THE INA QUARTERLY

Summer 1996

Volume 23 • No. 2

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On the cover: What was once the greenhouse of an Egyptian prince's villa now provides a light-filled space for cleaning and treating marine artifacts at the Alexandria Conservation Laboratory for Submerged Artifacts. Photo by D. Haldane.

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The Institute of Nautical Archaeology is a non-profit scientific and educational organization, incorporated in 1972. Since 1976, INA has been affiliated with Texas A&M University, where INA faculty teach in the Nautical Archaeology Program of the Department of Anthropology.

The *INA Quarterly* was formerly the *INA Newsletter* (vols. 1-18). Editor: Christine A. Powell

The Alexandria Conservation Laboratory for Submerged Antiquities

by Douglas Haldane

When Alexandria was the cultural and political capital of Hellenistic and Roman Egypt, it was a world-famous center of learning. Scholars came from the entire known world to study in its schools or consult its famous Library. In addition, Alexandria has served as the main port of Egypt for thousands of years, drawing merchant ships from Russia, Italy, the Levant, and many other places because of the rich and varied cargoes that could be obtained there. Spices, wine, grain, fabrics, dyes and other chemicals, and fine pottery are only a few of the goods that ship owners and captains sought.

INA-Egypt's headquarters are in Alexandria, in part because of this rich history, but also to work more closely with Egypt's National Maritime Museum. We can accomplish enormously more in synergism with Egyptian nautical archaeologists, historians, conservators, archivists, and curators than we could possibly do alone. The Maritime Museum occupies almost half a city block of Alexandrian seafront property. Two large buildings serve as offices and exhibit halls, but the outbuildings attracted our interest from the first visit we made to the site. They have now become the Alexandria Conservation Laboratory for Submerged Antiquities.

INA-Egypt was in a quandary during the 1994 Red Sea Survey (*INA Quarterly* 21.3). Our permit allowed us to find shipwrecks and raise and record artifacts, but made no provision for the transport and storage of objects. Egypt is so rich in artifacts that the Supreme Council for Antiquities (SCA) faces persistent conservation problems due to sheer volume. The SCA properly avoids temporary solutions. It is better to leave objects in place rather than to remove them without reasonable prospects for proper conservation and curation. The Alexandria Conservation Laboratory was born from the need to provide a permanent answer to the conservation and preservation of artifacts from under water and from waterlogged land sites.

The first step in making the laboratory a reality was to obtain permission to create it from the SCA's governing body, the Permanent Committee. In October 1994, INA-Egypt submitted a plan to convert five outbuildings in the National Maritime Museum into a complex for conserving antiquities from INA-Egypt projects and for training Egyptian conservators (fig. 1).

The Egyptian National Maritime Museum was originally a villa complex built in 1912 for Prince Youssef Kamal, King Farouk's uncle. After the 1952 revolution, the villa became the property of the Egyptian government. In 1986, the estate was commissioned as a maritime museum. The spacious grounds include a greenhouse, three-car garage, laundry, and other structures at the rear of the property. Since conservation of waterlogged artifacts requires large areas that will survive constant wetting, these buildings seemed perfect for a laboratory dedicated to the conservation of such materials. We also appreciated the large open space between the buildings as a possible site for storage tanks.

The SCA Permanent Committee decided to appoint a subcommittee to study INA-Egypt's proposal. Dr. Shawky Nakhla, General Director of Conservation and Restoration for the SCA, served as chairman. The subcommittee agreed that the buildings would make a first-rate laboratory. Indeed, Dr. Nakhla eventually named the facility. We settled on an ambitious, but manageable, scheme for renovating five buildings. These will become laboratories for small and large artifact cleaning and preservation, equipment storage centers, a workshop

Photo: D. Haldane

Fig. 1. *Five buildings below terraces at Alexandria's Maritime Museum will serve as a comprehensive laboratory and documentation center for the conservation of waterlogged artifacts. The Supreme Council of Antiquities for Egypt owns the buildings, but INA-Egypt is responsible for their contents. Besides treating objects, sharing information with local conservators is an important part of our long-range program in Egypt.*

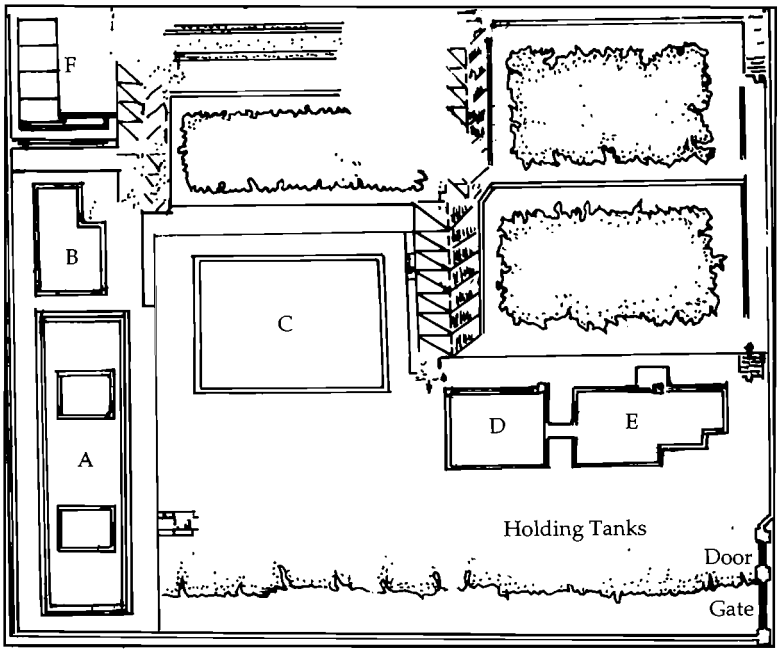


Fig. 2. *The SCA architectural plan for the Alexandria Conservation Laboratory. Buildings include: A. the main laboratory, the former greenhouse; B. mechanical support, the former toolshed; and C. large artifact conservation, the former 3-car garage. D. illustration and storage; and E. photodocumentation were converted from the former laundry and staff living quarters. F. is the proposed library, a former potting shed.*

that can be converted for the preservation of large artifacts such as ship's timbers, and a documentation center for both written and visual recording (fig. 2). On April 15, 1995, the Permanent Committee granted INA-Egypt permission to begin the renovation.

When the SCA approved INA-Egypt's Sadana Island Shipwreck Excavation proposal (*INA Quarterly* 22.3), one of the conditions was that a fully renovated and equipped laboratory exist in the Maritime Museum before the excavation began. I was able to work out a compromise for a staged process, since a complete laboratory would take two to three years to create. Two stages are now complete, and planning for the third is well underway.

Stage 1

The first stage involved providing access to the laboratory area and installing wet-artifact storage tanks there. I met with Thomas Thomason, Regional Manager for Bechtel, who put Bechtel's considerable expertise behind the laboratory project by lending us an architect to pilot us through the estimate/tender/bidding process. From my experience in the Bodrum Museum of Underwater Archaeology, I could roughly define the uses of the buildings, but I was not qualified to define the mechanics of a full-scale renovation. With Bechtel's assistance, we created a renovation plan and identified the contractor for the job.

However, we were still not "in the door"... there was no door. The gate leading to the outbuilding area fell down years ago and the SCA replaced it with a wall to maintain security. On March 28, we installed a beautiful, wave-patterned iron gate generously provided by Kamal Sayyid Ahmed in the name of the Alexandria Business Association. We were in... just. We still needed to clear away accumulated rubbish, including rubble from the gate installation. The Arab Contractors Alexandria Division remedied this situation with the loan of two very large dump trucks that we filled to capacity while clearing the lab grounds.

Now the renovation could begin, but there was still one hitch. We had no money. At this point, Billings K. Ruddock stepped in and provided funds for two large water tanks with rolling, locking lids and drains so we could guarantee compliance with our excavation permit conditions. These required that we preserve the excavated objects from damage caused by dissolved salts (chiefly sodium chloride) that form crystals as absorbed seawater evaporates.

The common thread that runs through conservation of all artifacts from marine environments is removing salts from the objects. A salt crystal forming at the surface of an artifact has an explosive power of 40,000 pounds per square inch. A single tiny salt crystal will probably not do much damage, but a multitude of crystals will turn an artifact to dust. Unfortunately, the Red Sea has one of the highest salinity rates in the world. Desalinization is the reason we built the tanks first. Prolonged immersion in fresh water baths is the basic step in removing soluble salts without allowing them to crystallize.

A suggestion from prospective INA-Egypt conservator Howard Wellman prompted us to install electrical outlets and water taps on the tanks. As artifacts in fresh water give off their salts, a cloud of highly saline water forms around the artifact, and the desalinization process slows. A small sump pump in the tank will circulate the water and dispel the cloud, allowing desalinization to continue. Moreover, it is possible to put electrodes into the tank and pull the negative and positive salt ions out of the artifacts (i.e., "turbo-charged desalinization").

Stage 2

While excavating at Sadana Island last summer, we learned that the Egyptian Antiquities Project (EAP) had awarded us a grant to renovate four of the five buildings. The EAP, funded by the United States Agency for Interna-

tional Development (USAID), is headed by former INA President Chip Vincent and administered by the American Research Center in Egypt. We filled the storage tanks with the Sadana porcelain and other objects at the end of August 1995 and started the renovation of the buildings at the end of October.

The contractor tackled the three-car garage first, finishing in early December. This building will be used for the conservation of large objects (such as ship timbers), for storage, and as a workshop to maintain the laboratory. By early January, we had transformed the former greenhouse into the main laboratory (fig. 3) and the toolshed into the compressor and X-ray facility. The main lab has some interesting features.

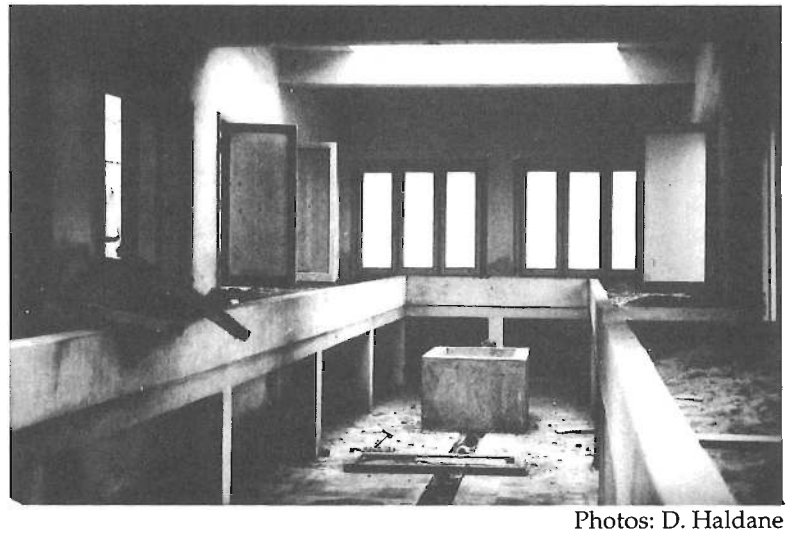
First, as all the buildings do, it has rainwater cutoff valves on the drainpipes. These valves symbolize one reason why Alexandria is the best place in Egypt for this kind of laboratory—rainfall. During the laboratory-planning stage, I learned that the chlorine level of Alexandrian tapwater is too high for conservation work and only increases during the summer with the influx of tourists. This was a significant problem as conservators are trying to dispel chloride salts, not introduce them. Where were we to get large amounts of chloride-free water for conservation? Jane Pannell, INA Conservator at the Bodrum Museum, solved this problem for us when she told me that Tufan Turanlı had renovated a derelict section of the Bodrum castle's rainwater catchment system to provide both the laboratory and the museum with an abundant water supply.

By Egyptian standards, it rains a lot in Alexandria during the winter. We have measured about 15 cm (6 inches) in the water tanks so far, with only passive collection. All we need to do is catch the water that falls on the five roofs by diverting water to storage barrels vía the cutoff valves. From the barrels, we will pump the water up to storage tanks behind the x-ray facility. From there, a pipe runs through a de-ionization filter to one of two large sinks in the main laboratory building. Most of the final desalinization will be accomplished in the former greenhouse plant bed area, now workspace. The runoff will be carried away by the renovated drainage system.

Mr. Vahan Alexanian, Chairman of Egyptian Textiles Industries, donated the funds for the storage-tank platform that provides head pressure for the water running to the main laboratory. He has also offered us, free of charge, the distilled water produced as a byproduct of his dyeworks, if we ever run short of rainwater.

The main laboratory also features compressed air on tap. We placed the compressor room in the adjacent building, as I have learned through experience that nothing drives a normally placid conservator insane faster than the loud thump of an air compressor coupled with the high whine of a pneumatic chisel. A gift from Richard and Bari Bienia provided an essential but missing piece of equipment—the electrical meter that is the foundation for the lab's independent electrical network. This will provide both 110 and 220 volt electricity to all buildings.

The renovation process continued as our illustrations studio and artifacts storeroom building received new interior and exterior finishings. We ensured that sufficient natural light would reach the studio. Discussions with engineers helped solve a problem with keeping moisture out of stored objects on the ground floor of this building. A



Photos: D. Haldane

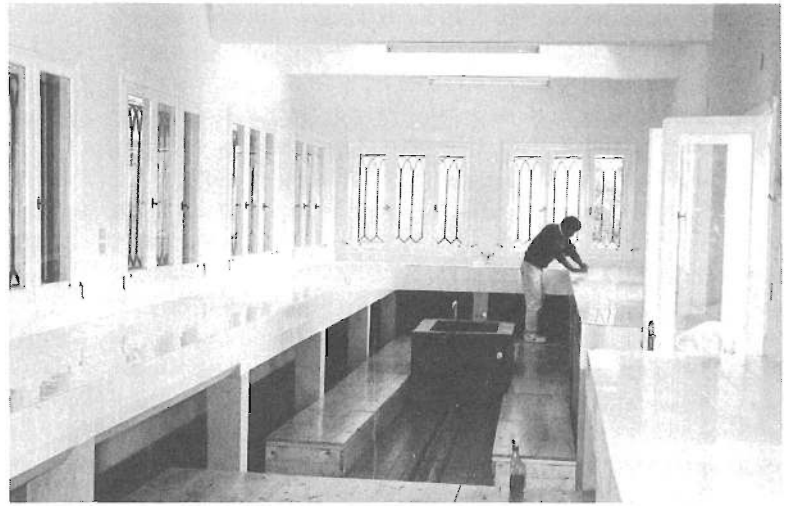


Fig. 3. *Before and after views of the greenhouse, now converted into the main laboratory building, showing the dramatic transformation achieved by the dedicated workers.*

Photo: D. Haldane

Fig. 4. *When funds become available, this potting shed will be converted into a reference library for the laboratory, and the walled area in the foreground will be incorporated into the existing garden terraces.*

dehumidifier running twenty-four hours a day is not the best way to keep Alexandria's high summer humidity away from conserved artifacts. Bill Remsen of the EAP suggested it is more cost-effective to provide a vapor barrier of thick plastic sheeting with a 60 cm overlap. Finishing the barrier with gypsum board was not as easy, but we found a supplier, then completed the process by sealing the floor with vinyl. If someone does not know the vapor barrier is there, they will not learn it by looking at the ceiling or walls.

The photo documentation center was completed with assistance from the Amoco Foundation. On the roof, we have renewed the privacy screen. This will furnish illustrators, conservators, and volunteers a place to work outside in the gentle sea breezes off the Mediterranean.

Plans for the Alexandria Conservation Laboratory

With the first two stages complete, the five buildings have now been renovated through INA-Egypt's labor and fundraising. In the third stage, we are seeking contributions and grants to equip these buildings and provide the laboratory's external workings: electrical wiring, water supply, and drainage. We are also in discussions with the SCA to add a sixth building to the laboratory complex to serve as a conservation reference library (fig. 4).

The renovated buildings will be used in cooperation with the SCA for the conservation and preservation of waterlogged antiquities from both land and underwater archaeological sites. The Alexandria Conservation Laboratory for Submerged Antiquities will also be a center for sharing information with Egyptian conservators about the special needs of wet objects. For example, our laboratory will work closely with the metals conservation lab provided by the French Navy team working at Abu Kir, the site of a Napoleonic battle with Horatio Nelson's fleet in 1798, and a land battle the next year.

Although INA-Egypt often receives compliments on the beauty of the buildings, we know we were only a catalyst to bring conservators, archaeologists, architects, and engineers together for a common goal. The Alexandria Conservation Laboratory is another important step in the development of the Arab world's first (and, we hope, foremost) national maritime museum. Alexandria has once again become a world-class center of learning.

Acknowledgments. As always, funding projects like this requires the cooperation of many organizations and individuals. None of this work would have been possible without these contributors. Their names will be recorded at the entrance so all visitors will know who really created the Alexandria Conservation Laboratory for Submerged Antiquities.

The Egyptian Supreme Council for Antiquities and its dedicated staff spent long hours pouring over proposals and refining plans. We are particularly grateful to Bechtel Corporation, and especially Regional Manager Thomas Thomason, for assistance with architectural estimates for work at the Museum and consultations about the requirements of renovation. Thanks also go to Kamal Sayyid Ahmed of the Alexandria Businessmen's Association, which donated the new gate to allow passage for trucks carrying ancient cargo into a modern laboratory. The Arab Contractors Alexandria Division provided invaluable assistance by loaning trucks for hauling away construction debris from the buildings.

Major funding for the renovation has been provided by the Egyptian Antiquities Project, The Amoco Foundation, the Alexanian Foundation, Billings K. Ruddock, and Richard and Bari Bienia. In addition, the American Research Center in Egypt continues to provide us with support through sharing facilities, and through discussions with its Cairo Director, Mark Easton.

The new issue of El Bahri, *INA-Egypt's local newsletter, is available upon request from INA-Egypt, P.O. Box 432, El Ibrahimiyya, Alexandria, Egypt or from INA.*

The Logs from the Mombasa Wreck

by Christine A. Powell

The excavation of an archaeological site is only the beginning of the work that needs to be done. Months of excavation are followed by years of conservation, study, analysis, and publication. A case in point is a wreck that INA excavated at Mombasa, Kenya, in the late 1970s (INA Quarterly 18.2). This was almost certainly of Santo António de Tanná, *a Portuguese* fragata *built in India during 1680 and sunk in 1697. The excavation team is now scattered across five continents, but they and their newer associates continue to study the ship and its contents while moving steadily towards a final report. The following is an example of the specialized studies that form the essential preliminaries to an eventual synthesis.*

One of the more unusual features of the Mombasa site was the large number of hardwood logs or similar timbers that were scattered around the wreck. A number of these logs bore graffiti in the form of carved initials. The author was asked to investigate the logs, but quickly found it necessary to examine a wider context. Elements of this context include the political situation of the Portuguese presence in the Indian Ocean, trade patterns involving Portuguese Africa and India, and the immediate history surrounding the loss of this ship. It is particularly important to determine where the ship had been immediately prior to sinking, and why it had been there.

The Logs

To expose the ship's structure in the central area, it was necessary to remove over fifty cubic meters of ballast. Above the ballast was a layer of crushed barrels and hardwood logs up to two meters long. In some areas, the surface levels consisted primarily of jumbled logs and collapsed ship's structure. It has been estimated that there were two hundred logs. Since these were of substantially identical appearance, they were primarily treated in bulk, rather than as individual artifacts. The log plan made by the excavators shows about 80 logs out of the total found (fig. 1). Robin C.M. Piercy, the Project Director, believes that the log plan shows a "fairly balanced view of their distribution."

The most interesting of the logs are those, at least 30, that had graffiti carved on them. These bore incised marks ΓM, LM, DM, and DW. The "Γ" mark may be an inverted "L" (fig. 2). The single "W" may likewise be an inverted "M" (fig. 3). Aside from the marks, there do not appear to have been differences between the carved logs and the much more numerous uncarved ones.

Since the logs were at the very top of the deposit, they were possibly disturbed by the salvage efforts of Portugal's Arab enemies after the ship sank. The positions in which they were recorded almost certainly do not correspond to their positions in the ship before it sank, and thus there is no longer any way to determine if the logs with the same carved marks were originally located together in the ship.

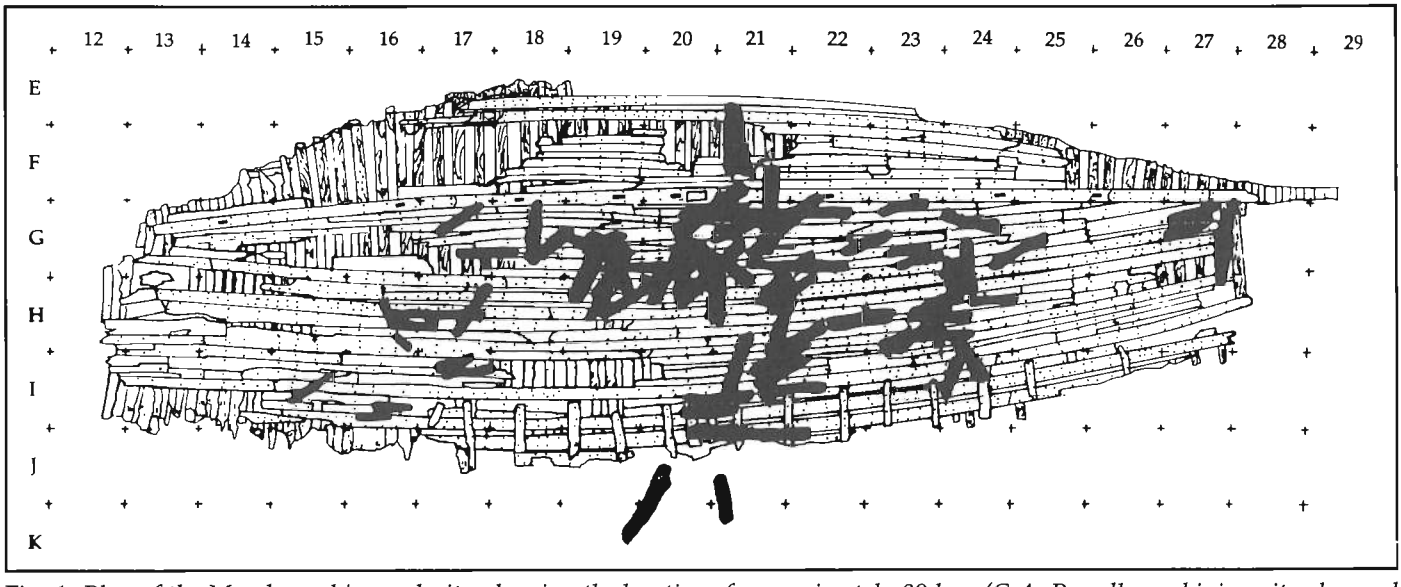
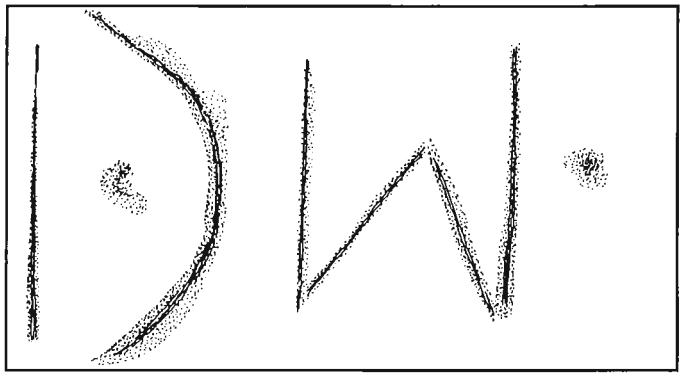


Fig. 1. *Plan of the Mombasa shipwreck site, showing the location of approximately 80 logs (C.A. Powell, combining site plan and log plan by R.C.M. Piercy).*

Photo: INA



Drawing: Netia Piercy

Fig. 2 (left). *Log MH 7031, showing the ΓM inscription.*

Fig. 3 (above). *DW inscription on Log MH 7050.*

The Type of Wood

The logs are composed of a very hard wood that was originally believed to be ebony. However, placing the logs in fresh water produced such a dark red stain that it was then thought that the logs were of camwood (*Baphita nitida*). This was a logical assumption, as dyewoods were an important item of trade in the sixteenth and seventeenth centuries. Recent testing, however, has changed this conclusion. The wood samples are of the genus *Dalbergia*, probably African blackwood, *Dalbergia melanoxylon*. This is the species known to the ancient Egyptians as ebony (a name that goes back five thousand years). The wood called ebony today is from a different family found primarily in Asia. *Dalbergia* logs have been found in many ancient sites, including the fourteenth century B.C. wreck excavated by INA at Uluburun.

Dalbergia melanoxylon has an extensive range in Eastern African savanna regions. The tree is relatively small (generally under 7 meters), much branched and multistemmed. It has a short bole, rarely over 30 cm in diameter, that is often fluted. This is consistent with the Mombasa wreck remains—the average diameter of the incised logs was 16.5 centimeters, the largest being 22.5 cm in diameter.

The heartwood of African blackwood is dark purplish brown with black streaking. The texture is fine and even and the grain straight; the wood has a low luster and tends to be slightly oily. It is a difficult wood to work, even with machine tools. Blackwood is so hard that it can quickly blunt a saw. The wood is, however, excellent for turnery and can be worked to a smooth, lustrous finish with metal-working tools. Blackwood is now used primarily for the manufacture of woodwind instruments as well as other forms of turnery work: brush backs, knife handles, walking sticks, inlay work, carvings, and the like. If you have seen a clarinet, you have quite probably seen African blackwood. It is interesting that among the Mombasa wreck finds were pieces of lathe-turned hardwood furniture.

The basic specific gravity of African blackwood (oven dry weight/green volume) is about 1.08. In other words, this very dense wood is heavier than fresh water, and will not float easily even in seawater, which helps explain why the logs stayed with the Mombasa ship when it broke up. The high durability of the wood suggests how two hundred logs could survive three hundred years of exposure on or near the top of the wreck deposit.

Background: Trade in the Portuguese Empire

Early in the fifteenth century, Portugal began sending expeditions down the west coast of Africa, seeking a trade route to the Orient that would avoid dealing with the multitude of middlemen that made goods from the East so expensive. The real breakthrough came in 1497, when Vasco da Gama left Portugal for India. On Saturday, 7th April 1498, de Gama reached Mombasa, which was already a busy harbor. By 1509, the Portuguese had won naval command of the Indian Ocean, occupying Malacca (at the gate to the Pacific) in 1511 and Hormuz (commanding the entrance to the Arabian Gulf) by 1515.

From the late 1400s until nearly 1600, the Indian Ocean was effectively a Portuguese lake (fig. 4). Any vessel sailing in the northwestern Indian Ocean needed a Portuguese passport, or it was subject to seizure (and the crew to enslavement). The monopoly affected not only the other European powers, but also the Arab traders who had linked East Africa and India to the Gulf for centuries. Dhow traffic in the area was much reduced, since the captains had to obtain passports and call at Portuguese ports to pay duties.

To guard her trade route to the East, Portugal governed, from Goa in India, twelve cities and twenty-three fortress-towns stretching from Southeast Africa to the Far

East. Trade items from throughout this broad area were brought to Goa for shipment back to Europe. Mozambique and Mombasa were the major centers on the coast of Africa and there was a Portuguese presence for over 300 miles up the Zambezi River. Europeans traded cloth and beads for the major exports from the African territories: gold, ivory, amber, rhinoceros horns, hippopotamus tusks, and slaves. The Portuguese profited from both the production of luxury goods in Africa and from the production of cloth in India. In fact, it was Portuguese policy when they conquered an area to require the natives to buy clothing, since this promoted commerce throughout the Portuguese domains.

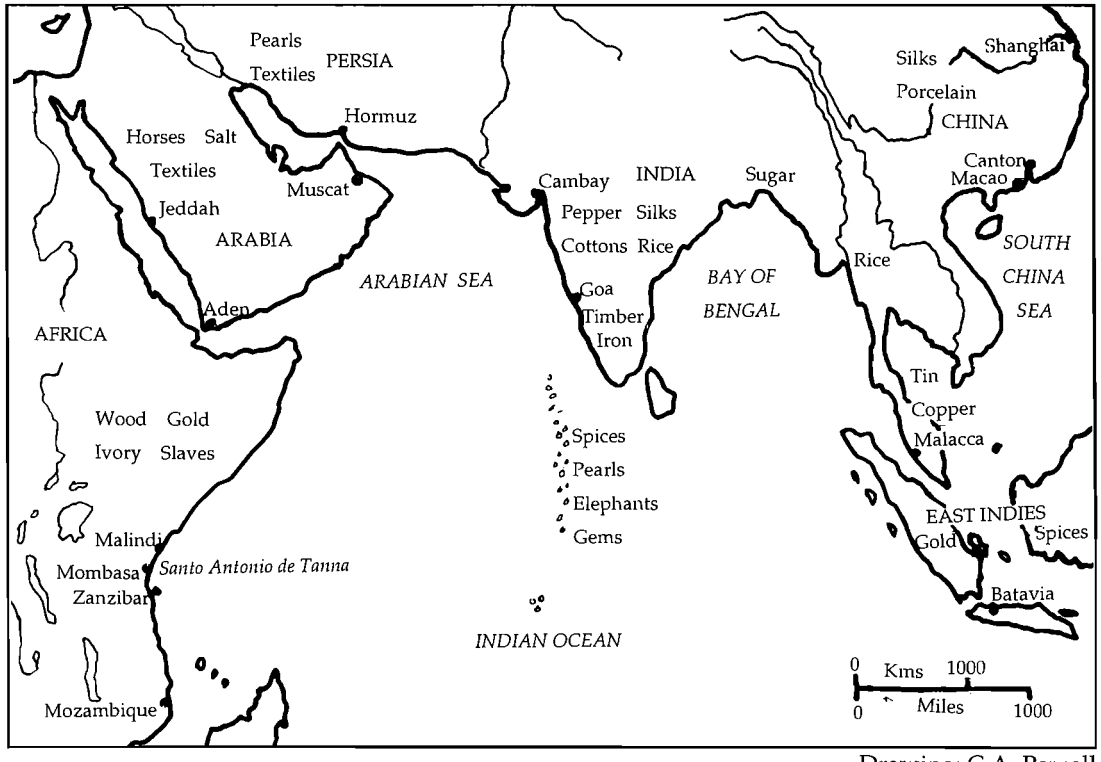
It was common for Portuguese officers and seamen to carry goods on their own account alongside the "official" cargo. As part of their compensation, they were assigned volumes in the hold known as *liberdades*. The holders of the *liberdades* could then sell the space to merchants or carry their own cargo. A 1692 letter in the Goa archives from the then-captain of the *Santo António de Tanná* complained that the official cargo had been so large, and the frigate's hold so small, that the *liberdades* of the captain and his officers would not fit. Perhaps the Mombasa logs were just such private goods, carried in the officers' *liberdades*.

Throughout the Portuguese empire, wood was a significant trade item. One Viceroy in Goa claimed that the Captain of Bassein (the Indian port where *Santo António de Tanná* was built) was making a thousand per cent profit on sales of local teak, and by far the most valuable export of Brazil was brazil wood. Wood was also a mainstay of trade in the Far East, where the Portuguese (and later the Dutch) sent large quantities of dye and incense woods from Southeast Asia to China and Japan. For example, hundreds of tons of wood were imported by the Dutch into Japan each year in the 1670s, and the Portuguese at Macao traded sandalwood from Timor to China. Large volumes of wood also came back to Europe for luxury uses.

In East Africa, mangrove poles were shipped from the coast near Mombasa to Arabia. Trees on the coast south of Mombasa were a source of pitch and timber particularly good for ship-building, since the pitch in the wood preserved it. "Ebony" (probably African blackwood) was apparently so common on the mainland adjacent to Mozambique in the 1650s that "when any man wants it he may have it for the charges of fetching." We should therefore not be surprised to find that the Portuguese ship from Mombasa was carrying wood in its hold.

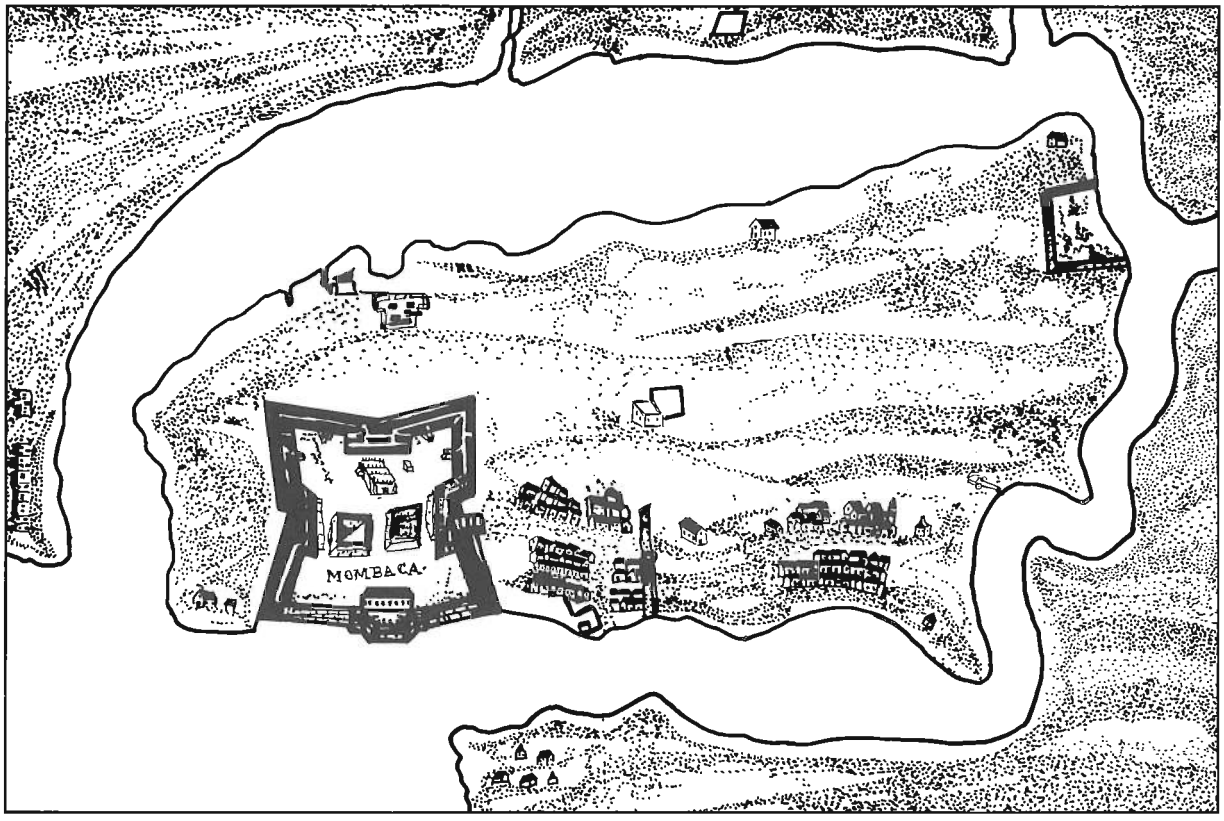
Background: Mombasa

Mombasa was probably founded in the twelth century, and grew rapidly enough to be mentioned in the works of the Arab-Sicilian geographer Al-Idrisi, who died in 1166. It was located on a three-mile-long island flanked



Drawing: C.A. Powell

Fig. 4. *The Indian Ocean trade sphere during the era of Portuguese domination, showing Mombasa, the wreck site of* Santo António de Tanná.



Drawing: C. A. Powell

Fig. 5. *A 1634 plan of Mombasa, after a map by Pierre Berthelot in P. Barreto de Rezende MS. in the British Museum.*

by two excellent harbors (fig. 5). By the fifteenth century, it had become one of the most important towns on the Swahili coast. When the Portuguese arrived, Mombasa was the leading African port for the importation of cotton cloth. This was traded for ivory from the interior, particularly the large pieces which had no competition from the smaller Indian elephants (which did not have tusks massive enough for large bracelets). The Portuguese simply plugged themselves into the existing trade pattern, substituting their customs duties for those of the native ruler.

Mombasa was occupied by the Portuguese in 1593 to guard against Turkish expansion from the north. The island was both fruitful and comparatively healthful, so there were suggestions that it should become the major port-of-call between Lisbon and Goa. However, it remained chiefly a trading station and outer defense for Mozambique and the Zambezi River settlements, as well as the major customs station on the upper coast.

The fortress at Mombasa, Fort Jesus, was important to the Portuguese in the late 1600s primarily for two reasons: trade and security. First, it was a trading center between the Europeans and the people of interior East Africa. By far the most important product was ivory. There was also a lesser trade in ambergris, tortoiseshell, beeswax, cows, sheep, and other items.

The Portuguese profited from both ends of the trade, since the primary import traded for all these products was cloth produced in Portuguese India. Because of the danger that an oversupply of cloth would drive prices down, the Portuguese tightly controlled imports. The Afro-Arab traders along the coast resented the unfair competition. In 1631, there was a major revolt in Mombasa, with 152 persons massacred. Mombasa never completely recovered.

If Mombasa had only been valuable for its own trade, the Portuguese would not have gone to such great lengths to protect it. Its primary importance was strategic. It inhibited Arab or Turkish forces from threatening the much more valuable Portuguese holdings farther south, along the Zambezi River and at Mozambique. It also helped prevent either the Arabs or the other European powers from threatening the vital sea routes linking Portugal with India and the Far East. The Portuguese needed all the bases they could hold. In 1693, the Viceroy in Goa had only one galleon, five frigates, eleven galliots, and seven smaller craft to guard an empire stretching from Mozambique to Macao. The fortress at Mombasa became particularly important after the Sultan of Oman expelled the Portuguese from Muscat and built a fleet large enough to compete for mastery of the Arabian Sea and northwest Indian Ocean. The Portuguese domains rapidly deterio-

rated in the late 1600s. England and the Netherlands had begun intruding around the end of the 1500s. The Arabs posed an additional threat after the new dynasty in Muscat and Oman obtained allied bases in Zanzibar, Pate, and other of the coastal islands. This deprived both Mombasa and Mozambique of much of their trade.

The Portuguese were particularly affected by these changing circumstances, since they were spread so thinly that they had to rely on native collaborators. The Portuguese were never able to adequately reinforce their overseas garrisons because their home country was so small, with a total population not much greater than 1.25 million. They lacked the manpower that was available to large countries like Spain and France, and to densely populated lands like England and Holland. The Portuguese residents in Mombasa occupied only about 70 houses. Along the 2,100 miles of southeast African coast, Portugal probably had a permanent presence of only about 400 fighting men, reinforced from time to time by passing armadas.

The Siege of Mombasa and the First Relief Expedition

The Mombasa wreck was almost certainly that of *Santo António de Tanná*, a Portuguese *fragata* built in Portuguese India. *Fragata* (frigate) and *naõ* (ship) are used interchangeably in the Portuguese sources to include any large seagoing craft. Like the English and Dutch Indiamen, Portuguese frigates were designed both to fight and carry cargo. The ship was ordered from the Captain of Bassein in February 1678, but was not completed until December 1680. Bassein and Tanna (a timber center that probably contributed both materials and name to the ship) are now northern suburbs of Bombay.

Santo António de Tanná was lost in late 1697 during a 33-month siege of Mombasa by Arab forces from the Oman. The siege began with the appearance of seven Arab vessels on 11th March 1696. The relief expedition sent from Goa included two frigates, two galliots, and four hundred soldiers. The flagship was *Santo António de Tanná*, which had eight additional guns and gunports added for the mission, bringing its battery to fifty. The expedition was commanded by General Luis de Mello de Sampaio.

De Mello came from a wealthy family with property in India. He had been Governor of Macao in 1679–82. Although his property had been impounded for debt in 1683, he was on the Council of State for Portuguese India by 1690, apparently having received the favor of the Viceroy by participating in the unpopular government-sponsored trade monopoly. His last reward was appointment as head of the Mombasa relief party, with a dual appointment as governor of the rich Zambezi River settlements. The Viceroy presumably felt he could rely on de Mello not to take unnecessary risks. In the event, the excessive caution of the Viceroy's appointees was to cost Portugal a frigate (*Santo António de Tanná*), four galliots, and over a thousand men...without saving Mombasa.

The first relief expedition sailed from Goa on 25th November 1696. In addition to its military force, it carried supplies for the besieged garrison, including rice, meat, wine, spices, cannon and musket balls, fuses, powder, medicine, gun flints, wheel carriages, and crowbars. The force arrived at Mombasa on 25th December. A galliot commanded by Christovão de Mello (one of the General's nephews) was beached under the fortress and began offloading supplies on the 28th.

The fleet remained in anchorages near Mombasa until 14th January 1697, when it resumed cruising nearby. Strong winds had tangled the anchor cables of the frigates, breaking the cables and casting the ships adrift under dangerous conditions. This was the first manifestation of a problem with remaining properly anchored that repeatedly affected *Santo António de Tanná* during its last year.

General de Mello was under orders to remain in Mombasa only long enough to lift the siege. Once the crisis was resolved, he was to go to Mozambique to take up his commission as governor of the Zambezi River territories. His orders, preserved in the Goa archives, clearly anticipate that he was to take one of the galliots, leaving the two frigates to guard Mombasa. Although most of his staff urged General de Mello to follow these instructions, he insisted on taking *Santo António de Tanná* to Mozambique, leaving on 25th January 1697. The small remaining force spent the next few months anchored at Zanzibar before leaving for Goa. Thus, the Arabs at Mombasa were able to reinforce and supply their besieging units, while the defenders exhausted their supplies and were decimated by enemy action and fever. Conditions were so bad that the last Portuguese died on 28th August, leaving the fortress in the charge of Portugal's Afro-Arab allies.

In Mozambique, Luis de Mello initially prepared to take up his governance of the gold-rich settlements along the Zambezi River. Half-hearted attempts to send help to Mombasa were delayed by a major storm that lasted for fifteen days at the beginning of April. Half the houses and trees of Mozambique were overturned by the wind, and every ship in the harbor was driven aground. *Santo António de Tanná* again lost her anchors and was driven stern-first, so that her rudder was broken off and found beneath the hull when the ship was refloated.

The Wreck of *Santo António de Tanná*

Towards the end of the summer of 1697, it became clear that the situation in Mombasa was critical. General de Mello began to organize his relief force for a return north. He put 300 soldiers, 60 seamen, and 24 recruits and boys aboard *Santo António de Tanná*, along with a surgeon

and medicines, meat, sweets, fish, wine, and other items. He loaded a merchant galliot with further provisions, salt fish, powder, and shot. The expedition left at the beginning of September and stopped for a few days in Zanzibar. Cloth brought from Mozambique was used to buy additional supplies for Mombasa in Zanzibar.

The expedition left Zanzibar on the 14th of September and entered the small harbor below Fort Jesus the next day. *Santo António de Tanná* was anchored near the fortress with three cables and a warping line at the poop, because the harbor was too narrow to allow the ship to swing with the tides. There was an ongoing problem with the cables being severed by gunfire. Eventually, the ship used all its anchors in the effort to hold itself in position.

The Arab forces immediately began a bombardment, which set a number of fires on the flagship and caused a small powder explosion. The enemy cannon were so close that the fires were set by the blazing wadding from the guns. The plan had been to beach the galliot to allow unloading, but it was blown against the frigate on 18th September. The galliot was badly damaged, both by the collision and by gunfire. There is no mention of damage to *Santo António de Tanná* from the collision.

A note in a contemporary source may be significant for what INA found nearly three centuries later. A cable had been run from the frigate to the shore, so that boats of supplies could be hauled ashore more easily. After several weeks, the Master of *Santo António de Tanná* reported that there was nothing else left aboard, and the resupply operations ceased. However, when the ship was lost some days later, forty pipes of wine (a pipe was approximately 477 liters), a quantity of rice, six barrels of meat and cod, and a barrel of olive oil were found in the sea. Obviously, the Master was holding back goods for some reason. This may have been for the crew's use, for his own account, or on behalf of others. The volume of wine may indicate that at least some of the senior officers on the frigate were planning to carry trade items from Goa, Mozambique, or Zanzibar to some destination other than Mombasa. Presumably, the ship would have returned to India when the monsoon turned in April. The logs may also have been such trade items.

The anchor cable from the poop of *Santo António de Tanná* was cut by gunfire or other cause during the course of October 1697. On the 20th of that month, a shot from the Arab artillery struck the two remaining cables and cut the ship adrift. The wind was mild and the harbor calm, so the anchorless ship just drifted out of control, rather than being driven ashore. The ebb tide left her stranded on the northeast part of the shoal. As had happened in the April storm in Mozambique, the ship lost her rudder. Stronger winds in the afternoon carried her on the next tide to ground again, bow first, below the enemy stockade. An expedition from the fortress attached two hawsers from the land at the foot of Fort Jesus to the *Santo António de Tanná*. She was refloated on the next flood tide and hauled back to a position under the fortress. After the frigate was remoored, additional meat, rice, biscuit, salt fish, and wine were hauled ashore on ropes from the ship to the land. Since few personal items were found in the ship, much of the crew probably abandoned it at this time to join the garrison ashore.

Before the ship's contents could be completely unloaded, a spring flood tide at the beginning of November 1697 carried the ship onto the reef near the foot of the fortress, with the after half of the ship aground and the forward half hanging over deeper water. During the night, the low spring ebb led the weight of the prow to heel the ship over and capsize her below the reef. Only the topmasts were left projecting out of the water. General Luis de Mello was already ill; he "became worse from the vexation and fatigue of the whole night spent in rescuing the men of the frigate, and exhausted by fever died on 18th November of the same year."

A Portuguese relief expedition sailed from Goa on the 1st of December. It arrived on the 28th and landed further supplies and reinforcements. Showing the same pattern of excessive caution that had led de Mello to leave Mombasa a year earlier, this fleet left on 19th January 1698. When a third relief expedition arrived eleven months later, on the 19th of December, they found that Fort Jesus had fallen six days earlier. The only first-hand report of the defeat came from the Indian servant of the Master of *Santo António de Tanná*, who managed to return to Goa on 29th October 1701. He reported that some of the cannon from the sunken ship had been salvaged by the Arab victors and used to help fortify Mombasa.

The 1698 defeat at Mombasa directly led the Portuguese to abandon most of the East African coast, and indirectly contributed to their almost total exclusion from India by the English and from Indonesia by the Dutch.

Possible Conclusions: The Logs

It does not seem likely that the logs (fig. 6) were loaded unto the *Santo António de Tanná* as part of the relief supplies for Mombasa. African blackwood is very hard and difficult to work with most tools. It was not useful as a construction material. The only possibility would have been to use the extremely dense and hard logs as a bulwark against enemy artillery. If that was the intent, it seems strange that the wood was not unloaded when the ship was obviously in trouble.

Another possibility is that the wood was being carried to bargain with the besieging forces, or to buy the support of native rulers who were "sitting on the fence." The war was disrupting normal trade between the northern and southern segments of the coast, and normal supplies of luxury materials had been cut off to combatants and

Photo: INA

Fig. 6. *Over 200 logs were strewn across the sea floor on or towards the top of the Mombasa shipwreck site. The heavy African blackwood logs may have acted as extra ballast as well as cargo.*

neutrals alike. However, bribes could more easily have been made up of material that was not accessible inland, and not so bulky, heavy, and hard to handle. Thus, this remains only a possibility.

It is far more likely that the wood was carried as additional cargo. The sources do not tell us where the *Santo António de Tanná* would have gone next if it had not been sunk at Mombasa. Originally, of course, it had been expected that both frigates with the relief expedition would return to India via the Arabian Gulf. The diversion of the frigate to Mozambique may have changed that expectation. When the expedition left Mozambique in September to return to Mombasa, the General and his officers would have known that the winds would be favorable for a return to Mozambique after the first of the year, or for sailing to the Gulf or India with the April monsoon. Since the General still had his valuable appointment to the Zambezi River colonies, it seems likely that he—at least—expected to head back south after dealing with the Mombasa situation. It would seem strange to load any African cargo on the ship at Mozambique if the frigate was planning to return there before heading on to India. If, on the other hand, the General was planning to use the galliot to return to the River, any extra space in the frigate could have been loaded with cargo for India before it left Mozambique. As noted above, "ebony" (actually blackwood) was almost free for the taking in Mozambique, but precious at market.

However, there is another possibility. The *Santo António de Tanná* had made one additional stop. Between the departure from Mozambique and the arrival at Mombasa, the relief expedition had spent several days at Zanzibar. When they arrived there, an Arab vessel was just clearing the harbor, so the Queen of Zanzibar was plainly playing both sides off against one another. She was more than willing to provide additional supplies to fill some of the empty space on the Portuguese ships. She may also have found it expedient to make a valuable present to General Luis de Mello, just in case he succeeded in defeating Oman. If this supposition is correct, the logs were loaded on the ship at Zanzibar, and would have made their way to the market in Goa if they had not ended up on the bottom of Mombasa Harbor.

Either way, it does not seem likely that the logs constituted part of an "official" cargo. Surely any space available to the government would have been used to carry supplies to Fort Jesus. It would have been hard to justify to the Viceroy why space was taken up for profitable cargo when the fortress was in such dire straits. However, the "official" cargo space was not all the capacity aboard. The hardwood logs from the Mombasa wreck were more likely from the *liberdades* of the officers or crew, most likely the highest-ranking officers who had the most space. The right to ship private cargo constituted an important part of their compensation, and would not have been denied except under circumstances that even the crew conceded to be an emergency. It was hard enough to maintain loyalty without shorting men on their pay. The records show that the captain and crew of the *Santo António de Tanná* were barely dissuaded from sailing back to Goa even as it was.

It was not unusual to carry secondary cargo. Most ships carried cargoes both for the long-distance and local markets. This ensured that vessels sailed to capacity and that the market was exploited to its fullest. So, no one would have seen it as out of the ordinary that additional space on a relief mission might be allocated to making a profit. In particular, the cargoes transported were not just preferred for their resale value. Some items were selected to be used as ballast. Heavy, dense African blackwood would have been ideal for this purpose. The location of the logs in the wreck suggests that they were stored just above the stone ballast.

Possible Conclusions: The Marks

The letters carved into thirty of the logs have a number of possible explanations. The Greek "Gamma" and the Roman "W" are letters that would not normally occur in Portuguese. However, if the person who was carving the letters was illiterate (at least in the Roman alphabet), it is possible that the "Γ" is actually a vertical mirror-image of an "L," and likewise the "W" an inverted "M." This would be possible for someone using a template. If so, there are

Photo: INA

Fig. 7. *Several of the Mombasa logs, showing the most common inscriptions, DM and LM.*

only two sets of letters: "DM" and "LM" (fig. 7). The most likely explanation is that these are the initials of an individual or individuals, but we should consider other possibilities.

The initialled logs may originally have been bundled with the others to identify them in some way. The letters "LM" are, of course, the Roman numerals for 950. "MD" would be 1500, although "DM" would be a very long way of saying 500. Given the possible problem with backwards letters, it is possible that the "DM" is actually backwards for "MD," or "LM" a backwards "ML" (1050). It does not seem that the letters represent a count of the logs. Even if half the logs had been lost at the time of the sinking or subsequent Arab salvage, there were nowhere near 750, or even 250, logs found on the wreck.

Another possibility would be that the numbers (if they are numbers) represent the weight of the logs. If the 25 logs in the original list of logs with initials fairly represent the total population of 200, the average length would be 36.65 cm and the average diameter 16.5 cm. That gives an average volume of 7832.7 cubic cm, which would weigh 8.45 kilograms (assuming that all the logs were of African blackwood with a specific gravity of 1.08). Two hundred logs of this size would weigh 1690 kg. This would have been an extremely small load as compared to the wood cargoes listed in contemporary records. There is, of course, no way to know either how many of the logs have been lost, or how much the size of the surviving logs has been eroded from their original dimensions. Some of the initialled logs show erosion. It is, therefore, impossible to even guess the original weight of the log cargo. One cannot eliminate the possibility that the letters on the logs represent a weight.

The most likely explanation, however, is that the marks represent someone's initials. If so, whose? The name that heads the list of officers on the *Santo António de Tanná* is the commander of the First Relief Expedition, General Luis de Mello de Sampaio. Either "LM" or "DM" would be possible initials for General de Mello. There seems to be no other likely "suspect" for the "LM" initials. There is a broader field for "DM," although none outside the de Mello family. Since nepotism was not illegal in those days, there were a number of other members of the General's family along on the expedition. One of these was Diego de Mello de Castro, nephew of the General and a Captain of the infantry forces on *Santo António de Tanná*. "DM" could be either Diego de Mello, another individual member of the de Mello family (including the General), or even a group of de Mello family members who had pooled their *liberdades*. No other likely individuals seem to have had the right initials, although we do not have all the names of the ordinary seamen and soldiers, who would not have had much space anyway.

Final Conclusions

The Mombasa ship is most likely *Santo António de Tanná*, a 50-gun (recently enlarged from 42) Portuguese frigate that sank near the beginning of November 1697. The ship had originally come from Goa and had stopped in first in Mombasa, and them visited Mozambique and Zanzibar before returning to Mombasa. If it had not sunk, the ship would have been headed back to Goa, possibly by way of Mozambique or the Gulf ports. From Goa, its cargo could have been headed anywhere within the Portuguese empire in the Indian Ocean and Orient, or even back to Europe.

The two hundred Mombasa logs would have taken only a very small part of the capacity of the ship, and may have constituted part of the private goods carried in the officers' or crew's *liberdades*. The heavy wood may have been selected because it would take up little space in relation to its value, and because its weight low in the ship

would provide additional ballasting. The logs may have been loaded aboard in Mozambique or during the stop in Zanzibar, where the Queen would have had a powerful motive to assist the financial ambitions of the expedition's officers.

The 175 or more logs without graffiti were presumably associated with the initialed logs. The excavators did not note any differences between the two sets of logs, apart from the initials themselves. It is possible that some of the other logs also bore inscriptions that did not survive the three centuries between the sinking and excavation. Since there is no way to know how many logs disappeared entirely over that span of time, it is difficult to reach any firm conclusions about the original character of this part of the ship's contents.

Since the unmarked logs were apparently of identical appearance, it was a reasonable decision of the excavators to handle them in bulk. Only the initialed logs and a selected sample of the others were individually recorded or recovered. However many details may be added by additional research, it seems unlikely to disturb the general conclusions reached above.

Acknowledgments. This research would not have been possible without the assistance of Robin C.M. Pierce, Project Director of the Mombasa Ship Excavation, and an INA staff member at Bodrum, Turkey, who provided access to the Project files and answered faxes by return electron. Additional assistance was provided by Dr. Kevin Crisman of INA and the Nautical Archaeology Program at Texas A&M University. Much of the historical information presented was derived from an unpublished manuscript edited by James Kirkman and Jill Dias, and made available to Dr. George Bass after Dr. Kirkman's death in 1989 by Mrs. Kirkman. Other information was gathered by Jean-Yves Blot and Maria-Luisa Pinheiro Blot during a 1984 fact-finding trip to India as a part of the research for the final publication of the excavation.

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Shipwrecks of the Great Lakes

Conference Announcement and Call for Papers
October 10–12, 1996

The Minnesota State Historic Preservation Office (SHPO) in cooperation with the Gales of November Conference is sponsoring a conference entitled *Shipwrecks of the Great Lakes* between October 10 and 12, 1996, in Duluth, Minnesota. The conference is aimed at a wide audience of archaeologists, historians, sport divers, and the interested public. Although shipwreck investigations in the Great Lakes will be the focus of the conference, other aspects of underwater archaeology and the history of water transportation in the midcontinent will also be featured. A principal goal of the conference is to explore methods of shipwreck preservation and interpretation.

Four sequential symposia will feature papers on The Archaeology and History of Great Lakes Shipping, The Archaeology and History of Inland Waterways, The Archaeology and History of Harbors and Ports, and The Management of Underwater Cultural Resources in the Great Lakes Region. A Friday banquet will feature a presentation on a major underwater archaeological project. Other discussions and activities will include a general session on Minnesota's plan for underwater cultural resource management and a tour of Duluth-Superior Harbor.

Those interested in presenting papers should contact Scott Anfinson at the Minnesota SHPO (612–296–5434). Michele Decker at the Minnesota SHPO (612–296–5434) can provide registration information.

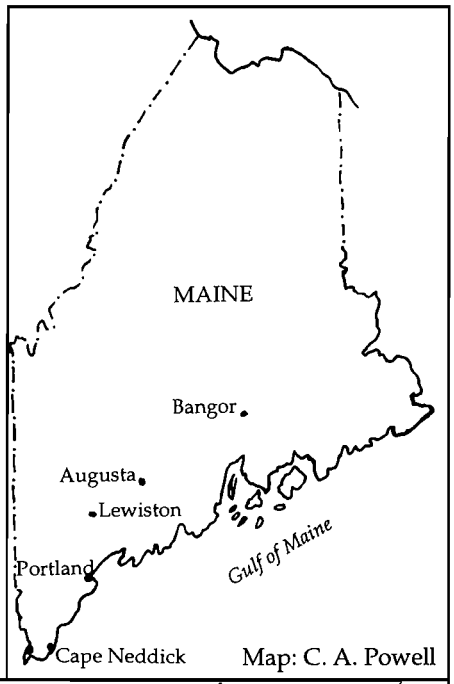
Annabella: the Excavation of a Nineteenth-Century Coasting Schooner in Cape Neddick, Maine

by Stefan Claesson

The term "nautical archaeology" conjures images of scientists using complex equipment to explore sites far beneath the sea, but much valuable research into the history of seafaring can be conducted in other ways. An archaeologist may as likely be found struggling through cold mud as diving in tropical waters. An important site in the Cape Neddick River near York in southern Maine is a case in point (fig. 1).

Four archaeologists gathered in late May 1995 to excavate the remains of a nineteenth-century ship located at this site. They were Samuel Turner from King's College, London; Chris Ellis from the University of Edinburgh, Scotland; and two students from the Nautical Archaeology Program at Texas A&M University, Mason McDaniel and the author. The ship was situated in a tidal flat, where the hull remains could be excavated during low tide by wading through knee-deep mud.

The vessel was listing on its port side and, as a result, the ship's starboard frames, apron, and stern knee were exposed during low tide (fig. 2). These surfaces had deteriorated considerably, due primarily to the constant tidal changes in the river and the destructive forces of ice each winter. However, the port side of the vessel lay buried beneath a layer of sediment, pro-



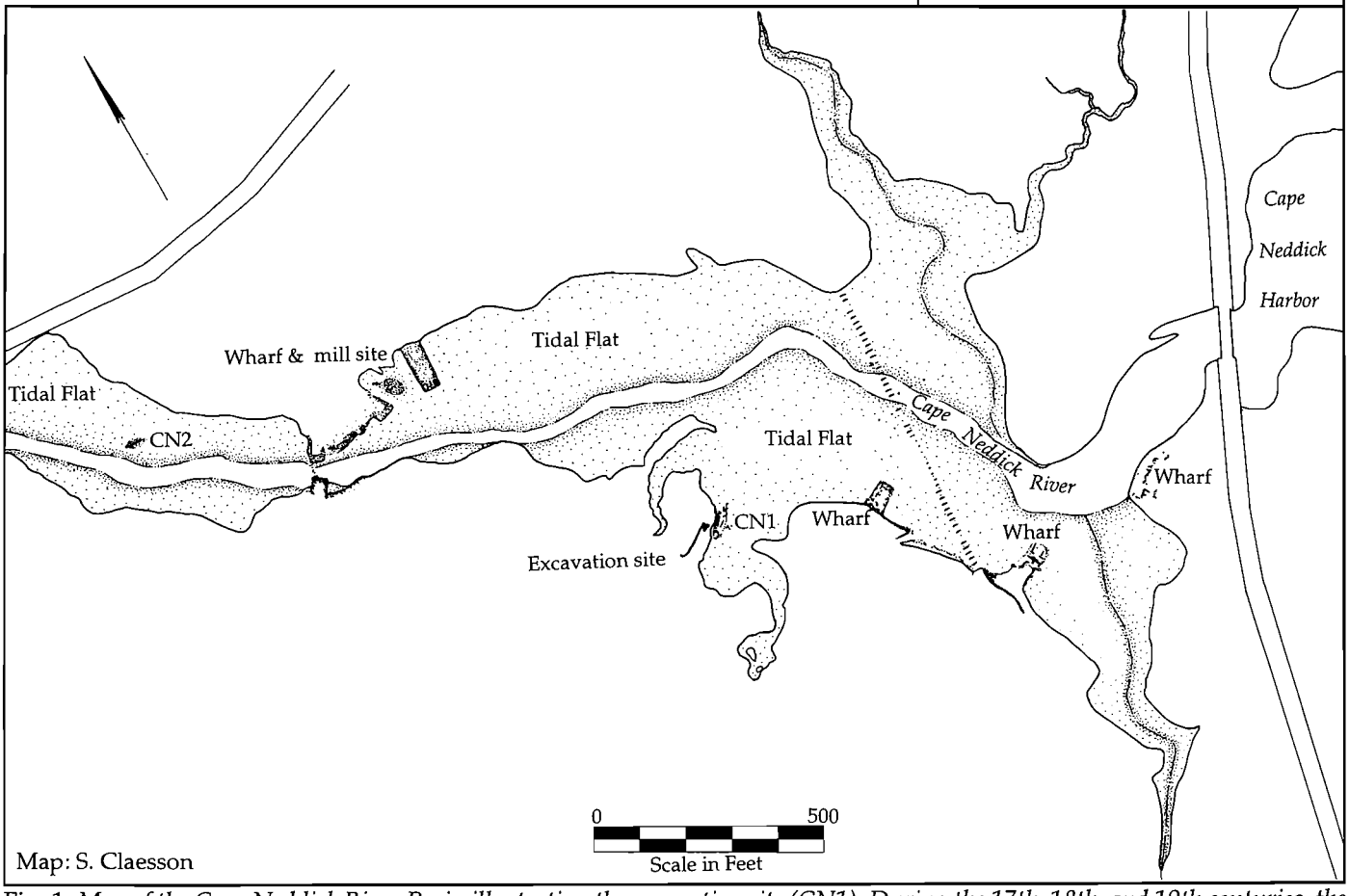


Fig. 1. *Map of the Cape Neddick River Basin illustrating the excavation site (CN1). During the 17th, 18th, and 19th centuries, the "wharf and mill site" was the center of maritime activity in the river. An electric railroad built across the river in the 20th century effectively prevented vessels from reaching the primary wharves.*

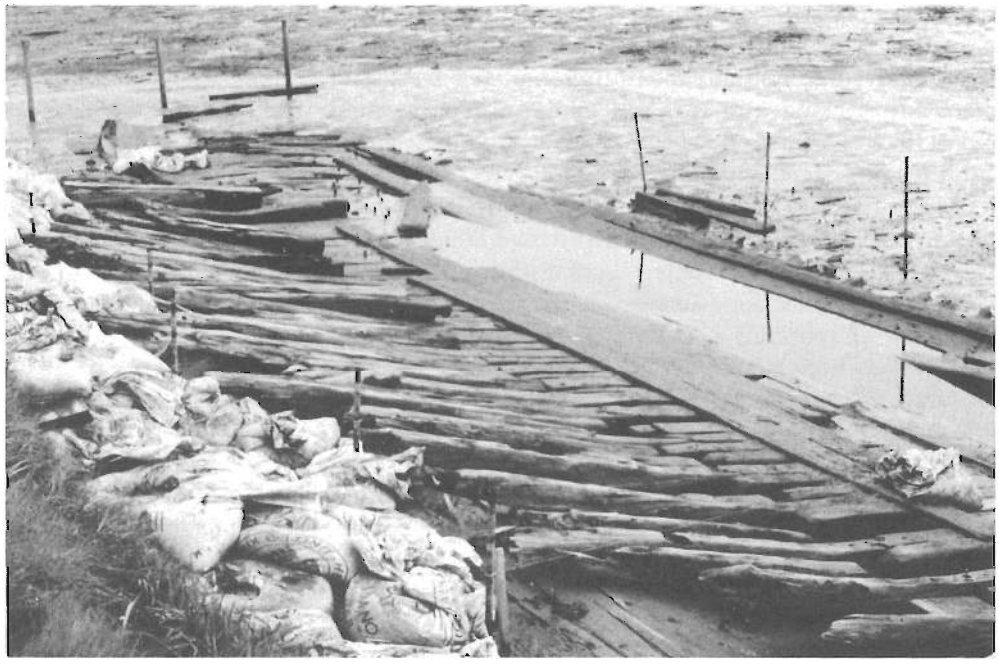


Fig. 2. *The excavated remains of the 19th century coasting schooner* Annabella *seen at low tide. Approximately 35% of the hull is intact. Sediment excavated from the hull was put in semi-permeable sandbags and placed along the starboard side of the vessel.*

tecting it from the harsh environment and protecting the wood from the damaging effects of decay.

Even prior to excavation, the visible features of the hull and its location in the shallow tidal flat suggested much about the ship. It was apparently a derelict vessel, laid up against the bank after it was no longer profitable to repair. Fasteners in the hull were primarily treenails and iron bolts. The arrangement and sturdy character of timbers indicated that the vessel was likely a coasting schooner designed to carry heavy cargo such as stone or timber. Because no other vessel from this period had been excavated along the Maine coast, an in-depth analysis of the hull would shed new light on a type of vessel that was in widespread use in New England and was characteristic of the ante-bellum coasting trade.

The first step in documenting the hull was to establish a measuring system (fig. 3). Using the keel of the ship as a baseline, local surveyors set up a grid composed of two meter squares over the entire site. Once the grid was laid, we could clear the sediment from the individual squares and place it into semi-permeable sandbags. This not only prevented the mud from sliding back into areas that had already been excavated, but also prevented it from settling elsewhere in the river, which might have resulted in altering the water channels. The excavated sediment could be used in the re-burial of the wreck as well, providing an environment similar to the one that preserved the timbers for over a century.

The overburden was first removed from the bow, exposing cant frames splayed out radially and the large apron timber seen in the site plan. The wood was remarkably preserved beneath the mud. On the port side of the vessel—in stark contrast to the starboard—the ceiling, hull plank-

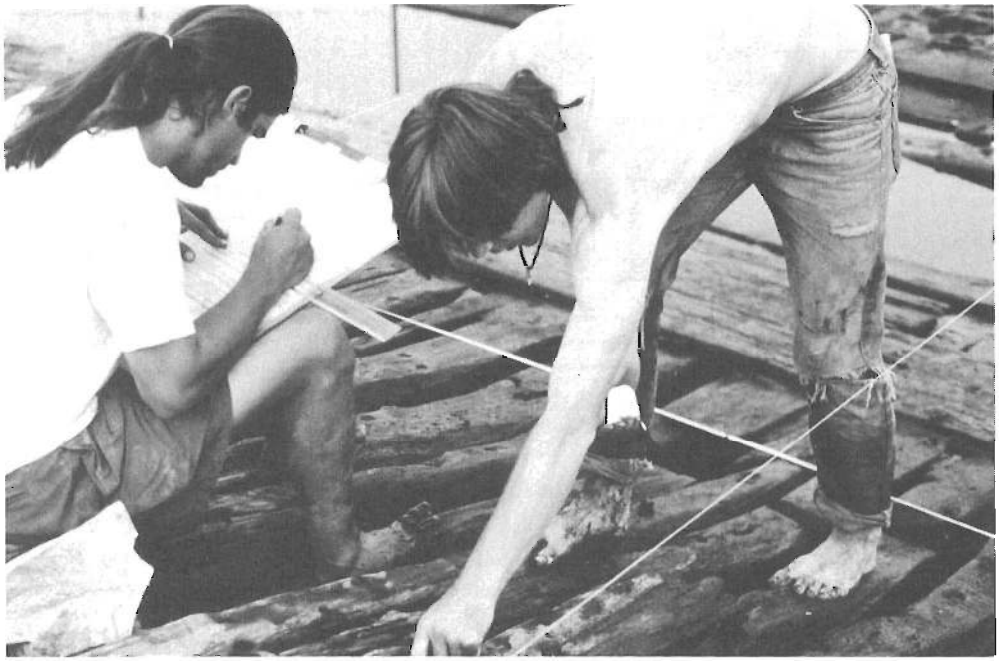


Fig. 3. *Texas A&M Nautical Archaeology Program alumnus Samuel Turner and the author map the hull using direct measuring techniques.*

ing and frames were in almost pristine condition. The remains are 63 feet in length, a maximum breadth of 20 feet, and a maximum depth of hold approximately 5 feet. Most major timbers below the turn of the bilge are represented except for a keelson or mast step(s). In addition, the entire rudder is preserved (fig. 4).

Excavating immediately aft of the apron and between the frames revealed two distinctive deposits. The first was a dark brown material consisting primarily of wood chips. Similar deposits were also located in the stern, extending almost half a foot deep. Interspersed within these wood chips, just above the surface of the keel and garboard, were brick chips and dust. The deposits are significant because they are suggestive of brick and cordwood cargoes.

Adhering to the surface of the keel and lower hull planks was a hard, black, granular substance. Once removed, the material was identified as tar. High concentrations of tar were located around the apron and adjacent timbers and around the stern knee, particularly at the after end of the timber. Though the bow and stern exhibited the highest concentrations, tar was found along the entire length of the keel and garboards.

Direct measurements were taken from the grid with a measuring tape and plumb bob. With only these simple tools, we were able to map every timber, fastener and artifact located during excavation. Hull sections were taken at approximately three-meter intervals along the length of the hull to record timber dimensions and determine the shape of the lower portion of the hull. Longitudinal sections were taken at the bow and stern in order to illustrate the construction and dimensions of important timbers such as the keel, apron, deadwood, stern knee and garboards. In addition, a series of black and white photographs were taken along the entire hull; the individual pictures are currently being assembled by means of a computer to create a seamless photomosaic of the remains.

The excavation revealed a variety of artifacts dating from the 1840s to the early twentieth century. Considering factors such as tidal changes and vandalism, not all of the artifacts recovered can be associated with the vessel. Therefore, the location of artifacts and their distribution is essential in determining which artifacts are associated with the ship and in distinguishing between cargoes and shipboard items. Forward and to port of the stern knee, a number of items of pottery were recovered

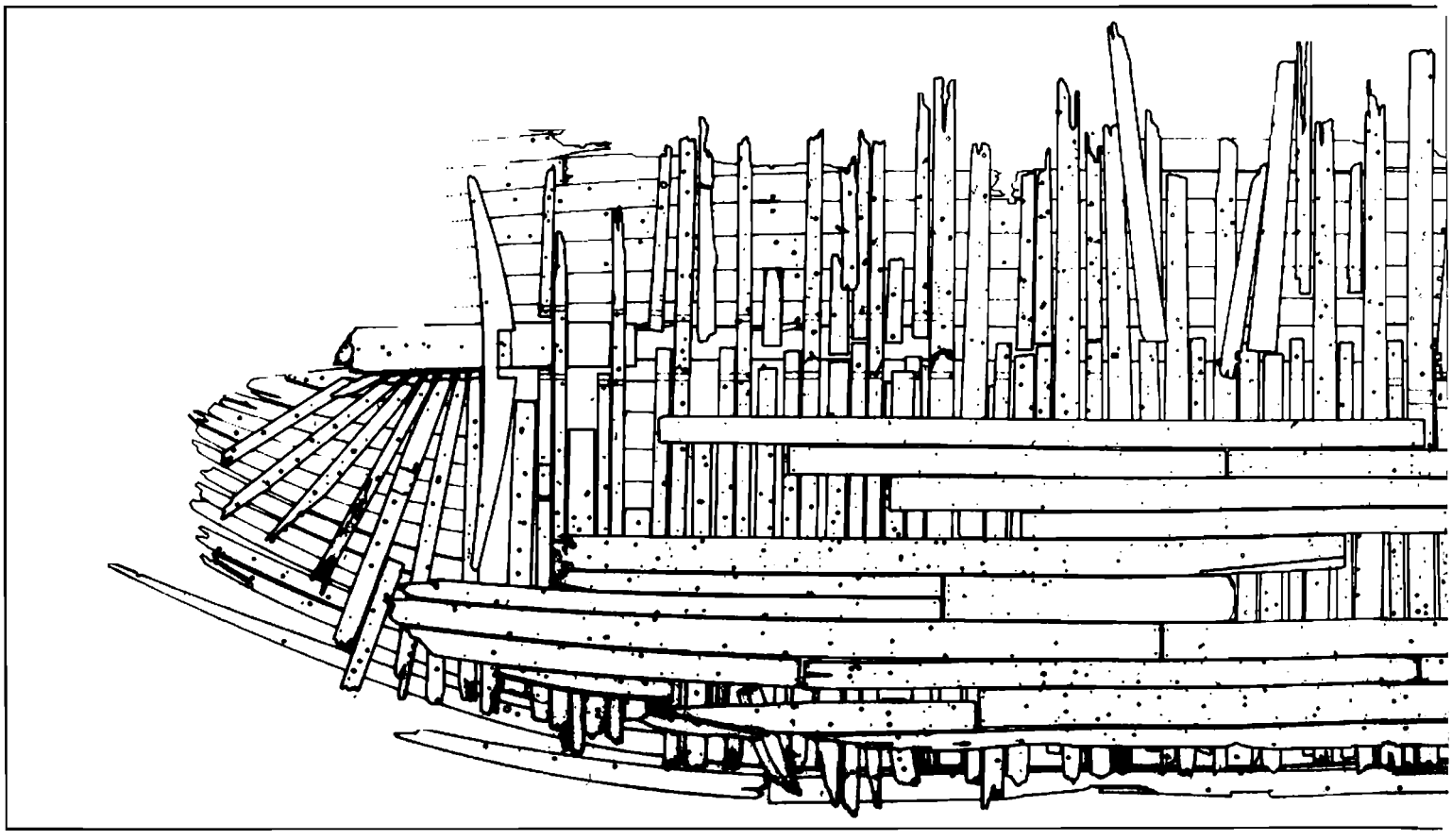


Fig. 4. *Site Plan of the wooden-hulled schooner excavated at Cape Neddick.*

that date to the mid to late nineteenth century. As most of these utilitarian ceramics were located in the stern, it suggests that the galley was located there rather than in the bow.

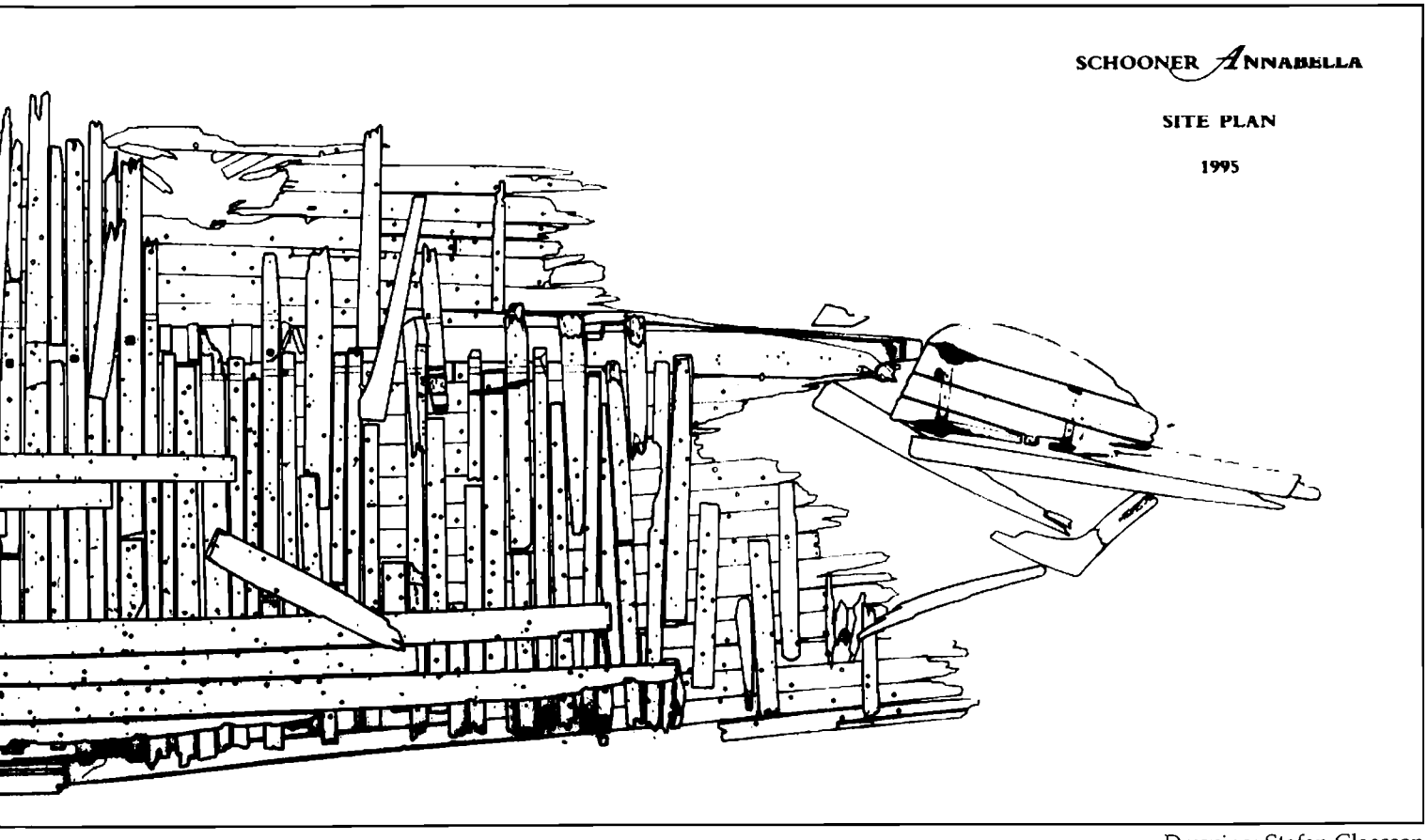
Historical Research

In determining the historical context of a vessel and how it is adapted to its milieu, several basic questions must be answered. These include: how old is the vessel; what kind of vessel is she (sloop, schooner, brig, etc.); who owned and captained her; what was her cargo; and where were her destinations? These seemingly simple questions often remain unanswered, particularly in the case of abandoned or derelict vessels. In order for these questions to be answered definitively for the Cape Neddick ship, it was essential to identify the ship by name.

When the tide was high, most of our time was spent in libraries and combing through manuscripts. We asked local residents what they knew about the deteriorated hull in Cape Neddick. They recounted endless tales and legends about the ship that "was put together with wooden nails." During the excavation season, we had the fortune to meet Harry Hutchins, who had witnessed the history of Cape Neddick for the past 93 years. When we inquired about our derelict vessel, he answered "Yes, I remember my grandfather telling me he was going down to work on the *Annabella*... I'm pretty sure that's the one." He knew the river and harbor well, and drew a map showing our wreck's exact location. To our amazement, Mr. Hutchins proceeded to draw a map, almost to scale, showing the location of three other shipwrecks in the river. But how could we be sure of his identification of our ship as *Annabella?*

During the excavation we had uncovered a number of artifacts that dated the wreck to the second half of the nineteenth century. Ceramics found within the hull included lead glazed redware, Albany slipped stoneware (1840–1920), Rockingham (1845–1900), and whiteware sherds (1850–1930). Also found were pipe stems, buttons, tool handles, and a high quantity of concretions, primarily in the form of iron fasteners such as drift bolts and spikes. Most of the artifacts were located on the port side of the vessel as a result of the ship listing to that side.

Following up on Mr. Hutchins' lead, we examined ship registries and insurance records, and we found *Annabella* listed both in *American Lloyds' Registry of American and*



Drawing: Stefan Claesson

Table 1: *Lloyd's Register* 1862

No.: 330	When built: 1834
Schooner: Annabella	Where & by whom built: St. Marys
Captain: G. Goodwin	Port Belonging to: Wells, ME
Tons: 69	Owner or Consignees: S. Lindsey
Decks: 1	Model: F (full model)
Draft: 7	Remarks: Reps '53
Wood: Oak	Place & Date of Survey: Bos. Dec. '60
Fasteners: Iron	

Table 2: *Merchant Vessels of the United States*

No.: 1789	Tons: 65.28
Schooner: Annabella	Length: 67.9
Built: 1834	Breadth: 23.9
Where Built: Port Elizabeth, NJ	Depth: 6.5

Foreign Shipping (Table 1) and in *Merchant Vessels of the United States* (Table 2). The registries vary only slightly in tonnage, due to differences between dimensions taken off the hull and the formula used in calculating the tonnage of a ship. It is uncertain, however, why *Lloyds'* had listed St. Marys (perhaps St. Marys, Maryland) as a building site. Enrollment records gathered from the National Archives in Washington DC list the building site as Port Elizabeth, New Jersey, as indicated by *Merchant Vessels of the United States*. Unfortunately, the first enrollment record that would identify the builder or master carpenter is missing.

The dimensions listed in the U. S. Merchant Surveys agree with the dimensions taken in the field. The length of the keel is preserved end to end, its total length 58.56 feet (17.85 m). When considering the rake of the sternpost and protruding stem (fig. 5), the deck length would closely match the dimensions listed in the U. S. Merchant Survey of 67.9 feet (20.67 m). The beam, or breadth, and depth of hold listed in the registries also corresponds to the dimensions established in the field. In addition, other statistics recorded in *Lloyds'* registry such as wood type and fasteners agree with the white and red oak timbers and iron fasteners found throughout the hull.

The identification of the ship as the schooner *Annabella*, however, was still uncertain. There were a number of vessels plying the Maine coast of similar dimensions and name in the nineteenth century, not to mention the other shipwrecks in Cape Neddick River that were re-discovered through Mr. Hutchins. The question was finally laid to rest with the serendipitous discovery of nineteenth-century ledgers in the attic of a barn in Cape Neddick owned by Diane and John Goodwin.

A. Goodwin & Co., which monopolized the cordwood industry in Cape Neddick in the nineteenth century, carefully documented the maritime activity of the region. The ledgers listed each vessel that came in and out of Cape Neddick in the late nineteenth century. The Goodwin company had part ownership in the schooner *Annabella*. For each trip, the company recorded origin and destination, what she was shipping out of Cape Neddick and bringing back in return, and the amount and value of goods shipped. In addition, related bills such as wharfage, repairs, and outfitting were also recorded, as were the owners and companies to whom goods were shipped (fig. 6).

Annabella never strayed far from home. Her ports of call included Portland and Bangor, Maine; Dover Point and Portsmouth, New Hampshire; and Boston, Massachusetts, to mention only a few. Typically, she brought varieties of cordwood to Boston including hemlock, pine, poplar, and other soft- and hardwoods. The schooner also shipped brick, hay, coal and perishables (flour, vegetables, etc.). This corresponded to the evidence of brick and wood chips found during the excavation. These bulky cargoes were important in America's economy. Raw materials from Maine were essential for producing manufactured goods in primary ports such as Boston and New York. The southern states and Caribbean islands also relied on the seemingly inexhaustible supplies of raw materials from Maine.

The schooner *Annabella* returned with hogsheads of molasses and manufactured goods for sale in the store of A. Goodwin & Co. To further reinforce the identification of the vessel, the last enrollment record for the schooner relates that she was finally "surrendered at York October

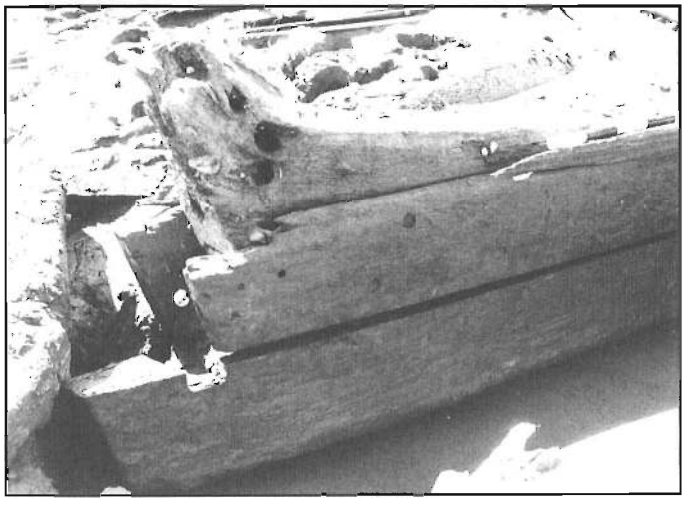


Fig. 5. *Detail of the stern showing knee, garboards, and keel.*

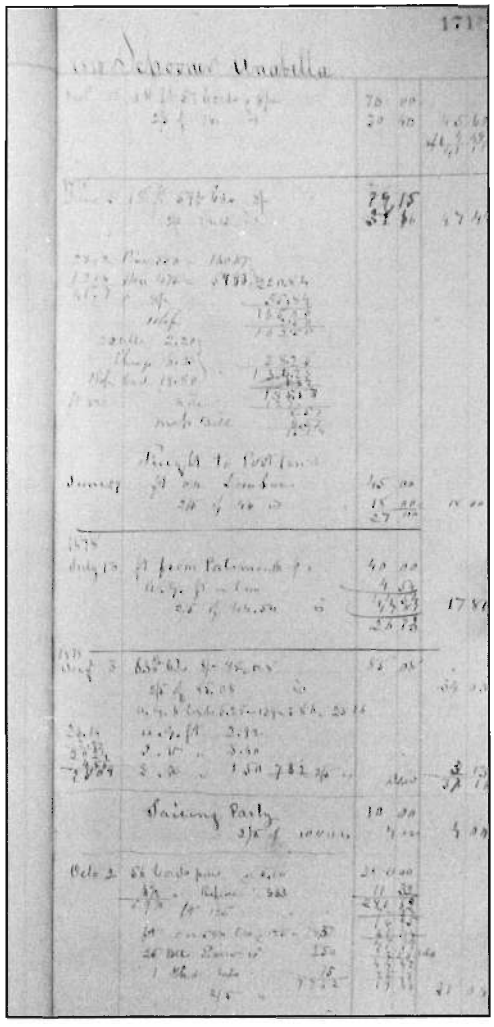


Fig. 6. *A page from the A. Goodwin & Co. ledger listing cargoes and destinations of* Annabella *in 1878. The ledger documents the vessel's activities from 1874-1881 including costs of outfitting, repairs, goods shipped, and the occasional "sailing party."*

17, 1885, vessel broken up or abandoned as unfit for service." Mr. Hutchins' recollection was ultimately verified by the ledgers that repeatedly mentioned a man hired to make repairs on *Annabella*, George H. Hutchins. This was none other than the grandfather of Harry Hutchins. The ledgers represent only a fraction of the vessel's life, from 1874 to 1881. Built in 1834, *Annabella* had endured over fifty years of service, surviving the antebellum coasting trade, the Civil War, and beyond.

Conclusion

This type of craft, though ubiquitous on the eastern seaboard in the nineteenth century, has not been documented before in a New England archaeological setting. The study of *Annabella* thus has far-reaching implications. Before the advent of railroads, economical and efficient coasting schooners were the primary means of transportation along the eastern United States coast. Maine played a pivotal role in America's economy, supplying the southern states and Caribbean Islands, via coasting schooners, with a seemingly inexhaustible reservoir of raw materials such as timber, stone, ice, lime, and agricultural goods.

Ships of the nineteenth century are partially documented in historical sources with plans, ship lines, and descriptions of general construction techniques. Our knowledge of ship construction, however, is usually not detailed or illustrative of the nuances of a particular shipwright's skills, or of how the craft was adapted to a particular economic and physical environment. This is particularly the case with coasting and fishing schooners, which exhibit a high degree of variation in their design and construction.

The historical significance of this vessel must be perceived in relation to the economics of the region to understand exactly how this ship is representative of maritime activity and technology of the nineteenth century. *Annabella* has provided us with an excellent look at what was probably a typical coasting vessel of the mid-nineteenth century. When all historical and archaeological data are assembled and analyzed, we will have that detailed look at coasting trade which has been missing.

Glass and ceramic vessels from the *Annabella* will be exhibited in 1996 at the Old York Historical Society Library in York, Maine. When the larger artifacts have undergone conservation. they will form the centerpiece of a larger exhibit on the schooner, the coasting trade, and maritime archaeology. It is hoped that this will raise public awareness of Maine's maritime history.

Acknowledgments. An earlier version of this article appeared in the *IMH Annual* (Spring 1996), published by the Institute of Maritime History in Cape Neddick. The full report documenting the project will be presented in the author's M.A. thesis.

Suggested Readings

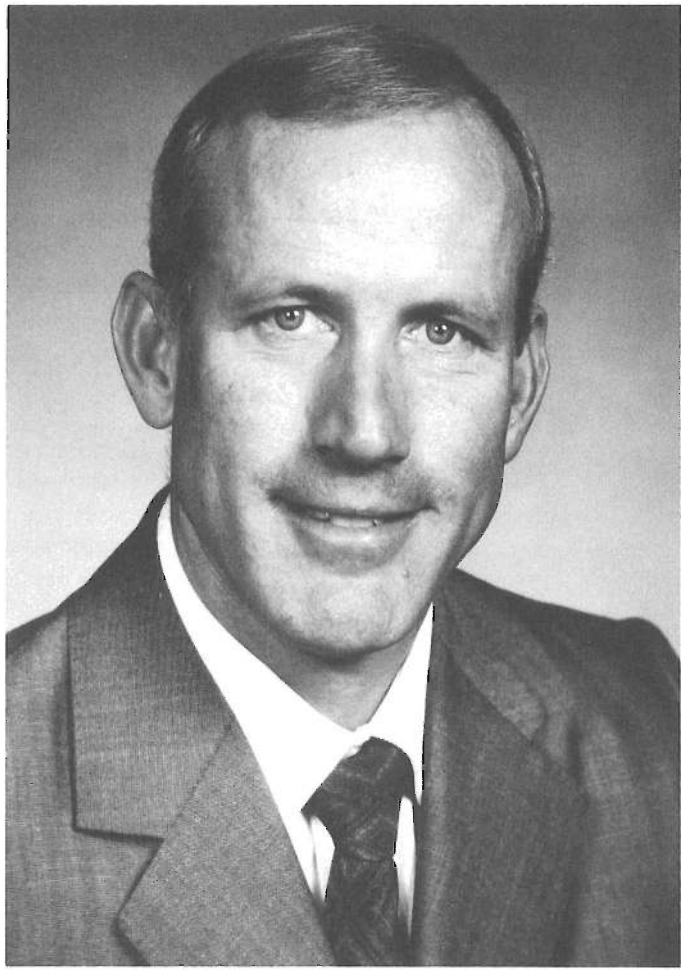
Chapelle, Howard I.
1973 *The American Fishing Schooner, 1825-1935.* New York.

Leavitt, John F.
1970 *Wake of the Coasters.* Wesleyan University Press, Middletown, Conn.

Saltonstall, William G.
1941 *Ports of Piscataqua.* Cambridge.

Profile:

Gregory M. Cook



Gregory M. Cook is the new Chairman of the INA Board of Directors. In a recent interview, he shared some of his past with INA, as well as his vision for its future. Mr. Cook's connection with nautical archaeology is rooted in his family's admiration for "the love of learning and the dedication to excellence in the pursuit of knowledge which has been the heart and soul of people like George Bass." He adds that all these wonderful people have "made the INA experience such an exciting one for so many people of so many different walks of life."

Gregory Cook is INA's first second-generation Chairman. His father, John Brown Cook (*INA Quarterly* 5.2/3, 4) was an early director who provided INA with its first decompression chamber and substantially supported the Kyrenia excavation. Gregory Cook's first experience with INA was diving on the Kyrenia wreck. The elder Mr. Cook was a director for many years. Following his death, his widow Marian Miner Cook (*INA Quarterly* 9.2/3, 3) became an INA director, eventually serving as Chairman. With this family history, it is hardly surprising that Gregory Cook became a director about this time and has been one ever since. He says his "interest in archaeology has really bloomed as a result of the INA experience, rather than being a predisposition."

Family is an important part of Mr. Cook's life. His mother now lives in Beverly Hills and his sister in Houston. He has two daughters; one graduated last year from Dartmouth College and is now in New York working for Goodman Sachs, while the other is a sophomore at Dartmouth. He has been with Nancy Korn, the "light of his life," for the last twelve years.

Gregory Cook, born in 1948, graduated from Cate School in Carpinteria, California, then Dartmouth and the Thayer School of Engineering. The new Chairman has been a real estate developer since the early 1970s. He bought an eighteenth century house and "got the bug." Mr. Cook started a company specializing in seventeenth and eighteenth century restoration contracting. He got involved in dismantling and reconstructing homes of that period, and even did a development of them. Mr. Cook then moved into historic-preservation-related commercial development, and from there into other development projects. He is active as member and director of a large number of nonprofit organizations, in addition to INA. The Chairman's interests and collections tend to be dynamic, and he hopes to bring this energy to his work with INA.

Gregory Cook has predominantly been living on the Big Island of Hawaii, which limited his INA activities, apart from membership on the Board. He is now, however, in the process of moving back to Connecticut full time. With the move, he will have "much greater flexibility in being able to get to College Station more easily," which has been a limiting factor in the past. Mr. Cook was at Bodrum for the opening of the Turkish headquarters complex in the summer of 1995, and was also able to dive on the Bozburun wreck.

The Chairman says that INA "is in the enviable position of having a track record of untarnished excellence in the field of underwater archaeology." It has "a tremendously rich combination of assets including a lengthy international list of first class excavations and publications, a dedicated and inquisitive group of archaeologists, a generous group of supporters including our thoughtful board of directors, the energy, integrity, and total devotion to excellence on the part of George Bass, and our symbiotic affiliation with Texas A&M University. We have a Turkish headquarters that is second to none, efforts underway for a similar facility in Egypt, and operations in other countries that could easily lead to more such international facilities."

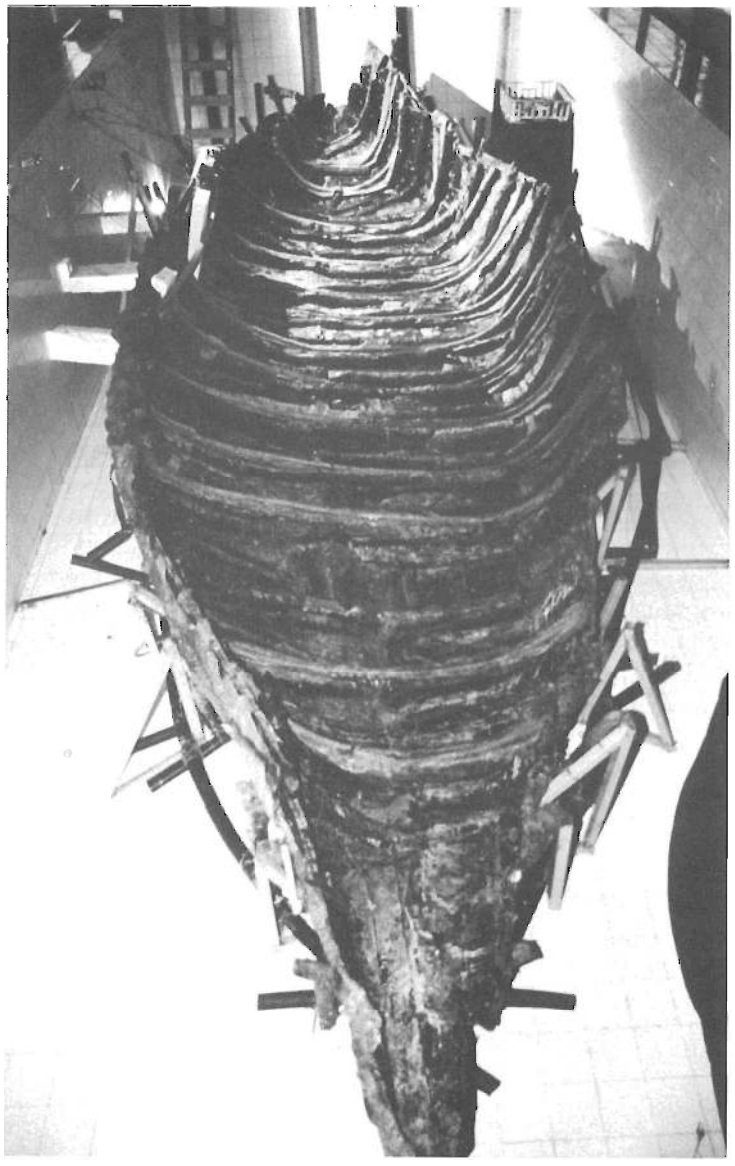
The major challenge for INA, Mr. Cook believes, is to broaden its base of support. "I have never found a person who does not get captivated by what we do. We need to build an organization whose sole function is to reach out to our potential constituencies and bring them into the INA family. The generosity and support which could flow from such an effort could endow INA with the funds and energy necessary to achieve our many dreams."

Review

The Sea of Galilee Boat

by Shelley Wachsmann
420 pages, New York: Plenum Press, 1995.

Reviewed by Patricia Sibella



The boat after completion of PEG treatment. Photo Courtesy Yigal Allon Museum.

Shelley Wachsmann, Meadows Assistant Professor of Biblical Archaeology in the Nautical Archaeology Program of Texas A&M University, shares with us a once-in-a-lifetime adventure: the 1986 recovery and excavation of a 2000-year old boat from the Sea of Galilee in northern Israel. This book is the personal account of the author from his first encounter with the oldest boat yet discovered in this Biblical location to the boat's removal and transportation to the area where it is being conserved and will eventually be put on display.

The book is divided into twelve chapters. Nine describe the discovery of the boat, its excavation, consolidation, and preservation. The remaining three recount the history of this inland sea of many names. This format, which may appear confusing at first, actually breaks the monotony of a traditional site report and allows for an easier and more enjoyable reading experience.

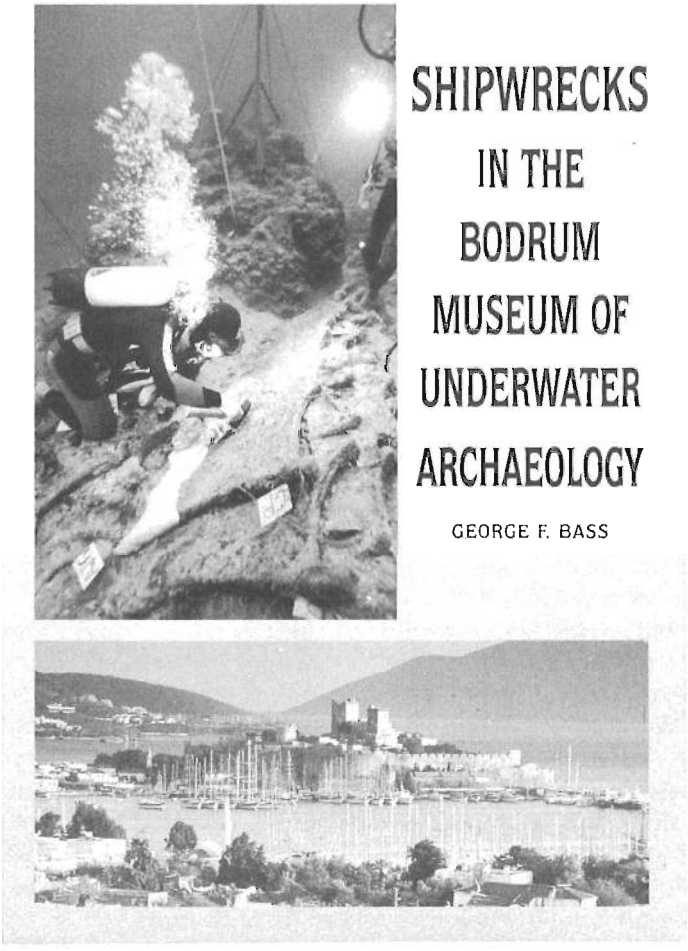
The story begins with an unfortunate driver who got stuck in mud flats exposed by an unusual lowering of the water level of the Sea of Galilee due to a 1985-1986 drought. While the driver was attempting to free his car, the spinning tires tossed out coins that were immediately recovered by two avid amateur archaeologists, the Lufans brothers of Kibbutz Ginosar. The brothers saw an opportunity in the drought to fulfill their dream of finding an ancient boat, and upon further investigations of the area, their hopes were soon realized. Wachsmann, then the Inspector of Underwater Antiquities of the Israel Department of Antiquities and Museums, was sent to lead an excavation. What started as a valuable archaeological find, however, turned into a political and religious free-for-all. The media dubbed the discovery "the Jesus boat," because both shared the same approximate time frame. Consequently, in order to preserve the integrity of the boat, an emergency excavation was conducted. This became all the more urgent as the lake began to rise rapidly to its original level.

The mostly-volunteer excavation team worked under police protection around the clock for eleven days to retrieve the 8.2-meter-long fishing boat. The vessel had come to rest on her port side, which caused the starboard stern quarter to fold over into the hull. Constructed of seven different wood types, the boat showed evidence of typical Mediterranean hull construction techniques and traditions. No cargo was found aboard the vessel, but two complete artifacts—a cooking pot and an oil lamp—as well as some coins and various sherds were discovered. Nearby, an arrowhead of pyramidal shape similar to those used in the First Jewish Revolt was recovered. Every detail of the excavation, together with the technical difficulties associated with the site—such as the encasement of the hull in a protective polyurethane cocoon and its berthing in a conservation pool—are clearly described in the text. Various mishaps were encountered during the process, but the author found simple solutions for the seemingly insurmountable problems. Perhaps he was assisted by the omnipresent rainbow that seemed to follow him throughout his endeavors.

Additionally, Wachsmann tries to place the Galilee boat in its proper historical context and discusses various possibilities for its origin. Could it be one of the boats used by Jesus and his apostles and disciples as related in the Gospels? Was it perhaps one of the boats that had washed ashore after the massacre of the Jews by the Romans at the Battle of Migdal? Was it simply a generic boat of the type used on the Sea of Galilee during the Roman period as depicted by the first-century AD mosaic from a house in Migdal? All these possibilities are discussed in detail.

The author succeeds in turning this extremely difficult and trying experience into a popular tale without compromising his scientific approach. Each chapter on the historical aspects of the excavation is enlivened with relevant excerpts from the Bible, Flavius Josephus, and other ancient writings; reproductions of old engravings; and even early travelers' guides. The sections on the excavation are illustrated with photographs of daily activities at the site, as well as photographs and drawings of archaeological objects. The illustrations are well integrated with the text. The overall organization is clear, easy to follow, and entertaining to read. A thorough bibliography at the end is divided according to each chapter, providing references to ancient authors, as well as to the most recent publications on the relevant topics. It is followed by a useful glossary of nautical terms, two technical illustrations detailing features of boat construction, and a 14-page index.

Wachsmann's work has the merit of offering to the reader a veritable bouquet of questions for further debate. This discovery is not only of significance to students of Jewish and Christian history, but to all audiences interested in historical and political aspects of first-century B.C.E. Judea. The style is such that scholar and layman will be equally captivated by the search for the boat's identity. Wachsmann clearly captures the excitement of the moment and brings to life one of the most vivid remains from the period of the New Testament.



New Book by Dr. George Bass

The founder of the Institute of Nautical Archaeology, Dr. George F. Bass, has recently published *Shipwrecks in the Bodrum Museum of Underwater Archaeology*, a publication of the Museum intended to provide a companion to its exhibits. An evocative foreword by Museum Director Oğuz Alpözen and an introduction by Dr. Bass describe the history of the Museum, while the text constitutes a history of nautical archaeology in Turkey. The book shows how inextricably that discipline is tied to the work of Dr. Bass, INA, and the Museum over the past 35 years. Dr. Bass includes entries he wrote for the forthcoming *Oxford Encyclopedia of Archaeology in the Near East* on nautical archaeology, Cape Gelidonya, Serçe Limanı, Şeytan Deresi, Uluburun, and Yassıada. Each chapter contains a useful bibliography. The 96-page book is richly illustrated with beautiful color pictures (mostly by INA Vice-President Don Frey), maps, and diagrams.

Even someone who is familiar with these excavations will find something new in this book, and it would provide a gripping introduction to the field for someone diving into nautical archaeology for the first time. At the special member's price of $6.00 ($10.00 for nonmembers), it would make an excellent gift to friends who might enjoy discovering the world of archaeology beneath the sea. Copies can be ordered directly from INA.

Studies in NAUTICAL ARCHAEOLOGY

The Texas A&M University Press and the Nautical Archaeology Program at Texas A&M are pleased to announce a new series, "Studies in Nautical Archaeology." This monograph series, under the general editorship of Dr. George F. Bass and directed by an Editorial Board of Nautical Archaeology Program faculty, will trace many themes in the history of seafaring. The first three titles are:

Those Vulgar Tubes:

External Sanitary Accommodations aboard European Ships of the Fifteenth through Seventeenth Centuries
by Joe J. Simmons III.

1–879735–00–8
paper $9.95
93 pp.
Now available.

The disposal of human waste is critical, especially where humans are in close quarters. As Joe J. Simmons III shows in this volume, information about this vital function on ships of the great era of sail is amazingly scarce. In *Those Vulgar Tubes,* Simmons has collected and interpreted the available archaeological and iconographical evidence, providing historians and anthropologists with a rich view of a historically censored subject.

In his introduction, Simmons discusses evidence of what methods early sailors used for relief. Subsequent chapters focus on each century of pre-modern exploration and the developments of ship design at bow and stern where sailors were accommodated. Officers had the luxury of enclosed, closetlike facilities; the book's title comes from a poem in which the ship's chaplain begs to be allowed to use the officers' luxurious facilities rather than the "vulgar tubes"—the downward projecting trunking through which effluvia was directed into the sea.

With clear illustrations and a timeline that graphs the development of sanitary facilities, *Those Vulgar Tubes* fills a long-standing void in the history of maritime travel.

The Development of the Rudder:

A Technological Tale
by Lawrence V. Mott

0–89096–723–7
paper $19.95. 224 pp.
Due out in November.

Far exceeding anything ever before written on the subject, *The Development of the Rudder* endeavors to unravel the mysteries of the evolution of a vital piece of seafaring equipment. In the process, author Lawrence V. Mott answers far-reaching questions on why some technologies developed and endured, while others were soon replaced. In this first considered historical overview of the rudder, Mott begins his examination in the Roman period and from there traces rudder development through the middle centuries to the age of exploratory navigation.

Before the twelfth century in northern Europe, ships were steered by a quarter-rudder mounted on the stern side of the vessel. The use of the quarter-rudder persisted up until the fourteenth century in the Mediterranean. There, two quarter-mounted steering oars were used.

By the age of exploration, the quarter-rudder had been replaced by the pintle-and gudgeon rudder, hung from the sternpost. Throughout, Mott offers a thorough analysis of the mechanics of these rudder systems while never losing sight of the human interest that attends the radical changes brought on by innovation.

Ships' Bilge Pumps:

A History of their Development, 1500–1900
by Thomas J. Oertling

0–89096–722–9
paper $17.95. 128 pp.
Due out in November.

All wooden ships leak, a stark fact that has terrified sailors since the earliest days of ocean travel. Maritime historical literature is filled with horrific descriptions of being aboard a slowly sinking ship. Starting from this human perspective, Thomas J. Oertling traces the five-hundred-year evolution of a seemingly mundane but obviously important piece of seafaring equipment in this one-of-a-kind history.

Beginning with early-sixteenth-century documents that recorded bilge pump design and installation and ending late in the nineteenth century, when bilge pumps were being mass-produced, Oertling covers a period of radical technological change. He describes the process of making long wooden pump tubes by hand, as well as the assembly of the machine-crafted pumps that helped revolutionize ship construction and design. Also given in detail are the creation, function, and development of all three types of pumps used from about 1500 to well into the nineteenth century: the burr pump, the suction or common pump, and the chain pump. Of further interest is Oertling's overall examination of the nature and management of leaks in ships' hulls. Line drawings and photographs illustrate the text.

In the Field

Traditionally, the Summer Issue of the INA Quarterly *discusses a sampling of the field and research projects in which the Institute of Nautical Archaeology has a part. While most other academic programs are in their summer vacations, the work of INA accelerates. Summer of 1996 will see a very full schedule of activities, including:*

Bozborun, Turkey

In the summer of 1996, a joint American-Turkish team, assisted by a multinational group of students and scholars, will conduct the second excavation campaign on the ninth century shipwreck near Bozburun, Turkey. Specific goals for this field season include the removal and documentation of the majority of the cargo and equipment in the amphora mound (fig. 1), preliminary evaluation of the hull, and the recovery of material scattered in the rocks above the mound.

The 1996 season will be conducted under the leadership of Field Director Frederick Hocker, with George F. Bass providing overall supervision and INA staff member Sheila Matthews returning as Assistant Director. Jane Pannell, of INA's Bodrum staff, will be the conservator, assisted by Asaf Oron of the Metropolitan Museum of Art and Ufuk Kocabaş. Other INA veterans participating this season include Robin Piercy, Murat Tilev, and Don Frey. INA adjunct professor Faith Hentschel will also return to the team. The Texas A&M Nautical Archaeology Program will be well-represented by graduate students William Charlton, Doreen Danis, Greg Gidden, Glen Grieco, Brian Jordan, Anne Lessmann, Ben An Liu, Tonka Ostoich, Christine Powell, Michael Scafuri, David Stewart, and Steven Thornton. Students from other universities include Otto Uldum, Tuğba Tanyeri, Erkut Arcak, Özalp Özer, Ela Serdaroğlu, Jihan Atabey, and Korhan Bircan. Dr. Jennifer Moody of Baylor University will visit in the middle of the season to assist with a survey of nearby medieval fortresses as part of our research into the maritime cultural landscape of which the Bozburun vessel was a part.

The Netherlands

During the summer of 1996, a team of archaeologists directed by Dr. Bob Neyland from the Naval Historical Center and Maria Jacobsen of INA will excavate and record the remains of a 15th-century ship found in the IJsselmeerpolders in the Netherlands. The work is sponsored by and conducted in cooperation with the *Centrum voor Scheepsarcheologie* and the *Rijksmuseum voor Scheepsarcheologie* in Ketelhaven. Joining the project are graduate students Janalyn Gober and Erika Washburn of the Nautical Archaeology Program at Texas A&M University, Kimberly Watson of East Carolina University, Grant Day of Michigan Technological University, William Bryan Yates of Florida State University, and longtime INA-volunteer Birgit Schroeder of Germany.

Sadana Island, Egypt

At Sadana Island in the Red Sea, an international team will continue excavating a 50 meter long ship for INA-Egypt. About 300 years ago, the ship sank after slamming into a coral reef. It carried a cargo of porcelain from China (fig. 2), coffee from Yemen, coconuts and pepper from India or farther east, and more than a thousand clay water jugs. It was rediscovered by sport divers, including some who looted the site repeatedly. Cheryl Haldane directs the scientific excavation.

The excavation will protect this site and learn more about the mechanisms of trade at a time that is poorly documented in regional sources. It also provides the chance to study an undocumented form of hull construction that seems to be non-European and non-Mediterranean. The excavation will run from 1 June through August; it is funded by private donors and corporate sponsors in Egypt, including the Amoco Foundation and CIB. All artifacts are stored and conserved in the Alexandria Laboratory for the Conservation of Submerged Antiquities, another joint project between INA-Egypt and the Supreme Council of Antiquities for Egypt.

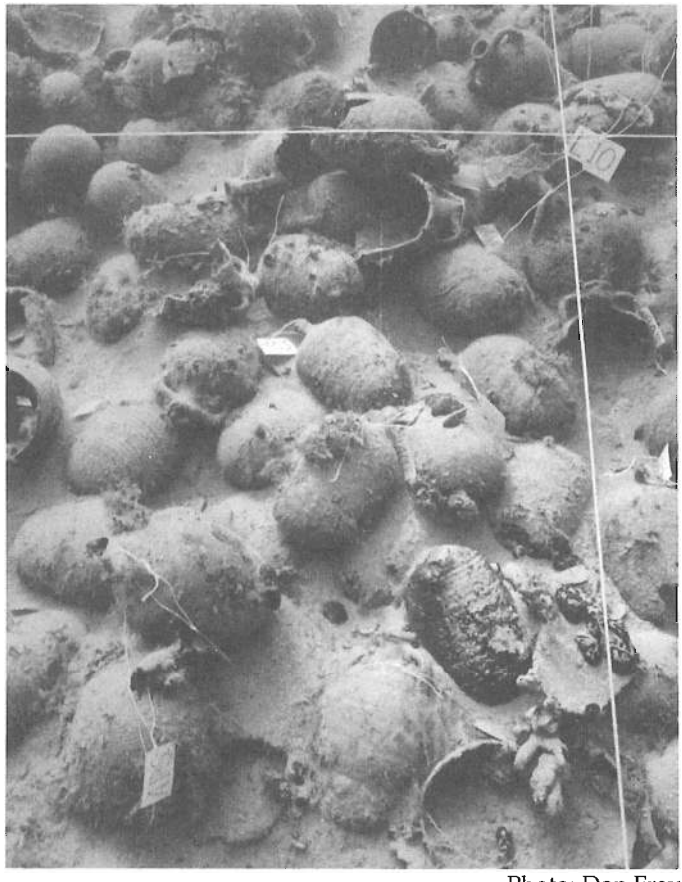
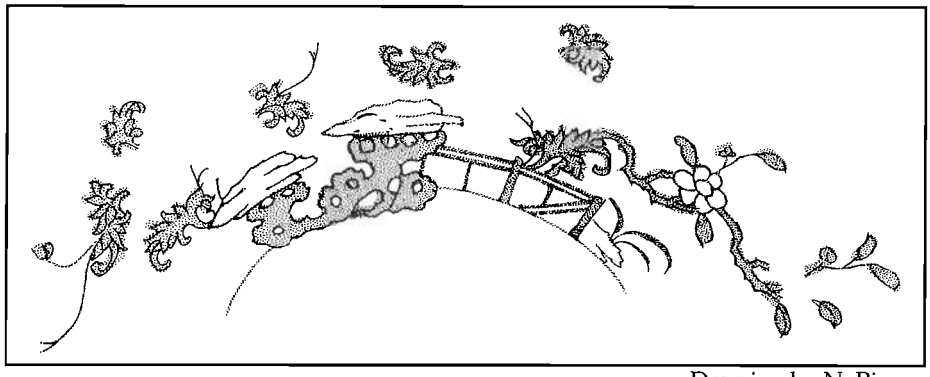


Photo: Don Frey

Fig. 1. *The focus of this season's excavation at Bozburun will be the raising of the amphoras for further analysis.*



Drawing by N. Piercy.

Fig 2. *A porcelain decorative design from the Sadana Island Excavation.*

Turkish Coast Survey

Cemal Pulak will direct an extended coastal survey starting in June and continuing until the end of October 1996. Mr. Pulak is Vice President of INA, and Mr. and Mrs. Ray H. Siegfried II Graduate Fellow in the Nautical Archaeology Program at Texas A&M University. The recently refurbished *Virazon*, captained by Tufan Turanlı, will play host to the survey team. Three distinct geographic locations on the Turkish coast will be targeted: the west coast, the southwestern coast, and the bay of Antalya.

It is hoped that the last location will reveal a Late Bronze Age shipwreck that was partially salvaged by sponge divers in 1907 and has since been lost. The Antalya survey will not only include the *Virazon* but also a sonar survey team, the purpose of which is to map all anomalies and possible targets in the area suspected as having the shipwreck. The *Virazon* team with its divers will investigate each target as found.

Initially, the survey will start along the southwestern coast, moving to the other areas as weather permits. Surveying on the southwestern and west coasts will concentrate on following up reports from sponge divers and fishermen. The survey will also conduct usual diving exploration in areas of hazardous sailing in antiquity, such as promontories, islands, shoals, and reefs.

Albanian Coast Survey

INA Research Associates Elizabeth Greene, Rezart Spahia, and Peter van Alfen are planning the first survey for ancient shipwrecks ever conducted in Albanian waters. The survey will initially focus on the southern Albanian coast near the ancient port cities of Butrint and Saranda, which lie opposite the Greek island of Corfu. The team will spend six weeks investigating reports of ancient wrecks dating from the 7th century B.C. to the 14th century A.D. Joining the crew will be Texas A&M Nautical Archaeology students Alan Flanigan and Roxani Margariti, as well as INA Director Claude Duthuit.

Azores Survey

Between August 24 and September 10, 1996, INA and the Museu de Angra do Heroísmo will jointly sponsor an intensive electronic-instrument and diver survey of the Bay of Angra on the southern coast of the Azorian island of Terceira. This bay was one of the principal anchorages for Azorian shipping from the fifteenth to the eighteenth centuries, and historical records indicate that scores of vessels were lost here due to storms, warfare, and accidents of navigation. The records also show that many different types and nationalities of vessels are represented among the wrecks. The objectives of the survey include locating a wide range of wrecks from the fifteenth to the seventeenth centuries, assessment of these wrecks for possible excavation, and the gathering of sedimentary data for determination of geological and oceanographical processes around the Azorian Islands.

The electronic-instrument portion of the survey will be directed by Dr. Williams Bryant of the Texas A&M University Geological Oceanography Department, assisted by Dr. Anne Rutledge, Brett Phaneuf, Edward Webb, and David Ball. Dr. Bryant intends to use a side-scanning sonar, a sub-bottom profiler, and a magnetometer to ensure maximum possible coverage of the sea floor. The diver verification portion of the survey will be directed by Dr. Kevin Crisman of the Nautical Archaeology Program at Texas A&M and INA Adjunct Professor Arthur B. Cohn, with assistance from Anne Lessmann and Brian Jordan. Diver-archaeologists from the Amigos do Museu, a volunteer organization connected with the Museu de Angra, will round out the project personnel. Support for the project has been provided by the generosity of Mrs. Sylvia Baird and by a grant from the Interdisciplinary Research Initiatives Program at Texas A&M University.

Bodrum, Turkey

At the Bodrum Museum of Underwater Archaeology, conservation, study, and documentation of Uluburun artifacts will continue with several teams working on specific projects. These include the complete study of all balance weights (151), continuing study of the copper ingots (354) and amphoras, and documentation of hull remains. These projects will be coordinated by Dr. Michael Fitzgerald and Patricia Sibella.

In addition, Dr. George Bass and Dr. Fred van Doorninck will continue their work in Bodrum on the cargo from the eleventh-century Serçe Limanı "Glass Wreck."

Some additional INA-related projects cannot be described now due to site security. We hope to bring details in future issues.

INSTITUTE OF NAUTICAL ARCHAEOLOGY