instruments, at

least the one we had with us. A more advanced magnetometer might be able to better filter out the island's magnetism and pinpoint wrecks or debris fields beneath the sand. The sub-bottom profiler we tested in 1997 yielded some stratigraphic data in sandy portions of the outer bay, but it is not a useful device for searching broad areas of sea bottom for wrecks. At this point in time the sonar appears to be the best tool for locating more shipwrecks in Azorian waters.

The survey concluded on September 28 with the departure of the INA crew from Terceira. During the 1997 project we thoroughly covered a total of two square kilometers of Angra and Fanal Bays with the Marine Sonics sonar, despite periods of unfavorable weather and a series of technical difficulties (fig.14). The amount of data collected was considerable and the sonar files are still undergoing analysis and getting pieced together into a mosaic at the Texas A&M New World Lab. The Trimble differential GPS system allowed us to maintain very tight navigational control of the survey, and gave us a 100% success rate in relocating sonar targets for diver verification. The combined approach of this survey, with



Drawing: Brett Phaneuf and Erich Heinold

Fig. 14. The 1997 sonar survey of Angra Bay.

sonar coverage followed by immediate target inspection by divers, was quite effective: the ability to compare sonar records with diver observations greatly improved our ability to interpret the sonar images (fig. 15). We have gained a much better idea of sea floor conditions in the Azores and a wealth of practical experience that will be invaluable on future surveys.

#### Future Work

The 1996 and 1997 surveys were just the beginning of what we hope will be a long and fruitful association of INA with shipwreck investigations in the Azores. These islands, the crossroads of so much of the world's shipping for the past five hundred years, offer an unparalleled opportunity to study the developments in ship technology, seafaring practices, trade and warfare that have shaped the modern world. The existence in the Azores of a regional government dedicated to protecting its shipwrecks, and of a group of professional and avocational archaeologists and historians dedicated to the study of those wrecks, bodes well for the future. We plan to continue the joint INA-Azorian surveys and wreck assessments over the next few years, at Terceira and around other islands in the Azores archipelago, and compile an inventory of sites that will guide further research.

*Acknowledgements.* The 1996 and 1997 Azorian surveys would not have been possible without the help of many people and institutions, and it is with pleasure that I take this opportunity to recognize their contributions. Funding and encouragement for the surveys have been provided by INA member Sylvia Baird, who gave the project a real boost when it needed it most, by Texas A&M University's Interdisciplinary Research Initiatives Program, and by the Azorian Direcção Regional dos Assuntos Culturais; special thanks are due to Professor José Álamo de Meneses, Secretario Regional da Educação e Assuntos Sociais and Dr. Luiz Fagundes Duarte, Director Regional dos Assuntos Culturais. I also wish to recognize the assistance of Dr. João Zilhão, Director Geral of the Instituto Português de Arqueologia, and Dr. Francisco Alves, Director, and Mr. Filipe Castro of the Centro Nacional de Arqueologia Náutica e Subaquática in Lisbon. The work on Terceira would simply not have been possible without the tireless efforts of Paulo Monteiro, Rui Teixeira, Albano Pereira, Thomas Spiker, and the other members of the Grupo de Arqueologia Subaquática, and of Dr. Olivio Mendes da Rocha, Director, Heliodoro Silva, Curator, and the staff of the Museu de Angra do Heroísmo. Art Cohn has been, as always, a true friend and wise council through thick and thin; Brian Jordan, Anne Lessmann, and Erick Tichonuk all greatly assisted in the field work. The electronic instrument surveys in 1996 and 1997 were conducted by Dr. William Bryant and Dr. Anne Rutledge of Texas A&M, Brett Phaneuf of Marine Sonic Technology, Ltd,



Photo: K. Crisman

Fig. 15. Rui Teixeira and Arthur Cohn follow a deep dive in Fanal Bay with ten minutes of breathing oxygen, observed by University of the Azores Marine Biologist Frederico Cardigos.

Jon Jolly of Jon B. Jolly, Inc. and Greg Gooding of Lunde Marine Electronics, Inc. Paulo Martins and Frederico Cardigos of the University of the Azores' R/V *Agua Viva* were of immense help in 1997. Colin Petty of Pacific Crest Inc., contributed radio modems. Transportation of INA equipment between the U.S. and Azores was carried out by the 102<sup>nd</sup> Rescue Squadron of West Hampton Beach, Long Island, New York and by the 167<sup>th</sup> Airlift Wing of Martinsburg, West Virginia; the process was greatly expedited by Captain George Smith, U.S.N. of the Pentagon's Office of International Security Affairs and by Master Sergeant Louis T. Amato, U.S.A.F. of Lajes Field, Terceira, Azores. Finally, many thanks are due to INA Board Chairman Gregory Cook, and to Becky Holloway, Claudia LeDoux, Angie Shafer and Michelle Chmelar at the INA/Nautical Program home office in College Station, Texas. ☺

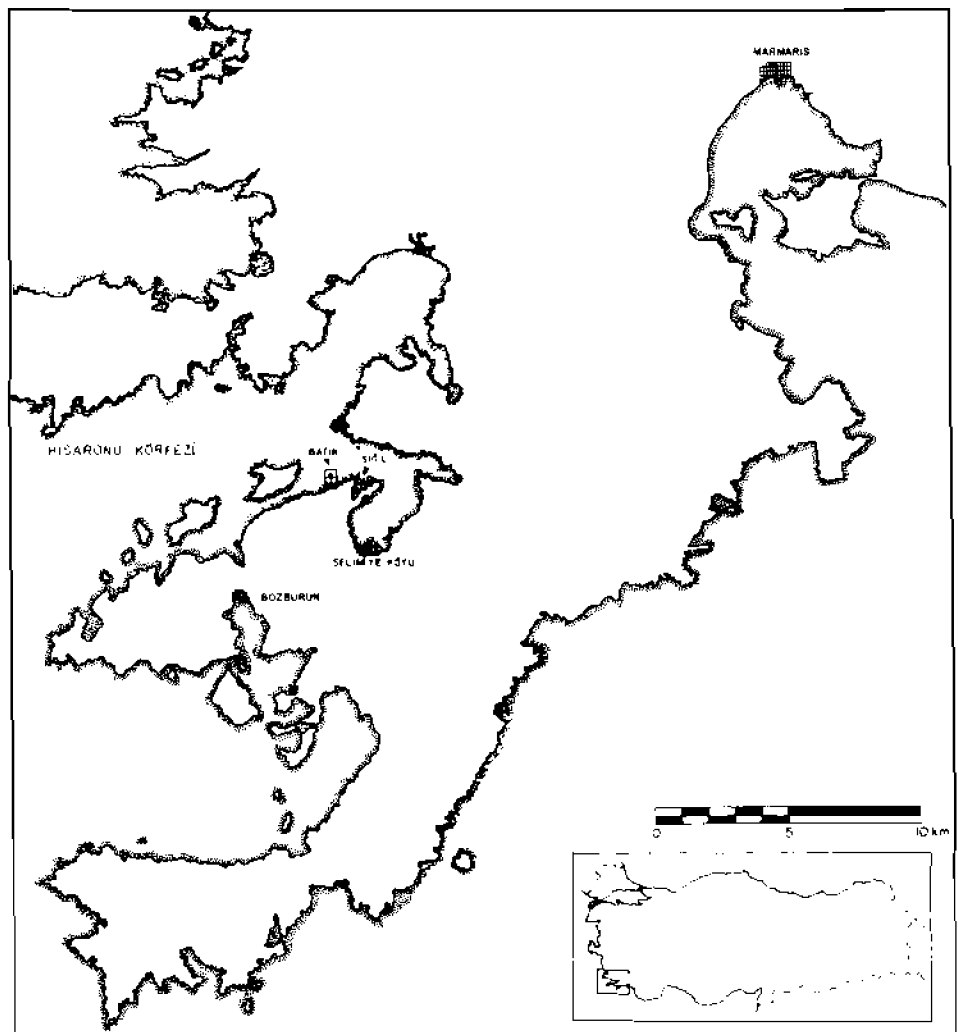
# The Byzantine Shipwreck at Bozburun, Turkey: The 1997 Field Season

by Frederick M. Hocker,  
Sara W. and George O. Yamini Associate Professor

At the Bozburun Byzantine shipwreck excavation, 1997 was the Year of the Amphora. At the end of the 1996 campaign, we could identify at least 500 whole or nearly complete amphoras remaining on site, and estimated that another 100 to 200 remained to be discovered under the sand. That season also gave us our first glimpse of the well-preserved hull remains under the cargo. In 1997, our twin goals were to map and recover as much of the cargo as possible and to expose more of the hull and begin raising it for study.

As in previous seasons, accommodations for project staff and work areas were established in an olive grove rented from a local farmer on Siğ (Shallow) Bay. The camp, which includes dormitories for up to 40 people, sanitary facilities, and a cooking/eating building, as well as the recompression chamber to treat potential diving incidents, was built by project staff as a temporary facility, to be dismantled between seasons and at the end of the project. No new facilities were constructed in 1997, but improvements were made to the artifact handling area (the addition of a concrete floor) and a new roof was built over the recompression chamber. The camp also features a small boat dock, from which the excavation site can be reached in as little as three minutes by motoring out of Siğ Bay to the north, around the point of Küçüven Burnu and back along the cliffs that stretch away to the southwest. Diving was conducted from a cement and wooden platform constructed on a projecting spur of the Küçüven Burnu cliff, the same spur against which the ship was wrecked over 1100 years ago.

As the site lies between 90 and 120 feet deep in the Aegean Sea (fig. 1), provisions for safe diving operations were a priority. Excavators dived on compressed air using dive tables compiled specifically for the project by Dr. Richard Vann of the Diving Physiology Research Center of Duke University. Using these tables, most excavators dived for 25 or 30 minutes in the morning and 20 to 30 minutes in the afternoon, following a five-hour surface interval. A few divers worked for up to 40 minutes at a time. Normally, excavators dived in teams of four, and up to six teams in succession could dive both morning and afternoon, although the usual number of dives was five. Divers decompressed at a depth of 6 meters on pure oxygen, supplied from the surface, for up to 35 minutes after each dive. Although this requires the transport and loading of heavy, unwieldy cylinders of compressed oxygen, it has been shown, largely through INA diving projects in Turkey, that in-water



Map: B. Jordan

Fig. 1. Southwestern Turkey, showing the location of the Bozburun shipwreck

oxygen decompression adds a significant safety factor to repetitive deep diving on compressed air. In total, we made over 2,000 individual dives, including training and acclimatization dives. Over the course of the season, no confirmed incidents of decompression sickness or embolism occurred, and there was no occasion to use the recompression chamber.

Work in previous seasons had shown that the majority of the cargo amphoras had tumbled about in the wreck, but about 60 jars were still stacked in orderly rows where medieval stevedores had left them. We also knew that this area of stacked jars backed up against a large concentration of stones and tiles that we suspected of being the ship's

hearth, and that the upper end of the site was the stern, where we could expect to find the personal possessions of the crew and a wide range of ship's equipment. Excavation in this area would have to go slowly. Farther down slope, where the previous season had been spent in removing much of the broken material lying on top of the whole amphoras, work could proceed more rapidly, as smaller finds normally filter down between the jars and are not encountered until later in the excavation.

Excavation proceeded rapidly in the lower half of the site and on the port side, where the hull had collapsed in the past. The majority of the site has now been completely cleared of cargo and other cultural material (fig. 2). The group of stacked amphoras remains in place, protecting the hull remains underneath, in squares F11, G11, and H11, and a similar number of tumbled amphoras remain in other squares. A total of 158 whole amphoras were recovered, along with 105 substantial partial amphoras. Another 222 amphoras were excavated, mapped and removed to underwater depots without raising, to await recovery in the future. In addition to whole jars, we also recovered over 400 kilograms of broken amphora sherds. Most of these cannot be joined and preserve no significant diagnostic information, such as rim profiles or graffiti. After cataloguing, the majority of this broken material was sorted by provenience and redeposited in a sherd dump excavated to the west of the site. Sherds saved for further analysis include substantial partial amphoras (often, the neck, handles and shoulder survive as a unit) and large shoulder sherds, which may have graffiti. A sample of the sherds was also saved for composition and fabric analysis.

The whole jars are full of mud, but the mud often preserves evidence of the contents of the jars. When sieved, the mud almost always contains grape seeds, indicating a wine cargo, although one jar

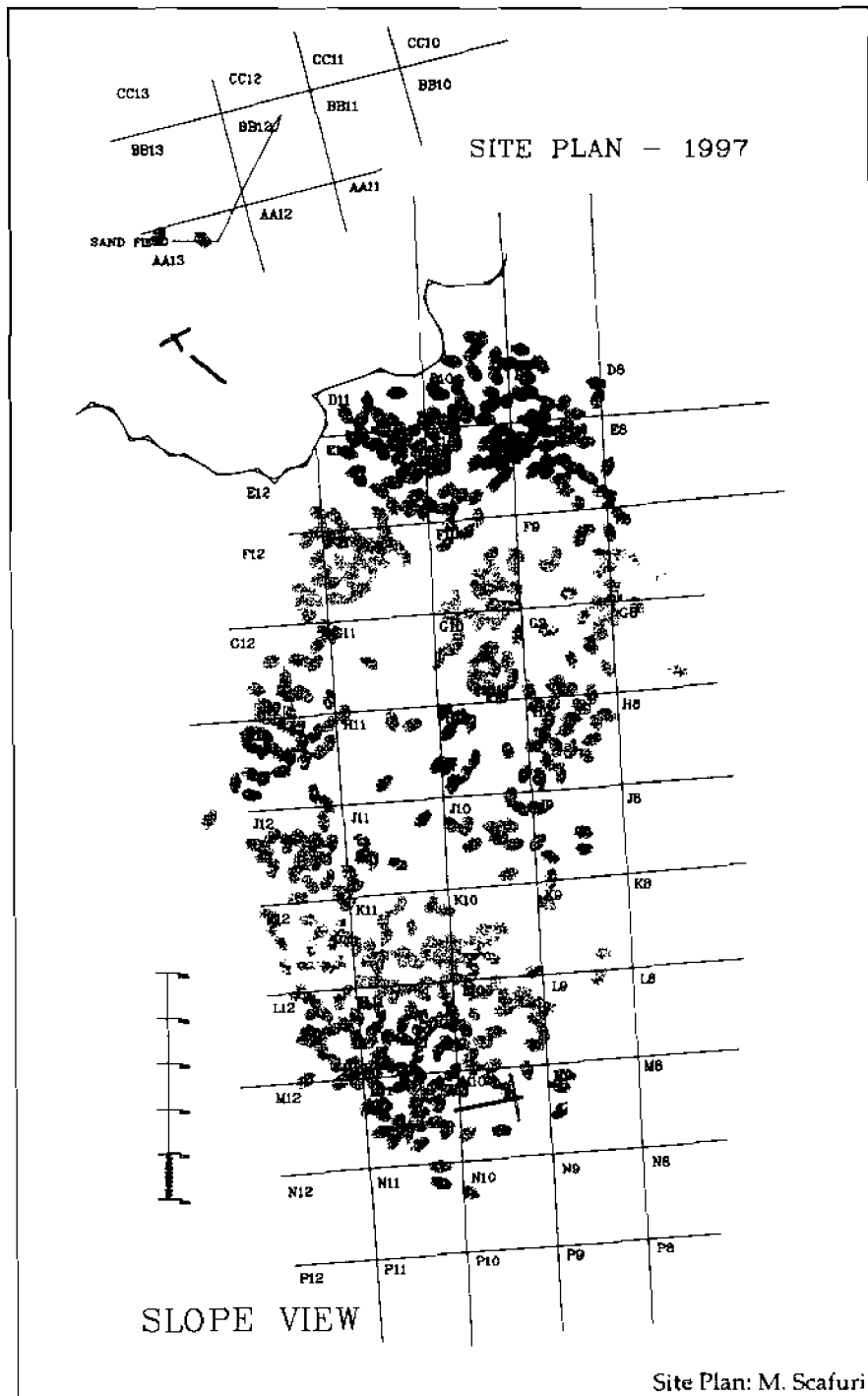


Fig. 2. Bozburun site plan, showing all whole amphoras recovered through the 1997 season.

found in 1996 was full of olive pits. A surprising number of amphoras have their stoppers, of clay tile fragments or pine bark, in place, but these jars are normally full of mud as well. Two amphoras recovered in 1997 still had their stoppers sealed in place, and had not admitted any marine sediment. These jars contained a clear liquid, which tasted suspiciously like sea water, and a small amount of dark reddish-brown sludge. The seeds and sludge are of great interest to specialists in the history of wine and grape cultivation, as DNA analysis of the seeds may reveal their relationship to modern grape varieties and chemical analysis of the sludge should reveal something about the processing of the grapes and thus what sort of wine was being carried in the jars.

Three major classes of amphoras had been identified in the 1995 and 1996 seasons, and all were represented in the 1997 finds. The first class, with an ovoid body, short neck and squared handles, continues to be the most common. Only two partial examples of the second class, with a shorter, flat-bottomed body and wider, flaring neck, were found in 1997. The third class, of similar body shape to the first but with a taller, narrower neck and rounded handles, was a common find in 1997 (fig. 3). These last are particularly interesting, as they match up well with a narrowly dated type from ninth-century kiln sites in the Crimea. Similar jars were also found in the summer of 1997 on an INA survey of a small shipwreck off the Crimean coast (*Quarterly* 24.4). Several unique amphoras, not clearly fitting into any of the three classes were also recovered, as was the upper half of a Roman amphora, probably contemporary with two Roman pots recovered in 1996.

Many of the amphoras have graffiti on their shoulders (fig. 4), probably indicating ownership. We have now seen enough of these graffiti to identify by name a few of the merchants participating in this particular venture. The most common mark, ΓΕ, is a common abbreviation for Γεοργιος (George). Other merchants represented are Leon, Niketas, and (possibly) Anastasios. The location of these marked jars is very important, as it is our best clue to the organization of trade in this period when the Mediterranean world was just beginning to recover from economic and political turmoil that followed the Arab conquest of the seventh century. In this case, all of George's amphoras are together in one part of the hold, all of Anastasios' are together in another. In addition, not all of one owner's amphoras are from the same kiln or source. This strongly suggests that these owners are not the vintners or producers of the wine, but are middlemen engaged in the purchase and resale of wine. The small number of jars for each owner also suggests the relatively small scale on which this venture was taking place. Taken together, these seemingly trivial bits of information may answer one of the great questions of Middle Byzantine economic history—how did long-distance trade recover in the ninth century, and who were the instigators?

In addition to amphoras, examples of domestic pottery were recovered in the stern, primarily, but not exclusively, in the area of the hearth (fig. 5). Eight cooking/serving pots of identical type were recovered. Three of these were intact, three others were complete but broken, and two are represented by sherds. These pots, in a dark, gritty clay, are characterized by a round bottom, inward curving sides, a flared rim, and a pair of vertical strap handles (fig. 6). The size of the pots is appropriate to a single

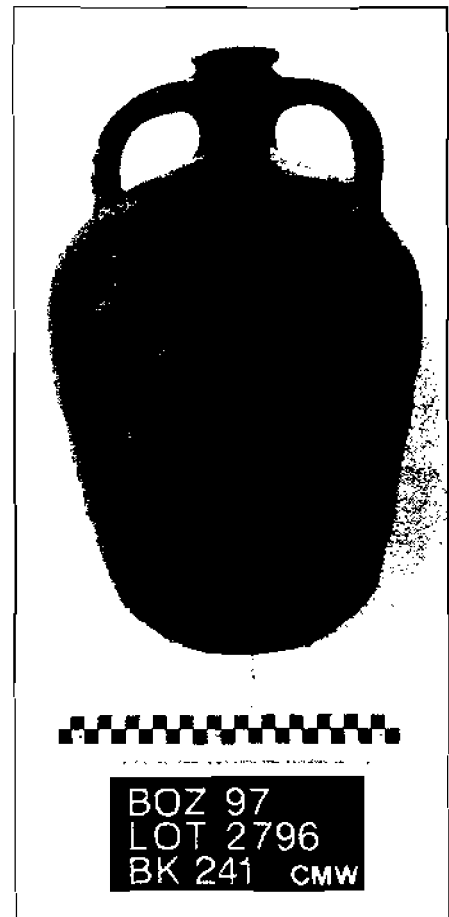


Photo: D. Carlson

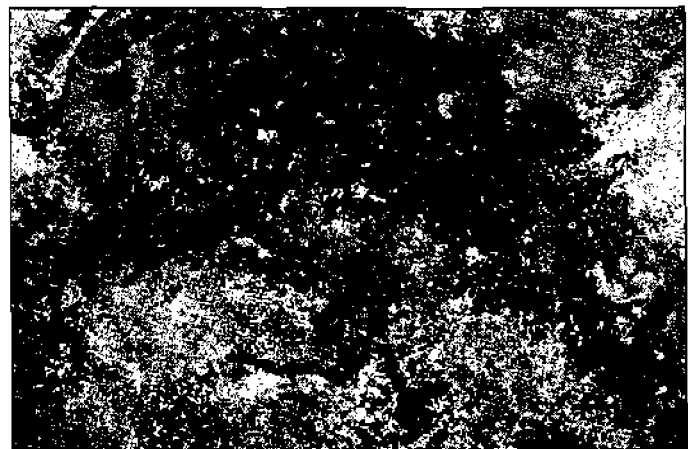


Photo: C. A. Powell

Fig. 3 (above). Amphora BK 241, a typical Class 3 jar. The distinguishing features are the tall, narrow neck and thin, rounded handles.

Fig. 4 (below). Typical amphora graffiti; this is the abbreviation for George.



Photo: D. Frey

Fig. 5. Dr. Faith Hentschel excavating tiles and cookware in the galley area.

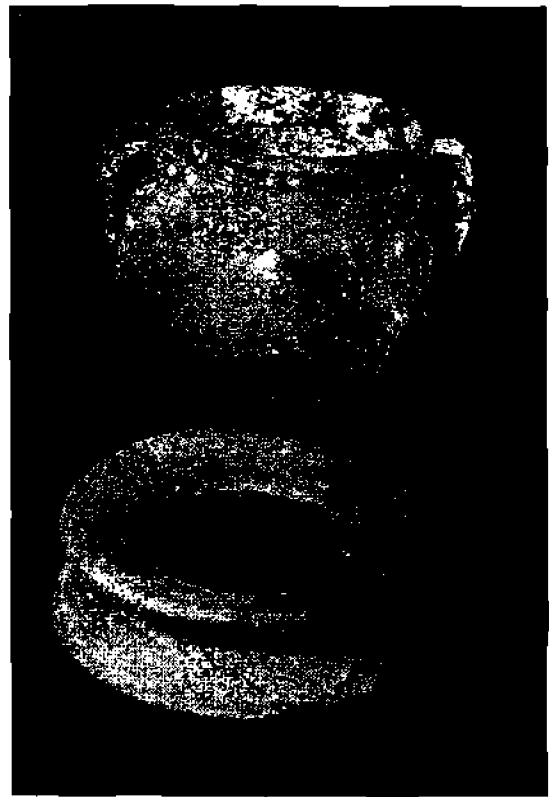


Photo: D. Frey

Fig. 6. One of eight cooking/serving pots recovered from the galley, with a collar stand to support it.

serving, and so the number of pots may indicate the size of the crew. For serving, these pots were probably set on a collar stand, such as one found in the same area. A partial pitcher, similar to one found in 1995, was also found in the hearth area. A rather enigmatic piece of pottery, a small glazed jug, was found smashed up slope and to port.

Another possible item of tableware, a glass goblet, had been found to port of the galley area in 1996. Its mate (fig. 7) was recovered next to the smashed glazed jug. Although broken between amphora sherds, the profile is nearly complete and matches the goblet found in 1996. A finely fluted glass flask (fig. 8) was recovered nearby. The goblets and flask, all found within less than two meters of each other may well be part of a set. No exact parallels have yet been found, but the basic form of the goblet is well known from Roman and Byzantine sites, and no similar vessels are known from the thousands of glass objects recovered from the eleventh-century Serçe Limanı wreck. Glass stemware is an unusual find on Mediterranean shipwrecks, probably because of its fragility, and so these pieces may be personal possessions.

The hearth itself is of simple construction, using earthenware tiles. It is too jumbled at the moment to permit accurate reconstruction, and some of it remains to be

excavated, but it is possible to say that the galley was located on the starboard side toward the stern, but did not extend all the way across the hull, as did the galley in the seventh-century Yassiada ship. Cargo was stacked to port. To balance this cargo, the hearth was built atop a layer of stone ballast, partly made up of large, cut blocks that may be former building material. Outside of this area, there is no separate ballast, except for a few small pebbles.

Removal of the cargo aft of the galley revealed the stern of the ship, lying in a crevice in the rocky bottom (fig. 9). The keel is preserved to its after end, where it began to turn up into the sternpost, and the first four strakes of planking survive to their ends on both sides. There are even close to their original locations, so that the run of plank seams is readily apparent and one can even get an impression of the shape of the lower part of the stern, where the planking runs into the keel. Some of the frames in the stern are in relatively poor condition, but others are sufficiently preserved to indicate something of the transverse shape of the hull. As in the area of hull exposed near midships in 1996, the keel and planking are of oak (*Quercus*, possibly *Quercus ilex*) and the internal timbers all of pine (*Pinus brutia*). All of the fastening, primarily nails, are of iron. A few iron bolts recovered loose in the stern suggest that there

may have been a keelson atop the frames, but no identifiable remains of it survived in the stern.

Toward the bow, our knowledge of the hull was expanded by the exposure of several frames and the keel down slope of the central area uncovered in 1996. This provides a minimum length for the keel of 13 meters, and indicates that some of the floor timbers (the central frame elements that rest on top of the keel) extended all the way out to a fairly hard bilge. All of the frames exposed to date have been broken off at the port side of the keel, where deep limber notches created a natural fault line in the structure. Except at the stern, almost nothing survives of the port side, which was probably suspended above the sand bottom after the ship sank and was more vulnerable to attack by marine borers (*Teredo navalis*). The eroded port ends of the frames are heavily damaged by these borers as well.

Several discoveries in 1997 have raised questions about how the ship sank. In the first surveys of the site in 1973, it had been noticed that there was a large number of amphoras strewn about the rocks above and to either side of the site, some of them more than 50 meters away from the main mound. We had presumed that these had fallen out of the ship as it dragged its stern down the underwater face of the cliff, but examination of the stern does not

show a great deal of damage. It does show that some amphoras came to rest on the bottom before the ship did—in the stern, one of these jars broke a hole in the planking from underneath as the ship settled onto it. It is possible that this is one of the jars that fell out of the hull as the upper works disintegrated but before the timbers worked their way down into the rocks, but it would have to have fallen up slope to have done so. The absence of any spare anchors, a typical feature of medieval Mediterranean wrecks, is also perplexing. Is it possible that the crew were desperately trying to lighten ship by casting overboard spare anchors and the upper layers of cargo before they finally abandoned the doomed vessel? Medieval maritime law assumed that this would be a normal method of saving a ship in distress and provided for a rational system of compensating those merchants whose cargo was lost or damaged in saving the ship.

Part of our task in 1998 will be a survey down slope in search of the anchors and other jettisoned material. Our primary goals are the excavation of the remaining cargo, ship's equipment, and personal possessions, and the recovery of the hull remains. Small objects under the hull may, in the end, be the best indicators of how the ship and her crew spent their last few minutes afloat.



Photo: D. Frey

Fig. 7. Doreen Danis with the glass goblet BK 401.

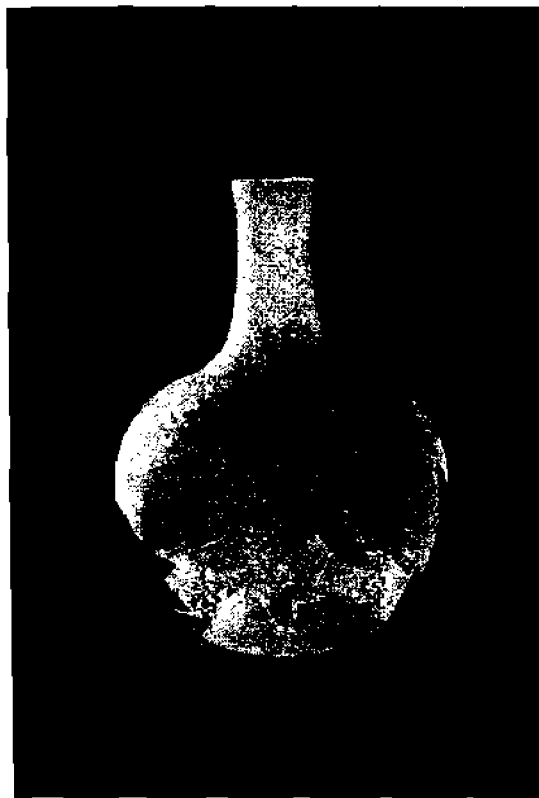


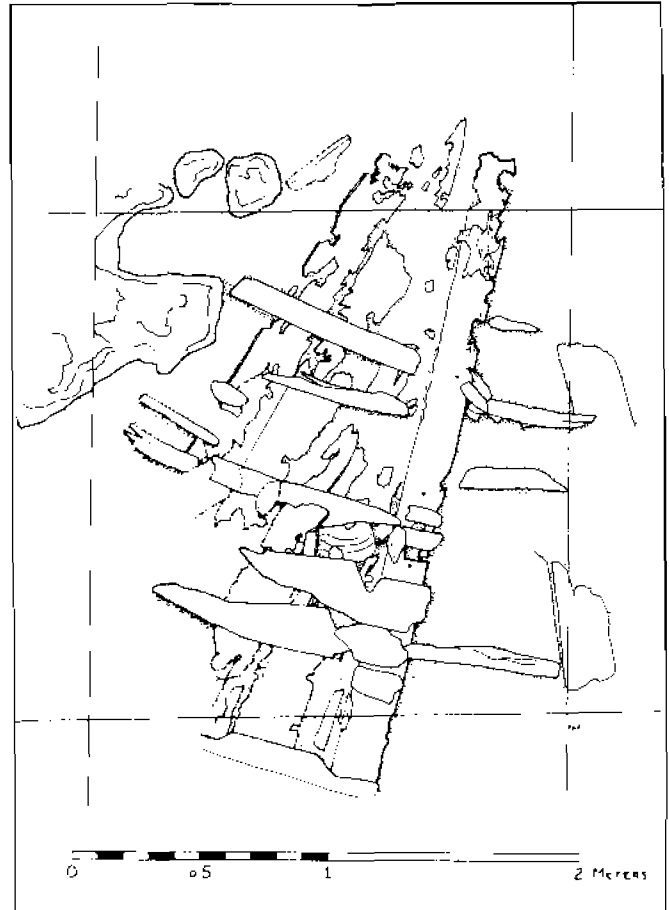
Photo: D. Frey

Fig. 8. Glass flask BK 272 after conservation.





Photo: F. Hocker



Drawing: F. Hocker

Fig. 9. Hull remains at the stern; left, the planking after removal of frame elements and right, plan of remains as excavated.

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rectorate of Monuments and Museums, who were represented by Mr. Yaşar Yıldız, and the Bodrum Museum of Underwater Archaeology and its Director, Mr. Oğuz Alpözen. Finally, no project of this scale can succeed without the efforts of large numbers of people who are willing to live and work for endless hours in demanding conditions. You know who you are. ☺

### Have You Turned to Point-and-Shoot?

If you no longer need your old Single Lens Reflex camera or equipment, and would enjoy a fair tax write-off, please consider donating it to INA. Vice-President Don Frey is looking for an O.M. body to replace his water-damaged O.M., so he can continue to use his existing lenses. However, Nikon, Minolta, and Canon equipment would all be appreciated. This is just one example of the ways in which INA members and friends can help the Institute by making contributions of used, but still usable, equipment to assist us. If you can be of help, please contact the INA offices in College Station, Bodrum, or Alexandria.

# Exploring the Dusty Halls of Antiquity: Archival resources of Lisbon

by Brian Jordan

My first view of Lisbon was through the sleep-deprived, red-rimmed eyes of a weary traveler who had just completed twenty-four hours of seemingly endless travel across Asia Minor and Europe by bus, plane, and taxi. The plan for the trip to Lisbon originated five months earlier at Texas A&M University. While trying to juggle a summer schedule between a two-and-a-half month stint working on the excavation of a ninth-century shipwreck off the coast of Selimiye, Turkey and a survey in the Azores in mid-August, 1996, I needed something to fill in a two-week gap between archaeological pursuits.

INA's Dr. Kevin Crisman, who was heading the survey in the Azores as well as working on the final publication of the seventeenth-century Portuguese frigate *Santo António de Tana*, generously offered to sponsor a trip to Lisbon in an attempt to uncover more information on the construction of this historic vessel. Since my thesis was also on the *Santo António* and I had the time, I eagerly accepted. During the course of the summer while struggling with non-functioning fax machines and power outages in Turkey, I was informed that due to delays in obtaining the permit the Azores survey was postponed two weeks. Instead of two weeks, I had an entire month to delve into the Lisbon archives.

Arriving from a remote hamlet in Southwest Turkey, I did not know any of our contacts in Lisbon, or whether any could offer assistance in the research we had come half-way around the world to attempt. I knew only my traveling companion Anne Lessmann, who was to fly to Holland and complete research of her own during this time, returning to Lisbon before flying to the Azores. While planning this excursion, I failed to take several factors into con-

sideration. First, as we were informed shortly after our arrival, August—the traditional holiday month—is perhaps the absolute worst time for any type of research in Portugal. This of course played havoc with our plans, as most of our contacts were gone. Having no idea where to start looking for a place to live, or how we were going to stretch our limited funds, panic had begun to rear its ugly head. Trying the last name on a short list, the phone rang for an eternity before a voice finally answered. I stumbled through my limited Portuguese and discovered that the person in question no longer worked at that location. Given another phone number, I grimly dialed and held my breath not daring to hope that anyone would pick up at the other end. As luck would have it, someone did answer and soon I was speaking to Filipe Castro, my only contact in Portugal. He excitedly welcomed us to Lisbon and gave us directions to Belém (fig. 1), just outside of Lisbon, where he was working at the Centro de Operações de Arqueologia Subaquática da EXPO '98 (COAS). In 1997, COAS became Centro Nacional de Arqueologia Subaquática (CNANS), a department within the newly-created Portuguese Institute of Archaeology (IPA). With much relief, I hung up the phone and smiled for the first time since arriving in this fast-paced city of close to three million.

Making our way to Belém via Lisbon's public transportation system we arrived and were greeted by Paulo Monteiro wearing a dark-blue INA T-shirt. Paulo was our contact for the Azores and was visiting his colleagues in Lisbon. We were taken to the new COAS headquarters which is located in a former army complex's motor pool a block away (fig. 2). There we were introduced to the director of COAS, Dr. Francisco Alves, and Filipe Castro his co-

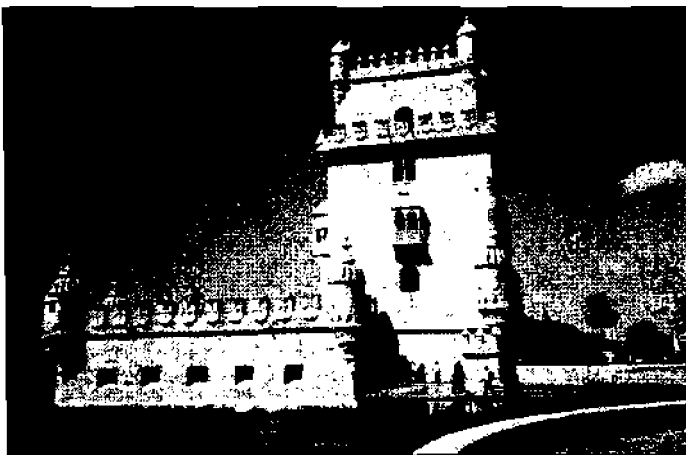


Photo: A Lessmann

Fig. 1. The Tower of Belém is one of the outstanding landmarks of this Lisbon suburb.



Photo: K Crisman

Fig. 2. Cannons from a seventeenth-century wreck in the south of Portugal laid out for study at the CNANS facility in Belém.

director in the Project S. Julião da Barra. They were extremely pleased to have us in Lisbon and immediately made us feel at home. Soon we were talking like old friends and the 2,000 pound weight that had been crushing down on my shoulders slid off with a silent crash of relief.

### Research Considerations

Now I was able to focus on more immediate concerns, such as housing. Belém, located just outside of Lisbon, was the obvious choice because of its proximity to several of the major archives and libraries in the area. This small town was noticeably less hectic than Lisbon, providing an atmosphere more conducive to research. Filipe, using his formidable powers of persuasion and abundant charm, located a room in a *pensão* for the entire month at a reasonable price. Our new dwelling was located on the third floor and provided a view of the Tagus river and the famous Mosteiro dos Jerónimos. Vasco da Gama prayed at the site of this massive church before and after his monumental voyage of discovery, and it exudes antiquity. Part of the funds from the *Carreira da Índia* were used for its construction, and nautical motifs are carved throughout the vaulted ceilings and massive columns. The monastery's block-long complex also houses the Biblioteca Central da Marinha, the Museu Nacional de Arqueologia, and the Museu da Marinha. Located within walking distance from the *pensão* were the Instituto de Investigação Científica Tropical, Centro de Estudos de História e Cartografia Antiga and the Arquivo Histórico Ultramarino. The COAS headquarters located a block away quickly became our base of operations, while the Biblioteca Central da Marinha was our research facility of choice.

Finally, I was prepared to initiate some serious research on seventeenth-century Portuguese seafaring. Unfortunately, this was not as easy as I had led myself to believe. First of all, the librarian at the Biblioteca Central da Marinha spoke no English, and although I could read Portuguese, my speaking skills were limited. This proved to be a significant hindrance, although not insurmountable. Second, none of the libraries and archives that were visited had computer-based card catalogues. Searching for documents was a time-consuming and often frustrating process. Last, the letter of introduction from Robin Piercy (INA-Turkey), the excavation director of the *Santo António de Tana* was written entirely in English and therefore rendered almost completely useless. Fortunately the latter was quickly remedied with a letter from Dr. Alves, and the other problems became more manageable with the passage of time and familiarity with the facilities.

The next several paragraphs will attempt to familiarize the reader with some of the archives and libraries visited and what one can expect from each. The more experienced researcher probably would not have had the difficulties which presented themselves to me, and un-



Photo: K. Crisman

Fig. 3. The Jerónimos Monastery, a fifteenth-century gothic church with subsequent construction that today house the Biblioteca Central da Marinha, the Museu Nacional de Arqueologia, and the Museu da Marinha.

doubtedly would have been better prepared. I, on the other hand, was inexperienced at the art of archival research. Nonetheless, I did uncover some extremely useful information about the *Santo António de Tana* and frigates of the seventeenth century. This article is not meant to be extensive nor overly detailed, but hopefully will provide assistance to someone with time constraints and limited fluency attempting to navigate the maze of historical material in Lisbon.

### Biblioteca Central da Marinha

The Biblioteca Central da Marinha is located through an arch directly across from the massive wooden doors of the Mosteiro dos Jerónimos (fig. 3). Outside the library's front doors is a small courtyard area with a large anchor sitting prominently in the middle. At the front desk, you must surrender your passport and your bag in exchange for a *Leitor* (reader) name badge. The clerks are Cadets at the Naval School and are very friendly, although they speak only fragmentary English. Down the hall and to the left is the lobby, which contains the librarian's desk and the card catalogues. The card catalogues are archaic, but are generally easy to understand once one becomes familiar with the system. The books themselves are kept in separate rooms upstairs. Once a request is given to the librarian, the material is brought out to you in the adjacent reading room.

The *leitura* is large and very comfortable with small stands to prop up the material for ease of reading. There are abundant reference sources in the reading room including several dictionaries in varied languages which provided me necessary assistance in translating some of the more difficult texts. One set of volumes stands out among the shelved books in this room: *Portugaliae Monumenta Carto-*

*graphica* by Armando Cortesão and Avelino Teixeira da Mota. The comprehensive six-volume set features stunningly beautiful color and black and white reproductions of maps and renderings of fortresses dating as far back as the twelfth century. The maps were exquisite and the descriptions even more spectacular. Each map has a date, description, the cartographer (if known) and its current location. The authors did an impressive job in organizing the maps chronologically and geographically. Also included are sections on the various types and styles of maps as well as synopses on the various cartographers who made them. It is an incredible source for gaining an understanding of how the Portuguese viewed their world through time.

The library has much more to offer besides reference material. Books and manuscripts range from historical material to technical manuals on sailing dating from the fifteenth century to the present. In order to examine anything before the turn of the century, a *credencial* or letter of introduction must be reviewed and approved by the Director of the library. This took several days and a call on my behalf from the former Director of the Archaeological Museum before approval was granted. It is well worth the trouble considering the material available. I was able to gently peruse original texts on rigging and pilot's *roteiros* from the sixteenth and seventeenth century that I had previously only read about in other's footnotes. The Biblioteca Central also possesses numerous manuscripts and copies of shipbuilding treatises from the seventeenth century. The Director graciously allowed me to obtain a photocopy of João Baptista Lavanha's *Arquitectura Naval* and two subsidiary texts dating to the early seventeenth century.

Another important group of resources within the Biblioteca Central are the catalogues of material in other libraries. The catalogues provide short summaries of vari-

ous collections at other institutions and saved me many hours of fruitless research. One catalogue in particular warrants mentioning: *Catálogo de Publicações* published by the Instituto de Investigação Científica Tropical. Of the catalogues examined, this one was extremely well organized and provided concise and informative abstracts of individual documents in various collections at other archives.

#### Centro Nacional de Arquelogia Subaquática (CNANS)

During my stay I frequently visited the COAS headquarters (as it then was). This center was organized and funded for the collection and organization of some of the historical and archaeological displays for the 1998 exposition celebrating the five hundredth anniversary of the opening of the sea route to India by Vasco da Gama. Headed by the former director of Lisbon's Archaeological Museum, Dr. Francisco Alves, the center offers amazing personal and archaeological resources (fig. 4). Though overwhelmed with work and the refurbishing of the old military motor pool which is their new home, the members of COAS always had time to discuss various aspects of my research and provided useful guidance throughout my stay in Lisbon. COAS also possesses a small but extremely useful library of archaeological texts and reports, as well as numerous reproductions of Portuguese shipbuilding treatises ranging from the sixteenth century to present.

Texts are not the only valuable resource available. A specialized team of archaeologists gathered by Dr. Alves have excavated two late fourteenth/early fifteenth century wrecks from northern Portugal and numerous cannons and Roman period anchors and stocks. This team has underwater as well as terrestrial experience and have participated in excavations of sites dating from the Roman occupation up to the present. Shelves of catalogued artifacts attest to their dedication, as do the timbers from the

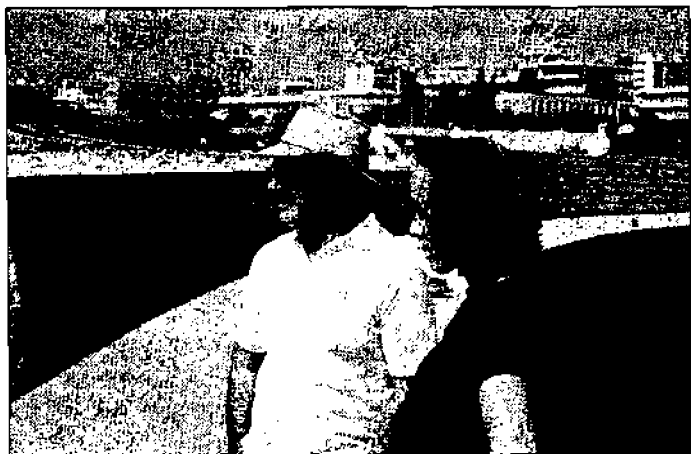


Photo: K. Crisman

Fig. 4. Dr. Francisco Alves, the Director of CNANS, with INA researcher Ann Lessman.



Photo: K. Crisman

Fig. 5. Timbers from a late fifteenth- or early sixteenth-century shipwreck discovered during construction of the subway.

early vessels undergoing conservation. The most spectacular archaeological feature on display at the headquarters is the timbers from a late fifteenth-century/early sixteenth-century shipwreck uncovered during the construction of the new subway system (fig. 5). The timbers are badly distorted, and the central part of the frames was destroyed before the construction process could be halted. However, entire frames, futtocks, and runs of outer hull and ceiling planking are fairly well preserved and laid out for recording on the floor of the center. Details of construction were readily visible, including scribe lines and roman numerals carved into the timbers by the shipwright, a section of a breasthook, and the remains of a whipstaff. These structural features are rarely found in excavated ships from this period and are an example of Portugal's archaeological wealth. Further study should provide exciting glimpses into the fabrication of vessels from this period.

### Museu da Marinha

If your interest runs toward the nautical, then the Museu de Marinha will be on your list of places to visit. Make sure to bring plenty of high speed film, because flashes are not allowed. The exhibits start from the Age of Exploration and continue to the present. Hundreds of detailed

ship models are on display alongside nautical artifacts and paintings (fig. 6). Relics, such as the fifteenth-century carving of the angel Rafael which accompanied Vasco de Gama on his voyage to India, bring the history of Portuguese seafaring to life. The details of the ship models are superb, with some possessing actual movable rigging. Many interesting artifacts showcase every aspect of the mariner's life. Mannequins dressed in authentic uniforms stand next to sixteenth and seventeenth century astrolabes (fig. 7). Quadrants, sextants, globes, and lead sounding weights are displayed next to cannons and sabers. The museum also includes many objects from Portugal's contacts with the Far East. A sinister curved sword with twelve small rings dangling from the blade hangs above a card explaining that each circle signifies a beheaded victim. At the end of the museum are the refurbished Royal barges of the late nineteenth century which were used to carry royalty up and down the Tagus River on pleasure cruises. This article is far too short to showcase the contents of the Museu de Marinha.

Adjacent to the museum is a small library which is rumored to be quite good. Unfortunately the library was closed during my visit, depriving me of the opportunity to peruse its contents. The director of the museum, *Capitão-*

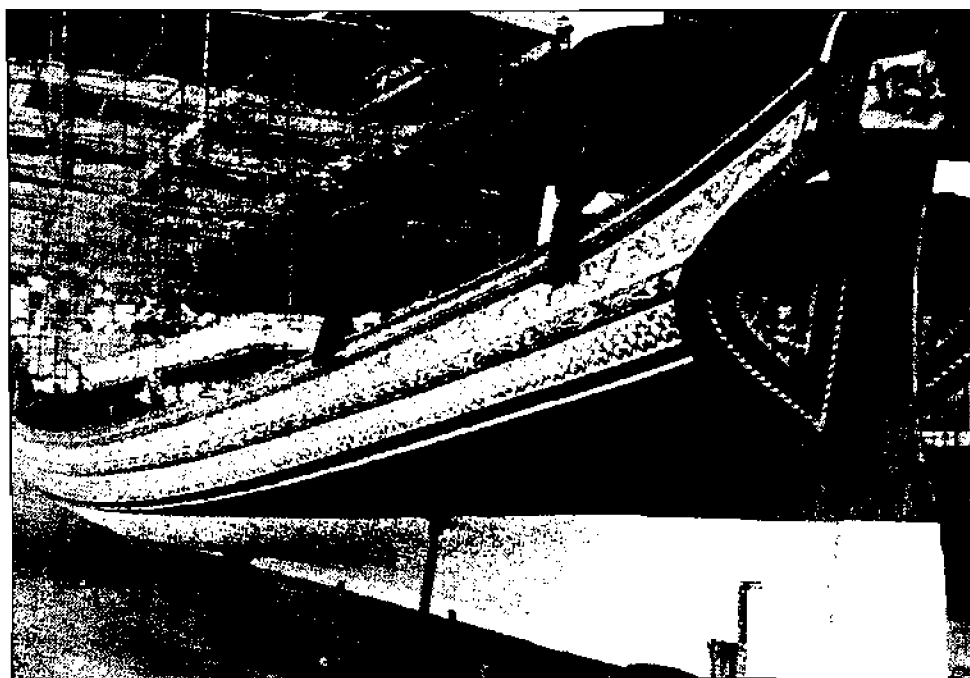


Fig. 6. Model of a late sixteenth-century galleass in the Museu da Marinha.



Fig. 7. Part of the astrolabe collection in the Museu da Marinha.

Photos: K. Crisman

*de-Mar-e-Guerra* José Fernandes Martins e Silva, was kind enough to meet with me and even mailed some requested information after my return to the United States. He is extremely knowledgeable on subjects concerning Portuguese seafaring, with a special interest in astrolabes. The museum's collection is most impressive.

### Arquivo Histórico Ultramarino

Tired of searching through the same places (although by no means exhausting their sources), I decided to venture further afield. Located about a mile from the pensão, the Arquivo Histórico Ultramarino was the most challenging of the facilities I visited. The material within the Overseas Archive is for the most part completely untranslated and very loosely organized. Fluency in historical Portuguese is absolutely necessary, as is familiarity with the subject matter. After the typical perusal of credentials and checking of the bags at the desk, you are ushered into a large reading room filled with studious historians poring over documents dating from the fifteenth, sixteenth and seventeenth centuries. Although some of the manuscripts have been translated and studied by such noted historians as C. R. Boxer, a vast majority of sources have not been studied in detail. The librarian will first ask which group of documents are of interest; each group representing a specific region of the Portuguese empire (i. e. India, or Macao). Within each geographic area, the manuscripts are grouped chronologically, primarily in ten-year lots. Once the time period has been selected the librarian wheels out a rather large and intimidating cart with *caixas* (boxes) or *pastas* (loose bundles) of documents. There is an enormous amount of original material in the individual folders indicating years (if known) within the containers. Some of the folders have short summaries of the texts within, but for the most part the contents must be read carefully. The writing is cramped, full of abbreviations, and generally hard to understand. Many of the pages have dark water stains causing the script to blur and further compounding the problem. Needless to say, I quickly felt overwhelmed, and retreated to more familiar ground. Maybe after many years of studying archaic Portuguese and substantially more practice at translating documents from this period, I can make another trip back to this incredible historical resource and delve into its hidden treasures with more understanding. The work involved in the translation of such documents makes one appreciate the life-long dedication historians must have to immerse themselves in a culture so far removed from our own.

### Instituto de Investigação Científica Tropical—Centro de Estudos de História e Cartografia Antiga

Having perused some of the catalogues in the Biblioteca Central (as stated above), I had marked many passages which I wished to study further. I was particularly

interested in one set of manuscripts called the *Livro das Monções* (Book of Monsoons) which contained letters from the *Estado da Índia* to Portugal and vice versa. The name of this set of manuscripts derives from the seasonal winds which propelled the carracks and galleons along the famous *Carreira da Índia* and controlled sea travel in the Indian Ocean. These documents contain enormous amounts of information detailing only a fraction of the bureaucracy encompassing the Portuguese empire in past centuries. My focus for research was the two decades surrounding the birth and death of the *Santo António de Tana* (1681-1696). The Instituto de Investigação Científica Tropical possesses a copy of these manuscripts on microfilm in a series called the *Boletim Filmoteca Ultramarinho Portuguesa*. The microfilm is listed chronologically in catalogues with short descriptions of each of the manuscripts. The documents are relatively clear, and the microfilm machines are fairly standard. Copies of specific manuscripts can be obtained by filling out the necessary forms. I found this method to be by far the easiest and most cost effective (less than \$1.00 a copy) way to obtain copies of original material.

### The Museu de Arte Antiga

Having had enough of stuffy archives for a while, I decided it was time to see some actual material from the period under study. The Museu de Arte Antiga is located between Belém and Lisbon, and situated conveniently on the *elétrico* (tram) route. The museum is set on a hillside overlooking the Tagus River with a nice picnic/park area in the back. For those interested in ancient art and more specifically religious art, this museum has copious quantities of both; rooms upon rooms of fascinating paintings and sculptures of saints and angels in various states of piety or martyrdom. Quite an impressive collection of pottery and furniture from the sixteenth, seventeenth and eighteenth centuries is also present. There are several pieces of Portuguese faience ware that are almost identical in pattern to those found on the *Santo António de Tana*. Unfortunately, paintings containing images of ships are not prevalent among the other great pieces. Only two paintings are of particular interest to the nautical enthusiast. The first is a large piece covering most of a wall featuring the River Tagus in front of the Mosteiro dos Jerónimos. Numerous types of ships in several shapes, sizes and in various states of repose grace the canvas. The detail of the vessels is incredible. One scene shows a carrack being careened in the water. The second painting features the martyrdom of a thousand virgins which, oddly enough, has an insert of a Portuguese carrack painted in exquisite detail.

### Academia de Marinha

The last place I visited in Portugal was the Academia de Marinha. Midway between the Cais do Sodré station

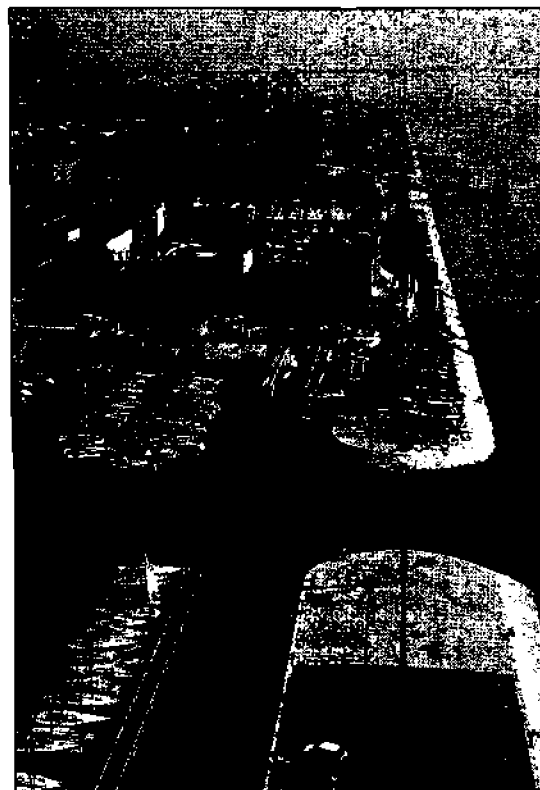
and the Praza do Comércio in Lisbon, the building itself is located on the site of Lisbon's historical shipyards. One of the two ships under conservation in the COAS headquarters was unearthed during renovation of one of these buildings. The Academia is a repository of several publications which may prove of interest to those studying Portuguese naval architecture in the sixteenth and seventeenth centuries. They have editions of several of Padre Fernando Oliveira's sixteenth-century manuscripts with copies of the original manuscript, as well as modern Portuguese and English translations. Also for sale is a beautiful over-sized volume of Manuel Fernandes' *Livro de Traças de Carpintaria*. This 1989 edition of the manuscript is in full color and is an amazing reproduction of the original. Other publications include good Portuguese-English and English-Portuguese nautical dictionaries, as well as the Academia's own series of books specifically dealing with aspects of historical Portuguese seafaring.

### Conclusion

Lisbon is a mesmerizing city with its abundant historical monuments, beautiful mosaic sidewalks, and tile covered buildings (figs. 8 and 9). There is a definite sense of history when walking along the broad *avenidas* in the Baixa district or the curving *travessas* and *escadinhas* of the Alfama district. The archives and libraries are much like the city itself; easy to get lost in, but holding treasures around every corner. This short trip to Lisbon was not meant to be a thorough research venture, but more of a reconnaissance of the historical resources available. Along the way, I met many people with similar interests and much more experience who were able to give considerable guidance in my bungling efforts. Hopefully this article can be of assistance to someone seeking knowledge of their own in Lisbon.

Figs. 8 and 9. *The Lisbon waterfront today.*

Photos: K. Crisman



*Acknowledgments.* I wish to thank Dr. Kevin Crisman, Mr. Robin Piercy and the Institute of Nautical Archaeology for the funding and guidance which made this trip possible. From COAS, I would like to thank Dr. Francisco Alves, Filipe Castro, Henrique de Brion and the entire staff who all have my undying gratitude for use of their facilities and for getting me started and helping along the way. Special thanks to Chico, Filipe and Siaska for inviting me into their homes and making me feel like an honored guest as well as an old friend. Hopefully I can repay the favor one day. There were so many other people that made this trip successful, that I can't name them all. But there are a few who went out of their way to make things easier: Cmdt. Carlos Gomes who took time out of his own busy research to provide sources and assistance with the librarian of the Biblioteca Central; and *Capitão-de-Mar-e-Guerra* José Fernandes Martins e Silva who agreed on extremely short notice to meet with me and then sent copies of sources after I reached home. Last but certainly not least, I would like to sincerely thank my co-traveler and friend Anne Lessmann, without whom I probably would not have made it through those first few shaky days.

All material copied during the author's trip to Lisbon belongs to the Institute of Nautical Archaeology and is located at Texas A&M University. ☞

# The Earliest Mast Step

By Sam Mark, Mr. & Mrs. Ray H. Siegfried II Fellow

Ancient Egyptian artisans painted thousands of scenes of ships and boats on the walls of tombs that have enriched our understanding of their long nautical tradition. Our knowledge of this rich heritage is supplemented by boat models and even a few full-size vessels that have been interred in or near tombs.

In 1987, one such model was discovered in a temple at Elephantine in Upper Egypt (fig. 1a and 1b) and dates to the Fourth Dynasty (ca. 2613–2494 B.C.). Despite being badly broken and lacking aesthetic value, it does have a few interesting features. The most important feature is an A-shaped mast step (fig. 1b). This is the earliest known example of a mast step and the only example from ancient Egypt. This model also reveals how the mast was secured. A supporting pole is stepped into the forward hole of the mast step, and the mast is stepped into the aft hole. A thwart, which is a timber that connects the port and starboard sides of a vessel, runs between both poles. Cords are then tied around the pole and mast directly above the thwart. Finally, the mast receives additional support from two forestays that run from the top of the mast to two small holes on each side of the bow (fig. 2).

Evidence of a single or center-line mast in this model is also important. Vessels with this type of mast date as early as the Late Predynastic period (c.a. 3200 B.C.). At this time, a sail and its rigging would have been supported by three poles. Known as a tripod mast, it was a necessary design. Egyptians made their first boats with bundles of papyrus, and, when shipwrights built their vessels with wood, they bound the planking together with cords. The weight of a center-line mast could force open planking seams in these types of vessels. In contrast, the tripod, and later biped mast, could distribute this weight over a larger area, which would preserve the integrity of the seams. Egyptian shipwrights appear to have patterned this A-shaped mast step after a tripod mast because they realized it would distribute the weight of a center-line mast step.

The holes on both sides of the hull are yet another interesting feature of the model for they allow us to date the introduction of

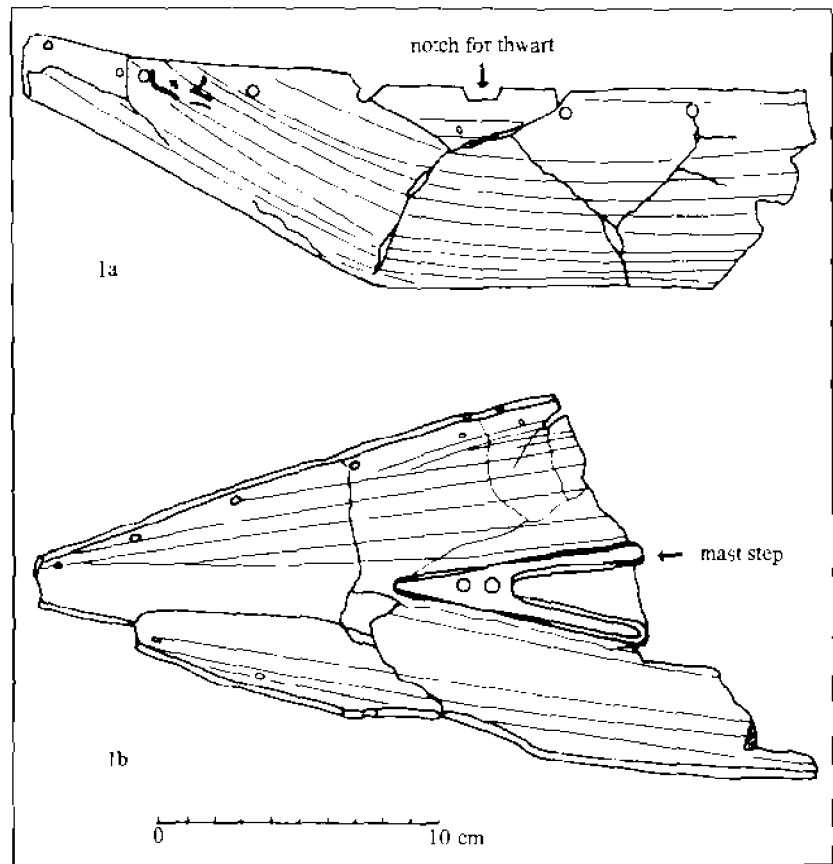
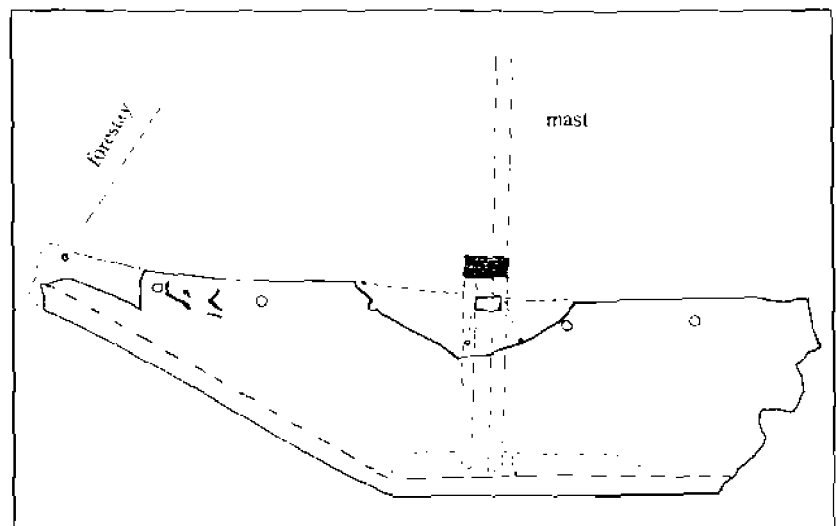


Fig. 1 a & b (above). Fourth Dynasty boat model.

Fig. 2 (below). Reconstruction of model.





oars from the Fifth Dynasty (ca. 2494–2345 B.C.) to the Fourth Dynasty (figs. 1 and 2). As previously mentioned, the forward-most holes are for securing forestays. Two small holes below the notch that holds the thwart (fig 1b) are for tying off the cords that secure the thwart. It seems unlikely that the remaining holes were used to tie off lines for the mast or rigging since all extant Egyptian iconography shows such lines being tied at the stern of vessels. Rather, the placement of these holes appears to be consistent with the

location of loops of rope used to hold oars. This is significant because the earliest evidence for oars in Egypt dates to the Fifth Dynasty.

This model has given us new insight into some features of early Egyptian boat construction. We now have an example of a mast step and a better understanding of how a mast was secured. Finally, we can move the introduction of oars from the Fifth to the Fourth Dynasty, all from a few bits of clay.✍

### Suggested Readings

- Kaiser, W. et al.,  
1988 "Stadt und Tempel von Elephantine," *Mitteilungen des deutschen archäologischen Instituts, Abteilung Kairo* 44: 174–177.
- Petrie, W. M.  
1915 *Prehistoric Egypt*. London.
- Casson, L.  
1995 *Ships and Seamanhip in the Ancient World*. Baltimore.

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## Review

by Patricia Sibella

*La navigation dans l'antiquité*

by Patrice Pomey et al.

Aix-en-Provence: Edisud, 1997.

ISBN 2-85744-799-X, 208 pages, hardcover, 23x30 cm

Price: 280 French Francs

*La navigation dans l'antiquité*, written under the direction of Patrice Pomey, sees the contributions of two French —P. Pomey himself, and A. Tchernia—, one Italian P. Gianfrotta—, and one Spanish —X. Nieto—underwater archaeologists who are well-known for having largely explored the western Mediterranean seafloor. These highly qualified and respected scholars present here chapters on subjects for which they are known masters. Furthermore, those years of laborious work spent in the field certainly count as decades of experience. All of this makes the reading of this volume even more interesting and enjoyable, as no detail is left aside.

*La navigation dans l'antiquité* is divided into five sections with a total of 206 pages. The introduction has the merit to rectify erroneous ideas on ancient navigation without falling into the reverse error. It clearly explains lacks and limitations of archaeological documents, but at the same time emphasizes the contribution of underwater archaeology.

Part One, titled "Navigation," contains three entries subdivided into a total of eight sub-entries. Accounts of ancient illustrious travelers such as Pythéas, Paul or Strabon are used to introduce and summarize the conquest of maritime space within and beyond the Mediterranean. The geographical and climatic constraints of this closed sea are clearly evoked while the absence of navigational tools and maritime charts are explained by the ability the ancients had to interpret natural phenomena. On the other hand, human greediness, through the existence of pirates, is presented as an unavoidable plague nurtured by political, economic, and social motivations.

Part Two, titled "Vessels and Men," is composed of two entries divided into eleven and two sub-entries, respectively. It introduces the notion that from the primitive craft of the Neolithic period and Aegean vessels of the Bronze Age onwards, ancient ships never stopped evolving. They gave birth to war and commerce vessels through formulas that perpetuate themselves well past

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