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On the cover: Timbers from the first Black Sea shipwreck ever to be scientifically excavated. Photo: K. Dimitrov

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Editor: Christine A. Powell

The First Black Sea Shipwreck Excavation: Kiten, Bulgaria

Kroum N. Batchvarov, INA Research Associate

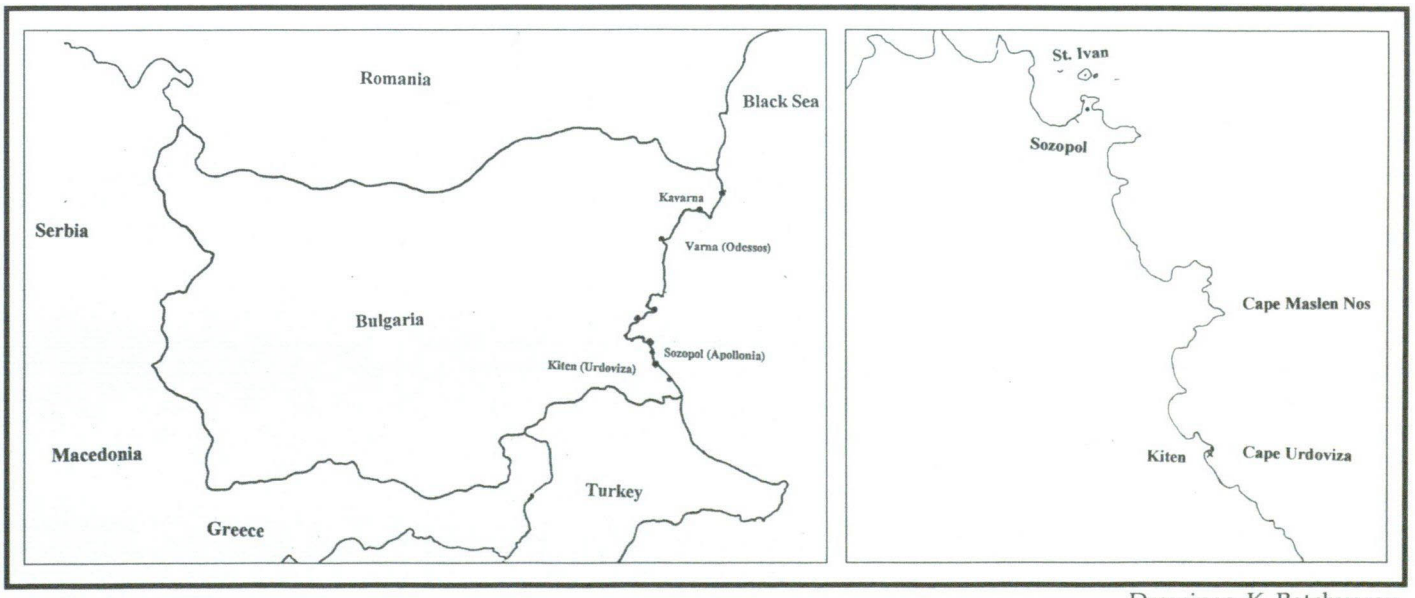
"Breakers off the starboard bow!" The cry of the lookout was immediately followed by "Breakers off the larboard bow!" Now that the ship approached the Bay of Urdoviza, the surf beating on the two Marmaliata shoals was clearly visible even from the quarterdeck. Somewhere dead ahead there was a narrow passage between the reefs—barely 300 paces. Running under foresail, the ship would pass through the gap, with some luck, and ride out the vicious storm protected by Cape Urdoviza. The vessel raced between the reefs, rounded up, and dropped anchor in the lee of the cape. The crew did not have the time to congratulate themselves for their delivery before the cable parted. The wind and waves grabbed the vessel and mercilessly drove it into the shallows off the beach. The ship struck stern first and swung out of control, bow pointing to the north. The waves started making a clear break across the deck. Beating on a sand bar, the hull opened up and the ship filled with water and sank.

The above paragraph is, of course, just one scenario, but it is likely to be close to what happened to this Black Sea trader which now lies under the formidable Cape Urdoviza. For generations, it had been lost and forgotten, until the 1980s when the wreck was discovered by archaeologists from the Center for Underwater Archaeology (CUA), Sozopol, Bulgaria. Some work was done then, but it was found that the shipwreck lies on top of a Bronze Age settlement. Consequently, the excavation shifted to the inundated settlement. During the summer of 2000, a joint INA/CUA expedition was in the Bay of Kiten, under Cape Urdoviza, to relocate the wreck and carry out the first complete shipwreck excavation in the Black Sea.

On the first dive of the season, Dr. Kalin Porozhanov, Director of the Institute of Thracology, Bulgarian Academy of Sciences, and I relocated the wreck within ten minutes. The rigid metal pipe squares used in the 1980s were still in place on the bottom, though partially buried in the sand.

The wreck lies under the imposing height of Cape Urdoviza at a depth of between eight and eight-and-a-half meters. This proved a great booster to our productivity, for we could spend almost unlimited time underwater. In the end, practicality limited bottom time to about five hours per person, per day. The main limiting factor was the small number of air tanks—all of them provided by our Bulgarian colleagues.

The Black Sea has the undeserved reputation of being dark with poor visibility. The black in the name, however, is not derived from the color of the water, which is green. The worst visibility that we had to deal with this summer was still more than two meters, while on better days it was more than seven meters. From the surface, it was possible to see the tags of the control points used for



Drawings: K. Batchvarov

Fig. 1. *The Bay of Kiten, sheltered by Cape Urdoviza on the Bulgarian coast, was the site of the first scientific excavation of a Black Sea shipwreck.*

the recording of the site. The Bulgarian archaeologists assured us that August is about the worst time for underwater work, as the weather is most unsettled, increasing chances for storms that destroy visibility. Their extensive experience (the average length of a season when they excavated the flooded settlements was about eight months) shows that the best period for work starts about the first week of September. Visibility in the fall and early winter months is usually about ten meters, with greatly lessened wave effects.

The temperature of the water hovered around twenty-two degrees Celsius (72° F.) and proved comfortable for extended dives. Experience has shown that one can expect warm water until the beginning of December. As the wreck lies in the surf zone, surge was present on the bottom after heavy waves. This was not strong enough to make work impossible, but frequently limited us in what we could do on the dives.

The Bay of Kiten is closed to the north and northeast by Cape Urdoviza and is one of the best anchorages south of Cape Maslen Nos. Sailors have used it for shelter since time immemorial. Indirect evidence from the inundated settlement shows that seafaring was part of people's lives in the area as early as the mid-third millennium BCE. As occupation of the cape continued throughout the centuries, cultural remains were deposited in the shallow waters. Dr. Porozhanov and Dr. Hristina Angelova, the Director of CUA, warned us of large quantities of intrusive pottery. Sure enough! The associated ceramic fragments would have suggested a date in the Early Bronze Age for the ship. Sherds of that period easily dominated our early findings—sometimes deeper into the hull than logic would dictate. Fragments of amphoras of the Classical period, the Middle Ages, and the Ottoman period were scattered around and within the ship. Troy Nowak—a fellow graduate student in the Nautical Archaeology Program at Texas A&M University—and I deduced the origin of these sherds over our first dinner in the excellent restaurant at the Marina. The blame for this mixture of styles and dates can be laid squarely on the surge caused by the storms. Even while we worked on our trenches changes in the distribution of artifacts occurred between dives. Ceramics were constantly deposited on top of our excavation. This mixing of cultural levels, the large number of wrecks (at least seven are known to the joint CUA/INA team so far), and the stacking of sites on top of each other have been encountered by INA on previous projects, such as Tantura Lagoon, Israel.

Considering the depth at which we were going to work and the available funds and time, Dr. Angelova, Kalin Dimitrov (an archaeologist with CUA), and I decided to build waterdredges. They have been successfully used on a wide range of sites, including the Lake Champlain vessels excavated by Dr. Kevin Crisman, the Dominican "Pipe Wreck" of Dr. Jerome Lynn Hall, and Jon Adams' *Sea Venture* in Bermuda. They were recommended also by Dr. Frederick Hocker of the Danish Maritime Museum, who generously provided the design. All the credit for the building of the dredges goes to Kalin Dimitrov, who proved to be the technical genius and Guardian Angel of the expedition, in addition to his considerable archaeological talents. All the underwater photographs are also his doing. Although we would liked to have had three or four dredges, budgetary restraints limited us to two. We found them to be good, reliable tools, though sensitive and needing proper adjustment before becoming operational. With the help of Dr. Hocker, Kalin solved this problem, too.

The Excavation

When the wreck was relocated for this excavation, only small portions of the frames were visible. There was no indication of the position of these fragments, relative to the rest of the hull. Considering the short time we had, we decided to drive a trench perpendicular to the visible frames. This, the reasoning went, would give us the most information for the least expenditure of time and money. It would also indicate how much of the hull survived (we believed it was only the bottom), what breadth was still extant, and possibly the original beam measurement. If enough was left, it might also provide some artifacts and hints as to the construction. The theory behind the decision was perfectly sound. The practice... well, we shall come to that further on. The trench, itself divided into four

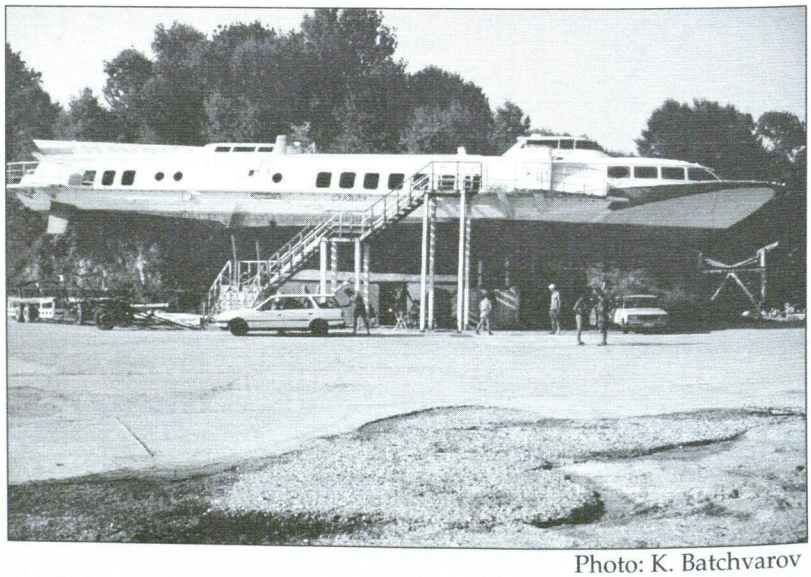


Photo: K. Batchvarov

Fig. 2. *The team's advance headquarters were located under a retired hydrofoil in Kiten.*

three-by-three-meter squares, was designated "F" and the squares were numbered from 3 to 6. Very early in the campaign, it became necessary to modify our original plan. We found the bow of the ship and needed to open one additional three-by-three-meter square. For the time being, it has no designation other than "the bow square."

The whole purpose of the exercise was to map the surviving hull structure. To this end, we decided to use the proven Direct Survey Measurement (DSM) system, so successfully used by INA at Bozburun. As our colleagues had less experience in shipwreck excavation than we did, the recording was left completely to the INA workers. I have always found it convenient to delegate duties, so the actual task of mapping fell mainly on Troy Nowak's shoulders. DSM was used to produce the site plan. For hull construction, we employed local recording.

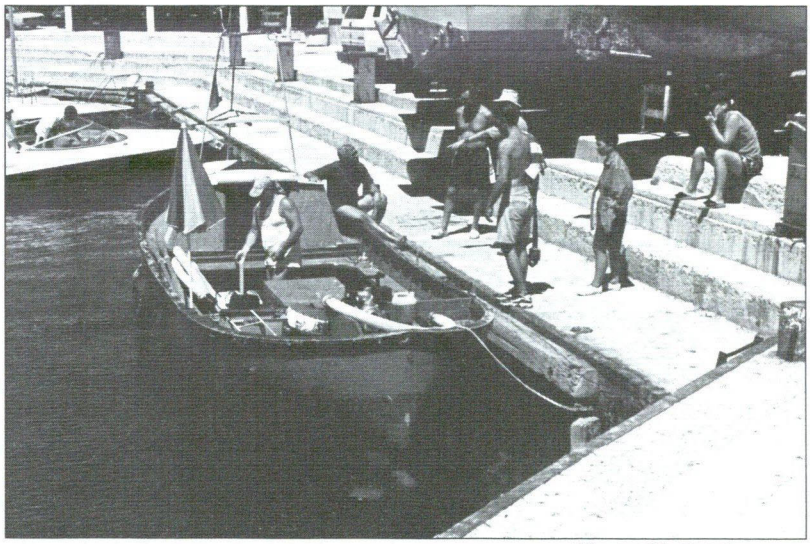


Photo: K. Batchvarov

Fig. 3. Velina, *captained by Petar Petrov, carried the team to each day's operations.*

A total of seventeen people participated in this expedition. On the INA side, these were Assistant Director Troy Nowak, Diving Safety Officer John McManamon, Mark Polzer, and myself as Co-director. Dr. Hocker, a dear friend, was good enough to give a whole week from his busy schedule and come to our assistance. His help with the dredges, and the advice he provided, are largely to be credited for our successes. The Bulgarian team consisted of Co-director Dr. Porozhanov (who had been one of the main driving forces behind the investigation of the wreck in the 1980s), Dr. Angelova, Kalin Dimitrov, three Macedonian archaeology students, and five Bulgarian students from New Bulgarian University. Dr. Nikolai Ovcharov from the Bulgarian Institute of Archaeology visited the expedition for three days.

During the excavation, the crew was housed in the CUA base, just outside of Sozopol. The rooms had their own showers, a convenience that made life much more pleasant than on the typical excavation. Each morning after breakfast, we made our way to Kiten, about thirty kilometers farther south, to start a new day of work. Our headquarters there were located under an old passenger hydrofoil whose steaming days were over (fig. 2). It was a major attraction for the tourist crowds that flooded Kiten. There we stored our equipment. Each morning, the water pumps powering the dredges were loaded on *Velina*, CUA's research vessel (fig. 3). Captain Petar Petrov proved to be not just an exceptionally competent seaman, but a hard working and talented archaeologist as well. Throughout the day, the boat would be anchored on top of the site and the pumps would be working on her deck (fig. 4). Normally, Dr. Angelova and her intrepid crew of students were on the first dive and they ran the dredges for hours on end under her archaeological tutelage. Next, the recording crew dived. These—more often than not—were the INA team, who measured and mapped the trench and its adjacent areas. Once we decided to start the new square in the bow area, it was up to John McManamon and me to do it. We received active help from Captain Pete. Unfortunately, the advancing date and the beginning of the school year tore John from us. Deprived of his company, I was left alone on "our" bow. The afternoon usually saw another set of

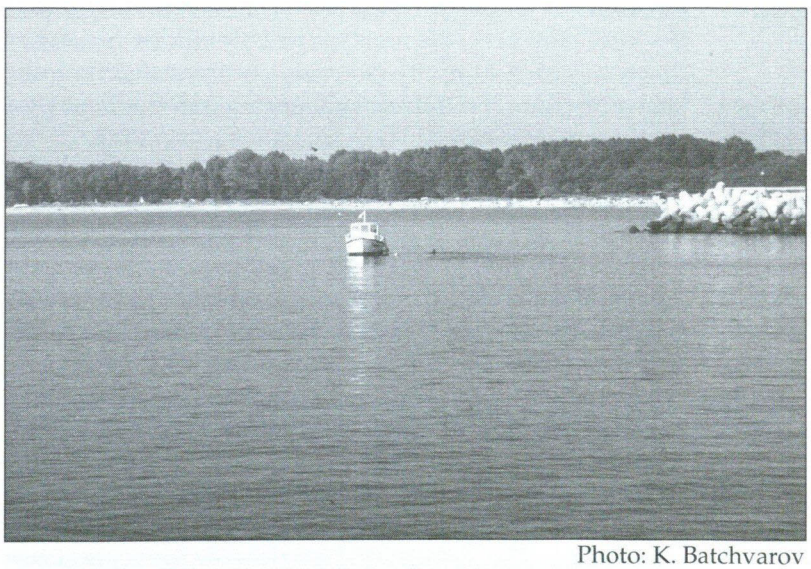


Photo: K. Batchvarov

Fig. 4. Velina *remained anchored over the site throughout the day with the pumps working on her deck.*

dives. After filling the tanks late in the evening, we headed back to Sozopol, dinner, and hot showers. The crew went to bed, Troy to the archaic machine that passed as our computer, and Dr. Angelova and I to a council of war that often lasted hours.

Any vessel entering the Bay of Urdoviza has to run the gauntlet between two shoals parallel to the shore that leave a gap of no more than a hundred meters. In heavy weather, the sight of the breaking waves is both impressive and horrifying. If you are a sailor trying to run between them, it is *only* horrifying. While the bay usually offers some measure of protection from the prevailing winds, it clearly proved insufficient to save this ship. Having sunk into the bottom, the wreck patiently waited for centuries until archaeologists could uncover her secrets. Once we started excavating the timbers, the sea itself helped us. In the first week, wave action uncovered many of the frames.

We decided to run our trench perpendicularly to the visible frames. Very little was protruding from the bottom, so it was impossible to determine where the trench was along the length of the vessel. In fact, we quickly found that we had started work far aft, where the side of the ship curved towards the stern. Consequently, our trench crossed the centerline at an angle. As the square grid was not used for recording, but only for orientation, the angle did not cause any inconvenience.

In the 1980s, archaeologists had estimated the length of the ship at about twenty-two meters (although they did not find the bow), with about seven meters of breadth extant. This is consistent with our findings: eighteen meters of existing length were measured and recorded this summer, but we did not reach the stern, as the earlier team had. From the shape in the stern area where we opened our trench, it is reasonable to conclude that there might be about three meters more to reach the sternpost.

Ship Construction

The first impression that the wreck made on us was of a very heavily built ship. Some of the stringers (longitudinal strengthening members) and planking were visible almost immediately after we started work. The scantlings were impressive for such a relatively small vessel. The hull structure—frames, stringers, and planking—are believed to be oak.

Earlier in the article, I mentioned that our theory and the reality differed. We believed it was improbable to find a well-preserved hull. Our wreck was in a surf zone. Even in quiet water, archaeologists are used to seeing wrecks heavily damaged or destroyed by marine borers (such as teredo worms). Consequently, we expected the trench to provide few constructional details of the ship. If we were lucky, we might find the keelson and floors, and perhaps a maststep, ceiling, or interior planking.

However, once the trench was opened and Dr. Angelova began the excavation in F3 and F4, we ran into a jumble of timber. For awhile it was not clear what we were seeing. We continued finding pieces of timber, roughly oriented along the centerline of the ship, without reaching the bottom. It began to dawn on us that we were looking at a very well preserved hull. Mark and Troy ran into knees, which are normally associated with the deck structure. Dr. Angelova discovered a heavy plank to which eyebolts were still attached. These are generally associated with the rigging, so this was additional evidence that we were looking at remains of the deck structure (figs. 5 and 6). By the end of the season, the trench had reached a depth of about seventy-five to eighty centimeters, but had not reached the bottom of the ship. Instead, we were still working on the starboard side.

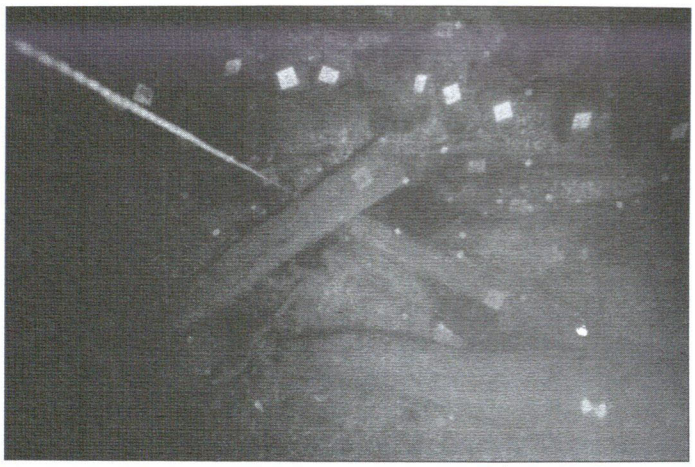


Photo: K. Dimitrov

Fig. 5. *Frames and collapsed deck structure in square F3 of the shipwreck.*

The bow provided additional information (fig. 7). When we found the top of the stem barely visible above the sand, we assumed it was only a few centimeters above the keel. However, the level of the bow square was taken down as much as in the stern area without reaching the keel or keelson. A number of interesting constructional features were uncovered.

The bow of a ship has always been hard to frame because the extreme curvature of the planking requires additional support. Beginning in the eighteenth century, this was provided by cant frames mounted to the keel at a less than ninety degree angle, perpendicular to the planking. Our vessel used Y-frames, an older system. We found that the visible Y-frame was lying on top of the stem and not on the keel. To starboard, the frames were sandwiched between two heavy longitudinal timbers, notched around them. Matching fastening holes indicated that the timbers were through-bolted, providing massive longitudinal support to the hull. Our working theory is that these are a wale and stringer. The stringer may prove to be the beam clamp that supported the deck. Next season should give a definite answer. From the plan, one can see that to starboard

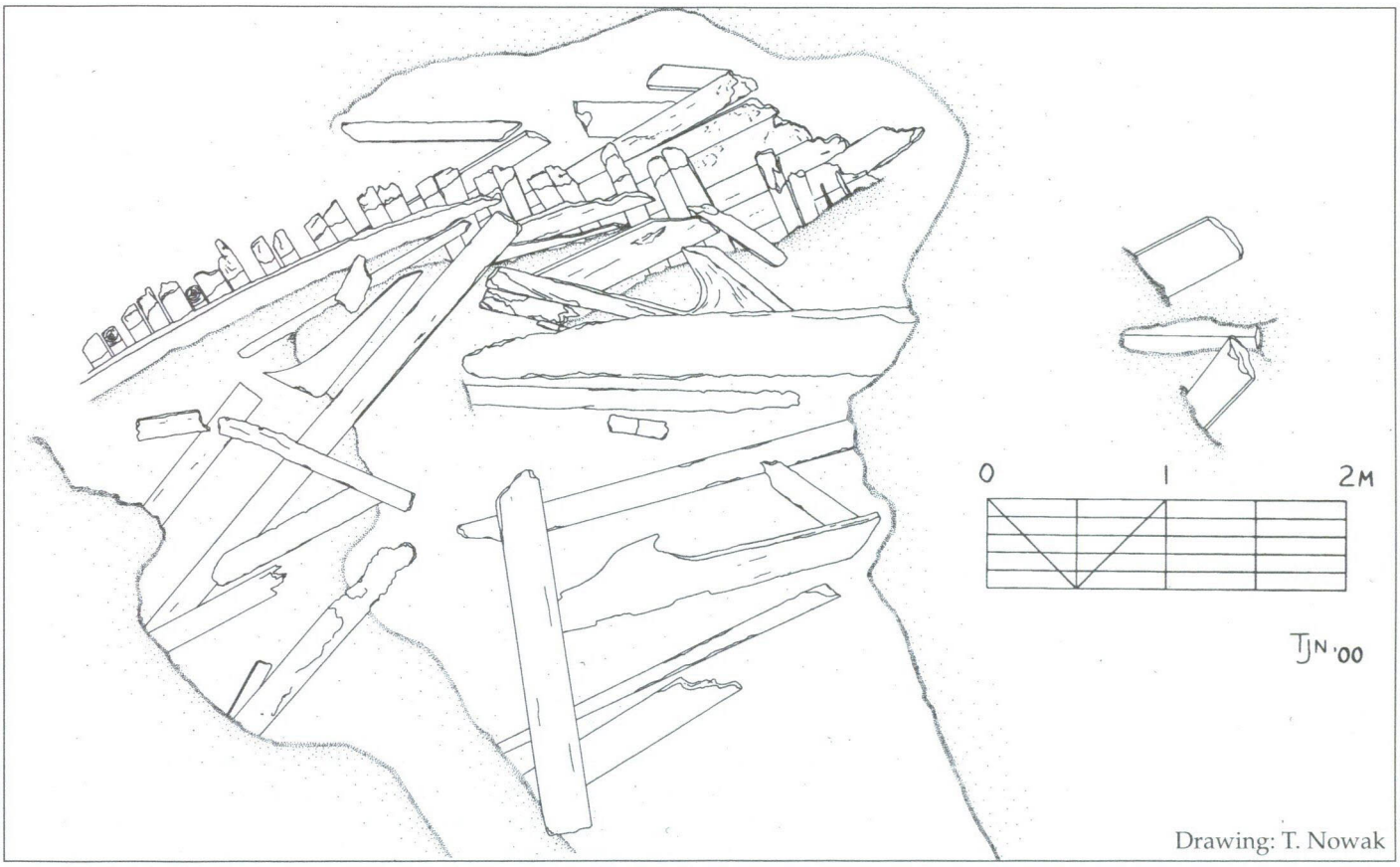


Fig. 6. *Trench F plan. The position of the collapsed timbers will allow future reconstruction of the Kiten vessel's design.*

the planking of the board is still in situ, even though it has fallen out of the stem rabbet. These planking strakes suggest that the ship survives to about deck level. The stern is buried deeper than the bow, so more of the hull probably survives there than forward.

As of now, we have no definite date for the vessel. Wood samples have been sent to Dr. Peter Kuniholm at Cornell University for dating. The artifact assemblages recovered in the 1980s and in August 2000 imply that the ship was built, operated, and lost in the Ottoman period, probably after the early seventeenth century. Nothing more definite can yet be said. As this is the first Black Sea ship ever excavated by archaeologists, we have little comparable material, which makes dating more difficult.

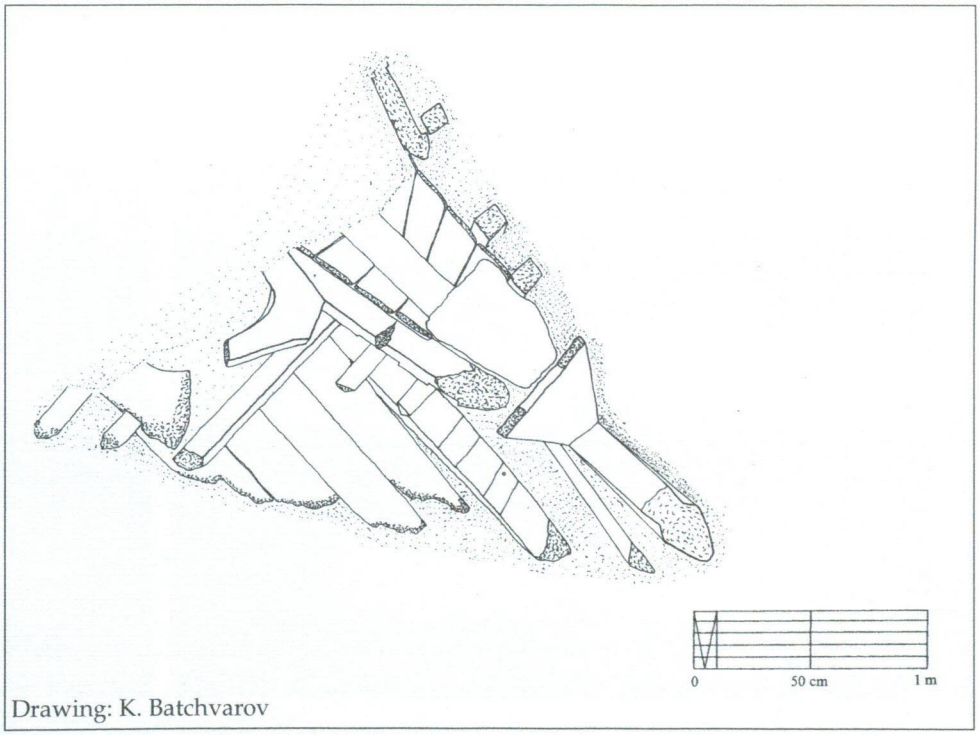


Fig. 7. *The bow provided valuable information about the ship's construction.*

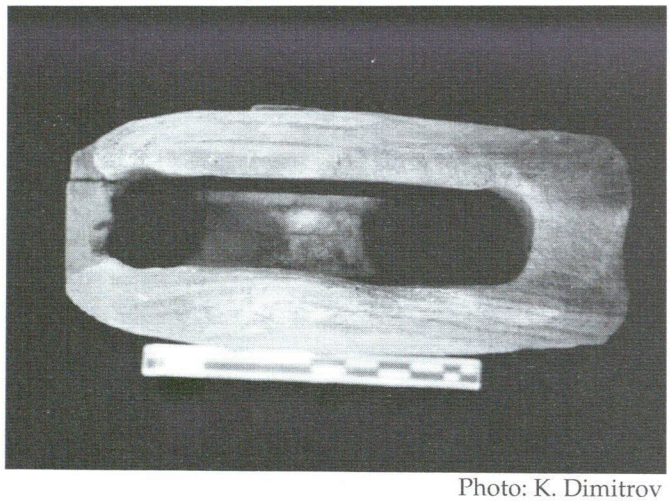


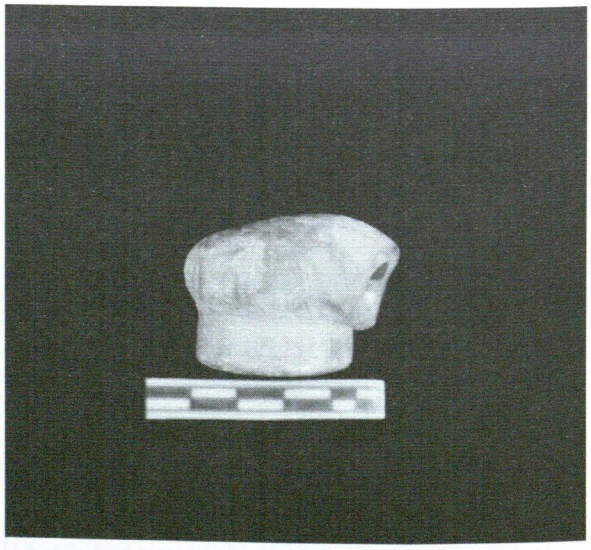
Photo: K. Dimitrov

Fig. 8. *This wooden block, from the bow square, was just one of the many rigging elements unearthed during the excavation.*

The Artifacts

Complete Y-frames and knees are rare finds and naturally were of great interest to us. However, these were not the only finds that came from the site. The bow square did not provide us with any personal effects or household goods, but two important and interesting finds more than compensated us. Under the stem, I found an intact wooden block lying on the remains of the rope that probably ran through it (fig. 8). After the complete excavation of the wreck, the location of the block may assist us in reconstructing the rig. The second find was a large sheave, found among the upper-side planking to starboard.

The trench provided a wider range of artifacts. Besides the large number of pottery sherds from the last four and a half millennia, we found items that may very well have been associated with the wreck (fig. 9). The previous expedition found two bronze ink-pots, Christian decorative elements, pottery, a large number of rigging elements, copper cooking pots, and a pig's skin. The designs and swine hide suggest Christian ownership of the vessel, while the writing implements suggest that someone on board was literate. We found additional support for this hypothesis: a small wooden piece with incised decoration that may have been a penholder. A



Figs. 9 and 10. *Artifacts (left) recovered in the 1980s are similar to those found during the 2000 excavation season. A number of interesting pipes (right) from the Ottoman period were uncovered.*

Photos: K. Dimitrov

small, almost intact, glazed bowl was discovered by Troy while Mark found large quantities of rope under the timbers. A belt buckle and a rhomboidal piece of leather were probably part of a crewman's attire. From the location in the stern, they may have belonged to an officer. In the same area was the rim of another copper pan, as well as an applique with a floral design that may have graced the handle of a knife. Dr. Angelova and the students working under her direction found a number of interesting pipes of the Ottoman period (fig. 10). In F6, Petar uncovered two small pieces of woman's jewelry—a small earring and a ring.

Future Work

We had a very short time in which to do our work. Due to budgetary constraints, our crew of just seventeen people had only a month on site. Just short of a third of this time was lost to bad weather. Nevertheless, we achieved a number of very important objectives. First, INA was a partner in the first excavation of a shipwreck in the Black Sea. This season confirmed the excellent preservation to be found in Bulgarian waters. We also established that the lower cost of living and working in Bulgaria allow the efficient use of INA's finite resources.

Second, an excellent working partnership was established between INA and CUA. This paves the way for further work in this promising region. We made important contacts and obtained leads on further shipwrecks. Besides the seven wrecks in the Bay of Kiten, we have been told of a wreck—possibly Hellenistic—in the Bay of Sozopol, and a post-medieval armed ship sunk off Cape Talassacra. A wreck further north has been discovered, but not excavated, by Bulgarian archaeologists. The director of that survey confirmed extensive hull preservation and, on the basis of the amphoras, has dated the site to the fifth century BCE. A wreck of the Roman period is known off Shabla. This summer, I saw a video of another two well preserved ships. Following the example of INA in Turkey, we are developing contacts among coastal fishermen. Many of them are willing to tell us where they find amphoras and old pieces of timber. The potential for nautical archaeology in Bulgaria is tremendous and we can look forward to great accomplishments.

For the 2001 season, the team hopes to finish excavating the post-medieval wreck under Cape Urdoviza. We hope to uncover the rest of the hull, reaching the bottom and stern of the ship. The 2000 season in Bulgaria was extremely successful, and there is no doubt that the next one will be even more so.

Acknowledgments: First and foremost, I would like to thank Dr. Kevin Crisman. Without his support, this project would never have materialized. Our thanks go also to the magnificent faculty of the Nautical Archaeology Program at Texas A&M University. The success of their students is their success.

I am personally indebted to Dr. Hristina Angelova, a co-director of the project, for making it happen. This expedition has cost her enormous labor. I thank her for her friendship and patience in putting it together. Without her, there would not have been an expedition. I would also like to thank Dr. Kalin Porozhanov for giving us the chance to work on this exciting ship and for all he did to help.

My thanks also go to Dr. Hocker, Dr. McManamon, Mr. Nowak, and Mr. Polzer. They constituted a dream team: patient, understanding, hard working and—above all else—exceptional people. A large part of the credit for the success of the expedition is due to them. I do not know what would we have done without Petar Petrov and Kalin Dimitrov. The Bulgarian and Macedonian students were magnificent.

Last, but not least, I would like to thank Mr. and Mrs. Ron Factor for their generous financial support.

Suggested Readings

Anderson, R.C.
1952 *Naval Wars in the Levant, 1559–1853*. Liverpool: Liverpool University Press.

Ovcharov, Nikolai
1992 *Ships and Shipping in the Black Sea, 14th–19th centuries*. Sofia: St. Clement of Ochrida.

Porozhanov, Kalin
1991 "Le Site Submerge D"Ordoviza," *Thracia Pontica*, vol. 4. Sozopol: Center for Underwater Archaeology.

Porozhanov, Kalin,
In Press The Sunken Ship at Urdoviza—Preliminary Notes. Sozopol: Bourgas Museum.

Prins, A. H. J.,
1992 "Mediterranean Ships and Shipping, 1650–1850," *The Heyday of Sail: The Merchant Sailing Ship 1650-1830*, Chapter 4: 77–104. London: Conway Maritime Press.

A Cargo of Knowledge

J. Richard Steffy

Sara W. & George O. Yamini Professor of Nautical Archaeology, Emeritus

When wooden merchantmen sailed the seven seas, they carried two kinds of cargo—material and intellectual. On INA field projects, we excavate both. The material cargo is usually turned over to the conservator, who preserves it for later display or study. The intellectual cargo is information that was stored in the material cargo as well as in the artifacts, ballast, chandlery, hull timbers, and anything else that survived. This form of cargo is first entered into field catalogs, then dispersed for processing in computers, darkrooms, and various other research media. Eventually, those results are shared with others in the form of books, articles, television documentaries, museum displays, and lectures. If a project is properly conducted, the material cargo can never be as valuable as its intellectual counterpart. Even if that material consists of tons of gold objects or fine statuary, its importance can never match the knowledge gleaned from a well researched, well disseminated shipwreck study. That knowledge grows and spreads over the years, and its dividends can be priceless.

Of course, the value of the intellectual cargo is directly dependent on the quality of recording and research. These days, with information from dozens of published wrecks and efficient electronic communication, even the simplest trinket might yield pages of data. For something as complex as a ship's hull, the potential for information has become so great over the past decade that we have been forced to adopt new methods of analysis to ensure that we do not overlook important details.

Ships, even small ones, are usually the most complex objects found on wreck sites. Take the Kyrenia ship, for example (fig. 1). This fourth-century BCE Greek merchantman was only about fourteen meters long, yet originally it would have been constructed from at least 425 pieces of pine, each different than the others, whose weight after processing totaled nearly eight tons. Its planking shell was held together by at least four thousand mortise-and-tenon joints and its framework was attached to the planks with about three thousand double-clenched copper nails. It was covered with pitch, resin, and a sheathing of lead fastened by thousands of copper tacks. There were spars, sails, rigging, brailing gear, anchors, rudders, ballast, dunnage, oars or sweeps, decks, bulkheads, and dozens of other ship-related items. All of this had to be shaped and assembled so that the completed vessel was buoyant, seaworthy, and capable of carrying two and one-half times its own weight in cargo to any port its owners desired. The Kyrenia ship was a very small freighter. Can you imagine the complexity of those big, double-planked Roman hulls like that of the Madrague de Giens wreck excavated in southern France? When discovered, it carried more than twenty times the cargo capacity of the Kyrenia ship. How about that beautiful 44-gun British warship *Charon* that we investigated near Yorktown, Virginia back in the 1980s? The components from these hulls would have numbered in the thousands and their designs and methods of assembly were an even greater challenge. One needs excellent recording and research procedures to completely document such monuments to technology.

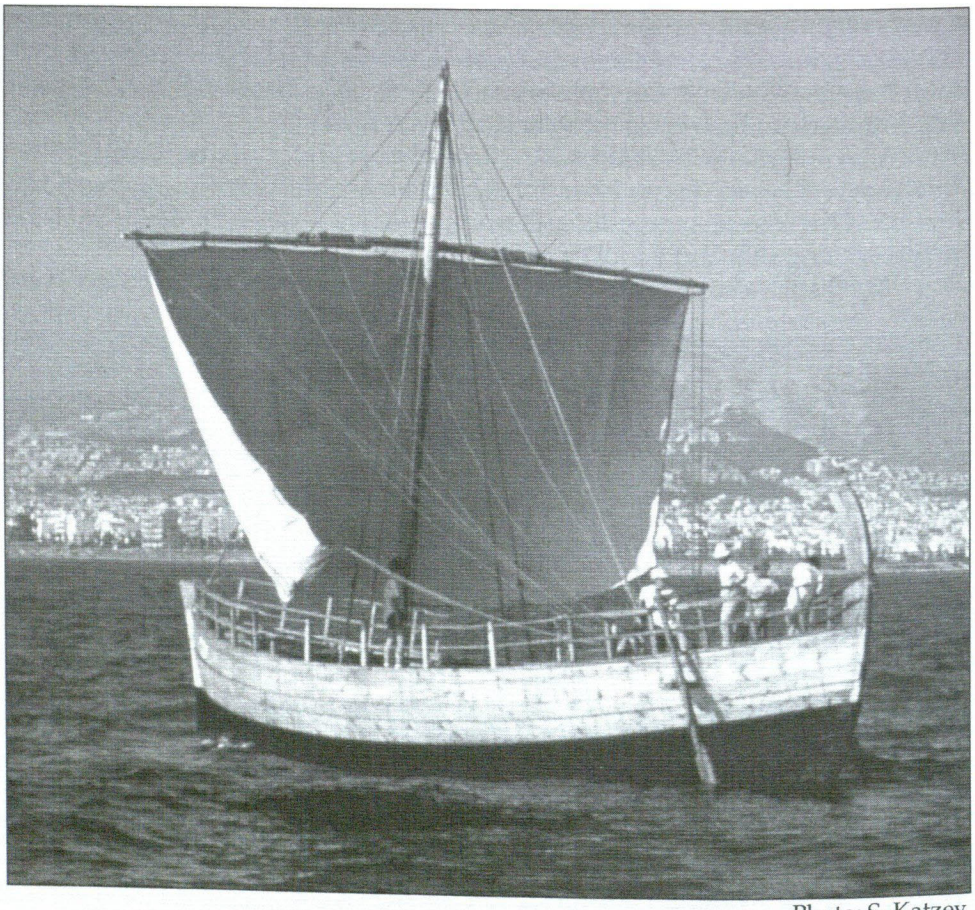


Photo: S. Katzev

Fig. 1. Kyrenia II, *a modern reproduction of the Kyrenia ship.*

When I became involved with the earliest INA projects, we were pleased if we could identify framing patterns, planking dimensions, the types of wood and metal employed and, with a little luck, the applications of pitch or caulking on the planks. If preservation was good enough, we could also supply lines drawings and construction plans. But that is not enough anymore. Now we want to know where that wood and pitch and metal originated and how each was processed, the techniques and tools used in projecting and shaping those frames, and the method of laying out and cutting the planking. Where simple drawings used to suffice, we now try to determine various hydrostatic and hydrodynamic properties of the hull as well. The geometry used to design hull shapes and control the dimensions of its various components is a target of many hull interpretations these days (for instance, see the bottom of page 13 in Filipe Castro's article in the Winter, 1999, issue of the *INA Quarterly* [26.4, 12–15]). Because ship's ceiling (the inner lining of planking upon which the cargo rested) is sometimes made from second-hand wood taken from abandoned vessels, the information from those contemporary hulls must be documented as well. Now and then we excavate a wreck that has been repaired or overhauled, sometimes on several occasions and perhaps by different ship carpenters. What techniques were used for these replacements, how did the tools and workmanship differ from the original hull, and what was the arrangement of the original components that were replaced? Then there were the people. Many lives were involved with the construction and operation of that vessel. Can their tool marks reveal their mechanical discipline, and how did that graffiti on the ceiling describe the ladening of the hold? Once these and hundreds of other data have been determined, they must be compared with similar vessels for proper analysis and with excavations of earlier and later periods to further establish timelines.

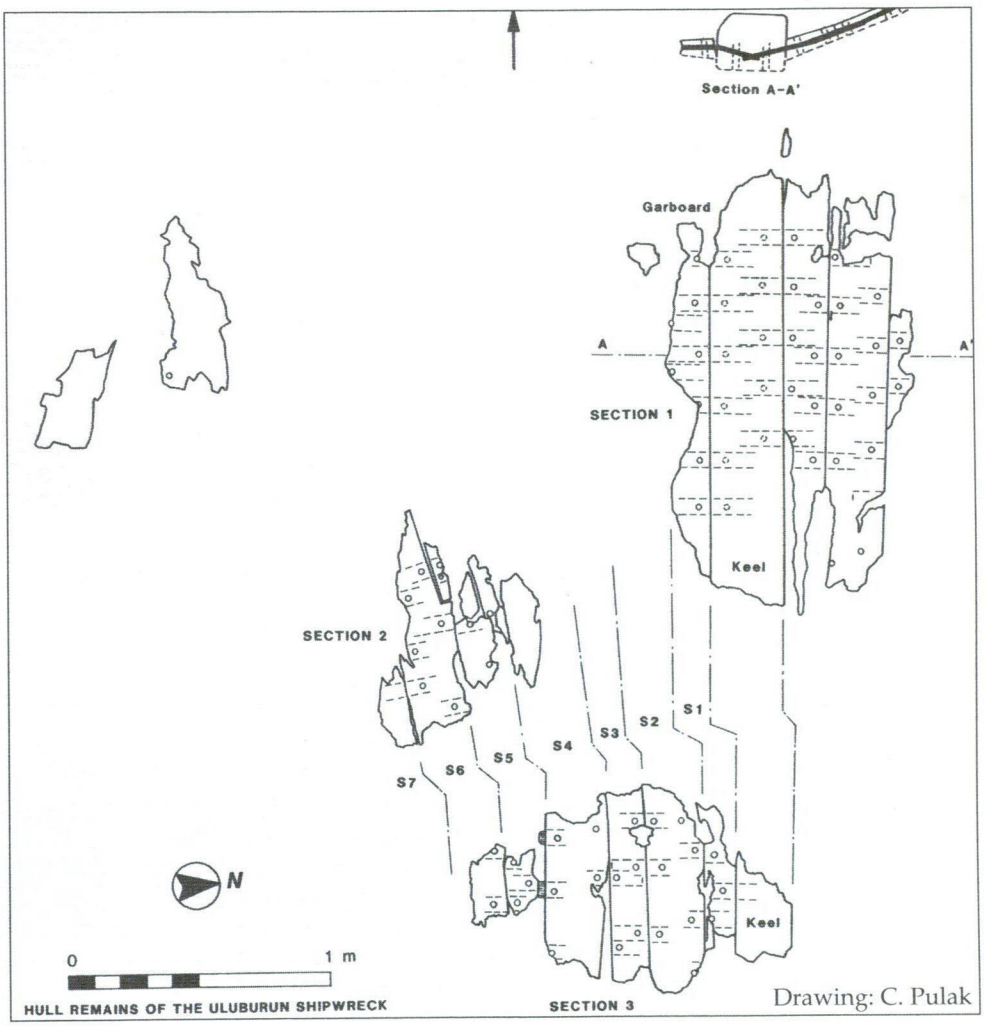


Fig. 2. *The Uluburun hull timbers.*

Even where hulls have been sparsely preserved, it is now possible to glean large amounts of information. A good example of that was the article on the Uluburun ship by Cemal Pulak in that same issue of the *Quarterly* (26.4, 16–21). Dr. Pulak wrote an extensive analysis of many of the features of this fourteenth-century BCE hull, even though only one or two percent of its original structure survived (fig. 2). However, that is not all he will have to say about those hull properties. His research continues and I guarantee that he will make many more interesting statements about that oldest seagoing hull ever to be excavated. It is a good example of our present-day contention that all hull remains—even a few small fragments—are potentially valuable and must be recorded carefully.

By now you must have realized that we have had to constantly improve our recording and research techniques, not only in ship analyses but for all phases of underwater projects. When I first became associated with nautical archaeology more than three and one-half decades ago, we interpreted site drawings and catalogs directly. The only research engines were libraries and our work was conveyed in longhand or on typewriters. Then, for ship studies, we began developing research models in order to extract more information. At first they simply helped us understand where the pieces belonged and the general nature of the hull. Then we learned to use batten models that described the geomet-

ric shapes and properties of the vessel, seabed models to study dispersion of the timbers, and construction models that helped us determine the methods of shipwrightery involved (fig 3). Then came computers, at first ideal for storage of information and word processing. Now, with the latest developments, powerful portable computers can be used on the most remote sites and the process of excavation and evaluation has risen to still greater heights. A good illustration of this is in that same issue of the *INA Quarterly* (26.4, 3–8). At the top of page 8, Deborah Carlson explains how even the wreck site is now recorded with a photogrammetric system that utilizes calibrated and digital underwater cameras to record artifact locations with amazing accuracy. The artifact catalog is then united with the team roster, diving log, and a daily journal by means of an ingenious relational database.

Hopefully, we can soon add hull catalogs to that or other field databases. Last spring I supplied the Tektafl Burnu crew with a check list for recording ancient Greek hull timbers, should they come across any hull remains this season. It was really just an expansion of the recording and research lists I published in a book and several papers a few years ago. But, when programmed as a relational database, such a list can be used as a research tool to determine structural similarities from other projects, variations from common practices, or patterns that might provide information concerning trade routes or nationality.

Recently, such a database was presented to INA for use by its personnel for recording, researching, and publishing hull data. Originally, it was developed for reevaluating all our earlier ship projects and for background material for future research. In 1996, it was publicly introduced to scholars of ancient ship construction in a paper I presented at a symposium in Greece. Over the past four years, however, it has been expanded and improved to include wooden ships and boats of all periods and areas. In its simplest form, this database is categorized into a series of relational tables that compare about 150 basic details about each vessel—its structural properties, site details, dating methods, and other vital information. It will probably be most useful for comparative research, since it can be adapted for all areas and periods. In a few years, such a comparative tool will be a necessity because of the great number of excavations that have been reported.

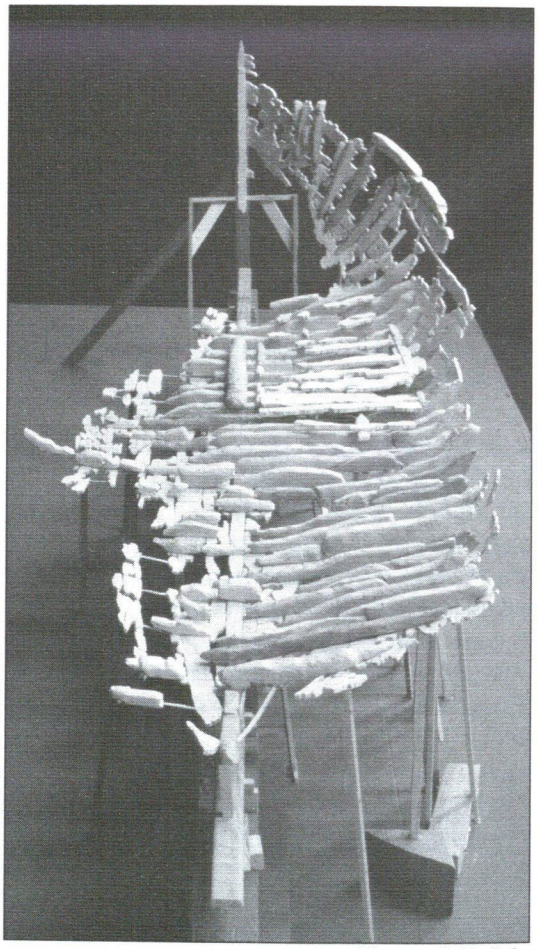


Photo: C. Pulak

Fig. 3. *A fragment model used to study the Serçe Limanı medieval hull.*

Several years ago, I compiled a list of more than 150 known ancient and medieval wrecks in the Mediterranean area alone that contained hull remains. It was gleaned from dozens of publications and, in some cases, from knowledgeable acquaintances some of us have made over the years. The vessels on this list were craft that I believed could provide varying amounts of information about hull construction. By now, there are at least two dozen more. Some are relatively unknown, others have been published thoroughly. The point to be made is that there must be a thousand or more known wrecks of all periods worldwide. Add to that the virtually unlimited sources of contemporary publications, naval contracts and specifications, recorded scantling lists, and iconographic and model collections. Combined, it suggests a bonanza for investigators... provided all of that information is put into readily available, relational form. That, in a nutshell, is our intention.

Of course, much work remains to be done on the ship database. I am anything but computer savvy, and so my creation will need the work of people versed in computer technology before it is fully operational. Hopefully, though, it will be something we can put on our website for the use of anyone interested in shipbuilding technology. It is merely our latest answer to this continuing demand for more efficient research vehicles, so that the work of future and past INA projects will produce even more revelations about our maritime heritage.

Suggested Reading

Pomey, Patrice
1982 "Le navire romain de la Madrague de Giens." *Comptes rendus de l'académie des inscriptions* (Jan.-Mar.): 133-54.

Steffy, J. Richard
1994 *Wooden Ship Building and the Interpretation of Shipwrecks*. College Station: Texas A&M University Press.

New Hunting Grounds: Searching for Shipwrecks in Guantanamo Bay, Cuba

Mark Feulner, INA Research Associate

Realizing a long-term dream of President Jerome Hall, INA has conducted an investigation in Cuba (fig. 1). In 1993, he discussed the rich archaeological potential of Cuban waters and expressed his desire to take INA there (*INA Quarterly* 20.3, 3–6). During August 2000, Dr. Hall joined a small team of INA researchers in a visual reconnaissance conducted at Guantanamo Bay.

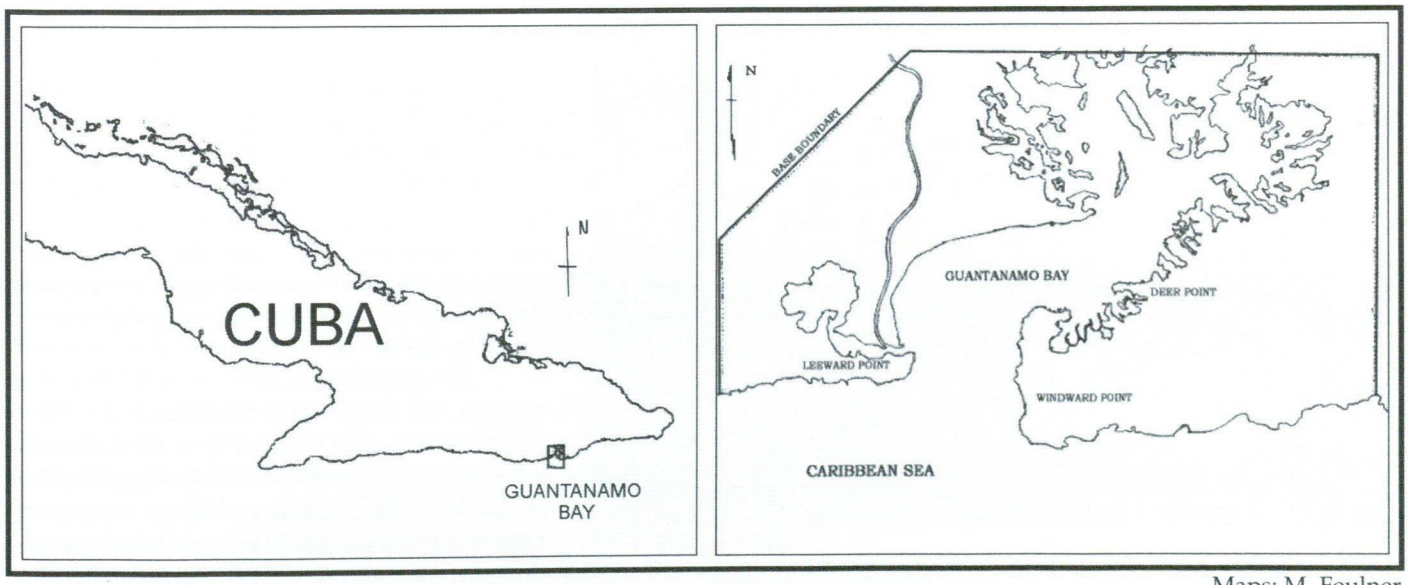
The survey was conducted from the United States Naval Station. The Navy hosts warmly greeted the INA archaeologists and exhibited a strong interest in their work. The support of the base personnel made this project a singular experience and allowed the team to accomplish a great deal in a short time.

Background

The first European visit to Guantanamo Bay was made by Christopher Columbus during his second voyage to the New World in 1494. Columbus named the bay "Puerto Grande," then moved on in his search for gold. Despite its meager supply of fresh water—the region is semi-arid—the bay saw a fair amount of activity during the following centuries. The nineteen by eight kilometer bay has numerous mangrove inlets protected by surrounding mountains. It is deep enough for large vessels and has a narrow entrance. These sheltered waters have long been used as a haven for ships during the frequent hurricanes of the Caribbean. In the heyday of the Spanish Main, Guantanamo Bay was a stronghold for pirates preying on ships traversing the Windward Passage from Europe to New Spain. The pirates Naum, Sores, and Rosillo are all reputed to have used it, and legend has it that the New Orleans pirate Rosario was chased into the Bay and took refuge up the Guantanamo River.

On July 18, 1741, the British West Indies Squadron under the command of Vice Admiral Edward Vernon sailed into Guantanamo Bay, known then as Walthenham Harbor. The bay was to be used as a landing point for British troops who would march overland to attack Santiago de Cuba. Due to delays, the troops had time to succumb to tropical disease, foiling the attempt. Local lore is that the present-day Hospital Cay in Guantanamo Bay bears that name because the British established a hospital there to treat its ailing soldiers and sailors. In 1854, the islet served the same purpose for HMS *Buzzard*, which put ashore ten to twelve yellow fever patients for isolation and treatment. All recovered except the ship's paymaster, E. N. Harrison, who is buried on the south end of the cay.

In 1898, Guantanamo Bay was used by the United States in an expedition against Santiago de Cuba during the Spanish-American War. On June 10, a battalion of United States Marines landed at Fisherman's Point in the Bay, and established control of the region after capturing and destroying the Spanish headquarters at Cuzco Wells. The American forces held down seven thousand Spanish troops at Guantanamo City, directly contributing to the United States victory at Santiago de Cuba. In 1903, five years after



Maps: M. Feulner

Fig. 1. *Guantanamo Bay became the first area of Cuba to be the subject of an INA survey in August 2000.*

the Spanish-American War, the United States acquired Guantanamo Bay as a coaling and naval station, and it has been occupied by U.S. forces ever since.

The maritime activity that Guantanamo Bay has seen through the centuries suggests that it offers a wealth of submerged cultural resources. These enjoy special protection since the waters are under the control of the United States Navy. The bay has been closed to salvors and treasure hunters and has seen only limited recreational diving. However, sport divers have noted the locations of two or three wooden shipwrecks and have recovered artifacts of various periods from the bay. The history of the region, and these reports, were the primary motivation for this investigation (fig. 2).

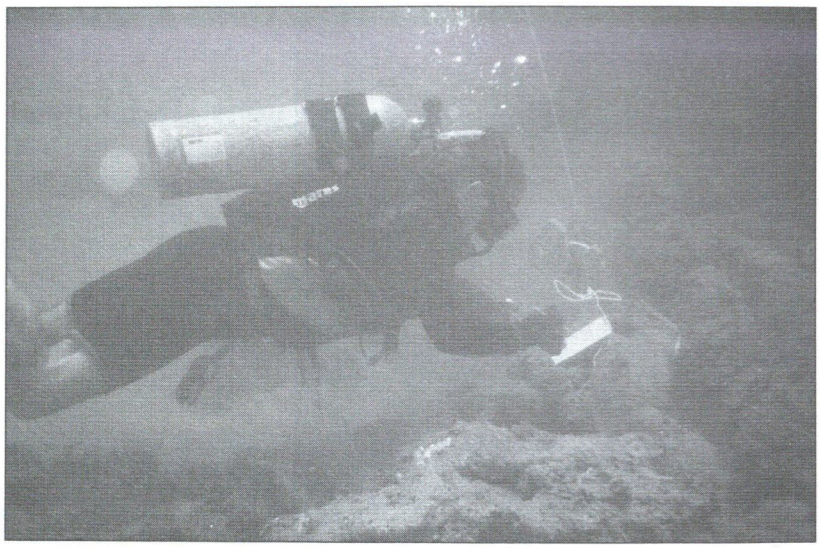


Photo: M. Feulner

Fig. 2. *William Charlton makes notes during one of the many survey dives.*

Deer Point

Several independent oral reports indicate the existence of the remains of a wooden vessel just west of Deer Point, in eight to nine meters of water. Clay tobacco pipes were purportedly among the artifacts found on the site, suggesting that the ship dated to the seventeenth century. This wreck site was the primary target of the survey.

Searches were conducted near channel markers 1, 3, and 5, which line the western and southwestern side of Deer Point. Below six meters depth, visibility dropped to less than a meter, limiting the effectiveness of visual reconnaissance. As remarked by survey team member William Charlton, "This is like diving in liquid talcum powder." Between the shore and the markers, the shallow grass flats at less than two meters depth drop abruptly to a shallow reef system at five to eight meters. Beyond the reef, a flat comprising a thick layer of silt extends out beyond the markers, varying in depth from ten to thirteen meters. The searches began at the grass flats and extended to around fifty meters beyond the channel indicators. Marker 5 set the southern and westernmost limit of the area searched, and the pattern ran about one hundred meters north of marker 1.

No evidence of the shipwreck was located during these searches. However, the reporters had not dived on the wreck in four to five years, and the remains may have been buried by shifting sediment. It is also possible that the wreck was overlooked in the poor visibility, or that the search area was erroneously defined due to inaccurate information.

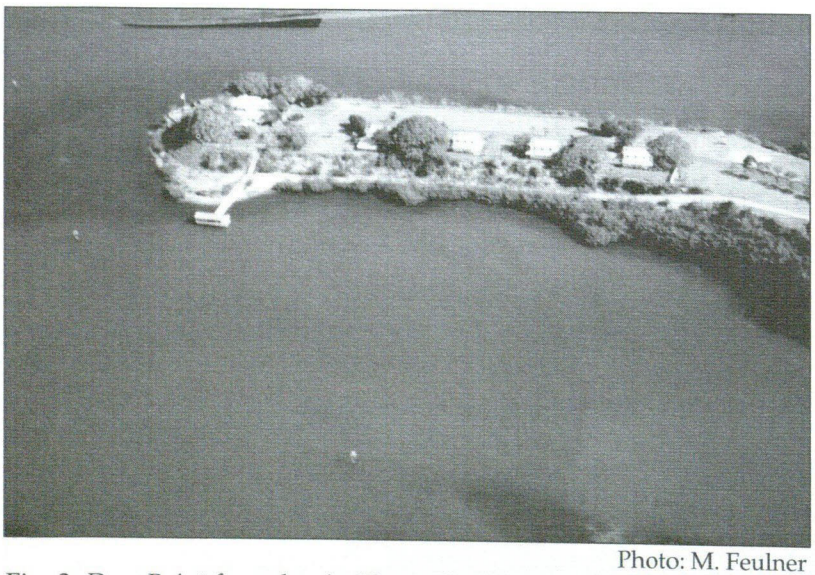


Photo: M. Feulner

Fig. 3. *Deer Point from the air. The outline of USS* Monongahela *can be seen below the point.*

USS *Monongahela*

The historical record aided in location of the remains of another vessel in the waters around Deer Point (fig. 3). During the spring of 1908, USS *Monongahela*, the station supply ship at Guantanamo Bay, caught fire while anchored in deep water between South Toro Cay and Granadillo Point. She was towed to a shallow location on the south side of Deer Point and beached. Much was salvaged, but the ship was a total loss, and several weeks later it settled into the silt and submerged.

Monongahela, a wooden hulled screw steamer that fought in the American Civil War, was launched in Philadelphia in 1862. She saw action under Admiral David Farragut at Port Hudson on the Mississippi River during the Vicksburg campaign. The screw sloop would again serve Farragut in the Battle of Mobile Bay, aggressively attacking the Confederate iron-

clad ram *Tennessee* as it sortied against the fleet, and in the bombardment of Fort Morgan. After the Civil War, her engines were removed and she was converted into a sailing vessel. She served as a training ship until her assignment to Guantanamo.

After a brief search, *Monongahela* was relocated in the position indicated by the historical record. It lies about sixty meters from the present Flag Landing on the southern side of Deer Point. The hull is upright in six to eight meters of water, oriented east to west and parallel to the shore less than fifty meters away.

The sternpost in the eastern part of the wreck is standing, and extends to within two meters below the surface. The bow appears to have collapsed. A great deal of the hull remains, just under ninety meters of it held together by copper sheathing. Much metal can be found on the wreck, in the form of sheeting, bolts, heavy rods, and spikes. Iron deck structure remains on the vessel, and large fragments of iron superstructure are located in a five-meter arc around the sternpost. A wooden member, ten to twelve centimeters thick, was found attached to the starboard side, which may have been the deck clamp or part of the hull planking. Amidships of the vessel, a barrel-shaped structure stands upright on the deck; this is likely a capstan.

The copper sheeting peeling off the hull and the loosened bolts are easily removed, as are other portions of the vessel. As recognized by international law, *Monongahela* remains the property of the United States Navy, and the wreck is a protected site.

Leeward Point

The second search area was off Leeward Point at the entrance to the bay. An old ceramic jenever (gin) bottle had been recovered by a diver from a reef in this area (fig. 4). The bottle was inscribed with:

"ERVEN LUCAS BOLS
HET LOOTSJE
AMSTERDAM."

The inscription merely names the distiller, but its wording suggests an antiquated form of Dutch. There were also reports of a wooden shipwreck in this vicinity. The prevailing winds and geography of the bay suggest that the reefs in this area would pose a serious hazard to a vessel attempting to enter the bay, especially in foul weather. A brief search was made of the reef just south of Saint Nicolas Point. This reef extended from the surface down to about six or seven meters, where it ended in a sandy flat. Another search was conducted further south of this position near some old pilings. This investigation revealed a spur and groove reef system extending into the deeper waters of the main channel. Neither search revealed any evidence of wreckage, but the survey was far from comprehensive. This area merits closer attention.

Conde Beach

Our final investigation took place off the southern portion of Conde Beach. A diver had reported the remains of a wooden vessel just north of the mouth of the Guantanamo River, within a hundred meters of the shore. A search of the area revealed a sandy bottom with numerous grass beds in less than two meters of water. The depth did not vary as the search extended to about two hundred meters from the shore. There was no evidence of a shipwreck in this area.

Public Relations

An important aspect of the team's work in Guantanamo involved community education and involvement. In an effort to familiarize the public with nautical archaeology, the INA team presented two lectures on past INA projects. First, Jerome Hall addressed the Society of American Military Engineers (SAME) at their monthly luncheon, where he spoke about nautical archaeology and the Monte Cristi "Pipe Wreck." The enthusiasm continued as the local community turned out for William Charlton's lecture on the Uluburun excavation, where he discussed the challenges of underwater archaeology as well as the richness and significance of the wreck itself. Charlton and I were interviewed on a local radio broadcast, and he accepted an invitation to be a guest speaker for a class at the local college. These presentations further enhanced public knowledge.

The community remained extremely supportive of our activities during survey. Many people approached the team, offering support and information. One of the greatest benefits was the help of individuals who volunteered to dive with the team and greatly aided us in our work. We hope we inspired more than a few avocational archaeologists.

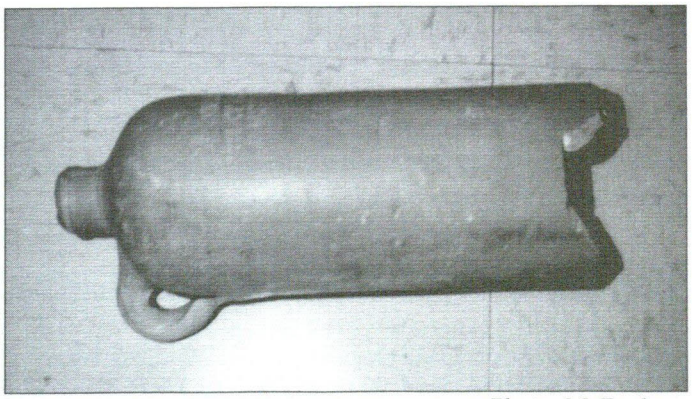


Photo: M. Feulner

Fig. 4. *A jenever (gin) bottle found off Leeward Point by a recreational diver.*

Assessment and Recommendations

The region of Guantanamo Bay has substantial ties to the history of the Caribbean. The amount of maritime activity the bay has seen through the years alone warrants further investigation. The reports of wreck sites within the bay define the areas that call for more intensive scrutiny. The poor visibility found in the upper regions of Guantanamo Bay and the size of the reef systems around the entrance make visual reconnaissance of limited efficacy. Remote sensing surveys using magnetometers and side-scan sonar conducted in these areas would be of considerable value. A sub-bottom profiler would also be helpful in revealing what may lie beneath the thick layers of silt. At this time, an expedition to conduct a magnetometer survey is being planned for this winter. The primary targets of the survey will be the previously identified areas around Deer Point, Leeward Point, Saint Nicolas Point, and Conde Beach. Additional areas of investigation may include Windward Point, Hicacal Beach, Caravella Point, and the inlet north of Caracoles Point. Previous research done in the 1950s suggested a high potential for shipwrecks to be located in the upper bay. However, this region is outside the area controlled by the United States, and investigations there must await a better political climate.

Photo: M. Feulner

Fig. 5. *A bronze cannon bearing the symbol of Louis XIV, the Sun King, is another mystery requiring further investigation.*

The remains of USS *Monongahela* should be preserved and monitored on a periodic basis. The site is located in restricted waters, and should remain off-limits to recreational SCUBA divers and swimmers to protect the integrity of the site. Should sufficient interest develop, the wreck can be accessed from shore or by boat as needed, facilitating a partial or full-scale excavation.

The scene of the Battle of Cuzco Wells offers a significant area for archaeological investigation of an important engagement during the Spanish-American War. The region around the wells is part of a restricted area, minimizing traffic and potential disturbance of the battlefield. The area would benefit from an assessment made by terrestrial archaeologists.

The Spanish-American War also offers an additional item of interest. A monument is placed at the crest of McCalla Hill, where the United States Marines established their first base camp upon landing at Guantanamo in 1898. The monument is a pedestal supporting a bronze French naval gun. The gun bears the symbol of the "Sun King," Louis XIV, as well as the three fleur-de-lis associated with him. This indicates that this cannon was manufactured during his reign, between 1643 and 1715. It is unknown how the gun came to be at Guantanamo. This too, warrants further investigation.

Acknowledgements: I would like to thank first my team—Jerome Hall, William Charlton, and Brix Gustavson—whose work, advice, and patience led to the success of this expedition. I also extend my gratitude to the sponsors—Gregory Cook, Donald and Elaine Feulner, James and Patricia Robison, Charles Schug, and Raquel Suliveres—whose support made this survey possible. I would like to recognize Dr. Kevin Crisman for his support and encouragement. Finally, I would like to thank our hosts, the United States Navy and the people of the Naval Station at Guantanamo Bay, in particular the Public Works Department. The help and support they offered were phenomenal, and not only contributed to the overall success of the survey, but made the experience enjoyable as well.

Suggested Readings

Anderson, B.
1962 *By Sea and by River: The Naval History of the Civil War.* New York: Alfred A. Knopf.

Coombe, J. D.
1999 *Gunfire Around the Gulf: The Last Major Naval Campaigns of the Civil War.* New York: Bantam Books.

Varner, B. D.
1964 *The History of Guantanamo Bay, 1494-1964.* 3rd Ed. Guantanamo Bay, Cuba.

Neptune 2K:
The Underwater Archaeology of D-Day

Brett A. Phaneuf, INA Research Associate

James S. Schmidt Naval Historical Center, Underwater Archaeologist

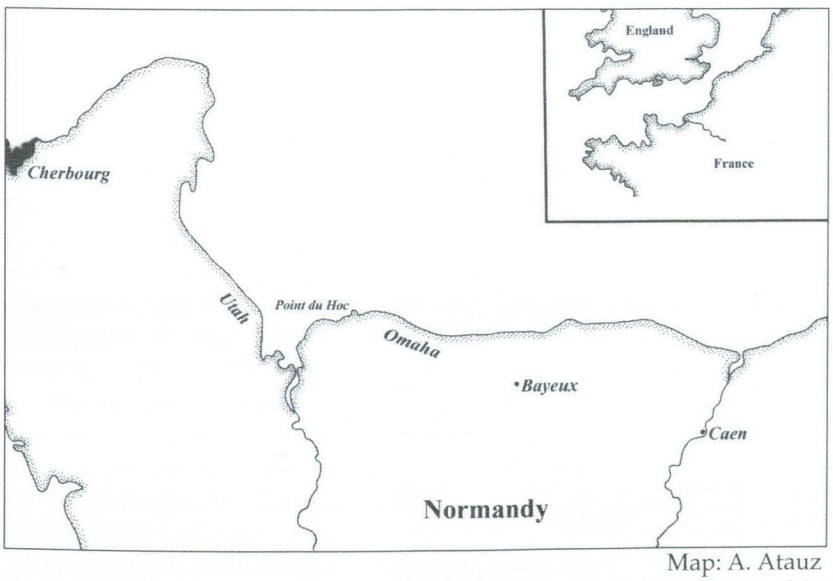
In 1997 Brett Phaneuf and Robert S. Neyland, Ph.D, Head of the Naval Historical Center's, Underwater Archaeology Branch, traveled to Cherbourg in Normandy, France to collect images of the wreck of the Civil War privateer *CSS Alabama* with high-resolution side-scan sonar. Although they were unable to make it to the site due to bad weather, this allowed several days to tour the American landing sectors (Utah and Omaha beaches) and other battlefield sites related to Operation Overlord, the Allied invasion of France. Both men agreed tha it is not possible to stand at Point du Hoc or on Omaha Beach and not wonder what remains of the invasion fleet might lie beneath the waves. Almost immediately, they began discussing the possibility of an archaeological remote sensing survey of the area (fig. 1).

Background

The site has unique importance: on June 6, 1944—D-Day—Operation Overlord went into action. The long anticipated Allied invasion of Nazi-held Europe had finally begun. The invasion plan had been set in motion the day before with Operation Neptune, the naval aspect of Overlord. The scope of this naval action, arguably the most significant and without question most massive in the history of war, is aptly described by author Cornelius Ryan, in *The Longest Day*:

> They came, rank after relentless rank, ten lanes wide, twenty miles across, five thousand ships of every description. There were fast new attack transports, slow rust-scarred freighters, small ocean liners, Channel steamers, hospital ships, weather-beaten tankers, coasters, and swarms of fussing tugs. There were endless columns of shallow-draft landing ships—great wallowing vessels, some of them almost 350 feet long. Many of these and the other heavier transports carried smaller landing craft for the actual beach assault—more than fifteen hundred of them. Ahead of the convoys were processions of mine sweepers, Coast Guard cutters, buoy-layers, and motor launches. Barrage balloons flew above the ships. Squadrons of fighter planes weaved below the clouds. And surrounding this fantastic cavalcade of ships packed with men, guns, tanks, motor vehicles and supplies, and excluding small naval vessels, was a formidable array of 702 warships.

We know that there were at least five thousand ships involved in Operation Neptune, and as many as eight thousand support aircraft, ranging from fighter planes to bombers, gliders, and paratroop transports. The landing craft in the British and American sectors taking part in the action together number more than 3,200 of various types, not including the specialized vehicles and equipment such as amphibious tanks and bulldozers, Jeeps, and artillery. The venerable battleship *Texas* was also on hand to lend artillery support to the troops storming the beaches. These included the Ranger Force assaulting Pointe du Hoc under the command of Lt. Col. James Earl Rudder—later to become Chancellor of Texas A&M University.



Map: A. Atauz

Fig. 1. *The activities of the allied forces were restricted to a short stretch of the Normandy coast and outlying waters.*

More than fifty years later, extensive historical research has been conducted at invasion-related sites. These range from the landing beaches (Utah, Omaha, Gold, Juno, and Sword), to the German fortifications that defended the shoreline, to the sites of the important battles further inland. However, there had been no underwater archaeological research. No attempt had been made to correlate the remaining undersea archaeological

material with the historical record of the naval aspects of the invasion. These continued for months as hundreds of thousands of troops and their equipment came ashore to liberate Europe from Nazi tyranny. Instead, the undersea archaeological record of the invasion has been subjected to decades of erosion, and to clearing of hazards to navigation—most notably, shipwrecks.

The Institute of Nautical Archaeology at Texas A&M University, in cooperation with the Naval Historical Center's Underwater Archaeology Branch, has undertaken a survey to determine the extent of the archaeological record of Operation Neptune. This will be the first underwater archaeological reconnaissance adjacent to the American D-Day landing beaches using state of the art remote sensing detection and imaging equipment. The landing areas will be surveyed from Utah Beach in the west across Omaha Beach in the east. The location of landing craft, artillery, ships, ordinance and any other equipment from Operation Neptune and its after-actions will be determined, mapped and entered into GIS (a Geographic Information System designed to manage "spatial" data like charts, maps, sonar imagery, and geomagnetic contours). The state of preservation of these most valuable archaeological resources will be assessed and recommendations made for further study and preservation. In addition to conducting a general archaeological reconnaissance of the invasion areas, the location of known losses will be examined with the intent to visually record the disposition of the ship, craft, or equipment.

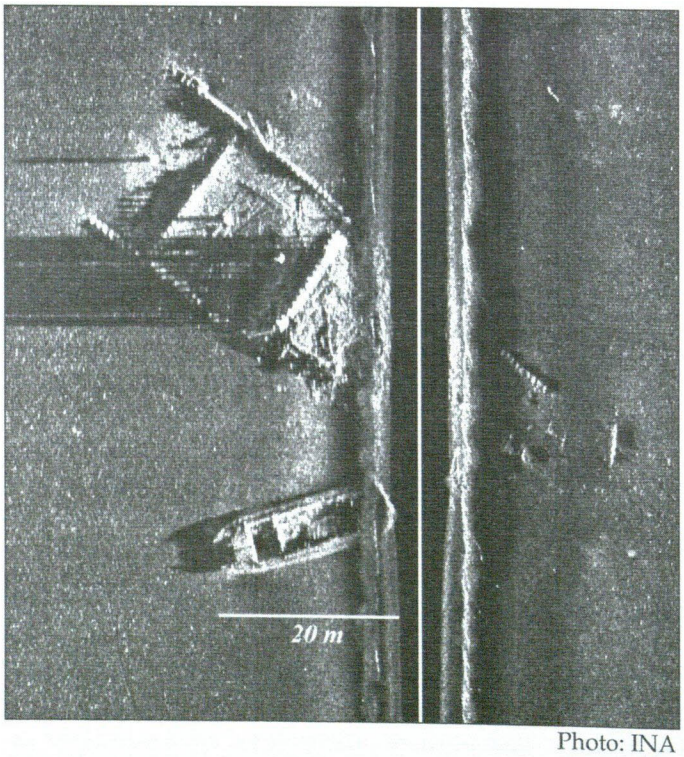


Photo: INA

Fig. 2. *Two landing vessels, a large LST and a small LCT (or possibly a small barge), sit companionably side by side off Utah Beach.*

Utah Beach

In late May of 2000, the *RV Robo* arrived in Normandy almost two weeks behind schedule after a difficult crossing of the Mediterranean Sea and Bay of Biscay from Israel. With little time to rest, the archaeology team and ship's crew prepared for work off Utah Beach, commencing on the first of June. Innumerable magnetometer anomalies (deviations in the Earth's magnetic field due to the presence of a massive, generally ferrous object, for example, a shipwreck or vehicle of WWII vintage) and sonar images were detected and recorded digitally. We used a cesium magnetometer coupled to a 300kHz Sea Scan PC side-scan sonar and HYPACK hydrographic survey software and correlated with precise geographic position . Survey transects were plotted parallel to the shore in a more or less NW-SE direction and spaced fifty meters apart. The lines began approximately 250 meters off the beachhead in three meters of water and extended seaward 4,700 meters to a depth of approximately twenty-two meters. In five days, the first fifty-five of ninety-one total planned lines were completed. This amounted to nearly nine hundred ninety acres or eighty-six line miles—nearly forty percent more than was thought possible for the first season. Although many of the targets appear to be buried in the soft, sandy sediments and were only detected by magnetometer, three targets were truly awesome sites to behold.

Sonar images of two shipwrecks, side by side and in all probability lost simultaneously, were captured near the southern end of the survey area (fig. 2). The larger of the two shipwrecks is most probably a Landing Ship Tank (LST), and is more than sixty-five meters in length, with the bow facing the right side of the image. The frame ends of the hull and considerable cargo still in the holds, most probably on the lower decks, are clearly visible. This wreck may have been salvaged shortly after the war, with much of its upper-works removed as a source of metal to aid in rebuilding Europe, or cleared as a hazard to navigation. However, the small wreck adjacent to the LST appears unmolested and may still be carrying its cargo. Initially, it was thought that the smaller of these two wrecks was a British designed Landing Craft Tank (LCT) used to ferry troops, artillery, and vehicles to shore from the larger LSTs. It may also be a small landing barge similar in dimension and purpose (approximately twenty-five meters in length). It is hoped that further investigation in 2001 will identify not only the type of ship, but also specifically which ship, and when in the invasion it was lost. Further north along Utah Beach, another remarkably well preserved wreck of a landing craft was located. However, it is even less clear what type of vessel this image represents (fig. 3).

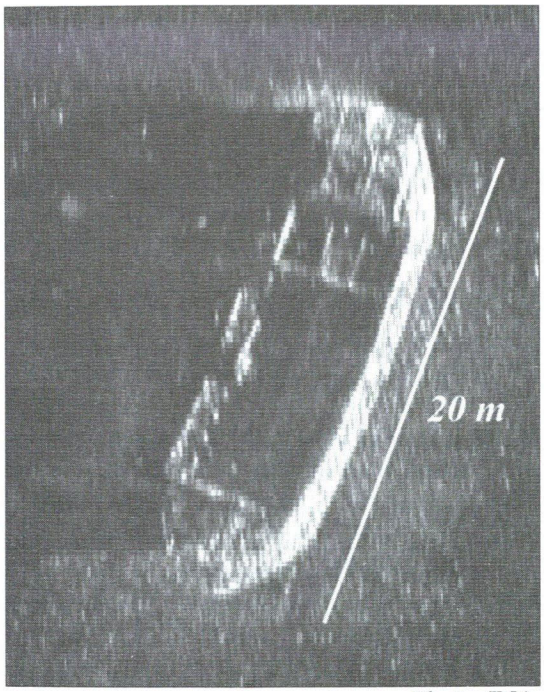


Photo: INA

Fig. 3. *A well preserved but as yet unidentified vessel off Utah Beach.*

Omaha Beach

Once work was completed for the 2000 survey along Utah Beach, we turned to the larger area in need of attention adjacent to Omaha Beach, in the shadow of the American Cemetery just to the southwest. Using the same high-resolution sonar, magnetometer, GPS equipment, and software, we laid out one 121 survey transects, each 4,700 meters long, parallel to shore running west to east. These were spaced fifty meters apart, extending from the remains of the artificial harbor caissons visible at low tide (destroyed in a gale June 19–22, 1944) nearly 5,200 meters seaward. In the eleven days the elements allowed for surveying, the team covered an area of 3,400 acres, or 190 line miles, nearly fifty percent more than anticipated.

The survey area is littered with objects that may be relics of the invasion force. However, there are strong concentrations of material close to the caissons—as would be expected—and a second concentration farther offshore. Most anomalies were detected by magnetometer and are not all correlated to objects imaged on the seafloor with side-scan sonar. Undoubtedly a countless number of objects, both modern and historic, are presently buried in the sediment. These represent shipwrecks, vehicles, ordinance, and personal equipment and effects of soldiers that never made it to the beach. Review of the data forced us to disregard targets, or anomalies, of small magnetic signature or small in size as imaged with the side scan sonar. Still, nearly four hundred promising targets of interest populate our GIS and will require further investigation in the survey seasons to come.

Of the innumerable images, several shipwrecks were clearly identified. The wreckage of what may be an LCT lies upside down off Omaha Beach, its propellers visible in the upper portion of the image, bow facing the bottom of the frame (fig. 4). Nearby are the small remains buried in the sand and mud of what may be an LCVP (Landing Craft Vehicle and Personnel)—or Higgins Boat—built in New Orleans, Louisiana at what is now the site of the National D-Day Museum (fig. 5). The possible remains of a "Rhino Barge" sit broken on the seafloor off Omaha Beach as well, its corroded internal framing exposed. These craft were used to ferry large numbers of vehicles to shore from LSTs. The larger craft stood off at sea with their bay doors open, disgorging cargo onto these low-to-the-water, shallow-draft barges driven by outboard motors (fig. 6).

Perhaps most interestingly, we found a collection of approximately thirteen vehicles assumed to be tanks. These were located a considerable distance offshore along the eastern end of the survey area at Omaha Beach. These are most likely the British duplex drive (DD) M-4 Sherman amphibious tanks assigned to support the American Infantry in the first wave of the invasion (fig. 7). In the landing zones code-named 'Easy Red' and 'Fox Green' only five of the thirty-two DD tanks (741st Tank Battalion) made shore.

For necessary bouyancy, the tanks' hatches were

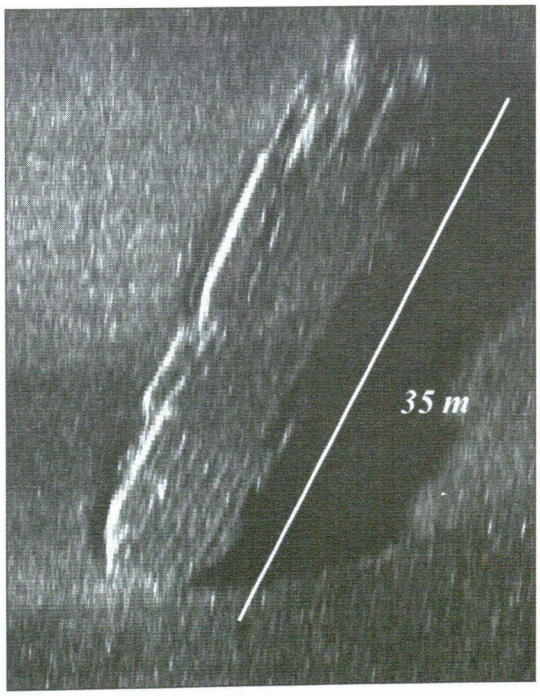
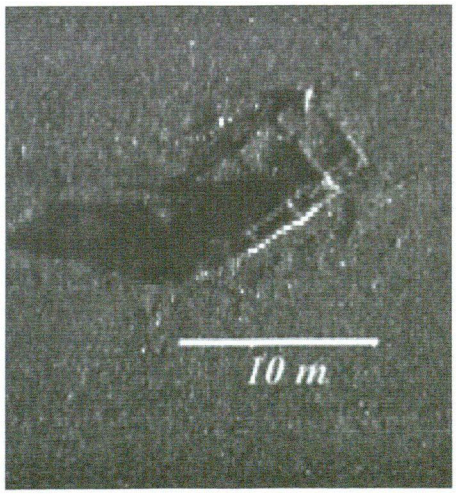


Fig. 4. *An upside-down LCT with its propellers still visible found off Omaha Beach.*

Fig. 5. *A possible LCVP or Higgins boat was found close to the LCT in fig. 4.*

Photos: INA



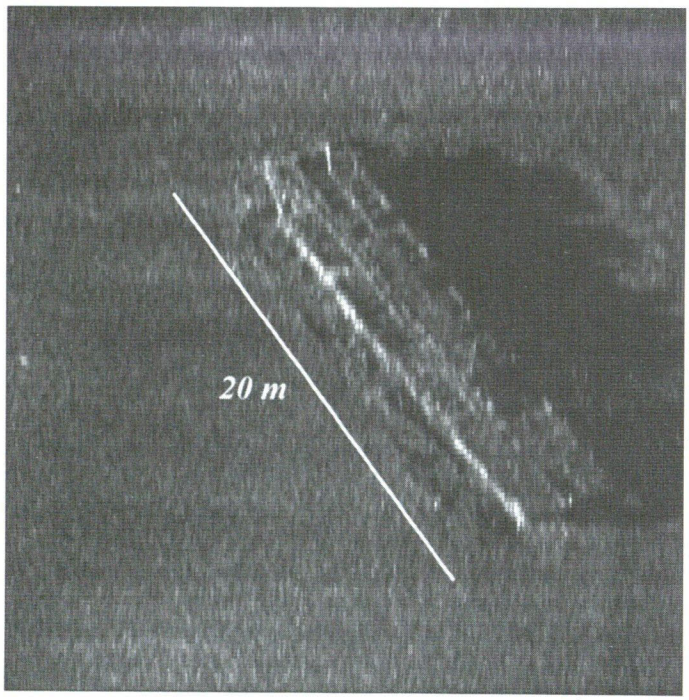


Photo: INA

Fig. 6. *The possible wreckage of a "Rhino Barge."*

sealed and large canvas skirts erected around the upper portion of the vehicles. These would be lowered upon reaching the surf zone. The launch of the first group of DD tanks proved disastrous, sending twenty-seven to the sea floor as they swamped in the heavy seas. The second group of tanks and the crews of the LCTs from which they would be launched witnessed this horror and instead steered close to shore and landed the tanks near the beach. Even if both waves of tanks been launched at the designated time and position the current running strong to the east would have caused the vehicles to come ashore in an area with little or no maneuvering room. This would have forced them to traverse a narrow littoral margin under heavy fire, either to the west to support American troops or east to Gold Beach to support the British. In either case, they would most likely have been destroyed.

Ironically, the same current that so hampered efforts at Omaha Beach and Point du Hoc was largely responsible for the successful landing at Utah Beach with relatively few casualties. The Utah landing force came ashore about a mile south of the intended area and faced little opposition on the beach, and was out of range of the major emplacements of German artillery, many of which had been destroyed in the preceding aerial bombardment. Fortunately, the decision was also made to launch the Utah Beach DD tanks closer to shore than originally planned and they were successful at supporting the infantry on the beach. In all, between June 6 and 16 the Americans landed more than 300, 000 men and more than thirty-five thousand vehicles at Utah and Omaha Beach.

Point du Hoc

The final survey area to be examined in the 2000 field season, Point du Hoc, a promontory situated nearly halfway between Omaha and Utah Beaches, was the site of German artillery emplacements that could have jeopardized the landing operations. On the morning of June 6, 1944, the 2nd and 5th Ranger Battalions under the command of Lt. Col. James Earl Rudder headed ashore in LCVPs (one source stated LCAs) to attack the high cliffs of Point du Hoc and neutralize the threat to the Allied advance. Prior to the Ranger assault, a massive campaign of aerial and ship-to-shore bombardment had been carried out to dislodge the German defenders entrenched in heavy concrete bunkers. Initially, the Rangers approached the shore to the east of their objective due to the long-shore current and heavy seas that swamped one of the landing craft. Traversing the coastline to the west under fire, they landed at Point du Hoc and began to scale the cliff face using rocket-propelled grapnels and ladders attached to the bow of their landing craft. Unfortunately, their late arrival at the objective allowed the German defenders time to regroup after the Allied bombing campaign. This cost the Rangers nearly ninety percent of their complement before Point du Hoc fell to the Allies and the German guns were destroyed. The remains of the bombardment—shattered concrete bunkers, and barbed wire atop the cliffs—provide an eerie reminder of the carnage that ensued there on D-Day.

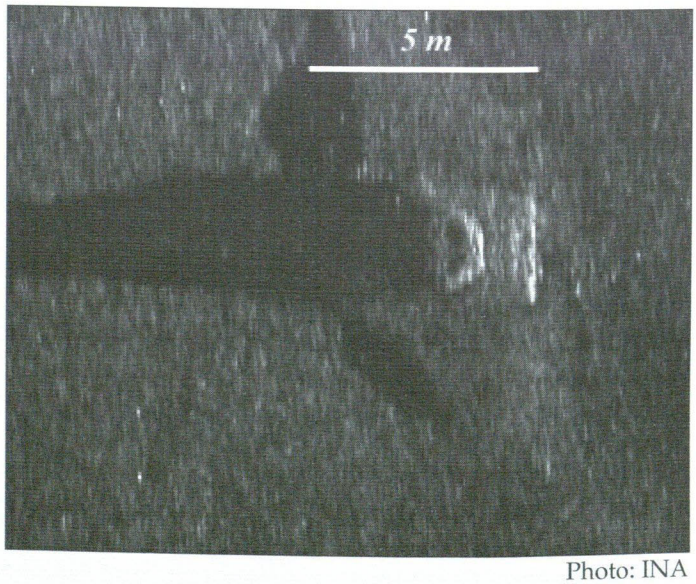


Photo: INA

Fig. 7. *One of the thirteen vehicles assumed to be tanks found off the eastern end of Omaha Beach.*

The survey area extended seaward approximately two thousand meters from the rocky and uneven seafloor at the five-meter depth contour. Survey transects were similarly prepared as at Utah and Omaha Beach. However weather and time permitted us only one day's work in the area covering a total of 392 acres, twenty-two line miles. We found no clear indications of shipwrecks in the area. There are many anomalies that will require investigation in 2001. Certainly there needs to be more work conducted offshore of Point du Hoc, given the importance of the battle to overall Allied success.

Plans

Presently all the sonar and magnetometer data is being carefully reviewed and entered into our GIS. All the anomalies are being plotted not only on modern charts, but on period charts and digital, geo-referenced copies of top-secret "Biggot" maps compiled by the Allies in 1943–4 outlining the German defenses along the Normandy coast in scrupulous detail. Additionally, aerial photographs taken just prior to and after the invasion have been located in the custody of the United States National Archives and Records Administration and will also be included in our GIS. Modern images and anomalies indicating wrecks and vehicles can in this way be checked against period accounts and images. This should assist us in identifying not only the ship and vehicle type, but hopefully the specific ship or vehicle we find years later.

Promising targets located during the 2000 season will eventually be investigated by "drop" camera and ROV (remotely operated vehicle). Diving at this stage is precluded, since all the sites contain considerable amounts of unexploded ordinance. Over the past fifty-six years, trawl fishing in the waters adjacent to the landing beaches continued. Whenever ordinance was recovered in fishing nets, it was usually disposed of by dropping back into the sea over known snags (wreck sites), since trawlers avoided the wrecks for obvious reasons.

As research progresses, and ships and vehicles are located and identified, this information will be correlated with archival records to compile a comprehensive report on archaeological and historical research into the naval action of D-Day, Operation Neptune. This should be the definitive story of the action, incorporating survivor accounts, battlefield historians' notes, and the considerable information gleaned from countless studies of terrestrial conflicts in the wake of the invasion.

Acknowledgments: The authors wish to acknowledge all those who provided assistance for our research, particularly the French Ministry of Culture and Communication, and the Department for Underwater and Undersea Archeological Research, for permitting the survey work. They also provided invaluable advice and encouragement. SeaGrant Texas and the Department of Defense Legacy Resource Management Program provided funding. Geometrics, Inc., Marine Sonic Technology, Ltd., Coastal Oceanographics, Inc., OmniSTAR, Inc. / Fugro SeaSTAR all provided equipment that made the survey possible. A special thanks extends to Mr. George Robb (INA Director) for providing the majority of the funds and equipment necessary to conduct this research.

Suggested Reading

Morison, Samuel Eliot
1963 *The Two Ocean War, A Short History of the United States Navy in the Second World War.* Boston: Little, Brown.

Ryan, Cornelius
1959 *The Longest Day: June 6, 1944.* New York: Simon & Schuster.

Ambrose, Stephen E.
1994 *D-Day, June 6, 1944: The Climactic Battle of World War II.* New York: Simon & Schuster.

Jonathan Gawne
1998 *Spearheading D-Day: American Special Units in Normandy.* Paris: Histoire and Collections.

Underwater Survey of Malta: The Reconnaissance Season of 2000

Ayşe D. Atauz and John McManamon
INA Research Associates

The Maltese archipelago, consisting of the islands of Malta, Gozo, Comino, and some other minor islets, lies almost at the center of the Mediterranean Sea. Covering a total area of approximately 316 km^2, with a population of about four hundred thousand people, Malta has one of the highest densities in all of Europe.

Maltese history, from the arrival of the first farmers (possibly from Sicily ca. 5200 BCE) to the energetic activities of today's residents, is directly tied to seafaring activities and naval warfare. The islanders had to depend on maritime trade from the beginning, and so developed skills for navigation, sailing, and shipbuilding. Seafaring also affected the social and political organization of the archipelago, as the local economy depended upon commerce... and piracy. A succession of invaders arrived by sea. The islands are at the strategic intersection of major trans-Mediterranean trade routes. Terrestrial and maritime archaeology have yielded evidence for various types of ships and cargoes carried along those routes throughout history.

Despite the archaeological potential of Maltese waters, no previous systematic underwater survey has been carried out there. This is primarily due to the overwhelming workload of the staff of the National Museum of Archaeology (NMA) in Valletta. The islands have a significant number of important land sites, which are receiving appropriate scientific study by a small, permanent staff. Further factors in the absence of a prior survey are the high costs of underwater investigations and of excavation and conservation following the discovery of shipwrecks.

Previous archaeological work in Malta

Recovery of underwater archeological material in Malta first started in the 1960s, when sport divers began to give the NMA amphoras, anchors, and shipborne artillery that they had recovered. In 1967, a shipwreck in Mellieha Bay was partly excavated by a team directed by Honor Frost. The site yielded a primary cargo of materials that were almost surely manufactured in Southern Italy; amphoras and glass vessels were also raised. The ship was likely a trading vessel of the Severan Era (ca. 200 CE).

After a lengthy hiatus, serious interest in submerged cultural resources in Maltese waters was revived by collaboration between the NMA and archaeologists from Europe. In 1988–1989, a group from Specialist Archaeology Systems (SAS) conducted a survey and identified at least two promising targets in the Grand Harbor. Unfortunately, subsequent excavation using a water dredge produced only a scatter of modern detritus. The SAS team also surveyed extensively in St. Paul's Bay, traditionally associated with the wreck of the Alexandrian grain vessel that carried Paul of Tarsus to his final appeal before the emperor in Rome. The search showed the virtual absence of archaeological material along Tal-Ghazzenin Reef, reportedly the site where St. Paul's ship foundered.

In 1992, the NMA began a three-year period of collaboration with a French team from the Department des Recherches Archeologiques Subaquatiques et Sous-Marines (DRASM). A survey was conducted from December 14–19, 1992, in the area around Manoel Island and the Lazzaretto in Marsamxett Harbor. This successfully determined the location of the iron ship *Carolita*. In December 1993, joint rescue excavation by DRASM and the NMA in the Marsascala Bay yielded ceramic finds. These ranged widely in date but had their greatest concentration in the period from the fourth to sixth centuries CE.

Archaeological work by INA

The Institute of Nautical Archaeology at Texas A&M University (INA) launched a new phase of nautical archaeology in Malta in the fall of 1999. The years of economic growth on the islands and throughout Western Europe have spurred a series of waterfront development projects at Cottonera and Manoel Island. In an effort to ensure that

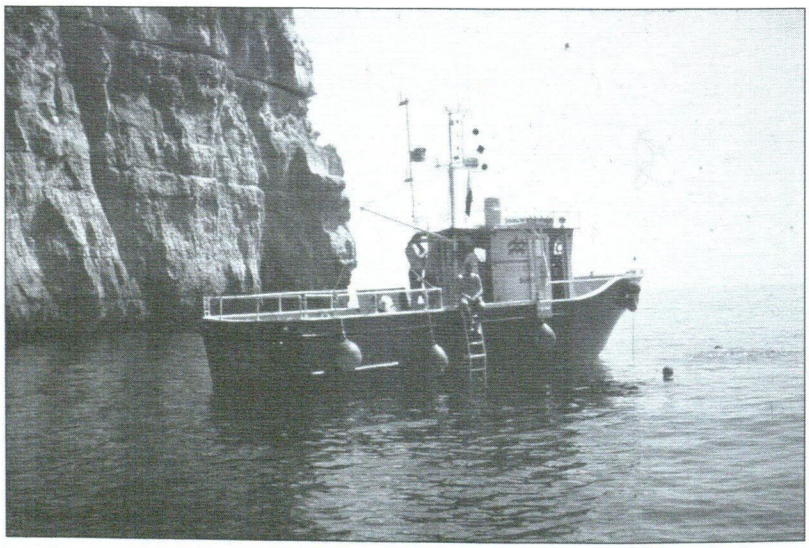


Photo: A. Atauz

Fig. 1. *The survey vessel,* Madonna ta Pinu, *was kindly supplied by the Malta Maritime Authority.*

marina construction and other seaside works do not destroy submerged cultural resources, developers have contracted with INA to conduct a series of surveys under the auspices of the curators of the NMA. The team from INA conducted a survey in Malta during October 1999 (*INA Quarterly* 27.1, 6–10).

In April 2000, INA conducted an archaeological and geological hazard survey around Manoel Island on behalf of the Museums Department and TBA Periti Associates Architectural Corporation. The team surveyed the area around Manoel Island in two series of closely spaced parallel tracks, one set being perpendicular to the other. We utilized the Malta Maritime Authority's (MMA) 14-meter hydrographic survey vessel (fig. 1). This was outfitted with a high-resolution sub-bottom profiler (also provided by MMA) and coupled to an advanced digital data collection system (provided by CODA Technologies, Houston, TX) and a precision global positioning system (GPS) accurate to within fifty centimeters (provided by Omnistar, Houston, TX). We collected two gigabytes of sub-bottom profile data. Our efforts were focused predominantly on areas adjacent to Lazzaretto, the site of the old quarantine hospital for ships entering Malta and Europe, and the proposed site of the breakwater construction. These areas are the most probable locations for potential negative impact to archaeological resources, and the largest square area scheduled for seabed modification. We detected two known shipwrecks within the survey areas. However, the Museums Department was aware of their location, disposition, and origin, and they are not particularly significant from an archaeological perspective, so no further research is scheduled. We detected several other sub-bottom anomalies within the general survey area, and INA has prepared detailed recommendations to mitigate the potential damage to these resources.

One area of concentrated sub-bottom anomalies detected during the survey was investigated by divers later in the summer. We found archeological material ranging from fragments of Roman amphora and other pottery to modern debris centered around a small mound on the seabed approximately five meters in diameter and extending in depth to approximately two meters beneath the seafloor. The area of high artifact density associated with this anomaly runs along a roughly north-south axis. However, no other anomalies indicative of similar deposits were detected on adjacent parallel transects.

Modern nautical charts indicate the presence of a "mound" directly along the anomaly path. This most probably represents dredge spoil from modern harbor works that contained ancient material as well as modern debris. Previous diving surveys conducted in the region noted that the area had been extensively dredged to allow for the berthing of deep draught ships. No records of the dredging activity were located at the MMA offices, and so it is impossible to determine the source location of the dredge spoil for further investigation. Based on the report submitted to the Museums Department, no construction will be allowed in the immediate area, hopefully protecting those artifacts yet to be recovered. More archaeological and geological hazard surveys are scheduled in 2001. These will not only serve to protect cultural resources but in part may help to finance future INA survey seasons.

The ongoing survey in Maltese territorial waters is a joint project between INA and the Museums Department of the NMA. The Department allowed INA to conduct work in Malta under a renewable two-year agreement that established the basis for cooperation. They agreed to respect fully and implement the principles and recommendations contained in the treaties protecting the archaeological heritage.

In May of 2000, a joint INA-Maltese team under the direction of Ayfle Atauz carried out a preliminary survey of the anchorages in and around the archipelago. The work was conducted using a Sea Scan PC side-scan sonar (Marine Sonic Technology, Ltd.), coupled with a GPS receiver. The team also included INA Research Associate John McManamon and personnel from the NMA, Edmond Cardona and Michael Spiteri. Timothy Gambin, a Maltese graduate student in maritime archaeology at the University of Bristol, UK, as well as Joseph Bianco and Godwin Borg from the MMA, comprised the rest of the team (fig. 2). The survey included several phases.

Fig. 2. *The survey team (left to right, standing) Manuel Cardona, Timothy Gambin, Francis Mifsud, Godwin Borg, Michael Spitteri, Edmond Cardona, (sitting) Joseph Bianco, Ayşe Atauz, John McManamon.*

Determining the potential for nautical archaeology

We first conducted research among the documents housed in the NMA archives. The museum possessed artifact files and annual reports dating back to the early 1960s. These files offered information about the context and location of underwater materials now conserved in the museum's storerooms. Re-evaluation of this data, utilizing geographical and chronological criteria, enabled us to determine the areas with higher concentrations of archaeological material. The museum curators also allowed us to examine the forms submitted by sport divers and fishers in order to indicate the location of artifacts they had seen. These provided valuable information about potential areas of artifact concentration. They also were very informative, since comparisons between earlier and more recent reports indicated the extent of damage to archaeological sites.

Our archival research also included the study of previously published material regarding the underwater finds. Moreover, many of our sources (for example, a map produced by an amateur diver in 1965 indicating the location of ancient anchors and amphoras) required considerable work to establish their reliability. We created a database of the information collected during the research, and mapped potential sites to determine the extent of the survey areas and establish the sites of highest priority for immediate attention.

Establishing local conditions

The winds of the Maltese archipelago are unpredictable, to say the least. The strongest and most hazardous are from the east and northeast. To avoid the dangers presented by sudden storms, seafarers were at times forced to sail along the southwestern coast. That stretch of coast is lined with high cliff faces towering above the sea, and it affords very few safe anchorages, which generally lack passage to inland regions. This area of the Maltese coastline has a high potential for shipwrecks.

Another factor we took into consideration when assessing priorities for the survey areas was the growing season for poseidonia grass. This type of seaweed has roots that reach nearly a meter into the sand bottom, with the visible portion of the plant reaching up to two meters in height. It grows in thick banks in water depths of over thirty meters. Poseidonia has a heavy bloom in summer and leaves behind a thick carpet of dead rhizomes in winter. The team noted that most archaeological artifacts were reported to the museum after storms. The wave action uncovered archaeological material uprooted along with that season's poseidonia. Surveying in the winter and early spring would most likely yield better results, but hazardous navigation conditions would prevent access to the areas of greatest interest.

Survey techniques

Every survey area required the use of a different approach, and the survey techniques were generally dictated by the nature and location of the site. However, other factors such as the availability of equipment or weather conditions also played a role in the choice of surveying techniques. These can be grouped as follows: diving investigations of previously known and reported sites, side scan survey, diving examination of the detected targets, and diving surveys on hazard points.

Surveyed sites and areas (fig. 3)

Marsaskala Bay (Area 1). Marsaskala Bay is one of few safe anchorages in northeast Malta. We made a visual inspection of the site of the rescue excavation conducted by NMA and DRASM in 1993 to determine the present state of preservation of materials left in situ. This area was included in the survey program at the explicit request of the Museum curators, who felt that detailed mapping of the site might help better determine its nature. If the artifact scatter presented other chronological concentrations beyond the fourth and sixth centuries, it might indicate a site with multiple shipwrecks. A lengthy diver search was

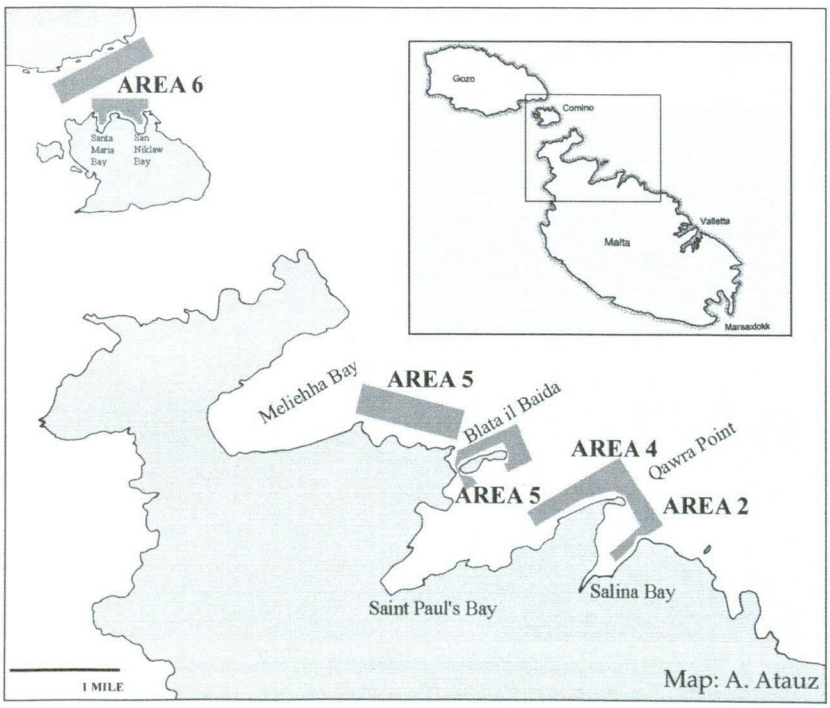


Fig. 3. *Major survey areas mentioned in the text.*

conducted but no further surveying of this site was carried out for three major reasons: (1) previous work in this area had produced material for the dating of the site, (2) the site is stable and preserved under the poseidonia grass, and (3) the bay is a popular swimming and diving area. The site is ideal for training archaeological divers, which would also help to rescue archaeological material from this vulnerable area.

Salina Bay (Area 2). On three different occasions in June, the team dived on a site that was brought to our attention by the NMA. This was characterized by a significant pile of stones not of local origin, mostly tufa with much smaller quantities of what appear to be slate and black marble. A photomosaic and measurements using a baseline and offsets generated a site map (fig. 4). Extensive diver inspection produced two amphora fragments buried deep within the pile of rocks. The base fragment includes the toe, while the body fragment is ridged. Possible parallels pointed to a North African type common in the fourth century CE. The sherds appear to be consistent with, and nonintrusive to, the mound of stones, which is considered to be the ballast of a Late Roman shipwreck (fig 5).

A petrological analysis of the rock samples from the site is required to determine the typology and, if possible, the provenance of the ballast. Unfortunately, there is little probability that wooden elements of the hull are preserved on the site. In two different locations, divers reached bedrock by hand fanning in and around the stones. Therefore, a full excavation of the site would almost surely not yield

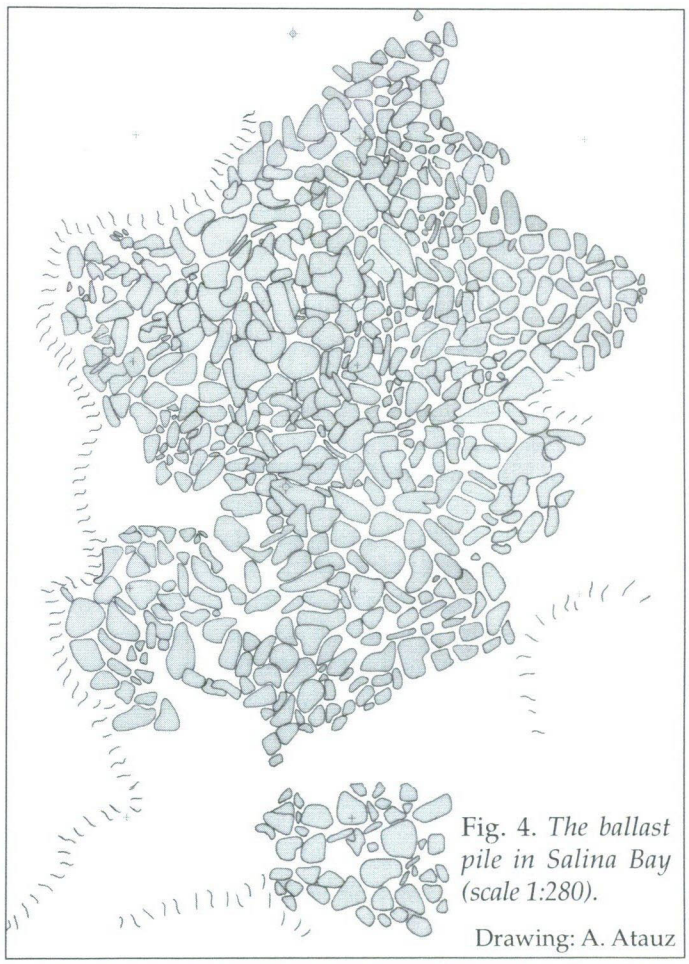


Fig. 4. *The ballast pile in Salina Bay (scale 1:280).* Drawing: A. Atauz

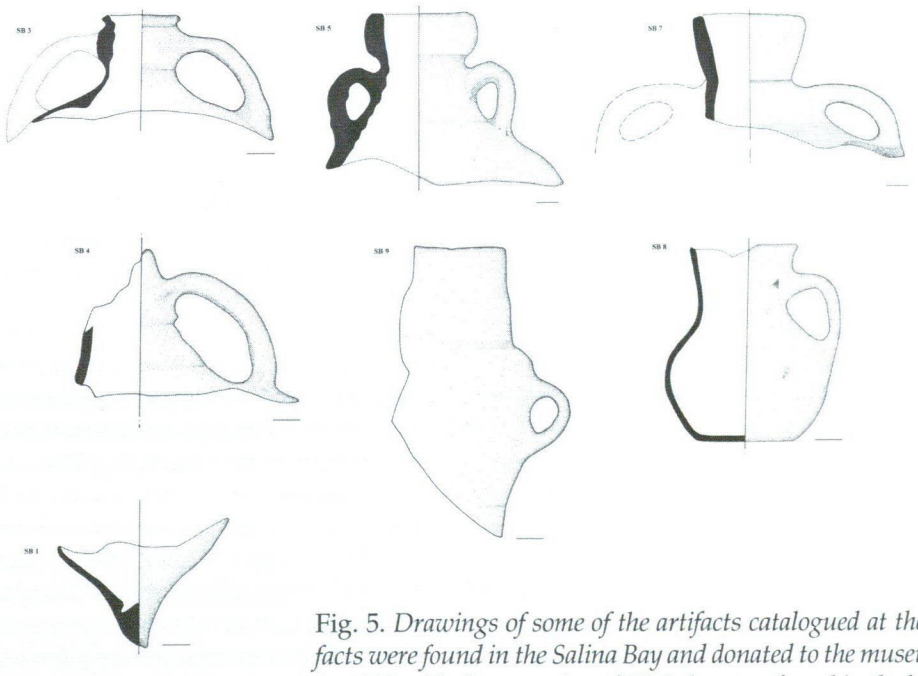


Fig. 5. *Drawings of some of the artifacts catalogued at the museum. All artifacts were found in the Salina Bay and donated to the museum by Joseph Grima in 1999 with the exception of SB 1 that was found in the ballast pile shown on fig. 4. (All scales represent 5 cm).* Drawing: A. Atauz

results commensurate with the costs. Given the findings published recently by Reuben Grima on further evidence of Roman activity in the Burmarrad-Salina basin, a survey of the alluvial plain to determine the former extent of the Bay is vital to determine the context of this wreck.

Munxar Point and Munxar Reef (Area 3). An amateur diver reported a wreck of "Spanish Romano" amphoras located in the vicinity of Munxar Point in 1964. Since this report was supported by later visual sightings of possible amphora sherds, Munxar Point was selected as one of our primary survey areas. Side scan track-lines were run parallel to the reef, and an area varying in depth from seven to fifty-one meters was covered. However, it was clear that diving investigations would be safer and more productive if carried out in another season. In summer, thick poseidonia obstructs the bottom, fish farms attract big, dangerous seasonal fish such as shark and tuna, and visibility is low due to the pollution caused by these fish farms.

Qawra Point (Area 4). A number of artifacts that were reportedly brought up off Qawra Point were donated to the museum in 1964 and 1969. Most of these are Roman anchor stocks and collars, including the largest Roman anchor stock ever found (about 4 meters long). In addition, debris consisting of Roman amphoras of the third century was reported in 1965 by a local amateur diver. There were also recent reports of eroded sherds washing up on shore after storms. The side scan sonar track-lines were run from Tal-Ghazzenin Reef to Qawra Point. Divers visually inspected one target at a depth of forty-one meters. This target included objects of human manufacture, but these were most probably jettisoned as refuse from a passing ship. Other side scan targets were also noted for future diver inspection. Due to the abundance of reports and archeological finds from this area, Qawra Point continues to be a priority area for next season.

St. Paul's Bay (Area 5). Various searches showed the virtual absence of archaeological material that might be dated to the period of Paul of Tarsus, although other artifacts have been reported. These include a pilgrim's flask similar to Byzantine types from the sixth and seventh centuries, a complete Dressel 20 amphora (manufactured in Southern Spain between the first and third centuries CE), a large grapnel type iron anchor of the eighteenth century CE, and scatters of Phoenician ceramics of the sixth to second century BCE. It is also reported that post-medieval ceramic materials, generally characterized as "Berber ware," wash into the inner bay after storms. A British man-of-war that ran aground in the Bay marks the latest site of interest.

The INA team ran several track-lines around St. Paul's Islands and across a reef at the head of the islands. Data were also gathered in the small bay to the west of the islands and the next peninsula to the west of St Paul's, Blata l-Bajda. We detected several anomalies and noted them for future visual inspection by divers. The reef immediately to the north of the islands is one of Malta's premier diving locations, and consequently the probability of finding undisturbed artifacts in this region is low.

Comino: Comino-Gozo Channel, Santa Marija Bay, and San Niklaw Bay (Area 6). Sport divers have extensively plundered this area. One wreck, pillaged in the 1970s, is said to have yielded an alabaster vase of unknown origin. Additionally, there are a few artifacts that were donated to the Museum, including a grapnel-type anchor with four flukes recovered by the Royal Navy from the Channel in 1965, two lead anchor stocks that were raised in 1994, and a Greco-Italic amphora found in the region in 1999. The archaeological evidence from land contexts dating to the Phoenician and Punic periods of occupation suggests extensive seafaring activities between the fifth and third centuries BCE. Furthermore, archaeological evidence points to the use of Comino as a winter base by corsairs in the later Middle Ages. We particularly selected the area as high priority based on the report of a possible Punic wreck site that contained amphoras from the late fourth century BCE. However, the sonar data from Santa Marija and San Niklaw Bays and from the channel between Comino and Gozo produced only a few targets of small scale that are not likely to be complete shipwreck sites. Visual diver inspections in the two bays did not locate any significant cultural artifacts beneath the thick bloom of poseidonia.

Gozo: Xatt l-Ahmar (Area 7). Museum divers reported sightings of large amphoras amidst boulders at the base of a cliffside approximately thirty meters to the south of Xatt l-Ahmar Point. The amphoras were visible after winter storms in the area. We ran several sonar tracklines parallel to the shore from the Point southward. Visual diver inspection located the aforementioned boulders, but divers saw no amphoras exposed above the sand. Any further investigation will require removal of the sand at a depth of over forty meters.

Gozo: Xlendi (Area 8). The entrance to Xlendi Bay is made treacherous by the presence of a pair of submerged reefs, and the area is known to have produced whole amphoras, which span a significant period in antiquity. Amphoras recovered from the Bay in the past forty years include examples of all of the following types: Punic, Aegean Greek, Greco-Italic, and Roman. Recently, a cylindrical fourth-century African amphora was recovered near the northern reef. Anthony Bonanno has proposed that the amphoras indicated a pair of Roman shipwrecks in this area. The earlier (second century BCE) carried a cargo of mixed amphoras from places such as North Africa and Apulia, Italy, and the later (fifth-sixth century) yielded only a few isolated jars. Reuben Grima suspects that some small jugs located in the past may have originated in the Balearic Islands. No harbor works have yet been located in the surrounding village and countryside. Therefore, ancient

sailors probably used Xlendi Bay only as a safe anchorage during storms. The INA team extensively surveyed this promising area, running one trackline into the Bay itself and several tracklines parallel to the shoreline across the entrance to the Bay. The lines covered the steep drop-off of the shore to a depth of approximately eighty meters. We noted a group of anomalies for further examination by divers or by a Remotely Operated Vehicle (ROV).

Establishing local connections

INA established contacts with several groups:

The National Museum of Archaeology (NMA). The Museum staff played an active part in the project from the outset, and they were represented in all stages of the planning, organization, and actual surveying. In addition to issuing the necessary permits for the survey, making arrangements for the funds to be transferred to Malta, and clearing the remote sensing equipment through customs, the Museum also gave access to their archives. Likewise, the Museum allowed Ms. Atauz access to the conservation laboratory and gave her permission to set up a desalination facility on Museum property. However, the Museum contributed most to the survey by assigning two staff members, Michael Spiteri and Edmond Cardona. The contribution of those two staff members was invaluable, given their familiarity with the sites and the archaeological material. In addition, the Museum also provided financial support by renting and filling diving tanks for the survey, and providing a vehicle for our transportation to shore-diving locations. Our ongoing cooperation with the Museum allowed us regular access to facilities such as the laboratory, computers, and other means of communication that proved to be crucial elements in our work.

The Malta Maritime Authority (MMA). This is a non-governmental organization that has been an active participant in the project from the beginning. The Authority made a major contribution by allowing us to use their survey vessel, the *Madonna ta Pinu*, both in the remote sensing survey in April 2000, and throughout this past summer. The vessel was well suited to survey work carried out on the project, and members of the MMA staff, Joseph Bianco and Godwin Borg, made valuable contributions to the project. MMA provided most of our knowledge about local navigation patterns and coastal geology and bathymetry. Godwin capably captained the vessel, while Joe, the MMA hydrographer, plotted the survey track-lines throughout the summer.

The Archaeological Society. This non-governmental organization aims to promote awareness about the archaeological heritage of Malta. The Society asked INA Research Associate Ayşe Atauz to give a lecture about nautical archaeology and INA to help promote connections with local preservation groups and create public awareness about the need to protect underwater sites in Malta.

University of Malta—Department of Classics and Archaeology. The Department did not have an active role in our projects. However, a number of students showed interest in participating in future INA projects. After communicating with professors from the university, we reached an agreement regarding the participation of students and the scheduling of such participation. The University staff has also provided tours of various ongoing terrestrial excavations and suggested possible maritime connections between those sites and nearby harbors. Their suggestions for collaborative research are included in the 2001 research schedule, which will require active participation of team members from the terrestrial excavations.

Others. Interviews with sport divers from a prominent local dive club, fishers, and others who were likely to have information about submerged cultural resources, or places where such materials have been found, comprised other sources tapped by the team. After their reports are considered and their accuracy is evaluated in concert with the Museum Department, some of the areas indicated may be included in the 2001 survey plans.

Future Plans

The finds of this first season of systematic surveying of Malta produced very important information about the potential of the islands and the nature of the underwater material in Malta. This information and the experience of being in Malta will be invaluable in terms of selecting the appropriate season, the necessary equipment, and the proper techniques for future survey in Malta. The most important aspect of this first season was to establish local contacts for future INA projects in Malta. Working relationships with the Museums Department and MMA promise excellent long-term collaboration with governmental and non-governmental bodies. Hands-on training of the team will also contribute to the success of future projects. With a trained group resident in Malta and ready to assist our work, time and funds will be used even more efficiently (this year we finished the field season forty per cent under budget!).

Work for the summer of 2001 will include the use of a magnetometer in the areas with thick poseidonia layers. Diving surveys will be given priority, and divers will search the shallow bays and natural harbors where archaeological material is reported to exist. No technology presently available seems to function well for remote sensing survey in the intractable waters of Malta.

We also believe that a search for shipwrecks in the areas that are beyond recreational diving limits should yield good results, since these depths are more or less protected from looting and casual artifacts collection. Therefore, our team is scheduled to employ an advanced multi-beam sonar system (provided by Kongseber-Simrad, Inc.) that will detect small seafloor anomalies in water up

to two hundred meters deep. A drop camera will be employed to ground-truth the archaeological targets detected by the multi-beam sonar.

The cataloging and conservation of the artifacts at the NMA in Valletta will continue. A database of the artifacts in the National Museum, the Maritime Museum, and the Gozo Archaeological Museum will enable us to quickly analyze the extent of the artifacts from underwater contexts in the museum storerooms, and locate their point of origin. The artifacts from underwater sites in museum storage have never before been studied. Cooperation with the University of Malta might encourage graduate students to compare this material with terrestrial finds in Malta and further afield.

Collaborative research projects by INA in Tunisia and Sicily with the Museums Department and MMA have also been proposed for 2001–2002. There can be no doubt that INA has a bright future in the navel of the Mediterranean—Malta.

Acknowledgements: The work in Malta was conducted using a Sea Scan PC side-scan sonar coupled with a GPS receiver generously provided by George Robb, Jr. (INA Director) and Marty Wilcox (former INA Director). Mr. John Van Tassel generously donated the computer used for data processing. The MMA generously provided its survey boat for the duration of our survey in exchange for training for its personnel on the side scan sonar system. The NMA provided the vehicle for our transportation. To all of them goes our deepest gratitude.

We would like to thank the Director of the NMA, Anthony Pace, for providing the permits for our work in Malta and the support of the museum, and Curators Reuben Grima and Nathaniel Cutajar for their expert counsel and generosity in providing access to the museum facilities.

We will take this opportunity to thank the excellent team we had in Malta: Edmond Cardona and Michael Spiteri from the NMA for their enthusiasm and providing the information concerning the land and underwater archaeology in Malta. Without their assistance and knowledge of ancient ceramics, it would have been impossible to locate the sites. Special thanks to Michael Spiteri for his skills in organizing the dives and watching our safety. Without Timothy Gambin, and his pioneering efforts, none of the INA projects in Malta would have been possible. Joseph Bianco and Godwin Borg, skilled employees of the MMA, had incredible contributions to the project. It would not have been possible to navigate and run our perfectly straight tracklines without their diligent and meticulous work.

Special thanks to INA Research Associate Brett Phaneuf, the general director of the Western Mediterranean Research Project, for his support and encouragement, making all the painstaking arrangements for the remote sensing equipment, and carrying out the Manoel Island survey to raise the funds for the 2000 season in Malta (fig. 6). I also would like to thank Fr. Eugene Theuma for his help and his interest in our work.

Finally, our warmest thanks go to the Gambin family, for their hospitality. Very special thanks are owed to Belinda Gambin for her friendship and for making us feel at home.

Suggested Reading

Bonanno, A. and M. Mintoff
1995 *Malta, an archaeological Paradise*. Malta: M. J. Publications.

Elliott, P.
1980 *The Cross and the Ensign: A Naval History of Malta 1798-1979*. London: Harper Collins.

Grima, R.
2000 "Naxxar - An Archaeological Profile," in P. Catania and L. J. Scerri eds., *Naxxar: A Village and Its People*: 52–57. Malta: P. Catania Publishers.

Milanes, V. Mallia
1992 *Venice and Hospitaller Malta, 1530–1798: Aspects of a Relationship*. Malta: P.E.G. Publishers.

Vassalo, C.
1997 *Corsairing to Commerce: Maltese Merchants in XVIII Century Spain*. Marsa: Malta University Publishers.

Wismayer, J. M.
1997 *The Fleet of the Order of St. John 1530-1798*. Malta: Midsea Books Ltd.

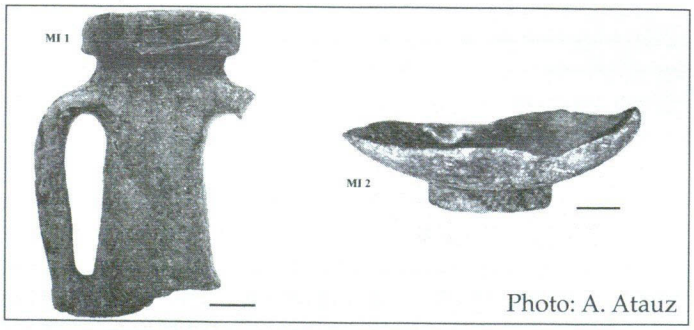


Fig. 6. *Finds from the Manoel Island area. (Scales represent 5 cm).*

Denbigh Revisited

An account of an underwater archaeological excavation as viewed through the eyes of two undergraduates.

Ashley Porter and Chris Dechillo

Denbigh, one of the most successful Confederate blockade runners, now rests on her keel in eight feet of water off the coast of Galveston, Texas. Her bow proudly points toward the Gulf in defiance of her obvious inability to conjure up the power to transport supplies one last time. Her iron hull was burnt to a blackened crisp during the dawn of March 23, 1865, after suffering bombardment by Union artillery fire. What now remains of the vessel is a dismal remnant.

As senior undergraduates at Texas A&M University, we had the privilege of working with the Institute of Nautical Archaeology (INA) during the summer of 2000 excavating *Denbigh*. J. Barto Arnold directed the excavation and made us part of his crew. We all worked side by side to aid Mr. Arnold in the painstaking task of recording and documenting information retrieved from long hours of work on the vessel. Each morning began with a brief meeting preparing the group of divers, engineers, archaeologists, and students on the proceedings for the day. After the morning meetings, we prepared the boats for launch and assembled all necessary tools for the labors ahead. Some of us had never worked in the temperatures of a Texas summer, and were not prepared for the relentless heat and humidity. After we acclimatized to the weather, it became increasingly easier to carry out delegated tasks. Since we were dealing with Texas summers, work was halted by uncooperative weather on more than one occasion.

Photo: INA

The Denbigh *excavation team for the 2000 season.*

Once out at site, operations commenced in an orderly fashion. We made plans for the day and willing individuals assembled dive gear. For the first four week, all that was accomplished was digging with gas powered water dredges through eight feet of muddy sediment. When we finally reached the hull of the vessel, we uttered sighs of relief, as it had seemed that the digging would go on forever. Throughout the remaining weeks, we dived multiple times locating sparsely scattered artifacts and fragments of coal and iron.

Usually when you imagine scuba diving, you visualize clear waters and tropical fish...or at least we did. Let us briefly describe the dismal solitude and obscurity that actually surrounded us during each dive: after the first diver entered the water, a cloud of silt rose from the bottom and blanked out the entire dive site. Close your eyes for one moment if you will, now cover your eyes with your hand. What is it that you see? Nothing? This is what we had to look forward to almost every day on site. We blindly felt for our excavation units, protruding deck structure, and minute artifacts. Sharp pieces of rusty iron pierced our wet suits and skin on more than one occasion.

Ashley writes: "I was stationed in unit four, which was midship just aft of the paddle wheels. We dug a hole about twelve feet in length by five feet in width and measuring seventeen feet from the water's surface. I affectionately refered to this unit as the 'cavern of darkness' for it resembled a tomb. On one of the last days of our project, we began to uncover some interesting artifacts. In the murky hollow, my partner and I located bits of preserved wood and multiple pieces of broken glass. I uncovered a sherd of crude pottery with what appeared to be the word 'Marine' stamped in a banner fluttering above an anchor. My partner found a leg of a porcelain doll. We were all thankful for these elusive pieces of history."

Days were long and work was tiring, but the crew would frequently find time to go dine and listen to the splendid music of a live Irish band. The sometimes backbreaking work formed a bond between crew and directors alike. As undergraduates, we felt warmly welcomed into the world of nautical archaeology. We realized that you *can* discover more than just the past on an excavation. You can also discover new friendships. Our understanding of the nautical world and what it means to be an archaeologist was greatly enhanced by the *Denbigh* project.

The wave currents, low visibility conditions, and the overhead environments in which we had to work each day gave us a good introduction to the challenges one encounters in this type of work. We agreed that, overall, our experiences this summer have inspired us to pursue careers in nautical archaeology.

Deep Wrecks and Research in the Gulf of Mexico

Brett A. Phaneuf, Deep Tow Research Group

Department of Oceanography, Texas A&M University

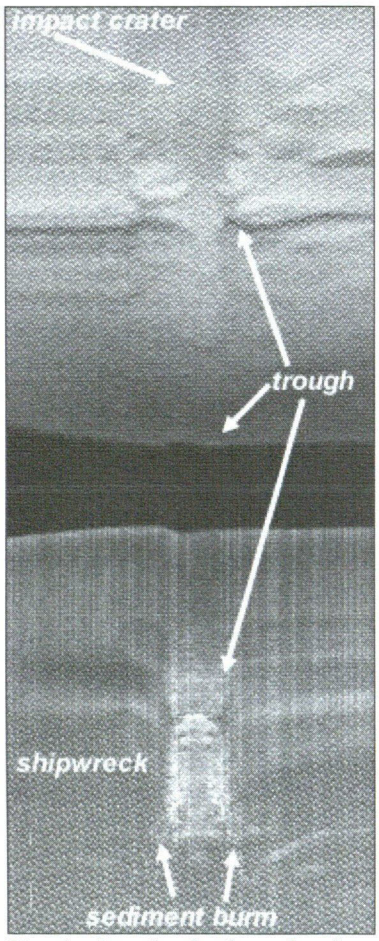


Fig. 1. *At a depth of nearly nineteen hundred meters along the west slope of North Terrebonne Basin, a ninety meter long shipwreck was located.*

A surprising discovery can often be made while reviewing seemingly endless data. Such was the case recently when studying voluminous deep-sea side-scan sonar and sub-bottom profiler data on the north-central Gulf of Mexico. The data, collected by the Deep Tow Research Group (DTRG) revealed two shipwrecks. The first is located along the steep west slope of North Terrebonne Basin, about 250 kilometers offshore from central Louisiana (fig. 1). The ship hit bottom at the top of the image, as is evident from the impact crater, and cut a trough in the seafloor as it slid down-slope nearly seven hundred meters, pushing sediment in front of it like a snowplow, finally coming to rest in approximately nineteen hundred meters of water. The second shipwreck is located near Vaca Basin, approximately 450 kilometers south of the central Louisiana shore in approximately 2,300 meters of water (fig. 2). The side-scan sonar image shows a largely intact metal hull, approximately seventy meters in length, the uncertainty owing to the fact that part of the wreck is obscured by the "acoustic shadow" of the side-scan pulse, indicating substantial relief. No other information is available about either shipwreck. These could be WWII losses in the Gulf, iron-hulled steamships heading north from Panama or ports in Mexico, or modern ships caught in a storm or suffering some mishap at sea. Any information about these two wrecks would be most welcome. The discovery of these shipwrecks shows the application of deep towing technology to nautical archaeology.

DTRG is part of the Geological Oceanography Section in the Department of Oceanography at Texas A&M University. The group operates an Edo Western Deep-Tow surveying system consisting of a 100kHz side-scan sonar and a 3.5kHz sub-bottom profiler, seven thousand meters of tow cable, a Dynacon handling system, and Triton-Elics *Isis*® data acquisition and processing system. Students working with DTRG have also written custom post-processing software that has greatly enhanced the group's productivity. The Deep-Tow is routinely deployed to depths in excess of three thousand meters to study deep-sea sediments and seafloor processes in the numerous basins and along the Sigsbee Escarpment in the Gulf of Mexico. It is towed thirty meters above the seafloor, allowing for the collection of extremely high resolution data from the top one hundred meters of sediments without the degradation caused by beam-spreading seen in typical shallow-towed systems (fig 3). Presently, data from the past three to five years is being reviewed, reprocessed, and reformatted for incorporation into a web-enabled GIS database. That will allow DTRG to disseminate large volumes of once inaccessible information about the deep Gulf of Mexico to the commercial and academic community at large. For more information see http://deeptowserver.tamu.edu/deeptow, currently under construction. DTRG has also collected innumerable gravity, piston, box, and jumbo-piston sediment cores throughout the Gulf of Mexico. It is currently correlating the geotechnical data (density, p-wave velocity, water

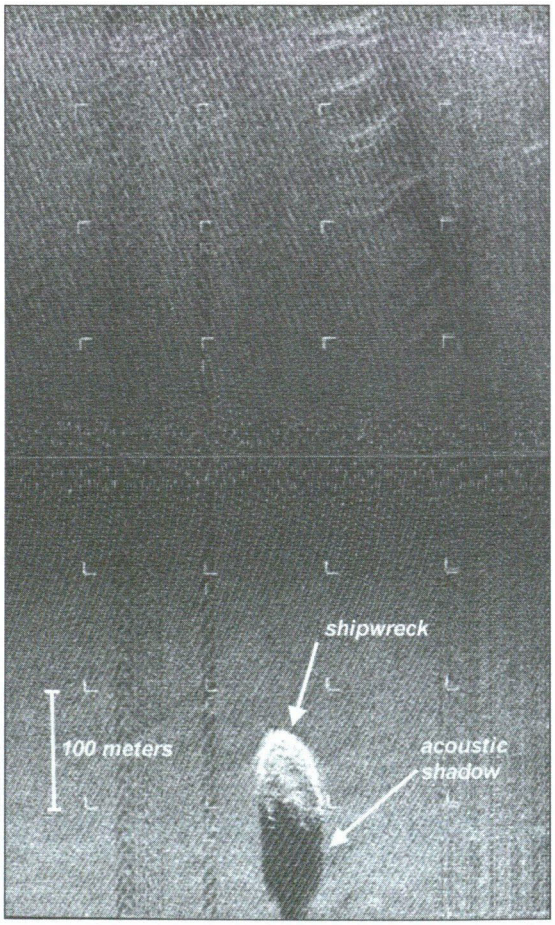


Fig. 2. *Near Vaca Basin, just north of the Sigsbee Escarpment in waters approximately 2,200 meters deep, a seventy plus meter long shipwreck was isolated using the deep-sea side-scan sonar.*

content, shears strength, grain size, etc.) with deep-tow seismic profiles and other commercial sources of seismic data. DTRG is incorporating it into the GIS database previously mentioned.

The Group is under the direction of Dr. William Bryant. It is currently seeking new research opportunities for students and faculty in the Gulf of Mexico and beyond, in partnership with academic and commercial institutions such as INA.

Photos: DTRG

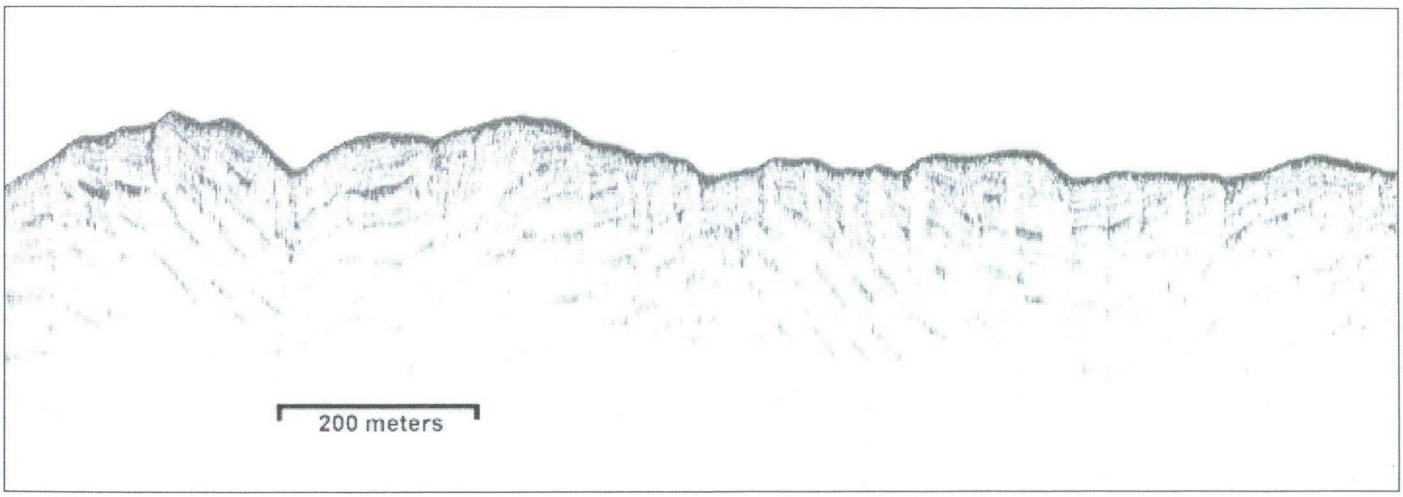


Fig. 3. *Sub-bottom profile near the Sigsbee Escarpment, west of Bryant Canyon–water depth approximately twenty-two hundred meters.*

Just Released

***Iron and Steamship Archaeology: Success and Failure on the SS* Xantho**
Michael McCarthy

In the early 1980s, many nautical archaeologists suggested that the excavation of steamships and other modern vessels was a waste of time. They felt that the materials themselves could provide no new information beyond what could already be found in historical records. Dr. George F. Bass argued for the minority position that archaeology could provide a valuable service, even for wrecks recent enough for plans and photographic evidence to exist. Excavation could not only supplement the historical record, but also provide a valuable independent check on the accuracy of the documentary evidence. The Western Australian Museum saw the SS *Xantho* (built 1848, sank 1872) as a useful test case to see whether archaeological study of a well-documented iron steamship could indeed provide useful new information. This book, the latest in the Plenum Series in Underwater Archaeology edited by INA's J. Barto Arnold III, describes the investigation of *Xantho* that began in 1983 and continues to inform us today.

Based on the historical record, the excavators expected to find a new, efficient engine in *Xantho*, which had been converted from paddles to screw propulsion only a year before it sank. Instead, they found a horizontal trunk engine designed for duty in Royal Navy gunboats during the Crimean War (1853–56). This used undiluted seawater to generate steam and exhausted directly into the air without a condenser. Because of the pitch of the propeller mounted on *Xantho*, the engine had to be run in reverse to go forward. All these factors made for a highly inefficient propulsion system, considering the cost of coal and inaccessibility of repair facilities on the remote stretch of northwest Australian coast where the ship was to operate. The attempt to explain these unexpected facts provided considerable new information about *Xantho* and its historical context. Dr. Bass was vindicated—the archeology of modern vessels *is* a useful exercise.

Michael McCarthy has been the archaeological director of this project for over seventeen years. His book vividly illustrates that nautical archeology is about more than just diving and excavation. Some of the most valuable information was discovered only during the long process of conserving and studying the *Xantho's* engine. This was raised from the bottom in 1984, and will be finally reassembled and displayed no sooner than 2002. The concretion that forms around submerged metal makes the study of iron steamships a very different proposition from older wooden ships. However, the *Xantho* project shows why nautical archaeologists have demonstrated increasing interest in the study of relatively modern shipwrecks. The number of steamships discussed in this issue of the *INA Quarterly* proves that.

2000 ISBN: 0–306–46365–2, 234 pages, 76 illustrations, references, bibliography, 2 appendices, index, hardback. Price $59.00.

News & Notes

Shipwreck Weekend 2001

Visitors learned about the Institute of Nautical Archaeology and the Nautical Archaeology Program at Texas A&M University during Shipwreck Weekend 2001. For eight hours on February 3, the audience of sports divers, avocational archaeologists and historians, and other interested individuals heard an impressive collection of presentations. These included illustrated lectures by Professor George Bass and six other scholars. Sheli Smith spoke on *Serapis* and John Paul Jones, Bill Lees on a nineteenth-century steamboat on the Red River, and Barto Arnold on the blockade runner *Denbigh* (see page 29 in this issue). Other speakers included Katherine Willis on the Black Sea Trade project, Brett Phaneuf on his work in Normandy (see pages 17–21), and Mark Feulner on the Guantanamo Bay survey (see pages 13–16). In addition to attending the lectures and viewing video footage of INA's ongoing projects, visitors could tour the facilities of the Institute and Program in the Anthropology Building at College Station. Potential students and collaborators could see the Conservation Research, Old World Projects, New World Projects, and Ship Reconstruction laboratories. All attendees had an informative time.

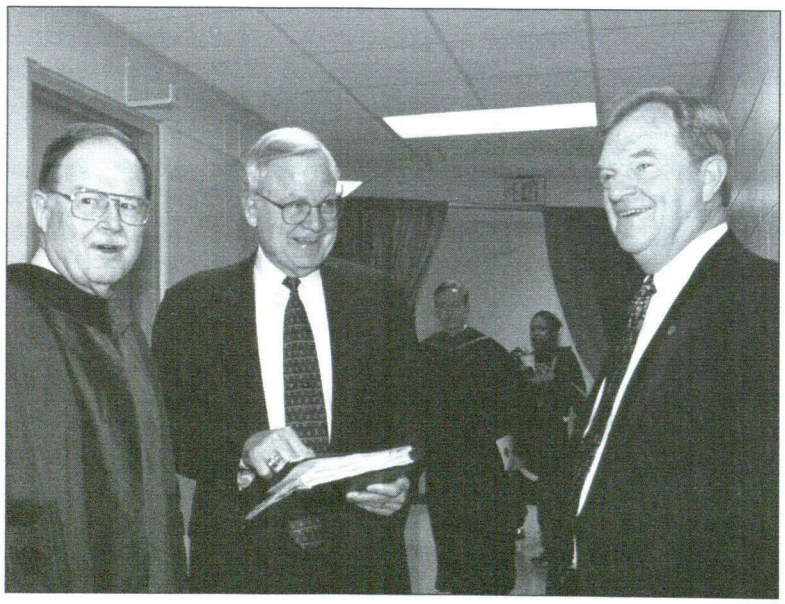
Students Receive 2000–2001 Honors

Texas A&M University has announced recent honors granted to students in the Nautical Archeology Program. These include INA Scholarships awarded to Christoph Bachhulsen, Katie Michelle Custer, Lauren Lancaster, Carrie Sowden, and Wendy Van Duivenvoorde. The Regent Scholarship recipient was Rebecca Ingram. Erkut Arcak, Sara Brigadier, Nancy DeBono, Erika Laanela, Sam Lin, Mason Miller, Asaf Oron, Anthony Randolph, Sue Vezeau, and Wendy Van Duivenvoorde all received Graduate Assistantships (Non-teaching). Filipe Castro was named Mr. and Mrs. Siegfried II Graduate Fellow while Matthew Harpster was named the Marian M. Cook Graduate Fellow.

Recent A&M Graduates

The Nautical Archaeology Program within the Department of Anthropology at Texas A&M University in College Station is proud to announce its latest graduating classes. At the Spring 2000 graduation exercises Samuel EuGene Mark became a Ph.D. His dissertation was entitled "Homeric Seafaring." Brendan Joseph McDermott, Schott McLauglin, and Daria Elizabeth Merwin were awarded their Master of Arts degrees. Joseph R. Cozzi became a Ph.D. in Summer 2000 for his work "The Lake Champlain Sailing Canal Boat." Also, Lee Dillon Gorham from the Anthropology Department received his Ph.D. for work carried out on various INA excavations and detailed in his dissertation "The Archaeobotany of the Bozburun Byzantine Shipwreck." Richard Keith Wills received the M.A. degree. In the Fall of 2000, David Andrew Johnson received his master's degree.

INA Founder Delivers Commencement Address



In an unusual honor for a faculty member, INA Founder George F. Bass delivered the Commencement Address to those graduating from the Colleges of Liberal Arts and Education at Texas A&M University on December 16, 2000. Just before the ceremonies in College Station, Dr. Bass chatted with University President Ray Bowen (center) and Vice President Robert Walker (right), both INA Directors.

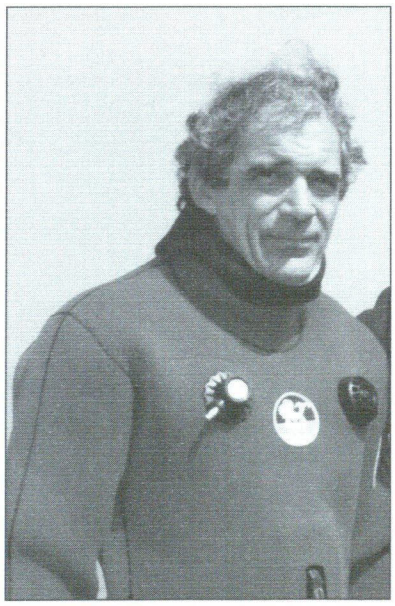
IN MEMORIAM

Richard W. Swete

1946–2000

On November 4, 2000, while directing the *Serapis* site investigation, Dick Swete succumbed to an acute attack of malaria on Ile St. Marie, Madagascar. An active nautical archaeologist for twenty-four years, Dick leaves a wife Sharon, two grown children—Amy Pruett and Richard A. Swete, three grand children, and many friends.

Born in California, Dick spent his early years in Guam, but returned to California to attend high school. He then enlisted in the Army and served two years in Vietnam in a night-fighting light infantry battalion. During the Tet offensive in 1968, he was seriously wounded in a massive firefight, losing his left foot. After recovering, he spent seven years with Army Intelligence, earned a bachelor's degree from Campbell University, and retired from the military in 1976, In January 1977, he began his masters degree work in Nautical Archaeology at Texas A&M. After receiving his MA, he worked for his Ph.D. at the College of William and Mary.



It was in Texas that many of us in INA met and grew to like Dick. He was intelligent, inquisitive, perceptive, and charming. Dick loved people. He was curious about them, cared about them, and inquired about them. It wasn't just to pass the time or for idle curiosity; he cared about each individual he met. People understood this, and loved him for it.

Always honest, hard-working, intelligent, and up for an adventure, Dick still will be for some time the first staff member many of us think about when something new is brewing. When we first met as graduate students in 1977, he said he wanted to stay out in the field, where the action was. Perfectly capable as a project director, he usually preferred to let someone else do the administration and take the bows as he stayed with the action. Never one for the ordinary, Dick would almost fall asleep if everything was going well.

Typically, Dick would be invaluable when planning and mobilizing his or someone else's project. Full of good ideas, organizational and diplomatic skills, he would work almost non-stop until the new shipwreck investigation was humming smoothly. "Can do easy" was his creed. When the weather turned nasty, the compressor broke, the plans didn't work, and everyone else knew we would not finish on time, Dick would state, "It don't get no better than this," rally everyone, and lead the way to a successful finish.

Over the years, because of his interests and abilities, Dick was an active team member on many projects around the world. He supervised or helped with the raising of a number of historic ships. He worked on projects in Stockton Springs, Bangor, Boon Island, Winterport, and Pemaquid, Maine; Mombassa, Kenya; all through Chesapeake Bay and its rivers; Gravisca, Italy; Isle aux Morts, Newfoundland; Boston, Salem, Hyannis, and Plymouth, Massachusetts; Manhattan, Athens, and Coney Island, New York; Port Stanley, Falkland Islands; the Dominican Republic, San Francisco Bay and Emerald Bay, California; and many others.

Dick developed an interest in the Revolutionary War hero John Paul Jones while still a schoolboy. Several years ago he was on the team of archaeologists that found Jones' first ship, *Providence*, off the coast of Maine. He then set out to locate *Serapis*, the ship Jones captured in the famous 1779 battle with his *Bonhomme Richard*. His goal was for all of Jones' ships to be found and archaeologically investigated rather than being picked over by treasure hunters.

His professional skills and work ethic under duress were important components of every project on which he worked. However, archaeologists knew him first as a wonderful, charming human being. Those who worked with him miss Dick as one of the best team members, but even more, as the best kind of friend.

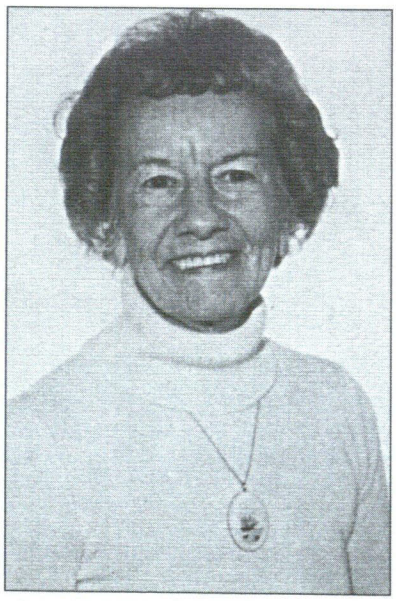
Warren Riess

IN MEMORIAM

Sylvia Thomas Baird
1911–2001

All of us at the Institute of Nautical Archaeology lost a kind friend and supporter with the death of Sylvia Thomas Baird in Cleveland, Ohio on January 14, 2001. Sylvia lived most of her life in Flushing, New York, where she was born in 1911. After graduating from Barnhard College, she entered into a thirty-eight-year career as an executive with the Society of Automotive Engineers. Several years after retirement, Sylvia married INA Director John H. Baird and moved to Shaker Heights, Ohio.

A charter member of INA, Sylvia's interest in the sea and seafaring developed from her family's heritage, for her grandfather Albert Thomas was a whaling captain who sailed the world's oceans. An active member of the Descendants of Whaling Masters, she decided after retirement to chronicle the experiences of her grandfather. Not content with following his path only through books and maps, she traveled to the Azores Islands and the Pacific Ocean to experience first-hand the lands and oceans familiar to nineteenth-century whalers. The result of her efforts was the book *Saga of a Yankee Whaleman* (New Bedford: Old Dartmouth Historical Society, 1981), the proceeds of which she donated to the New Bedford Whaling Museum along with artifacts relating to her grandfather's whaling career.



Sylvia's book describes each of Albert Thomas' five whaling voyages, and the interludes on shore between them. However, the account of the last trip may be the most interesting. From 1872–76, Captain Thomas took his wife and son (Sylvia's father) along on his fifth whaling voyage. The bark *Merlin* sailed out of New Bedford, and whaled the waters around the Azores and Cape Verde Islands before rounding Africa, Australia, and New Zealand enroute to the Chatham Islands. The ship spent over three years harvesting sperm whales in the South Pacific before returning around Cape Horn. During this entire voyage, most crewmembers only set foot on shore for a few days, although Mrs. Thomas needed occasional respites in various island harbors to recover from her chronic seasickness. *Merlin* spent nearly four years without touching on a continent, including one period when the family and crew did not even see an island for seven months.

Ernest Thomas, Sylvia's father, always remembered his exotic experiences, including horseback rides on Rarotonga in the Cook Islands when he was five years old. Those recollections inspired Sylvia's interest in seafaring and the whaling life (see her article in *INA Quarterly* [*AINA Newsletter*] 4.2, 1–4). In her book, Sylvia vividly described the *Merlin* voyage and its impact on her family. The account is based on meticulous research, but it is a story that the author found meaningful. Sylvia wrote, "I hope especially that I have succeeded in what I have tried hardest to do, which is to create an identity for my grandfather, Albert Alexander Thomas, who died when I was only three years old." She relished her grandmother's recollections and her father's memories of his childhood adventure, and we are lucky enough to have her book to remind us of her.

Sylvia and I shared an interest in Portugal's Azores Islands, a regular stopover point for American whaling ships and a source of valued crewmen. She generously supported INA's archaeological research there since the first season of survey in 1996, donating photographs she had taken of Azorian coastal whalers at work (an industry which has since ended), and regularly passing along news clipping about the islands and whaling. Her cheerful letters, her enthusiasm for maritime history, and her encouragement will all be missed.

Sylvia Baird is survived by her husband John, two nephews, and a cousin.

Kevin Crisman

IN MEMORIAM

Frank Darden

1926–2001

Of the few tributes I have had to write in my life, this is one of the most difficult. Mr. Frank Darden was a true friend to those of us who work at INA. Here at the College Station office, the words "kind," "appreciative," and "caring" are adjectives that are continually used to describe Frank. In fact, one staff member has described him as "the nicest man I know." Sadly, Frank Darden passed away on March 1, 2001, in Fort Worth, Texas.

Born in Stinnett in 1926, Frank was a classic Texas oilman. After his service in the Navy he worked as an engineer for Humble Oil and Refining. He founded Mercury Production Company in 1963, and was Chairman of the company at the time of his death. Frank was also serving as a director of Quicksilver Resources, Inc., a publicly traded oil and gas exploration and production company. He was a member of the American Society of Petroleum Engineers, the Fort Worth Wildcatters, and the Independent Petroleum Association of America. Also, he was active in the Kappa Sigma fraternity, Trinity Episcopal Church, and the Shady Oaks Country Club.

Mr. Darden had a long connection with the sea and INA. After his graduation as a mechanical engineer from the University of Kansas in 1946, he served in the United States Navy, being commissioned as a lieutenant on the battleship USS *Iowa*. An active yachtsman, he belonged to the New Your Yacht Club and was a past commodore of the Fort Worth Boat Club.

In 1984, Frank became an INA Director. The next year, he sailed his 48-foot ketch, *Ariane*, from The Netherlands to Texas via New England, Bermuda, the British Virgin Islands, and Florida. After his initial term on the INA board ended in 1989, he continued to support the Institute's work. He served again as an INA Director from 1995 until his passing.

Frank and his lovely wife, Lucy Darden (pictured above), were married for forty-nine years. He is survived by Lucy, by three children, Thomas F. "Toby" Darden (who is also an INA Director), Glenn M. Darden, and Anne Darden Self, by eight grandchildren, and by his sister, Mrs. John Knebles of Alberta, Canada.

The memorial service was "standing room only," a fitting tribute to a man loved by family, friends, colleagues, and employees. The presiding official of the service – The Reverend Walter W. Kesler of Trinity Episcopal Church in Fort Worth—read a selection by Theodore "Teddy" Roosevelt, a passage that both Frank and Lucy adopted as their own personal credo:

> "Far better it is to dare mighty things, to win glorious triumphs, even though checkered by failure, than to take rank with those poor spirits who neither enjoy nor suffer much, because they live in the gray twilight that knows neither victory nor defeat."

When the service closed with the hymn "Eternal Father, Strong to Save," a work that has come to be known as the anthem for departed mariners, an elderly gentleman seated next to me turned and with tear-filled eyes said, "I sailed with Frank many times in the Virgin Islands. Sometimes we sailed together; other times we raced against each other. Whether we were in the same boat or competing, Frank always made me a better sailor."

If you knew Frank, take a silent minute when you finish reading this and remember his life: His many kindnesses, his cheerful countenance, his dogged optimism, his ability to "dare mighty things," and his love for the sea. If you never had the privilege of meeting him, take a minute to ponder all of the wonderful people in your life who have "always made you a better sailor." Then you'll come close to knowing our friend, Frank Darden, whose life we remember with celebration, and whose presence in INA will, forevermore, be deeply missed.

Jerome Lynn Hall

INSTITUTE OF NAUTICAL ARCHAEOLOGY