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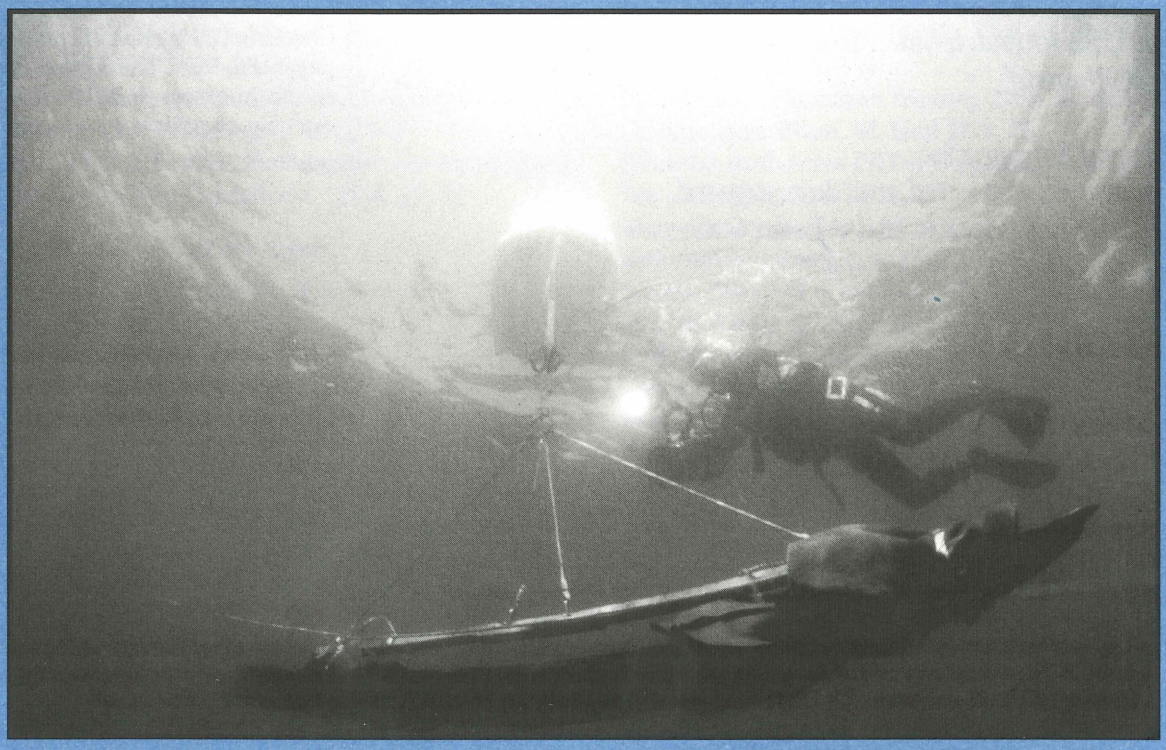

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On the cover: Divers lift a frame from the Pepper Wreck near Lisbon, Portugal. Photo: Guilherme Garcia.

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

The Last Field Season on the Pepper Wreck: A Preliminary Analysis of the Hull

Filipe Castro

It is almost as satisfying to reach a milestone in a significant project as to look back on a completed job well done. The fourth and final season on the Pepper Wreck (Site SJB2) finished in August 2000, at least in terms of the field work. The ship, believed to be *Nossa Senhora dos Mártires*, sank at the mouth of the Tagus River at São Julião da Barra just outside Lisbon on September 15, 1606. INA joined the Instituto Português de Arqueologia (IPA), which sponsored the excavation through its underwater archaeology department, the Centro Nacional de Arqueologia Náutica e Subaquática (CNANS). In this last season, we were also sponsored by MARCASCAIS, the company that manages the new marina of Cascais, where our boats were stationed.

The Pepper Wreck, thought to be the remains of an early seventeenth-century Portuguese East Indiaman, was discovered in 1994. Excavation, begun in 1996, yielded a collection of thousands of artifacts, as well as part of the hull structure (see *INA Quarterly* 26.4, 12–15). Our objectives in 2000 were to complete the recording of the remaining hull timbers to permit study, analysis, and partial reconstruction of the hull.

Some of the timbers were raised and some left in situ, protected from the strong dynamics of the sea under a layer of sandbags. We inspected a new area scarcely one hundred meters from the SJB2 site, where timber remains had been spotted last winter by our longtime collaborator and close friend Carlos Martins. This experienced diver has found most of the sites around São Julião da Barra, and has been our best guide to archaeological sites on that rough bottom. Unfortunately, a layer of sand no less than two meters thick, as well as a strong current, prevented us from reaching the remains in the three trial trenches we opened.

As always happens in underwater archaeology, the conservation and analysis of the artifacts will go on for a long time, as will reconstruction of the hull. Indeed, the hull has shown to be the most important artifact on this site. Although the remains consist only of a very small portion of the bottom of the ship, these timbers, with construction marks engraved on their faces, speak volumes.

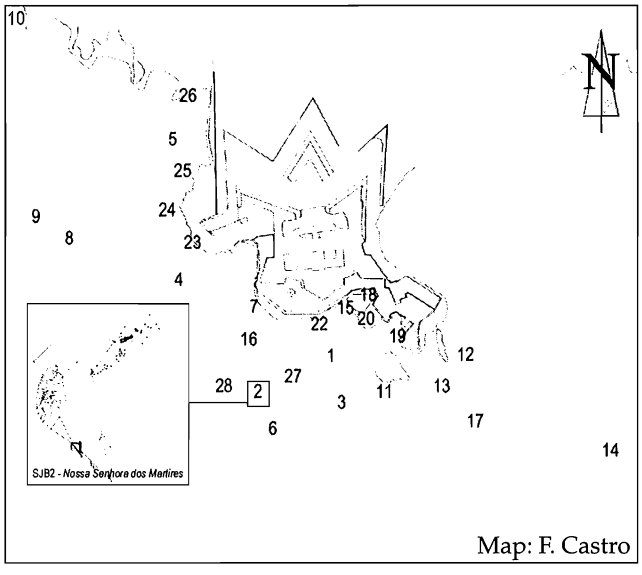


Fig. 1. *The SJB2 shipwreck site.*

The wreck is located within an area that might be termed an archaeological complex, a relatively small stretch of sea bottom containing several shipwrecks (fig. 1). The strong dynamics of the sea and the annual shift of sediments have combined to mix the artifacts from several wrecks. This site is an interesting and rich ship graveyard, but it is also a true nightmare for archaeologists. The material culture represented in the collection of artifacts encompasses a period of over 350 years. According to a CNANS database, many wrecks were lost at the "mouth" of the Tagus, a general designation that encompasses a very extensive area. Fortunately, the area of the fortress of São Julião da Barra is small and well defined. The official documents refer to most vessels wrecked here specifically as being lost off the fort, rather than at some less precise designation. These known sites date from the late sixteenth century to the middle twentieth century (table 1). The records often correspond with and explain the provenience of artifacts retrieved or located near São Julião da Barra.

The first challenge of this study has been the identification of the Pepper Wreck, designated as SJB2 in the map of the complex. One important clue was a thin layer of peppercorns, covering the hull timbers. These extended over a very large area that contained a very homogeneous collection of artifacts from the late sixteenth century and early seventeenth century. The Chinese, Japanese, and Burmese pottery found in the pepper layer can be dated to this same period. It bears a great resemblance to the ceramics collection of the Manila galleon *San Diego*, wrecked in the Philippines in 1600. The porcelain, from the Wan-Li period, is from the 1590s and 1600s. An astrolabe found within the site bears the date of 1605, establishing the earliest possible year for the wreck.

The evidence we have uncovered points to one particular vessel, presumably built in Lisbon: *Nossa Senhora dos Mártires*. It was employed in the Carreira da India, the lengthy voyage between Goa and Lisbon. *Mártires* wrecked off São Julião da Barra in 1606 on a return voyage from Cochin on the Malabar coast of India. The proposed identity

Table I. ***List of Wrecks in São Julião da Barra***

Year	*Ship*	*Provenience*	*Comments*
1587	*San Juan Baptista*	Lisbon	Near the fortress
1606	*Nossa Senhora dos Mártires*	Cochin, India	Under the walls of the fortress
1625	*São Francisco Xavier*	Cochin, India	Presumably near, south of the fortress
1704	English vessel (70 cannons)		Near the fortress
1733	*Union*	St. Malo, France	Near the fortress
1753	Dutch vessel		Presumably near, east of the fortress
1802	English vessel		Near the fortress
WW I	*Maria Eduarda*	Viana, Portugal	Presumably near, west of the fortress
1966	*Santa Mafalda*		Near the fortress

(Source: CNANS Database)

of the wreck is reinforced by the presence of a large quantity of peppercorns, indicating a bulk cargo of pepper, and therefore an Asian origin for the trip of the wrecked vessel. Study of the woods utilized–cork oak (*Quercus suber*) and umbrella pine (*Pinus pinea*)–and the scantling dimensions leave no doubt that this is a Portuguese-built hull.

During the sixteenth and seventeenth centuries, a small fleet would leave Lisbon for India almost every year, making this voyage the longest regular route of its time. The Portuguese designed and built the ships specifically to sustain a six-month-long trip. They had to offer enough space for their crew and passengers, together with their victuals, and leave enough free space for the large amounts of merchandise brought back on the return trip. Their main cargo–peppercorns–was a very light commodity to store in the holds, especially if these vessels were to carry heavy artillery on the upper decks. To maintain stability, they had to carry a large amount of ballast, creating an even greater demand for space in the holds. In light of these factors, it seems incredible that the average late sixteenth-century India route *nau* had a keel length of less than thirty meters!

Illustrations of early seventeenth ships are scarce and generally inaccurate, so we are lucky to have a few late sixteenth and early seventeenth-century texts that discuss the conception of the *nau*. Four texts have been especially important in the reconstruction of the hull remains. The first is the *Livro da Fabrica das Naus*, written in Portuguese by a priest and adventurer named Fernando Oliveira around 1580. It translates a previous Latin work of his, *Ars Nautica*, whose manuscript (dated to around 1570) is in the University of Leiden. The second is an anonymous list of the timbers necessary to build a three-decked, 600-ton *nau* for the India route. This is part of a codex in Lisbon's National Library, dating from the 1590s, known as the *Livro Náutico*. The third is a manuscript titled *Livro Primeiro de Arquitectura Naval*, providing an incomplete "recipe" for building a four-decked *nau*. This was written around 1610 by João Baptista Lavanha, engineer of the kingdom, mathematician, and author of many other books. The fourth is perhaps the most interesting and elusive of them all, since the author is virtually unknown in spite of the magnificent self-portrait and signature with which he opens his book. It is called *Livro de Traças de Carpintaria*, dated 1616, and signed by a Manoel Fernandez, shipwright.

From these texts, we have a fair idea of how these vessels were designed and built. However, when it comes to details, we have few certainties, many doubts, and a great deal of ignorance about the shipwrights' methods, techniques, and practices. The ability to answer such questions is why nautical archaeology is such an important contributor to maritime history.

The remains of the SJB2 hull consisted solely of a portion of the keel, eleven frames, an apron, and an area of planking covering around twelve by seven meters (fig. 2). In addition, the marks of the iron spikes with which the planks were nailed to the frames showed a clear pattern. This helped us to determine the position of another fourteen frames.

Before starting the reconstruction of the hull, I performed a series of checks on the accuracy of the 1997 1:10 site plan, drawn by reducing a large number of 1:1 drawings made over Plexiglas slates on the bottom. I compared the measurements of the timbers raised in 1999 and 2000 with their representations in the plan. I found a discrepancy of five centermeters over a distance of twelve meters in the longitudinal direction, representing an error of less than 0.5 percent. There was a difference of three cm in the transverse direction, representing again less than 0.5 percent error in the overall measures. An independent team checked the position of each spike hole in the planking on the north half of the wreck. This was only partially done on the southern half, leaving a few—not very important—doubts here and there.

The presumed positions of the fourteen vanished frames marked on the planking were strongly reinforced by the existence of a number of interesting remarks on the floors and futtocks. Once analyzed, the positions and meanings of these marks give us a very clear picture of the principles that guided the conception and construction of this vessel.

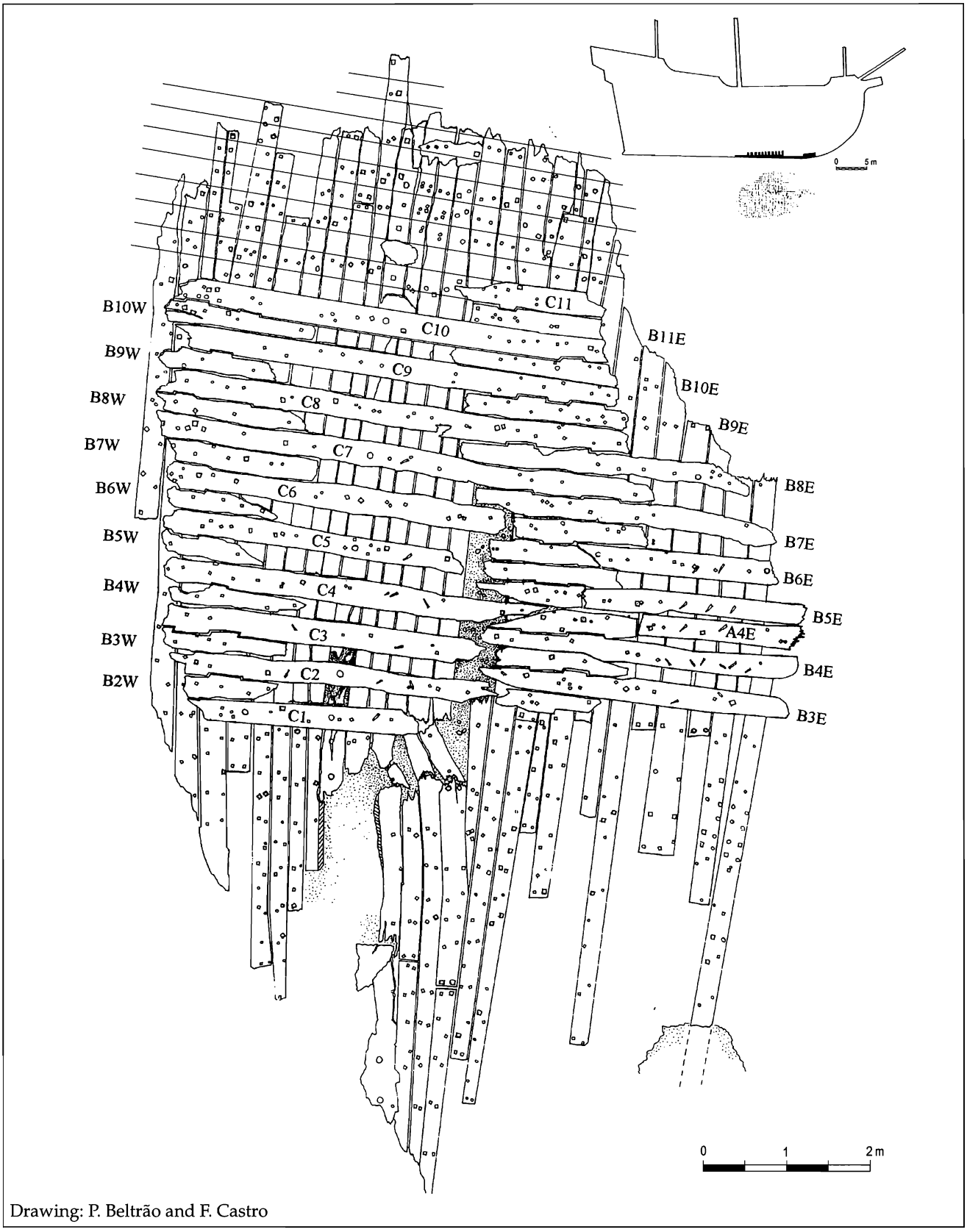


Fig. 2. *The presumed* Nossa Senhora dos Mártires *as it lay on the seabed.*

As mentioned above, eleven contiguous floor timbers were preserved over the keel, growing in their molded dimensions from the north to the south, in the direction of the bow. They show four types of marks: a sequential numbering in Roman numerals; a series of marks that seem to have no precise meaning, presumably resulting from scratching during the construction process; a series of vertical lines, marking the edges—in Portuguese *astilhas*—and the axis of the keel; and a series of lines marking other construction features. Of this last group, four vertical lines are clearly placed on what I believe to be the turn of the bilge points, and another three deserve a closer look, since their meaning is not clear at this point (fig. 3). Two are also vertical marks on the aft face of floor timbers C2 and C3, and the third is a line on the base of floor C3.

All four texts mentioned above describe a shipbuilding process generally known as skeleton-first, or frame-based, as it is perhaps more accurate to say. In this method—typical from the Mediterranean tradition and already many centuries old in the sixteenth century—the central section of the hull was defined through a certain number of pre-designed and pre-assembled frames that were mounted over the keel. The widest frame (or frames) of this group was generally placed in the center of the central portion and called midship frame(s), or master frame(s). The last of these pre-designed assemblies, fore and aft, were called tail frames. The fore and aft ends of the hull, called *delgados* in Portuguese, were defined by a series of ribbands that ran from post to post over these central, pre-designed frames. This ensured that the planking would have smooth runs and would not endure unnecessary stresses during its lifetime. At the same time, this system guaranteed that the bow and stern would have beautiful and fair shapes, cutting the water easily, and avoiding any turbulence around the rudder. The remaining frames may have been formed and fitted only after all the ribbands were set in place. In this system of construction, shipwrights did not depend on drawings to define the shape of the pre-designed frames. These were obtained from a rectangular mould and set of gauges, called *graminho*. These determined the rising of the bottom and its narrowing, from a maximum width at the flat midship frame to the 'V' shaped minimum width and maximum rise at the tail frames.

Following a very simple procedure, the total rising or narrowing was divided by the number of floor timbers over which it was to be distributed by a simple algorithm called *besta* (cross-bow) in Portuguese, the equivalent of the Italian *mezzaluna*. This algorithm was used to build a *graminho*, with the full scale measures to be added or subtracted from the main mold of the midship floor (fig. 4).

I measured the molded dimensions of the floors over the keel, and plotted their heights together with their respective sequential numbers. The spike marks on the northern planking clearly show a set of three floors placed together,

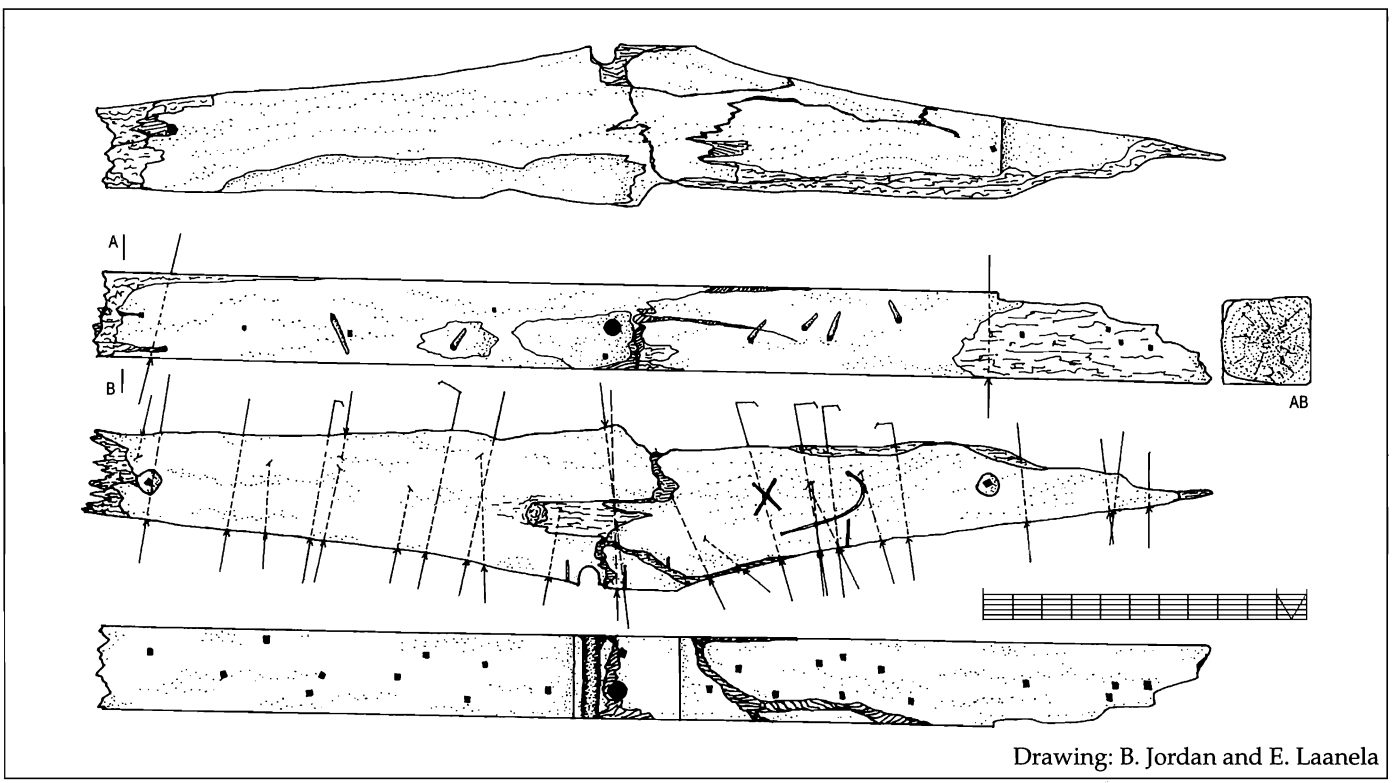


Fig. 3. *Floor timber C2. Note all four types of marks mentioned in the text: 1—the Roman numeral "X," 2—a round groove, probably just a scratch, 3—the axis and edges of the keel, and 4—a vertical line to port side.*

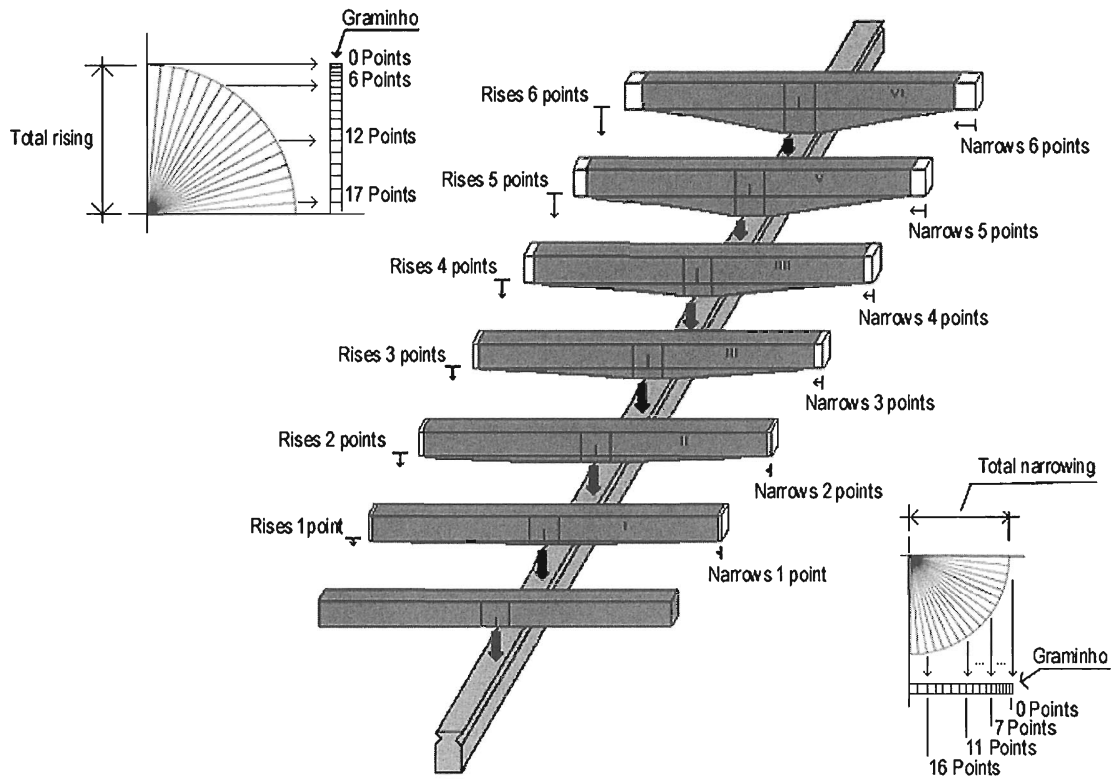


Fig. 4. *Rising and narrowing pre-designed floor timbers. Computer generated representations have become a great aid to the archaeologist to depict theories in a speedy—but sometimes a less than perfect—drawing. Drawing: F. Castro*

to which should be assigned the number zero, considering the numbering order observed in the preserved examples. My reconstruction produced a series of values that followed very closely the rising of the bottom recommended in Oliveira's *Livro da Fabrica das Naus* for a *nau* of eighteen *rumos* of keel (one *rumo* is 1.54 meters, so eighteen *rumos* equals 27.72 meters). According to Father Oliveira, an India route *nau* must have eighteen *rumos* of keel, three midship frames, and eighteen pre-designed frames before and abaft these three master frames (fig. 5). The total rising of the bottom should be the equivalent to one room-and-space (the distance from an edge of one frame to the same point on the

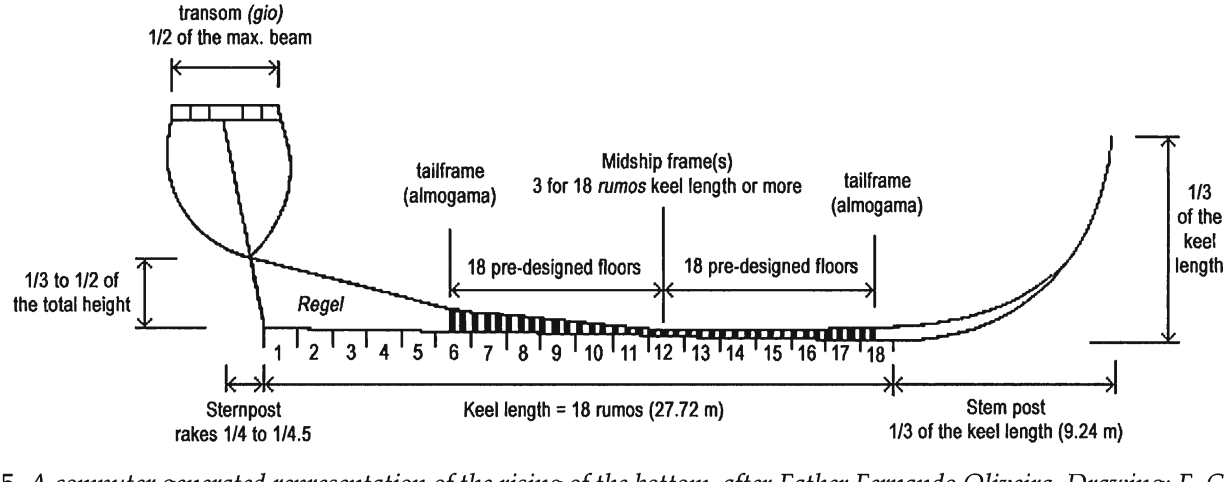


Fig. 5. *A computer generated representation of the rising of the bottom, after Father Fernando Oliveira. Drawing: F. Castro*

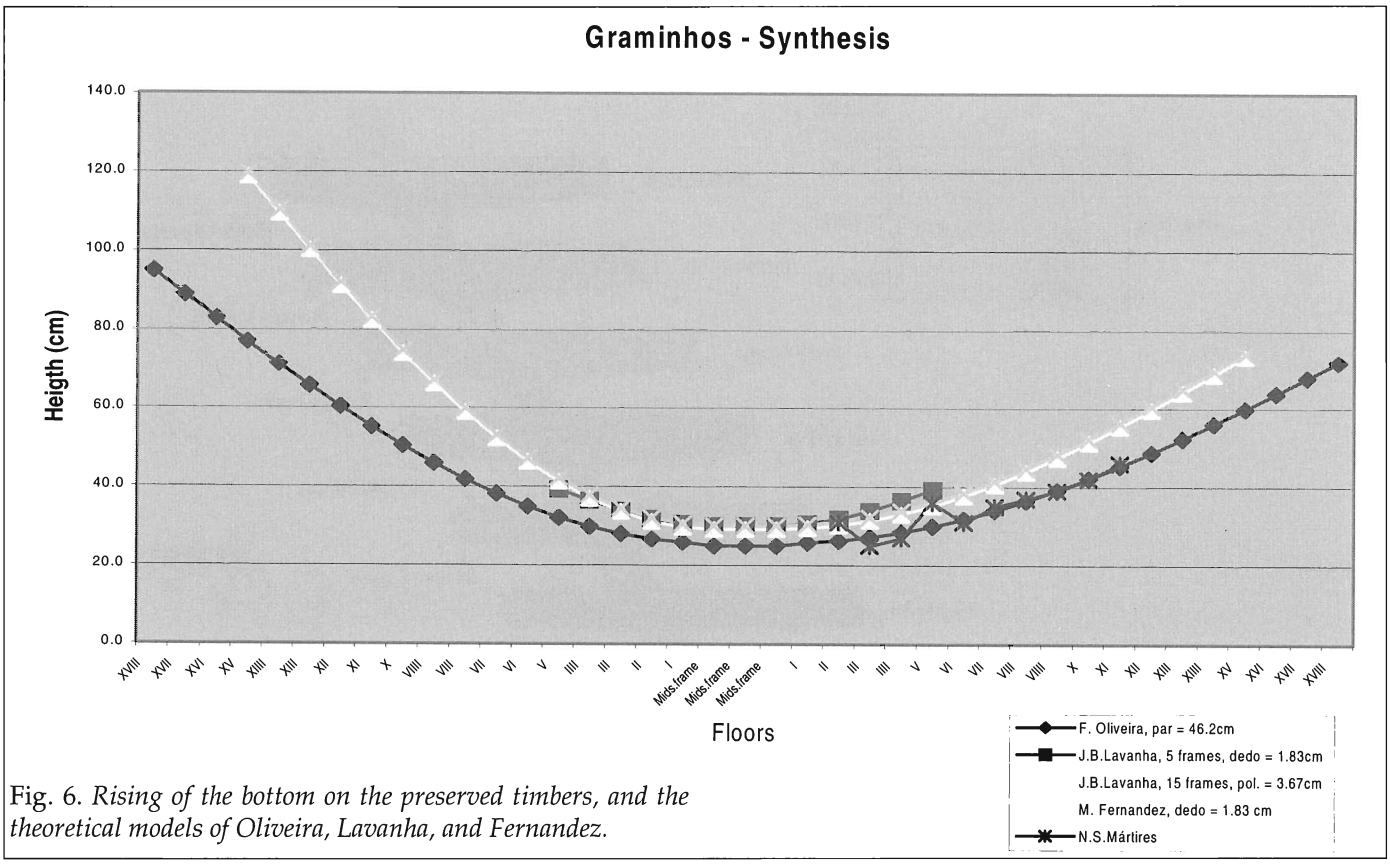


Fig. 6. *Rising of the bottom on the preserved timbers, and the theoretical models of Oliveira, Lavanha, and Fernandez.*

next frame) to the bow, and one and a half room-and-space to the stern.

I tried varying the number of pre-designed frames in my reconstruction, as well as the value of the rising, since the other sources suggested different designs. *Livro Náutico* determined that an India *nau* should have one single master frame, and seventeen pre-designed frames before and abaft the master frame, and rising of three *palmos de goa*—one *rumo* equaled six *palmos de goa*—to the stern (the rising in the direction of the bow is not mentioned). Lavanha's *Livro Primeiro* indicates only one master frame and five pre-designed frames fore and aft, but mentions an old method with fifteen pre-designed frames to each side of a single master frame. Fernandez's *Livro de Traças* indicates also fifteen pre-designed frames to each side of three master frames.

After considering all possible sets of values, it still looked very much like Oliveira's pattern was the formula used in constructing the bottom of what we presume to be the *nau Mártires* (fig. 6). Following this line of reasoning, I then tried to relate some of the vertical marks observed on the floors with a few theoretical curves drawn from Oliveira's book for the narrowing of the bottom. Again, if considering three master frames, as seems to have been the case, four consecutive marks match within 1 cm the expected values for the turn of the bilge. Both these values of the flat of the midship frames, or *plão*, and the total narrowing, are perfectly within the values indicated by Father Fernando Oliveira.

At the present time I have no explanation for the remaining three marks. Two of these consist of vertical marks, either less well preserved or less deeply engraved on the aft sides of floor timbers C2 and C3. The third is visible on the base of floor C3, and has no clear meaning at this stage.

Recording and reconstructing the shape and size of the thirty-nine central frames is only the first step in the reconstruction of the entire hull. The next step will be to analyze the curvature of the preserved futtocks, and determine how the midship section was designed, at least to the water line. To achieve this I am being helped immensely by Dr. Thomas Vogel of the TAMU Mathematics Department. From there, it will be easy to extrapolate a plausible shape of the ship, at least the submerged portion, and an acceptable full volume of the hull. The positions of the hatches, pumps, capstans, and mast steps are well defined in the texts mentioned above. They also describe the size and shape of the fore and aft castles, the size and rake of the main mast, and the length of the remaining masts, as well as some of the yards. Many questions remain, however, and many more will certainly appear as the reconstruction work evolves. This is why the wreck has been such a thrilling object to study, and why, when it is finished, it will provide a basis for analyzing and understanding similar vessels.

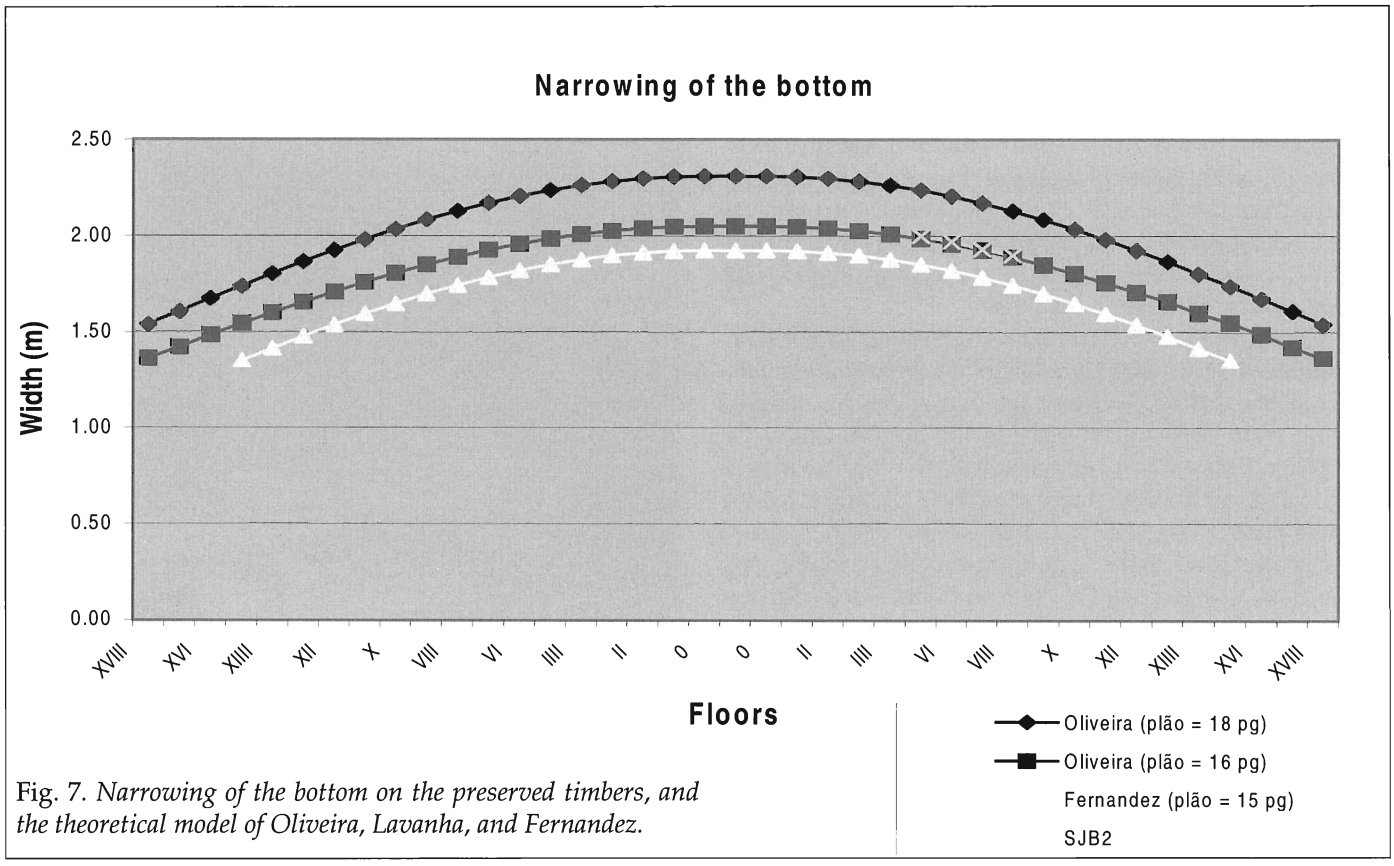


Fig. 7. *Narrowing of the bottom on the preserved timbers, and the theoretical model of Oliveira, Lavanha, and Fernandez.*

Acknowledgements: There are more people than I can name whose support was critical for the conclusion of the 1999 and 2000 field seasons of the Pepper Wreck project. I will start with Carlos Martins and Augusto Salgado, the skilled divers who covered the surveying, digging, measuring, drawing, and photographing in whatever weather conditions... and who always covered my back when I was short of personnel. I am also grateful to Mónica Belo and Gonçalo Caldeira, two hard workers whose enthusiasm never faded. I must also recognize the CNANS team, of which Miguel Aleluia, the resident Rock of Gibraltar, deserves the largest share of the merits for his competence, indefatigable strength, and infinite wisdom. As to the institutions involved, I start with CNANS and particularly Dr. Francisco Alves for all his support and patience, always backed by his IPA directors, Dr. João Zilhão and Eng. Monge Soares. The Portuguese Navy was a great help, specially the Direcção de Faróis and the cabinet of the Almirante Chefe de Estado Maior da Armada. I want to express my gratitude to the management of MARCASCAIS and all their personnel for extreme patience towards our schedule. Many students from the Texas A&M University Nautical Archaeology Program gave freely and enthusiastically of their time and should be acknowledged for the outstanding work they accomplished. Finally, I thank INA, its members, and Texas A&M University for supporting this project.

Suggested Readings

Afonso, Simonetta L
1998 *Nossa Senhora dos Mártires: The last Voyage.* Lisbon: Ed. Verbo/Expo'98.

Castro, Filipe
In Press "The remains of a Portuguese Indiaman at the Tagus Mouth, Lisbon, Portugal (Nossa Senhora dos Mártires, 1606," *Proceedings of the International Symposium 'Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition.'* Lisbon: Ed. IPA/CNANS.

Shangraw, Clarence and Edward van der Porten
1997 *Knaak Plate Design Sequence 1550–1655.* California.

The Artifacts from São Julião da Barra

Sara R. Brigadier

The Portuguese East Indiaman known as the Pepper Wreck is likely *Nossa Senhora dos Mártires*, which sank at the mouth of the Tagus River outside Lisbon on September 15, 1606. The ship had just completed its arduous journey from Cochin and failed in an attempt to enter the river after losing steering capabilities. It was heavily laden with a cargo of pepper and other exotic goods from the Far East when the wreck occurred.

From 1996–1998 excavations by the Portuguese Centro Nacional de Arqueologia Náutica e Subaquática (CNANS) at São Julião da Barra uncovered many of these artifacts from their burial place at the bottom of the Tagus. When Filipe Castro approached me with the idea of studying the artifacts found during this excavation for my Masters Thesis, I had no idea what was involved. I agreed to the project, and Filipe began organizing a small group of Nautical Archaeology Program students—Brian Jordan, Erika Laanela, Mason Miller, Anthony Randolph, and myself—to accomplish several tasks during the summer of 2000. Work would progress on timber recording and site management, and the artifacts from the excavation would at last be organized.

Upon my arrival in Lisbon in late May, I realized what a mountain of work was ahead in order to collect all the information needed. Six weeks is not a long time to examine and create a paper record for over two thousand objects. A fortnight of this time was allotted for artifact photography at the Museo de Marinha, where the more spectacular items from the excavation are housed. Without the generous assistance of Anthony Randolph on this project, I would not have been able to gather all the necessary data. He contributed countless hours to the cause, first teaching me how to catalogue artifacts and take artifact photographs, then helping finish both aspects of the project (fig. 1). We ended up spending three weeks at CNANS cataloguing, and two weeks in the attic of the Museo de Marinha photographing the collection. The entire process was facilitated by Filipe, tirelessly sorting through the paperwork to provide us space and supplies to work both at CNANS and the Museum.

Photo: S. Brigadier

Fig. 1. *Anthony Randolph and Erika Laanela catalogue artifacts at CNANS.*

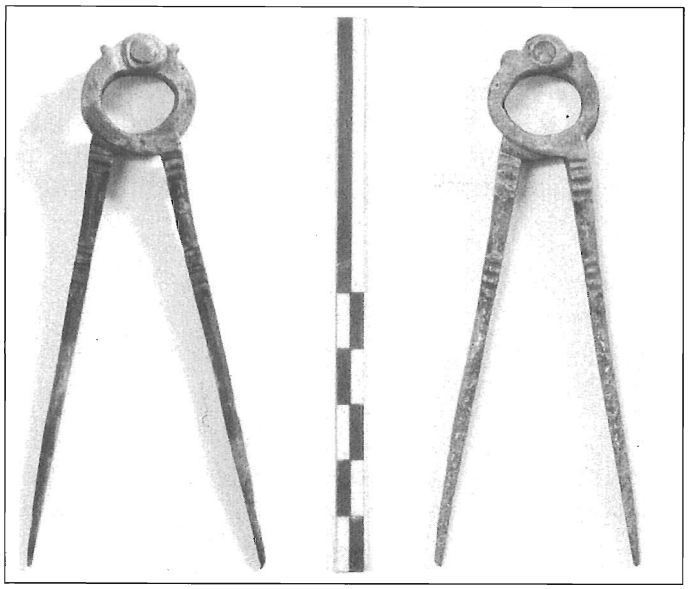
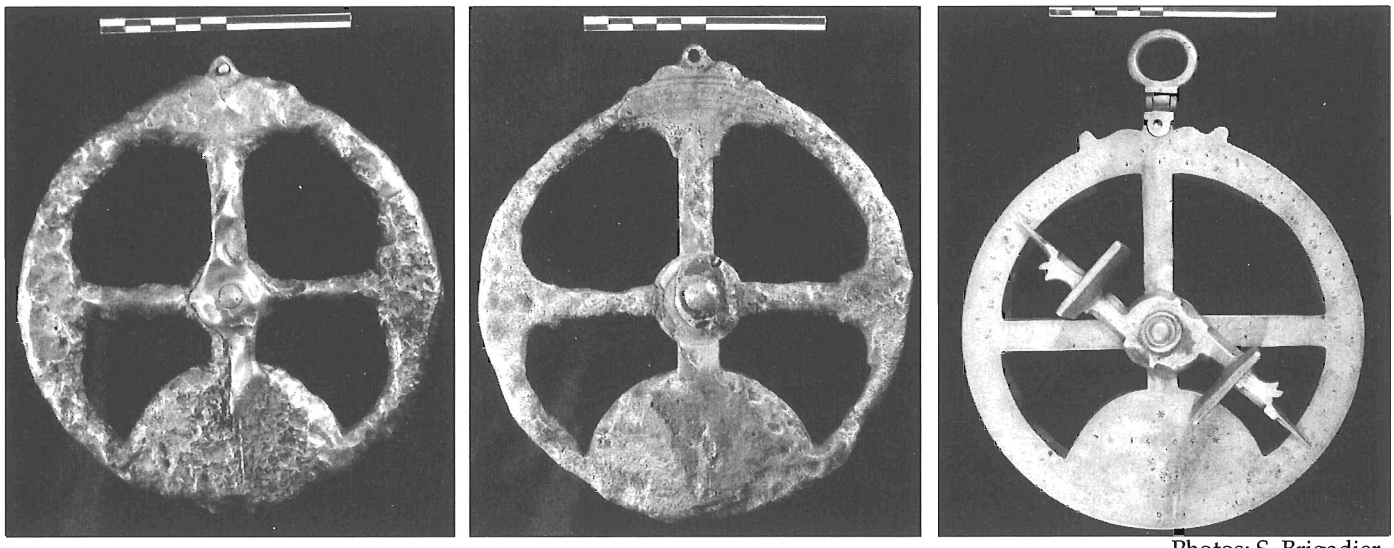


Photo: S. Brigadier

Fig. 2. *Charting compasses* SJB *96/98 001 and 002.*

This summer's work has provided the direction I needed to structure the entire project into two aspects of research. I am currently finishing the artifact catalogue, which I will then use to create a geodatabase using ESRI's GIS software to spatially organize the artifacts in relation to their location at the site as well as their type. The research portion of the project will focus on the artifacts from the excavation that are likely to have been aboard a Portuguese East Indiaman returning from Cochin during the early seventeenth century. The rocky point of São Julião da Barra, located inconveniently near a sandbar, has been a treacherous point for ships and sailors for centuries. The heavy surge has thoroughly mixed the remains of shipwrecks to produce a site that yields fragments from sixteenth century majolica to modern cola bottles. While everything from the excavation will be included in the catalogue, I am only focusing my thesis upon artifacts that could have been aboard *Nossa Senhora dos Mártires*. These primarily consist of the items photographed at the Museum, and fall into the following categories: navigational instruments (fig. 2), porcelain dishes, pewter plates, Asian stoneware ceramics, and miscellaneous pieces (including coral fragments and gaming pieces).



Photos: S. Brigadier

Fig. 3. *The three astrolabes from the Pepper Wreck. Left to right,* SJB I *(0172),* SJB II *(0173), and* SJB III *(0174).*

Navigational Instruments

The navigational instruments include three astrolabes (fig. 3) and three pairs of charting compasses. Of the three astrolabes associated with the Pepper Wreck, the one identified as *São Julião da Barra III (SJB III)* is in the best state of preservation. *SJB III* was protected from current and sand abrasion by a large rock, and from molecular deterioration by an iron cannon resting on top of it. As the iron decomposed, releasing its electrons into the surrounding water, it fed a constant flow of electrons to the brass astrolabe, forming a protective galvanic cell. The astrolabe is dated 1605 and bears a Portuguese mark of four six-pointed stars surrounding the date engraved on the lower portion of the ring. It is also marked with the letter "G," identified in the exposition book as the mark of Francisco de Goes. The Goes family was active in instrument making from 1587 until 1676. The other two astrolabes, *SJB I* and *SJB II*, are badly degraded and have Iberian shapes but few identifiable characteristics.

During the late sixteenth century, charting compasses were often cast as sets, and they were used until lost or broken beyond repair. Therefore, althougth the *SJB* compasses are more characteristic of the late sixteenth century, it is not surprising that they were still in use during the early seventeenth century. Two pairs are complete and almost identical, although one set is missing a leg and has a slightly less elaborate head. All three pairs are made entirely of a copper alloy, probably brass. These dividers are simple, consisting of two identical pieces riveted together at the top, forming two straight legs. Each leg has an arc at the head that makes a ninety-degree turn after completing half a circle to form the leg. The two complete pairs have an additional decorative ear on either side of the head rivet, along with decorative cross-hatching. The third pair lacks the ears, but does appear to have engravings. On all three pairs there are two horizontal lines present on the leg at the base of the head, and two more horizontal lines about one third of the distance down the leg. None of the compasses appear to have perfectly straight legs, and the tip of the leg on set three is bent. This damage could have occurred before the wreck or in the 394 years spent deteriorating at the bottom of the Tagus River.

Porcelain

The collection of porcelain from the excavation corresponds with the year of the *Mártires* wreck, 1606, within the Chinese Wan-Li Period (1573-1619). This era is marked by the intense popularity of a style known as kraak porcelain, so called because the Dutch referred to this style as the "*kraakporselein*" or "carrack porcelain" carried by the Portuguese East Indiamen. This underglaze blue and white style tends to mimic early Ming themes. The motifs, designed to capture a fleeting mood or motion, typically incorporate deer, horses, plants, or birds into landscape patterns. The background and foreground give the impression of looking into the natural habitat of the creatures (fig. 4). Kraak porcelain characteristically has decorations radiating from panels to a bracketed rim; on bowls and vases the entire piece may be organized in panels, but on plates and dishes the panels are usually confined to the border of the piece. The patterns were not made to order during the Wan-Li period as they were later, but they were made specifically for the European market, where these patterns were greatly admired.

In a recently conducted study of the border patterns of kraak porcelains from securely dated shipwreck sites, a reliable typology was assembled by Clarence Shangraw and Edward Von der Porten. The evolutionary sequence that they have established traces the development of decoration patterns used in border styles and layouts on blue and white dishes. Three out of five border styles used in the years between 1590 and 1600 are represented in our collection. These porcelains helped identify the wreck as the *Mártires*, which wrecked in 1606. Painstaking sorting and reconstructive work by the Portuguese team have thus far yielded a collection that includes two platters, seven plates, one bowl or vase base, and the neck of one vase. All of them appear to be kraak porcelains from the Ming Dynasty's Wan-Li Period, dated around the year 1600.

Photos: S. Brigadier

Fig. 4. *A typical, and one of the better preserved, porcelain plates,* SJB *96/98.0097.*

Other Items

I have only recently begun my research into the pewter plates, stoneware ceramics, and miscellaneous artifacts. The collection of pewter plates, includes seventeen artifact numbers (fig. 5). Some of the items are encrusted with pepper from the wreck, and are in varying sizes and degrees of preservation. This range includes everything from well-preserved intact plates to plate rims fused together. Almost all of the plates have markings, which I will be researching this fall in order to discover their origin. There are a large number of stoneware sherds that correspond to the known features of Chinese Dragon Jars and Martaban Jars, as well as some intact jars. Chinese Dragon Jars are characteristically stoneware with a buff-colored body and a green exterior glaze. Patterns such as dragons, flowers, or suns decorate the jar as cut-away appliques in a buff paste. Martaban Jars are usually a highly fired stoneware partially or entirely covered by an exterior dark brown glaze. Decorative elements of black or buff colored glazes are optional features, and the jars come in a wide range of sizes.

The miscellaneous artifacts include gaming pieces, fragments of trade coral, and cupreous buttons and decorative elements. These items provide a more personal perspective on the lives of the men and women involved in the shipwreck. From the styles of clothing and jewelry worn, to the games played to while away long hours aboard ship, the artifacts classified as "miscellaneous" are united by what they have to say about the people who owned them.

Photos: S. Brigadier

Fig. 5. SJB *96/98.0078, one of the well preserved pewter plates currently being studied.*

I have already completed some research on the artifacts and much of the work for the publication of the catalogue, but the entire collection includes over two thousand individual items. Incorporating them into a geodatabase will be a lengthy process. The final product will be globally referenced and able to be integrated into larger scale projects, or examined on a minute level. This type of database allows for the spatial examination of different classes of artifacts with relation to the location of the hull remains or the topography of the site, among other possibilities. The entire project should be completely ready to be included in the broader analysis of the Pepper Wreck by the summer of 2001.

*Acknowledgments:*I would like to thank Dr. Kevin Crisman, Nautical Archaeogy Faculty Fellow at Texas A&M Univerity, and of INA, for securing funds to fly me to Portugal to work, and also for his sound advice on every aspect of this project. I would also like to thank Francisco Alvarez of CNANS for providing room, board, and all manner of supplies while I was in Lisbon.

For all their assistance this summer, I would like to thank Texas A&M University Nautical Archaeology Program graduate students Erika Laanela, Mason Miller, Brian Jordan, and most especially Filipe Castro and Anthony Randolph. The staffs at CNANS and the Museo da Marinha were also instrumental in the successful completion of my work this summer.

New Underwater Archaeological Evidence from Pantelleria

Marco E. Chioffi and Sebastiano Tusa

The Quarterly *welcomes submissions by INA members concerning their work in the field of nautical archaeology. Dr. Chioffi is well known for his discovery of dozens of wreck sites off the coast of Tuscany. Since 1980, he has been working on the island of Pantelleria, in the crossroads of the Mediterranean west of Sicily and northeast of Tunisia. Dr. Tusa has been the director of GIASS (*Gruppo d'Indagine Archeologica Subacquea Sicilia*) and of* Sezione per i Beni Archeologici della Soprintendenza per i Beni Culturali ed Ambientali di Trapani *since 1999. Both men are renowned among Italian archaeologists as the authors of numerous books and articles on Mediterranean archaeology. In the summer of 2000, Dr. Chioffi, Dr. Tusa, and their co-workers will continue their work on Pantellerian sites.*

Neolithic voyagers reached Pantelleria, a small island halfway between Sicily and the coast of North Africa, by the fifth millennium BCE (fig. 1). Pantellerian obsidian has been found at ancient sites in Sicily and Malta. This volcanic glass was the main attraction in that period because it was superior to flint for producing tools and weapons. Although it is clear the island was visited in that period, no Neolithic sites have yet been found on Pantelleria.

The most ancient traces of human occupation are dated to the Early Bronze Age (beginning of the second millennium BCE). One of the largest and most interesting sites of this period in the entire Mediterranean has been excavated at Mursia on the northwestern coast. The settlement of round or oval huts was fortified by a high and massive defence wall, still well preserved and clearly visible. Outside the settlement was a large graveyard including several megalithic tumuli or stone cairns where bodies were buried in small tholos-like chambers. These—locally named *sesi*—are unique monuments in the panorama of Mediterranean pre- and protohistory.

Beside its prehistoric occupation, Pantelleria has had a long historical settlement. An early historical source (Pseudo-Skylax) describes the time Punic ships needed to reach the island during the fourth century BCE. During the Phoenician, Punic , and Roman periods, the political center of the island was an acropolis, a high place not far from the modern town in the area of San Marco and Santa Teresa. Although no real archaeological excavation has yet been done, it is possible to see many traces of buildings, mosaic pavements, well-defined stucco walls, and water tanks amidst the fields. Another important place during the same period was the Lake of Venus where we are excavating a Punic sanctuary dedicated to Astarte.

It is known from both literature and a recent field survey of the island that Pantelleria (then called Cossura) was very rich in the Roman period. The island was one of

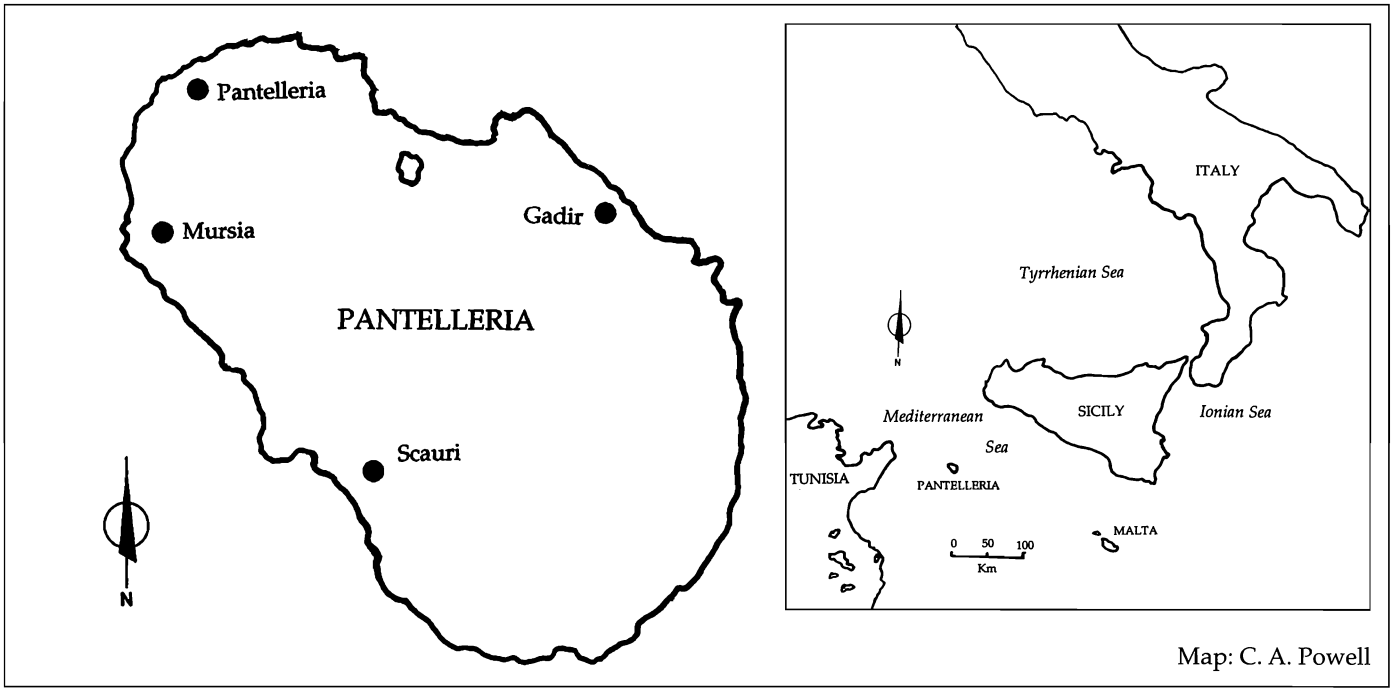


Fig. 1. *Pantelleria occupies the crossroads between Italy and Africa, and the Eastern and Western Mediterranean.*

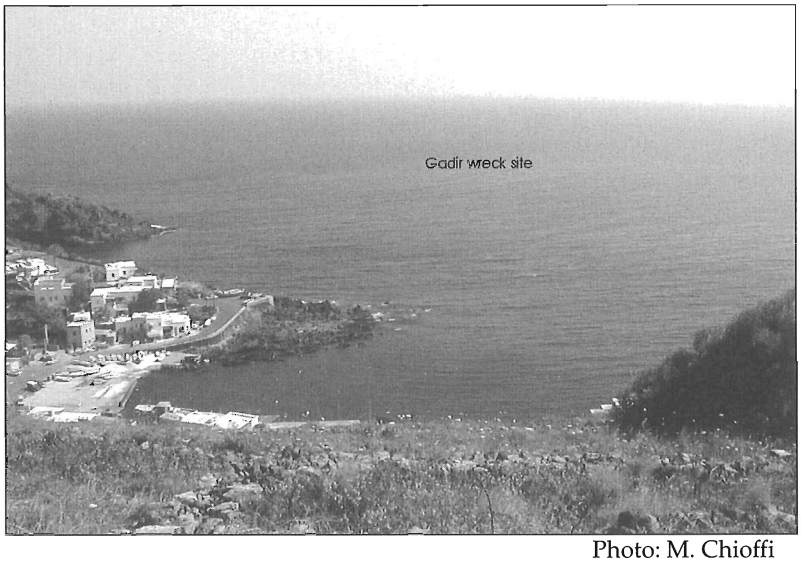


Photo: M. Chioffi

Fig. 2. *The waters of Gadir Bay hide a remarkable ancient shipwreck site.*

Fig. 3. *The amphora mound in Gadir Bay has yielded a wide variety of types.*

Photo: M. Chioffi

the main Mediterranean strategic trading ports after it became a Roman possession in 217 BCE (although Carthage tried to reconquer the lost territory for some years without any real result). By the first century BCE, Pantelleria had become one of the richest ports in the Mediterranean. It remained such until the Vandal conquest in the fifth century CE ended the island's most prosperous period.

These centuries of ancient commerce must have left evidence behind. Gadir Bay ranks high among the most likely ancient landing places for cargo ships from the south and east (fig. 2). It contains all the fundamental requirements of an ancient landing place, including an excellent natural shelter (from all except east winds) and a nearby spring of drinkable water. In the past, the sea penetrated inland for an additional 200 m, which would have made the landing place safer.

We have been exploring a mound of amphoras in Gadir for eighteen years in an attempt to pinpoint where the ship or ships that transported them are buried. The amphoras, covered by sand or mud, lie in the cove within a radius of about 300 m at depths varying from 27 to 42 m. Clandestine divers pillaged the site, but fortunately they disturbed only the visible part of the cargo. The amphoras so far recovered include Punic jars of twelve different types ("holemouth" included), Graeco-Italic types, and Roman examples of the Dressel lA, lB, lC, 2-6 types (fig. 3). These are unmistakable testimony to the presence of multiple shipwrecks here from the fourth century BCE onward.

Using the remotely operated vehicle (ROV) *Pluto*, we have started a systematic survey of the deeper areas near Gadir in collaboration with the *Carabinieri* (national police). A wide area of about 40,000 square meters at a depth between 50 and 120 m was surveyed (fig. 4). The gently sloping sea bottom shows many amphoras scattered down from the wreck site. We found both Punic and Italic amphoras, including Mana C 1, Mana C 2, Greco-Italic, and Dressel 1A 1, 1A 2, 1B, 1C, 2, 4, and 18. These data from the deep survey reinforce the idea that the Gadir site includes more than one wreck. Despite the severe damage from looters, the mound is well worth further study.

Two hundred of the Gadir amphoras are included in an exhibition at the Castle of Pantelleria arranged by the authors each summer since 1998. We will be very pleased to tell the story of each of these amphoras to every INA member who visits. A catalogue with four hundred photos and explicating text is available.

We have also explored natural landing place on the opposite coast of Pantelleria near Scauri. There we found the traces of wreck in front of the shoreline where we located traces of an industrial area. In the Late Roman period, the kilns in this region produced one of the most common wares exported to North Africa, Italy, Spain, and

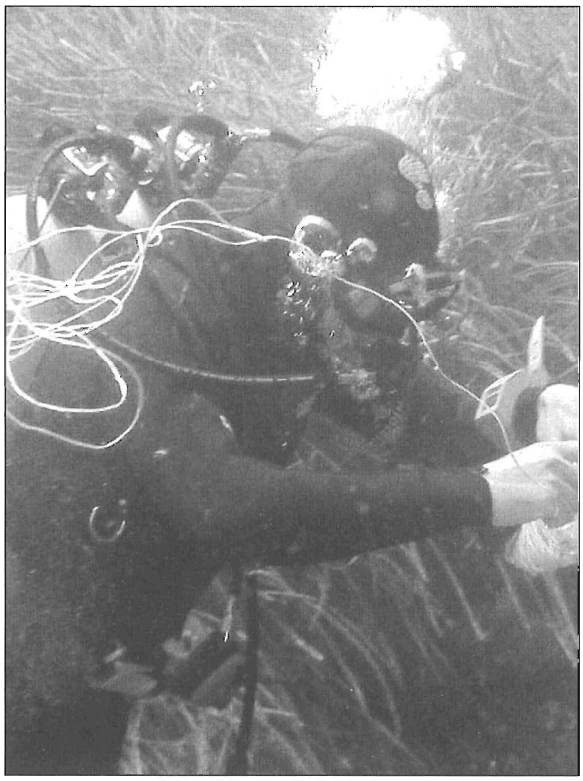


Photo: M. Chioffi

Fig. 4 (above). *An underwater archaeologist exploring the Gadir site.*

France. Pantellerian ware was used mainly for cooking purposes (fig. 5). The vessel near Scauri we are excavating was full of this pottery packed in straw. A fire destroyed the ship, which then sank offshore.

The excavation has shown the presence of a variety of Pantellerian ware from the cargo, as well as some Late Roman amphoras. Items used by the crew included dishes of *sigillata africana D* type with impressed palmettes, African lamps, glass bottles, and a game made of animal bone. We also discovered a silver ring with a carnelian gem decorated by an arrow-like incision and some glass beads. Wild pig and sheep bones were associated with the food storage of the vessel.

The vessel sank at the end of the fifth century CE. It is still too early to have any real idea of her route. However, due to the presence of late African elements among the crew items, we suspect they were coming from North Africa and sailing towards Sicily after loading a rich cargo of Pantellerian ware. Our future campaigns should certainly help us to solve this problem (fig 6).

Fig. 5 (below left). *Pantellarian ware was a common form of utility ceramics during Roman times.*

Fig. 6 (below right). *The keel of the Roman vessel the authors are excavating near Scauri.*

Photo: M. Chioffi

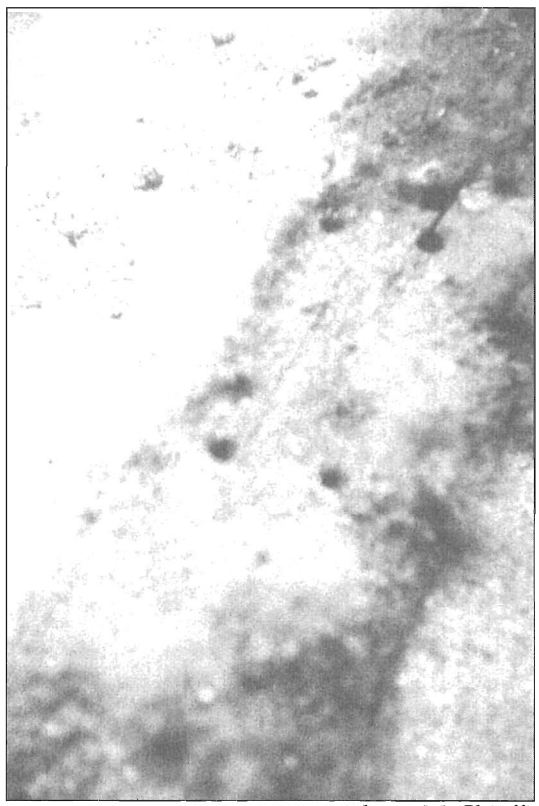


Photo: M. Chioffi

Diving into Knowledge: Two Schools for Scientific Divers

William H. Charlton Jr.

As a Ph.D. candidate in the Nautical Archaeology Program at Texas A&M University (TAMU) and INA's Diving Safety Officer (DSO), I have access to some truly exciting educational opportunities. For example, I served on the staffs of two different scientific diving training programs between May 3 and June 18, 2000. Both of these, conveniently enough, were in Panama City, Florida, where I arrived by a complicated route.

Scientists of any discipline who want to work on projects sponsored by institutions other than their own need to be trained to an accepted standard, and then need some way of proving their training and experience. That training standard in the underwater sciences of modern-day America has been established by the American Academy of Underwater Sciences (AAUS), and the method of proving one's training and experience is by attaining an AAUS Scientific Diver rating. However, the main TAMU campus in College Station does not have a scientific diving training program. There is a need for such a program, not only for our own Nautical Archaeology Program students, but also for students of other disciplines, (such as Wildlife and Fisheries, Biology, and Oceanography) who want to do their science underwater.

Dr. Tom Iliffe, a professor of Marine Biology at Texas A&M University at Galveston, teaches an AAUS scientific diving training course to students of the marine sciences at the Galveston campus. This course consists of an academic course on preforming scientific research in the sea during each spring semester. This includes a lot of in-water training in the black-water bayous of Galveston Island. The Galveston course is followed by a two-week trip to Florida at the beginning of each summer, which provides students with a broader experience. Iliffe's students are exposed to open-water and shore diving along the coast around Panama City and to diving in the freshwater springs of north-central Florida. As an A&M Diving Safety Officer, I joined the trip this summer to evaluate the Galveston program and to determine whether I would recommend that students of all disciplines from the main campus participate in the Galveston training course.

Photo: SITS

Fig. 1. *"The Scientist-In-The-Sea" Program emblem.*

Shortly after I had arranged with Dr. Iliffe to participate in his trip to Florida, I was contacted by Gregg Stanton, whom I have known for a number of years. Gregg conducts the "Scientist-In-The-Sea" (SITS—fig. 1) program at Florida State University's Panama City Campus. The SITS program is a six-week-long course designed to teach graduate students from any science discipline who want to conduct their science in the water. It teaches safe management practices for underwater research and state-of-the-art underwater research and life-support technology. An additional aim of this program is to enhance the students' diving skills. As we should all realize, if you are not a good diver you will not be able to do good research underwater.

Gregg asked me to work on his staff for the SITS program. I said "I'd love to work on SITS with you, Gregg, but I've already agreed to go on the TAMU-Galveston trip, which is during Weeks Two and Three of SITS." He responded with "Four weeks is better than none; I'd still like to have you." So, that's how I got to work with both these programs. I arrived in Panama City on May 3 to help set up for SITS and participate in Week One. While in Panama City, we lived at the Bachelor Quarters on the U.S. Navy's Coastal Systems Station (CSS) and ate in the Base's Mess Hall.

SITS: Week One

Week One consisted of introductions to the Navy Base and key personnel on the SITS Staff. We also had a tour of the Navy Experimental Diving Unit (NEDU). John Clarke, Ph.D., a SITS graduate, is the Scientific Director of NEDU, as well as the current SITS Academic Advisor. We would work closely with Dr. Clarke and a number of other people from NEDU. We were next introduced to the Naval Diving and Salvage Training Center (THE Navy Dive School). We would spend a lot of time in and around the Dive School, using their classrooms and training pool, and receiving training lectures from their senior staff. The Navy Base itself is deeply involved in undersea research. John Camperman, Ph.D., another SITS graduate, is an Ocean Engineering researcher and SITS advisor.

The remainder of Week One included diving equipment issue at the SITS Dive Locker, located in the National Marine Fisheries Service bayside facility. This is the same location where TAMU-Galveston's sea turtle research is carried out. Following diving check-outs in the Dive School's Training Pool, we had a full two-day scuba equipment repair clinic given by Tom Allen of Scubapro, a former Navy SEAL. We had a full day of how-to lectures on underwater photography (fig. 2) and practical application in the Training Pool. This week's lectures, though, were highlighted by the History of Diving lectures, including not a few sea stories, by now-retired hyperbaric physician and U.S. Navy Captain Claude Harvey. Claude Harvey was the successor to U.S. Navy Captain George Bond, the founder of Navy saturation diving, and he has lots of tales to tell.

TAMU Galveston Training Program

At the end of SITS Week One I met up with Tom Iliffe and his Galveston students on their arrival at the Navy Base. This group also stayed in the Base's Bachelor Quarters while they were in Panama City. We spent the first two days of this trip doing open water dives from a boat from the local Hydrospace Dive Shop. This was a great experience for the Galveston divers, and turned out to be the first deep-water (70-100 feet) open ocean dives for some of them. My first task with this group, though, was to train and certify them all as Nitrox divers. Nitrox (see *INA Quarterly* 25.4, 14–15) is an oxygen-enhanced breathing mixture that allows increased dive duration.

The next two days were spent diving from the beach in the vicinity of Panama City. Since they didn't need my help, I went back to SITS. During these two days, SITS received training in Aqua Lung's "Oxy-Lung" full oxygen rebreather from Bill Brumiller and Dominique Sumian (Fig. 3). Brumiller is a former Navy SEAL, and Sumian is a long-time associate of Jacques Cousteau and dive supervisor on many of Cousteau's expeditions. The Oxy-Lung is similar to the LAR-5 full oxygen rebreather used by U.S. military special warfare troops.

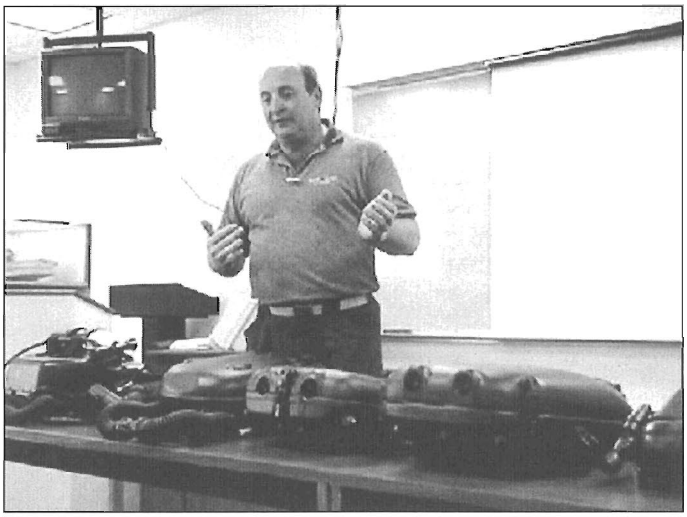


Photo: SITS

Fig. 3. *Dominique Sumian, one of Jacques Cousteau's long-time Divemasters, teachers Aqua Lung's full-oxygen rebreather to the SITS students.*

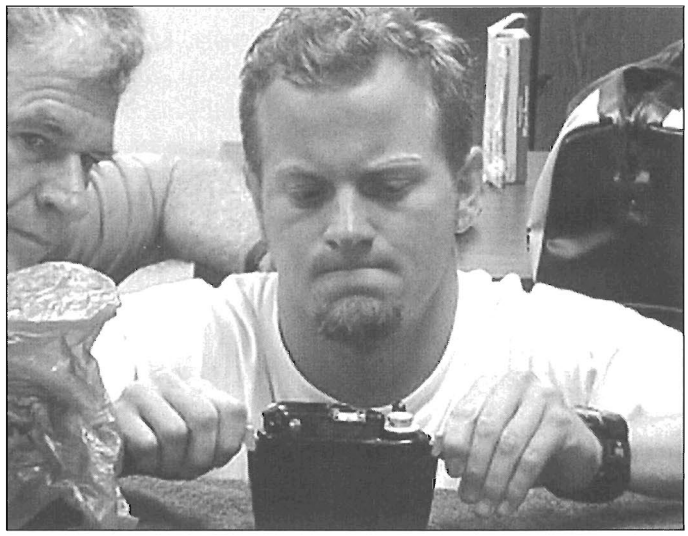


Photo: SITS

Fig. 2. *Bill Charlton and SITS student Jason Raupp check a Nikonis III during an underwater photography training class.*

The next week with Tom Iliffe's group would teach even an old diver like me a few new tricks. He trains all his students as Cavern Divers. For the uninitiated, a cavern is that entrance area of a submerged cave where natural daylight can still be seen. For the Cavern Diver certification, incursions are limited to shallower than seventy feet of depth and less than one hundred thirty feet of penetration, with at least forty feet of visibility. Tom Iliffe is a world-recognized submerged cave biologist. Some might think that he trains his students in cavern diving to entice them into cave diving, but this is not the case. His intent is simply to make them better divers. Cavern diver training stresses buoyancy control, attitude and trim in the water, and a better equipment configuration than is usually found on open water divers.

Just by chance, the day before the Galveston students were to drive home to Texas, the National Speleological Society's Cave Diving Section had their national conference in Lake City, Florida, not far from where we were staying. This is one of America's preeminent cave diving research organizations. There could not be a better way to introduce the students to the world of cave diving, even for those who would not be interested in taking part. One student even won a $1000 cave light system in the conference raffle! While there, I met Jim Bowden and Ann Kristovich, leaders of the team exploring the Zacaton Cenote in northern Mexico. Their presentations made quite an impression on me and made me decide to undertake cave diver training.

SITS Continues

Once the Galveston students had departed, I returned to SITS full-time. Tom Iliffe also stayed for the next week to give the SITS students the benefit of cavern diver training. At the same time, Gregg Stanton took two other cavern divers and me for the next step into cave diver training. When that week was over, it was back to Panama City where we undertook training on the Cis-Lunar fully-closed rebreather (fig. 4), the "Cadillac of rebreathers," from Jill and Paul Heinerth. The Heinerths were members of the U.S. Deep Cave Team that mapped Florida's Wakulla Springs submerged cave system.

After a long drive down to Key Largo (700 miles), the next week was spent at the Marine Resources Development Foundation. The SITS students and I (because I had not done it before), in teams of three, made forty-eight-hour-long saturation dives in the underwater habitat there. This included living in the habitat, and a lot of time in the water on hookah hoses (surface-supplied air) doing various scientific projects, but without surfacing for 48 hours. This qualified us as saturation diver "Aquanauts." After their "sat dives," each team was able to make a dive on the famous *Aquarius* habitat, located three miles off the shore of Islamorada Key, which is operated by the National Oceanographic and Atmospheric Administration (NOAA) and the National Undersea Research Center (NURC) of the University of North Carolina at Wilmington (UNCW). This was quite a treat because the area around *Aquarius* is restricted and few people get to dive there. While at Key Largo, some of the SITS students also received training on the Drager Dolphin semi-closed rebreather system.

Photo: SITS

Fig. 4. *Bill Charlton prepares for a training dive on the Cis-Lunar fully-closed rebreather under the instruction of Paul Heinerth.*

Photo: SITS

Fig. 5. *SITS students at a Surface-Supplied Diving class, which included helmet and hose diving training.*

After leaving Key Largo, we drove up to Florida Atlantic University's fantastic new "Sea Tech" ocean engineering facility at Dania, near Fort Lauderdale. While there, we toured the facility and received briefings on the state-of-the-art technology going into the newest Autonomous Underwater Vehicles (AUV's). Here I also met Dr. Ray McAllister, FAU Emeritus Professor of Ocean Engineering, who did some of the sub-bottom profiling for Jim Parrent on the Columbus Caravels Project in Jamaica a few years back. Next, we visited Harbor Branch Oceanographic Institute in Fort Pierce, where we toured their extensive ocean engineering facilities and received briefings on some of their most current technology.

Then it was back to Panama City for the final week of SITS. The students spent much time on their final course papers, but we also received some interesting briefings. We saw some of the newest "hard suits" being used for deep ocean work, as well as the Mark 8, Mod. 1 Swimmer Delivery Vehicle (SDV) used by Navy SEALS for clandestine incursions.

The six-week SITS program also incorporated many other topics not previously mentioned. These included Scientific Diving Procedures and Risk Management; Diving Physics, Physiology, and Tables; Recompression Chamber

Operations; Underwater Exposure Suits; and Surface-Supplied Hard Hat Diving lectures (fig. 5) and practical applications, such as using Remotely-Operated-Vehicle (ROV, fig. 6). We went through presentations and practical applications on Oxygen Cleaning of diving equipment, and received extensive information on Fire Hazards in Oxygen Systems. We covered Mixed-Gas Diving, including Nitrox, Heliox, and Trimix. The students received Gas Blending training and certification, and training in underwater crime scene management. We also learned of some of the newest underwater technology being investigated by the Navy Experimental Diving Unit, such as Cryogenic Scuba and Liquid Breathing. Finally, one very important aspect of research received extensive coverage: grantsmanship, or "How to sell yourself and your project to sponsors and get funded."

In my opinion, Florida State University's "Scientist-In-The-Sea" program has to be the best such program in the world. To have such a program, many parts must come together to make the whole, and Panama City is the only place where this can happen. First, Florida State University at Panama City's administration wants the SITS program, and provides great support to ensure that it succeeds. Second, this is the location of the Navy Base, the Coastal Systems Station, and its one-of-a-kind tenant commands, the Navy Experimental Diving Unit and the Naval Diving and Salvage Training Center. The senior officers of these three Navy commands also want the SITS program to happen. Without these key elements, and the partnership that all of them are willing to establish and maintain, the SITS program could not exist.

Credit is also due to the SITS staff led by Gregg Stanton, former head of the Academic Diving Program at FSU-Tallahassee and now head of the Advanced Scientific Diving Program at FSU-Panama City. Gregg is a SITS graduate and former Chief Instructor of SITS. Terry Johnson is a former U.S. Naval officer, a SITS graduate, and recently retired as Diving Officer at Florida Atlantic University. Steve Matthews recently retired as a Navy Chief Warrant Officer-4 (Master Diver) and was the Diving Officer at the Navy Experimental Diving Unit. I was the fourth wheel of this unit.

Photo: SITS

Fig. 6. *A student prepares a small Remotely-Operated-Vehicle (ROV) for operation.*

Recommendations

Would I recommend that aspiring underwater scientists—even our underwater archaeology students—attend the SITS program? Without hesitation, I most certainly would. I have met the products of past SITS programs, and many of them have gone on to long, satisfying, and meaningful careers in the underwater sciences. Attending SITS takes a serious decision. It is a graduate-level program, which during the summer of 2001 will be a ten- or twelve-week course, and requires normal tuition, books, and fees. However, Texas residents can apply to the Southeastern Educational Consortium and get in-state tuition in Florida. Students are also responsible for food, lodging, and transportation. It is not cheap to take part in the SITS program, but I believe, in the end, the benefits will far outweigh the expense and time spent.

Finally, back to the initial reason I decided to go to Florida, Dr. Tom Iliffe's TAMU Galveston scientific diving training course. Would I recommend that students who are aspiring underwater scientists of any discipline from Texas A&M at College Station take the Galveston course? Again, I would not hesitate. This answer, however, requires some discussion. To complete the course, students must take both the spring semester academic course and make the field trip to Florida. Taking both parts gets them well on their way to an AAUS Scientific Diver certification. The academic portion of this course is offered to College Station students via video network from Galveston. However, it is very important that all students in the course also take part in the water work to ensure that their skills are all on a par before the trip to Florida. This would entail trips to Galveston on a few weekends during the spring semester. I realize this may be difficult for some students, but again, I believe the result far outweighs the time and expense.

Acknowledgments: I want to thank Dr. Tom Iliffe and his Galveston students, and Gregg Stanton and the Scientist-In-The-Sea program staff and students, for making this a very memorable six weeks for me. My best wishes to all of you in your future endeavors. Additionally, I would like to thank Dr. Jerome Hall for allowing me to spend six weeks in Florida, while still functioning as INA's DSO via cell phone.

Notes from the Cenotes

William H. Charlton Jr.

The Yucatán Peninsula of Mexico is largely composed of a low, flat shelf of limestone between the Caribbean Sea and Gulf of Mexico. This limestone karst, filled with cracks due to an asteroid impact, has been eaten away by slightly acidic runoff to form numerous caves and sinkholes. Most of these features are filled with water because of the heavy rainfall and high water table. The sinkholes are known as cenotes—the Spanish pronunciation of the Mayan word *dzonot*, meaning a well, or water source. The peninsula has thousands of cenotes, over half of which may still be formally unidentified.

Dr. Thomas Iliffe, Professor of Marine Biology at Texas A&M University at Galveston, has been conducting research in the submerged cave systems of the Yucatán Peninsula for the past ten years. He has often seen archaeological remains in these submerged caves, and has spoken to many other divers who have shared his concern for these sites. However, he did not know of any cave diving underwater archaeologists, so could not pass the information along to someone trained in this discipline.

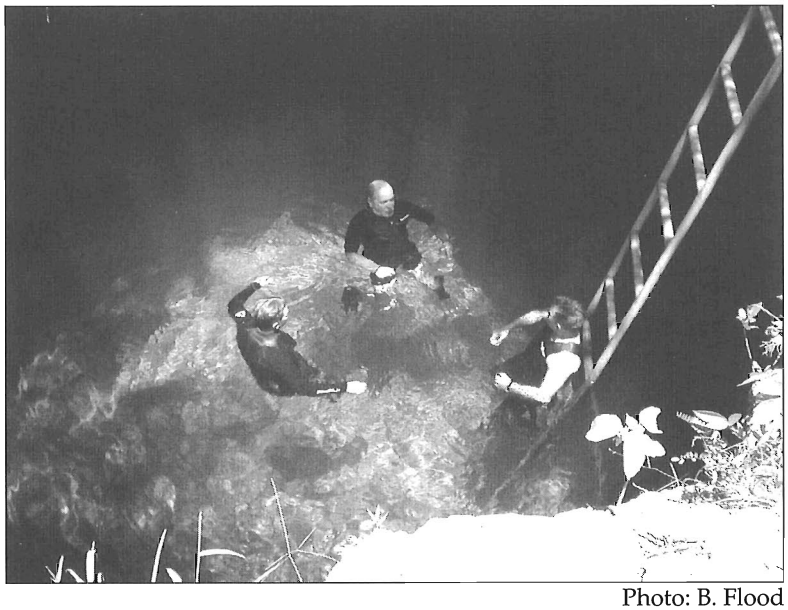


Photo: B. Flood

Fig. 1. *Tom, Bill, and Scott cool off before suiting up for a dive into the "Temple of Doom" cave system (after a long hike through the jungle to the cenote).*

I met Tom Iliffe during a project in Florida in May 2000 (see preceding article). When he learned that I was interested in becoming a cave diver, he shared his concerns about the Yucatán. Therefore, when I had completed my training, I joined Tom on a July trip to the peninsula. While there, I could dive and become familiar with the cave systems, and investigate the potential for doing underwater archaeology. Accompanying us on this expedition were Beverly Flood, Tom's undergraduate assistant and Scott Webb, his graduate student in Marine Biology. My sincere thanks to Dr. Donny Hamilton, Head of the Nautical Archaeology Program, Department of Anthropology, Texas A&M University in College Station for providing the funding so I could make this trip.

We flew into the Cancun airport, and spent the night in Akumal ("Place of the Turtles" in the Mayan language) in the Mexican State of Quintana Roo. Here we met with Tom's friends at the *Centro Ecologico Akumal* (CEA). The next morning, we drove up to Puerto Aventuras, where we met with Mike Madden, a well-known American dive guide. He loaned us three sets of double aluminum 80 cubic foot scuba tanks for the length of our stay (Beverly Flood is not a diver, yet). This would save us quite a bit of money on tank rentals.

Then it was off to our first cenote dive. As will be seen, many of the cenotes and their associated cave systems have been given colorful names by the cave divers. We dived Cenote "Temple of Doom," a small but beautiful cave system. There are no known archaeological remains in this cave, but Tom and Scott were able to begin their collections of cave creatures. They found mainly a small shrimp that is about a half inch long, from the genus *Typhlatya*, and another species about a quarter inch long from the order Thermosbaenacea. This was my first cave dive after my cave diving course—a fantastic new experience for me. I found that one certainly cannot be claustrophobic and dive in caves.

The next day, we went to meet with Nancy DeRosa, the American owner of Aquatech Villas DeRosa, one of the best-known technical and cave diving operations in Quintana Roo, and a long-time friend of Tom Iliffe. Nancy told us about her efforts at ecological conservation in her area; there is a lot of destruction of the habitat in the name of tourism along this area of the coast, known as the *Riviera Maya*. Nancy also offered us tank and air fill support for our stay.

Then it was off to cenote *Aktun Ha*, known to American divers as "Car Wash."This system has some spectacular stalactites, stalagmites, and complete columns, but no archaeological remains (fig. 2).

Nancy DeRosa and Steve Gerrard, the famous American cave photographer who also lives in Mexico, told us about a cenote that only a very few people know about

Photo: B. Flood

Fig. 2. *Surfacing after a dive into the "Car Wash" cave system.*

(fig. 3). There is a small stone shrine on land just outside the cenote. About four hundred feet inside the submerged cave there is another stone shrine with a complete human skeleton laying on top of it. It seems to those who have seen it obviously to be an ancient burial that was conducted when the cave was dry. The question is, how long has the cave been submerged? Tom Iliffe tells me that the general belief on this question, as a result of sea level change studies, is that the cave systems in this area of Quintana Roo have been wet for approximately the last eight thousand years. This brings up some very interesting questions about this burial. Since the Mayans have been in this area for only about the past four thousand years, did this burial actually occur some four thousand years before the Maya arrived? Only proper scientific investigation can answer this question.

After four days diving in Quintana Roo, we crossed the peninsula to Mérida, capitol of the Mexican State of Yucatán. This is one of the oldest cities in the New World, founded in 1542. We went to the *Secretaria de Ecologia* (SECOL), where Tom Iliffe met with his main point of contact when working in this area, Carlos Varguez. Carlos is a member of the Cenote Project, a separate section within SECOL whose sole job it is to document all of the cenotes in the State of Yucatán. At Tom's request, the Head of the Cenote Project, Jose Antonio Ruiz Silva, arranged a meeting for us with the Director of the *Institutio Nacional de Antropologia e Historia* (INAH) for the State of Yucatán, Alfredo Barrera Rubio. While at SECOL Andreas (Matt) Matthes, a well-known German deep cave explorer now living in Quintana Roo, came into the office. We were all saddened to learn that one of Matt's dive buddies had died on a deep dive they were conducting just a few days earlier.

Tom, Scott, Matt Matthes, Carlos Varguez, Jose Ruiz, and I went to the meeting at INAH. We discussed the possibility of doing collaborative work with some of the Mexican archaeologists to help them document cenotes that have evidence of ancient human usage. The Director then called in the Coordinator of his archaeological team, Dr. Fernando Robles (a student of Gordon Willey at Harvard), to join the discussions. We determined that I must submit any proposed work that I wish to initiate on my own in a proposal to the Federal Government in Mexico City for approval.

After our meetings, we packed up our dive gear. Tom wanted to return to Cenote Kambul at the village of Noc Ac just north of Mérida, so Scott could try to find more specimens of the cave shrimp he is studying. They were successful. We returned to town for further meetings with Roger Medina, Professor of Biology at the *Universidad Autónoma de Yucatán* (UADY), and Dr. José Alberto Pérez Romero, Professor of Anthropology. Alberto is working on Mayan-period studies and is very interested in what may be found in the cenotes. He has a student who is a certified diver who may be interested in working in the cenotes with me.

The next morning, we met Carlos Varguez and Matt Matthes at SECOL for a trip to the area of the village of Homun about sixty-five kilometers south of Mérida. Homun is well known for the large number of cenotes in its surrounding area, some of which are frequented by cave

Photo: B. Flood

Fig. 3. *Exploring a previously-unknown cenote site.*

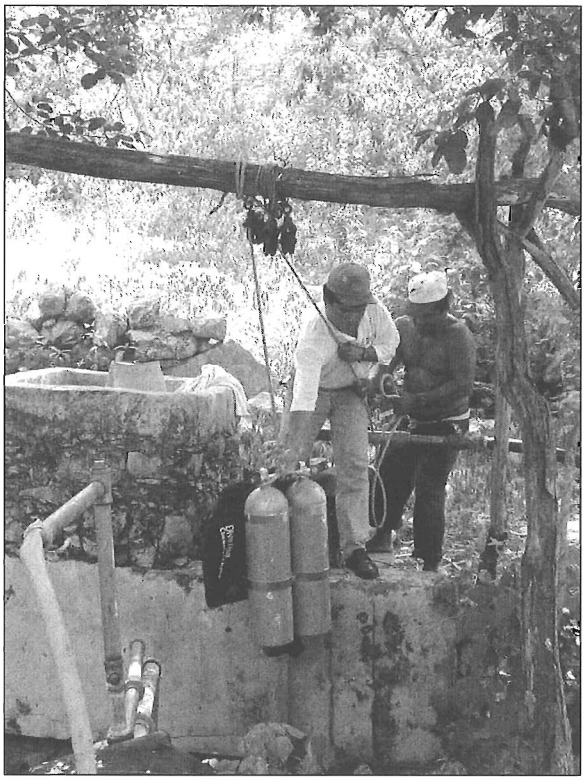


Photo: B. Flood

Fig. 4. *Lowering a set of double tanks into cenote Kakuel. The water is forty feet below.*

divers. These cenotes are all part of the famous Ring of Cenotes around Mérida. This resulted from the asteroid impact that occurred at the end of the Mesozoic at what is now known as the Chicxulub Crater (the "x" is pronounced "sh").

In Homun, we picked up our Mayan guide who took us to some cenotes that may well never have been seen by outsiders before. Some of these are easy to enter, some are not. For one cave, we had to crawl into a two foot wide hole and down a winding shaft about twenty feet until we saw a twenty foot drop into a pool of water. A portion may have seen human use in the past, other than solely as a water source. The only way to identify these would be by making a diving excursion into each one. Many cave divers report the presence of broken pottery in cenotes and caves all across the Yucatán Peninsula, but the age of such remains cannot be determined without proper scientific testing.

The next morning, we picked up Carlos at SECOL for another trip into the Ring of Cenotes south of Mérida. We drove through the Yucatecan jungle over some very rough tracks to a remote cenote Tom had never seen or heard of before. After recording the site with photography and GPS (Global Positioning System)—as we did at all the cenotes we visited—we drove to Cenote Xbatun. Matt Matthes reported having seen bones in the cave and burials in the cliff above. We dived the cenote and sure enough, the cave floor is littered with bones, as well as a lot of broken pottery. While I am not an osteologist, it was obvious that many of the bones were either too large or too small to be human. However, some certainly could fit the category and those were only the ones appearing on the surface. There could be, and probably are, many more below. Excavating in a cave, however, would be extremely difficult. Silt accumulation is a constant problem, and when silt is stirred up, visibility can go to zero. We would have to devise a new set of dredging tools and techniques for such a project. It is not impossible, just challenging!

After a day for Tom to catch up on his lab work, we were off to the jungle again. We picked up a Mayan guide who has worked for divers before—Dionicio—who took us far into the jungle to Cenote Kakuel (fig. 4). This was a cenote with a five-foot-wide opening into a large, dark cavern below ground. We had to climb down a rickety iron ladder, which was tied to some tree roots, to a small patch of muddy earth about forty feet below. Our dive gear was lowered by rope, since we could not carry or wear the gear while climbing down the ladder. Tom and Scott caught some more cave creatures.

The next day, we dived Cenote Chi-Huan, which contains a human skeleton. The skeleton is completely disarticulated, but the skull and lower jawbone are side by side. Although I did not touch it, the skull appears not to have had any damage, i.e., cracks or breaks. The jawbone exhibits teeth that appear to be in good condition, i.e., no visible decay, and no dental work had been done to them. I have no way of guessing at an age for these bones.

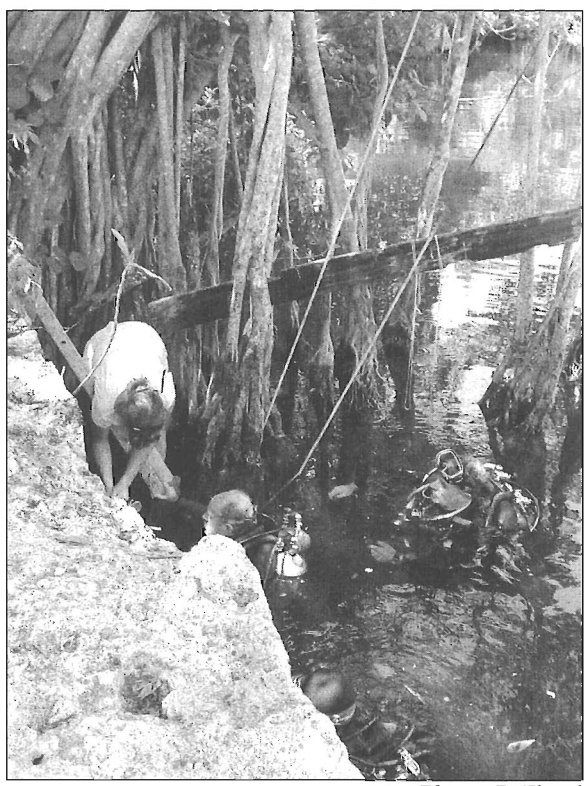


Photo: B. Flood

Fig. 5. *Tom and Bill prepare to descend into cenote Aayin-Aak's cave system.*

After our dive, Carlos took us to see two large cenotes, one just before and one in the town of Libre Union. Both are huge open pits with the water level at least sixty feet below ground level and no way to get down to the water. To Carlos' knowledge, neither has ever been dived. These types of cenotes, I feel, offer the greatest chance of finding in situ archaeological remains, but would be difficult to do because of the logistics of getting divers into the water. Again, not impossible, just challenging.

While diving Cenote Aayin-Áák (named after its most noticeable inhabitants: crocodiles and turtles—fig. 5)), I got to experience my first complete silt-out. This occurs when one is completely immersed in talcum powder-like silt and cannot see anything. A diver simply must follow the line he or she laid into the area back out, completely blindly. Cave divers try their utmost not to stir up silt while passing through a cave, but sometimes there is nothing one can do about it. In this case, we three divers were going through a long, narrow passage no more than about three feet in diameter. The surfaces all around us were covered in very fine, powdery silt that was released into the water column as soon as we passed by it. We were very quickly rendered completely blind. In such a case, one must get all team members turned around and headed out, all by touch. Like I said, you cannot be claustrophobic and dive in caves (fig. 6).

Matt Matthes invited me to attend their Third Annual Cave Diving Symposium to be held in Mérida in November 2000, for which he is one of the senior coordinators. He also feels a strong need to have a cave-trained underwater archaeologist, who is interested in Yucatecan studies, involved in all of their official activities. Matt has also asked me to contribute to an underwater checklist that he is putting together. He will give this to cave divers so they can report archaeological remains from the caves they dive, as well as other areas of scientific research, including biology and geology. There are a number of additional opportunities opening in the Yucatán for archaeological exploration of cenotes where other divers have already found artifacts or remains. This is potentially a huge field for our discipline.

Acknowledgments: I would like to take this opportunity to thank all those people who were involved in this reconnaissance trip. I especially thank Dr. Donny Hamilton for his support and continued interest.

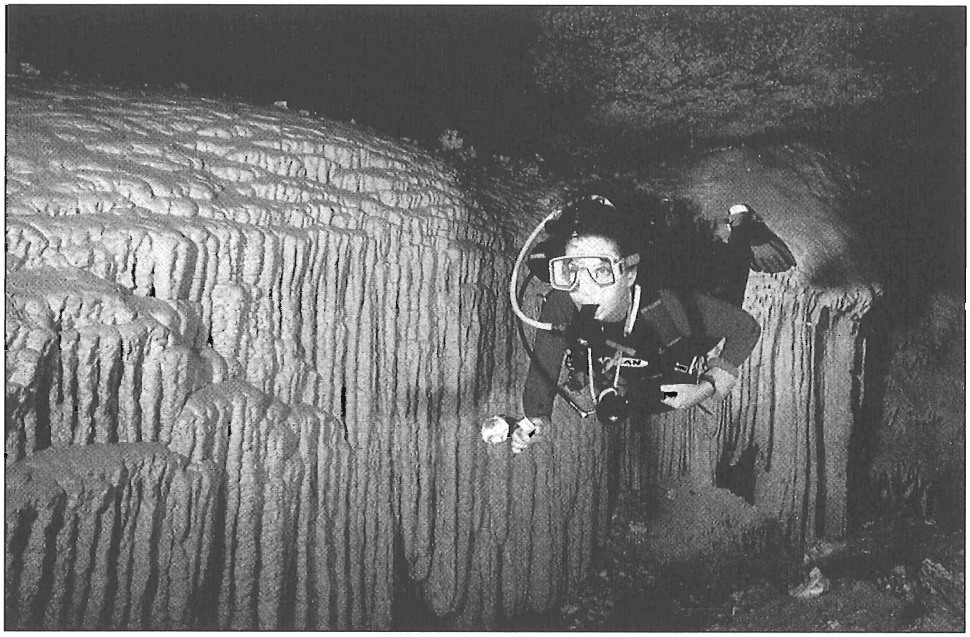


Photo: S. Gerrard

Fig. 6. *Nancy DeRosa exploring one of the many cenote and cave systems of the state of Quintana Roo, Mexico.*

Notes From The Cenotes—Dos
III Encuentro Internacional de Espeleobuceo

William H. Charlton Jr.

The first two International Cave Diving Encounters (*Encuentros Internacional de Espeleobuceo*) sponsored by the *Secretaria de Ecologia* (SECOL) of the Government of the State of Yucatán in 1998 and 1999, were concerned only with the sport of cave diving. This was the main thrust of the *III Encuentro Internacional de Espeleobuceo*, held in Mérida during November, 2000, it also focused attention to a variety of underwater sciences. I thank Dr. Donny Hamilton for enabling me to attend the conference and pursue a new direction in underwater research.

Andreas (Matt) Matthes, the German deep cave explorer I met in July, had conceived a project designed to conduct underwater scientific research. A consummate cave diver and explorer, Matt is also very concerned with the safety of the environment he loves: the cenotes and cave systems of the Yucatán. He was able to convince a number of Yucatecan business enterprises to sponsor some very important research into the peninsula's primary source of water. With the help of trained scientists—all volunteers—he put together a "dive report sheet" that covered biology, geology, hydrology... and yes, even underwater archaeology. I contributed the archaeology checklist.

A team of volunteer divers, including some diving scientists, spent two weeks, spanning both ends of the three-day Encounter, gathering data from a number of cenotes and caves in the Mérida area. They made deep penetrations into the caves and reported on the types of cave creatures and geological features they saw, and took water samples testing. They also reported any evidence of human usage, such as ceramic pottery and bones, in these cenotes and cave systems. Matt intends this as just the beginning of creating a data bank on all scientific aspects of the water systems of the Yucatán. Many more such projects will gather data to be used in conjunction with the inventory being conducted by the Cenote Project of SECOL.

At the Encounter, I saw Nancy DeRosa, who had submitted my name to the United Nations as the underwater archaeologist to document the submerged shrine and burial mentioned on page 21. She told me I should be ready to come down as soon as she got word to proceed. I also met Octavio del Rio, assistant to the Director of Underwater Archaeology for the *Institutio Nacional de Antropologia e Historia* (INAH) in Mexico City, and Carlos Sosa, a member of the Encounter Staff and a life-long avocational archaeologist throughout the Yucatán, who knows most of the practicing archaeologists in the area.

Finally, I would like to mention two acquaintances from my early summer work in Florida who became my friends during this Encounter, Jim Bowden and Ann Kristovich, D.D.S. Jim is the founder and leader, and Ann is the co-leader, of the *Proyecto de Buceo Espeleólogico de México y América Central*, the Cave Diving Exploration Project of Mexico and Central America. They have explored wet and dry caves in Mexico, Belize, and Guatemala, but are best known for their accomplishments in the Zacatón cenote system in the state of Tamaulipas in northern Mexico. Zacatón is the deepest known water-filled pit in the world, measured at a depth of 1,080 feet. Jim holds the men's depth record for a dive on open-circuit scuba (trimix) for his dive to 925 feet in Zacatón in April of 1994. Ann formerly held the women's depth record, 554 feet in Zacatón in September of 1993. As with everyone I spoke to at the conference, these world famous cave explorers and deep divers are interested in the work we do in INA and all hope that the future will generate a greater understanding of cave archaeology.

Profile

M. Gail Vermillion

The Institute of Nautical Archaeology has welcomed a new member to the family. Many INA patrons may already have met M. Gail Vermillion, who became the Director of Development in July 2000. She has brought great enthusiasm to the position, along with her experience and talents. Gail has been associated with Texas A&M University for twenty years. She received her Bachelor of Science degree in 1984 and her Master's degree in May 2000. Gail has taught for the past three years as a lecturer in the A&M Marketing Department, leading classes in Advertising, Promotion Strategy, Personal Selling, and Sales Management. While teaching, she has also worked as a sales and management consultant. She helped companies to improve communication, increase management effectiveness, build cohesive teams, improve sales, develop accurate job descriptions and specifications, reduce turnover, and improve profits through better hiring decisions. Before rejoining the A&M community, Gail held important sales and marketing positions with Procter and Gamble, Helene Curtis, Black and Decker Power Tools, and Primera Vision, Inc.

Shortly after she joined INA, Gail attended the quarterly Executive Committee meeting in Turkey. The mix of modern and traditional cultures in Istanbul captivated her. "Istanbul is a diverse city," she writes, "where mosques sit right next door to high-rise office buildings." As a marketing expert, it is high praise when Gail describes the carpet merchants of the city as "by far the most persuasive and courteous salesmen I have ever met." She felt a special connection to Hagia Sophia, Justinian's church that Mehmed the Conqueror converted to a mosque after the Islamic conquest in 1453. The discovery of America, Gail points out, was a consequence of Columbus' search for a new route to the Indies after the Turks cut off direct access. The faint traces of the original Christian decoration in Hagia Sophia are therefore linked to Gail's own birth in Dallas. "Archaeologists always say that things tie together by different threads and tell a story about more than just whatever building or artifact you see."

Gail next attended the opening of the Bronze Age Exhibit Hall in the Bodrum Museum of Underwater Archaeology. "It was very strange and unexpected to attend a ribbon cutting where I could only understand two words. I would smile and nod as though I understood everything, and thankfully they said the two words I knew over and over… 'George Bass!'" She was very impressed with the exhibits showcasing the work of INA in excavating the Uluburun ship. "One room contained a cross-section of the ship that illustrated where everything was placed. This showed how cramped the ships were when traveling. The same room also replicated the ocean floor with artifacts placed where they had been sitting since 1300 BCE. The Bodrum museum exhibits got me so excited about nautical archeology that I was ready to say, 'Forget marketing, I need to become a nautical archeologist!' There were just so many new and interesting things to learn."

The INA group then traveled to Tektaş Burnu to watch the INA crew directed by George Bass excavating a Classical Greek shipwreck. "During our days on the site, the directors took rides in the new INA submersible so they could see the shipwreck and watch the divers at work uncovering and raising artifacts. There was nonstop action, but little in the way of entertainment… apart from the four new flushing toilets. The only way to communicate with the outside world was a few temperamental cell phones that might work if you were hanging off the cliff upside down. However, that cliff overlooks a sea that is a color of blue I had never seen before, with the Greek islands on the horizon. The spectacular scenery made up for many of the discomforts. Still, I found my earlier thoughts of becoming a nautical archaeologist fading away. I suppose I am more addicted to some of the comforts of home than I had realized.

"We sailed away from the site late in the afternoon, waving at the archaeologists as we left. I am not sure who was more relieved, those of us on the boat who knew we would be home soon, or those we left behind who knew they could get back to work without interruptions. Everyone agreed that we had just spent a wonderful three days on the site seeing and learning things that cannot be learned from a book or in class. Many of us were operating on brain overload and only wanted time to process all the new information."

Gail lives in College Station. She describes her family as "Me and my dog Topher, two wonderful sisters, and my Dad. My favorite thing in the world is to spend time with my nieces and nephew: Karen, Michael, and Abigail, all of whom are perfect!" In whatever spare time her duties with INA allow her, she reads, dives, sews, and windsurfs. Gail is excited to be taking part in discussions about the future of INA. "We share the vision of a worldwide INA that people everywhere respect as the top authority in nautical archaeology." In her new position as Director of Development, Gail Vermillion will help make that vision a reality.

The USS *Philadelphia*... Recaptured?

Brett Phaneuf

In 1997, while searching through countless charts and maps of the North African coast in the Library of Congress for information about shipwrecks in the Mahgreb, I came upon a naval chart entitled "A View of Tripoli in Barbary." Having long been interested in traveling to Libya to search for shipwrecks, I was quite excited. Most importantly, the chart (dated 1804) marked the location of the USS *Philadelphia* in two places, aground on shoals outside Tripoli, and at anchor in Tripoli Harbor (in modern Libya).

In the late eighteenth and early nineteenth century, immediately following the Revolutionary War, American merchant shipping in the Mediterranean Sea and the Atlantic Ocean was under increased pressure from Corsairs. These pirates were stationed along the Barbary Coast in fortified citadels in what is now the Mahgreb—Tunisia, Algeria, and Morocco—and Libya. In response to the harassment of American commerce, financed in part by Great Britain and other European states, a fleet was dispatched to confront the Corsairs, blockade the shores of Tripoli, and ultimately to engage in the Barbary Wars (1801-1805, 1815).

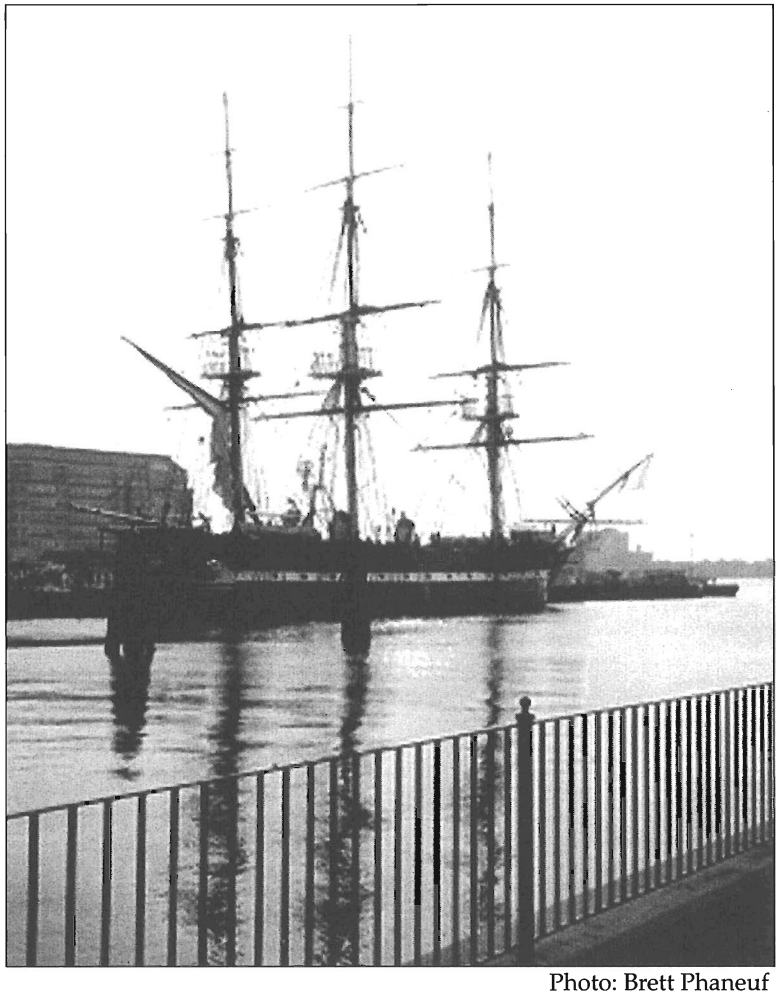


Photo: Brett Phaneuf

Fig. 1. *The* USS Constitution *at dock in Charlestown Navy Yard, Massachusetts.*

The Mediterranean Fleet consisted of several frigates and escorts including the *USS Constitution (Old Ironsides*, fig. 1) and her sister ship the *USS Philadelphia*. Built in its namesake city between 1798 and 1799, the 1,240 ton Frigate *Philadelphia* was 130′ long, 39′ abeam and 13.5′ in draught. Similar in design to *Constitution*, albeit smaller, the USS *Philadelphia* was every bit as successful at defending the maritime interests of the fledgling republic. She served in the West Indies with distinction, capturing five French vessels and recapturing six American merchant ships. *Philadelphia* sailed twice to the Mediterranean, first in 1800 and again in 1802.

While cruising off Tripoli on October 31, 1803, *Philadelphia* ran aground on uncharted shoals. Under heavy fire from enemy fortifications and gunboats the ship was captured and her crew imprisoned in the "Castle and House of the Bey" in Tripoli harbor, as noted on the chart – structure "B" (fig. 2). *Philadelphia* herself was towed into Tripoli Harbor and anchored guns out, facing the sea and the American force beyond, marked 'M' on the chart. Three and a half months later, 16 February, 1804, a volunteer group of sailors under the command of the famed Lt. Stephen Decatur, Jr. entered the harbor in a captured Corsair ketch dubbed *Intrepid*. They boarded *Philadelphia* and burned her to the waterline to prevent her being used against the American Fleet. This feat of courage is immortalized in the Marine Corps Hymn—"from the halls of Montezuma to the shores of Tripoli."

My curiosity was piqued... where was the USS *Philadelphia* now? Checking modern nautical charts and what aerial photographs were available of Tripoli, against the location given in the 1804 chart, I determined that the ship was most probably in the modern inner harbor. Though there had been considerable construction, the wreck was most probably in an area not dredged, at least until 1980. I called the US Department of State's Office of Egyptian and North African Affairs. I inquired about both more recent aerial photographs and the possibility of traveling to Libya in search of the wreck. At that time, there were no available aerial photographs, nor was there much hope in acquiring a visa for entry into Libya. However, my request stirred the mem-

ory of the Libya/Tunisia Desk Officer who had just received a transcription of a seven-page speech delivered by President Qadhafi on June 11, 1997 that mentioned the USS *Philadelphia* by name:

> "...In 1803 we captured its [America's] ship, *Philadelphia*. She was one of the biggest American ships destroyed. The remains of her mast can still be seen in Saraya al-Hamra in Tripoli Harbor. Tourists can go there and visit the Philadelphia's mast..."

The only question remaining was "where is Saraya al-Hamra?" No one in the State Department could tell me. Further in-depth research at a local bookstore answered my questions. A modern Arabic dictionary listed *Saraya* as meaning "neighborhood" in English. The *Lonely Planet Middle East* travel guide provided modern street maps of Tripoli, as well as a list of museums and the areas of the city in which they were located. Ironically, the "Castle and House of the Bey" noted on the 1804 chart (fig. 2), where the crew of the USS *Philadelphia* were held hostage and finally liberated, now was home to a museum of archaeology. This is the probable location of remains of *Philadelphia* discovered during the course of harbor works and dredging.

As relations between the Libyan and US government improve, it may be possible in the near future to travel to Tripoli. We can then check the veracity of this hypothesis, and embark on cooperative ventures of shipwreck exploration in the ancient province of Tripolitania.

Suggested Readings

1945 *Naval Documents Related to the United States Wars with the Barbary Powers: Naval Operations Including Diplomatic Background*. U. S. Office Of Naval Records & Library.

Stein, Richard Conrad
1982 *The Story of the Barbary Pirates*. Children's Press

Kitzen, Michael L. S.
1993 *Tripoli and the United States at War: A History of American Relations with the Barbary States, 1785-1805*. McFarland and Company, Incorporated.

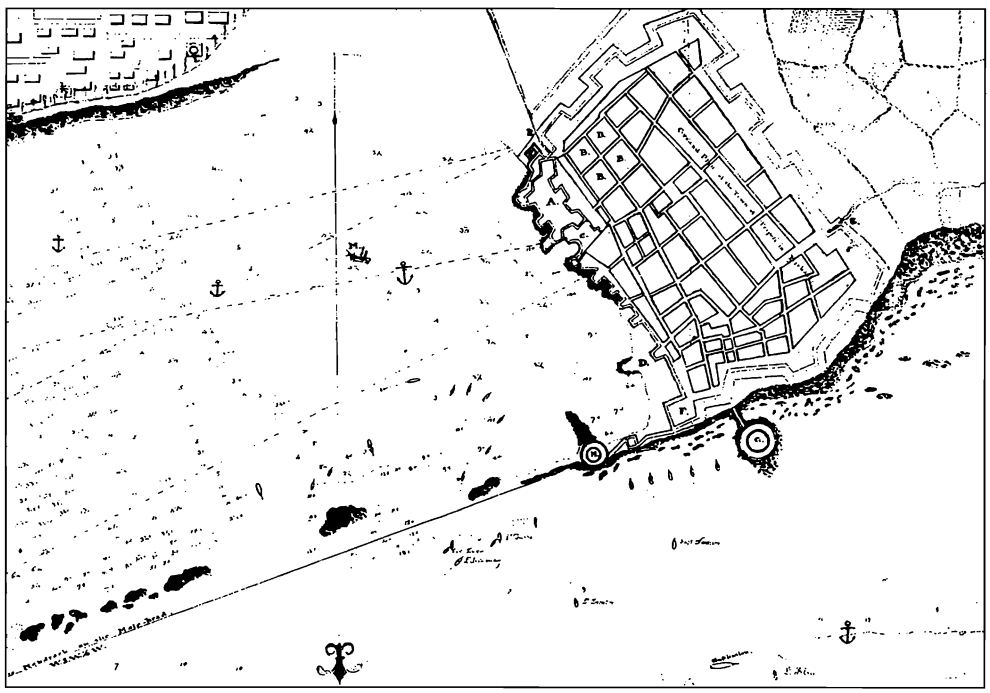
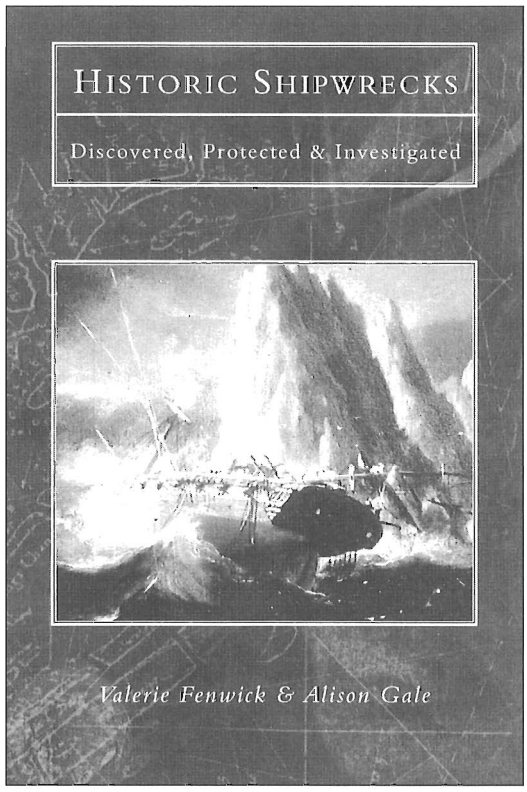


Fig. 2. Excerpt from "A View of Tripoli in Barbary," 1804 showing the "Castle and House of the Bey" and the position of the USS Philadelphia (Courtesy Library of Congress).

Review

by Christine Powell



Historic Shipwrecks: Discovered, Protected, and Investigated
By Valerie Fenwick and Alison Gale

Tempus Publishing Co., 1998. ISBN–07524–1416–X
pp. 160, 16 color plates, 96 B&W illustrations, Tables, Glossary, Index, hard cover.

Great Britain has thousands of historic shipwreck sites, but was comparatively late to adopt legislation to protect them. For decades after most other European countries had defined older sites as part of their national heritage, the British salvage lobby kept the law at bay. Anyone who found a wreck was free to recover its marketable artifacts and materials, and to destroy the site's scientific value in the process. Proper archaeological excavation techniques are slow, and require extended study of the items recovered. Commercial salvage, on the other hand, generally demands that artifacts be quickly extracted and sold. Salvors and thoughtless sport divers destroyed an increasing number of sites as fast as advancing technology made it possible to reach them. Finally, Parliament adopted the Protection of Wrecks Act (1973) as a private member's bill without government support. As one might expect from a compromise, the act protects only a limited number of sites. In the first quarter-century of the law, only forty-seven shipwrecks qualified for registration.

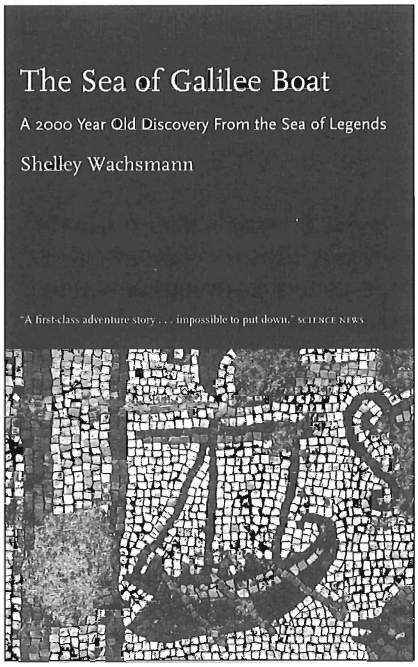
Historic Shipwrecks describes these sites, giving each one a two-page spread. A box at the head of each entry gives the location and a brief description of the type and date of the site. A narrative summary of the known information about the ship and site follows. Each entry ends with guidance on where the public can view the site and any artifacts on display, and with suggestions for further reading. The wrecks are divided into twelve groups, such as prehistoric wrecks, Indiamen, ships-of-the-line, and steam-driven vessels. The chapter devoted to each group includes a one-page introduction and, in most cases, additional maps and sidebars.

The introductory chapter provides a quick overview of how shipwrecks are located and excavated, and of their importance for historical and prehistoric archaeology. It has a clear description of why commercial salvage operations are generally incompatible with professional archaeology. This leads to a description of the Protection of Wrecks Act, including both its strong points and its shortcomings. Although the account is fair, it clearly advocates changes in the Act to provide better protection for the maritime heritage. A major theme of the book is the disparity between the treatment of underwater sites and of terrestrial sites. Britain is among the most zealous countries in the world when it comes to preserving historically significant buildings and archaeological sites, yet the protection provided shipwrecks is very different indeed. The same could be said for the United States.

The final chapter or "Stern View" continues the analysis of the Act as it has functioned in practice. Although some 90% of the documented shipping casualties and wrecks in British waters occurred after 1750, only 28% of the wrecks registered under the Act are so recent. Indeed, no ship built after 1805 was listed until 1990. This chronological bias also affects the ship types that are preserved. Only two of the forty-seven were engine-driven, and most of the others were armed vessels of one description or another. Thirty-one come from the English Channel, with other parts of the British Isles that have many documented ship losses entirely unrepresented among the listed Historic Wrecks.

Obviously, two pages with rich illustrations do not allow much depth in the coverage of any single wreck, although the descriptions are remarkable in their succinctness. The suggestions for further reading allow the interested reader to tap into the scientific literature for additional facts, since this book is not intended as a detailed reference work. Its strength is in its breadth. *Historic Shipwrecks* shows the enormous diversity of maritime archaeological sites, ranging from a cargo of Bronze Age weapons (ca. 1150 BCE) near Dover to an 1879 CE steam-driven submarine off North Wales. For that reason, it would be an excellent choice for a textbook in an introductory survey course on nautical archaeology.

News & Notes



The Sea of Galilee Boat ***now available in paperback***

In 1986, in the mist of a severe drought, two Israeli brothers discovered the remains of a biblical-era fishing boat in the exposed mudflats of the Sea of Galilee. Over the next few days, archaeologists, in partnership with local Israelis, worked frantically to excavate and preserve the vessel as rising waters and crowds of curious onlookers threatened its survival. In a gripping narrative, INA's Dr. Shelley Wachsmann, who led the excavation, recounts the fantastic obstacles the excavation team faced and the equally fantastic solutions they created as they worked to save and conserve the Galilee Boat.

The publication was the winner of the Biblical Archaeology Society's 1997 biennial award for best popular book in archaeology. A few copies signed by the author are still available at the discounted price of $10.20 each . Orders should be sent to the Institute of Nautical Archaeology, P. O. Drawer HG, College Station, TX 77841–5137and include 8.25% sales tax for books shipped within Texas. Shipping and handling is $3.00 per book for domestic orders and $10.00 for international orders.

Ready to Go Deep… With a Little Help from our Neighbors

The Gulf Coast area of Texas and Louisiana is home to hundreds of underwater engineering and survey companies, as well as all the major oil companies. Interaction and dialogue with the giants of this marine family—and infusing them with our love of seafaring history—will surely be to INA's benefit when we embark on our first "robotic" excavation in the deep sea. To that end, INA students Ayfle Atauz, Bill Charlton, Mark Fuelner, and Kathryn Willis traveled to Bayou Vista and Morgan City, Louisiana in November, 2000. There, they toured the ROV production center and dive training facility of Oceaneering International, Inc., at the invitation of CEO John Huff and Diving Manager Jack Couch (to whom we are most grateful).

Oceaneering is recognized as a world leader in the development and deployment of oceanographic survey equipment ranging from remotely operated vehicles (ROVs) and "deep-towing" acoustic imaging equipment to one-atmosphere diving suits and submersibles. They are also experts in commercial saturation diving. The company is no stranger to employing its technical expertise to the field of nautical archaeology, either. This past summer they raised the CSS *Hunley*, the famed Confederate Civil War submarine, from Charleston Bay, South Carolina.

While visiting the Bayou Vista facility, the largest ROV design and manufacturing center in the world, the gained valuable hands-on, hi-tech experience by piloting a "virtual" ROV on Oceaneering's state-of-the-art simulator (fig. 1). As the trainee is learning to pilot the ROV, the system operator sits behind, adjusting variables such as current direction and velocity, visibility, entanglement hazards and obstructions to provide a challenge. A shipwreck excavation will be considered for inclusion into the simulator's repertoire in the wake of our visit.

Photo: B. A. Phaneuf

Fig. 1. *Research Associate Ayşe Atauz looks on as Kathryn Willis pilots an ROV on Oceaneering's state-of-the-art simulator.*

The watched the one-atmosphere diving suit/submersible WASP conduct underwater construction training in the giant test-tank at the Oceaneering facility. Capable of diving to several thousand feet deep, and at the same time being rugged and portable, the WASP is an ideal tool for work in the "Oil-Patch" off Texas and Louisiana… and maybe on shipwreck sites as well.

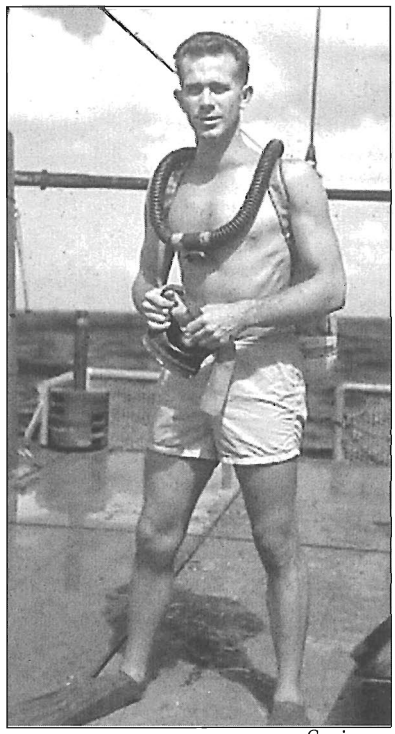
IN MEMORIAM

Willard Newell Bascom

1916–2000

The INA Quarterly regrets to announce the death of pioneer oceanographer and nautical archaeologist Willard Newell Bascom on September 20, 2000. Mr. Bascom was born in New York City in 1916 and trained in Colorado as a professional mining engineer. After World War II, he went into oceanographic research with the University of California at Berkeley at the princely salary of $250 a month. In 1950, he joined the Scripps Institution of Oceanography, where he worked on several projects, including the first large-scale geophysical exploration of the tropical Pacific and wave measurements at early hydrogen bomb tests.

During the 1960s, Willard Bascom directed the Mohole Project, an effort to drill a test shaft through the seabed and the earth's crust to the top of the mantle. He drilled test holes completely through the oceanic sediments from a floating platform four thousand meters above the bottom. To do so, he developed the first dynamic positioning system for holding a ship stationary over a fixed point on the bottom. When Bascom's involvement with Mohole ended, he formed a private company—Ocean Science and Engineering, Inc.—to facilitate undersea mining, salvage, and engineering operations.



Scripps

As early as 1961, Willard Bascom realized that the same techniques he had developed to explore the ocean depths could be used to locate ancient shipwrecks. In fact, archeaological surveys in deep water might in some ways be easier than in shallow water because deep bottoms are smoother and have lower sedimentation rates, fewer extraneous objects, and clearer water. He was among the first to suggest that the low-oxygen waters of the Black Sea and Sea of Marmara might provide an ideal environment for preserving ancient shipwrecks.

In the late 1960s, Willard Bascom directed the construction and operation of *Alcoa Seaprobe*. This seventy-five-meter ship was capable of detailed survey and excavation work on bottoms up to four thousand meters deep. It could be "hovered" over a site in very adverse surface conditions to conduct detailed examinations with sonar, television, and other remote sensing equipment. Unlike today's deep sea research vessels, which usually send their instruments down on cables or remotely operated vehicles, *Alcoa Seaprobe* carried its instruments at the end of a long pipe suspended below the vessel. The ship could lift objects as heavy as 100 tons from the ocean floor with manipulators also mounted at the end of the pipe. The same methods were used by the much larger *Hughes Glomar Explorer*, funded by the CIA to locate and recover part of a sunken Soviet submarine.

In 1971, Mr. Bascom teamed up with Robert Marx to explore the possibility of using *Alcoa Seaprobe* or a similar vessel to locate and recover the 1708 treasure galleon *San José* off Cartagena, Columbia. When local conditions made that expedition impossible, Marx and Bascom shifted their attention to the 1658 wreck of *Nuestra Señora de la Miravillas* in much shallower water on Little Bahama Bank. After a month-long search, they found the ship. Very little remained of it apart from ballast stones... and not quite enough silver for the expedition to break even.

From 1973 until he retired in 1985, Willard Bascom was director of the Southern California Coastal Water Research Project. This studied the effects of the billion gallons a day of municipal wastewater discharged into the Southern California Bight from the San Diego and Los Angeles metropolitan areas. The controversial conclusions of the study were that these discharges have no significant adverse effects on the environment.

After his "retirement," Willard Bascom wrote the last three of his six books. During the late 1980s, he discovered a Roman-era wreck off Cape Artimision, Greece. The site is noted for the three fine bronze statues that were recovered for the Greek National Museum. In 1996 (at age 80), he became involved in the search for and recovery of cargo from *Brother Jonathan*. This paddle-wheel steamer sank off the Northern California coast in 1866.

Willard Bascom's death from complications of an auto accident marks the end of a truly remarkable career. He will be missed, but his accomplishments and the technologies he developed will be with us for a very long time.

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