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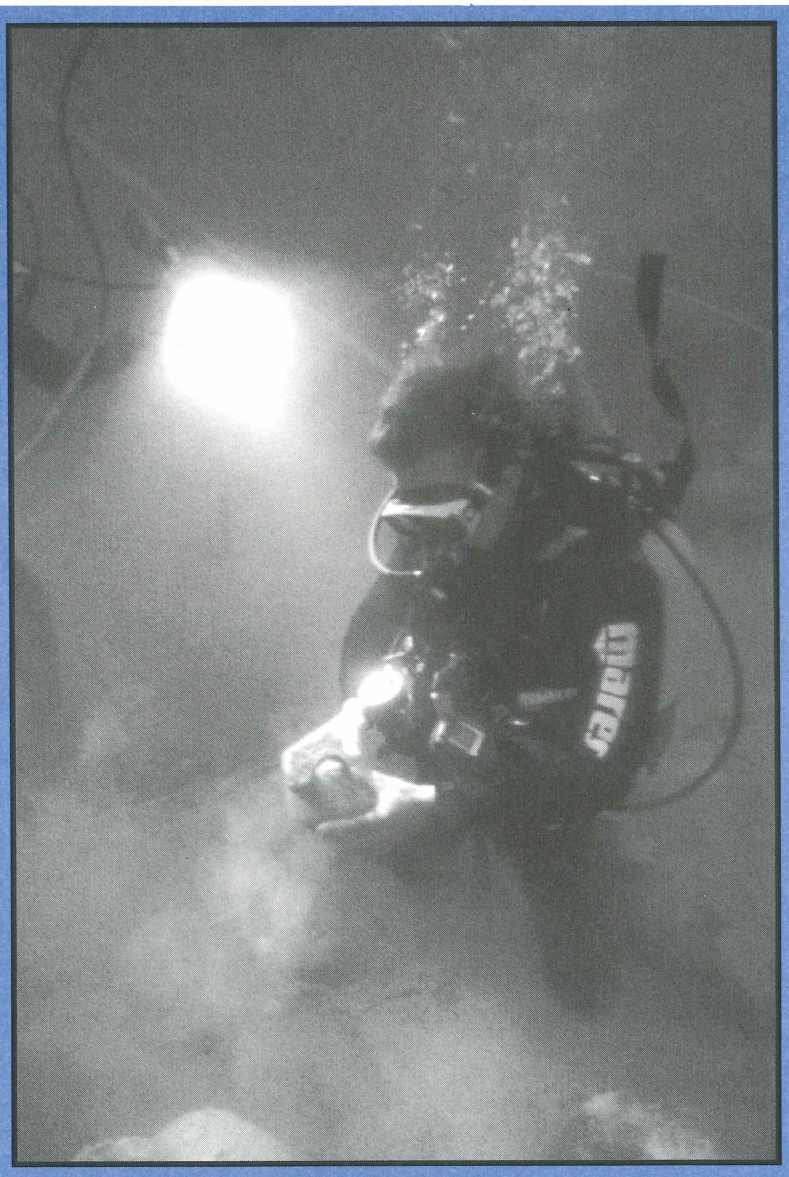

The INA Quarterly

Volume 23 • No. 4 Winter 1996

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On the cover: Texas A&M graduate student Glenn Grieco gently lifts one of the three pitchers found during the 1996 season of the Bozburun Byzantine Shipwreck Excavation. Photo by Don Frey.

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

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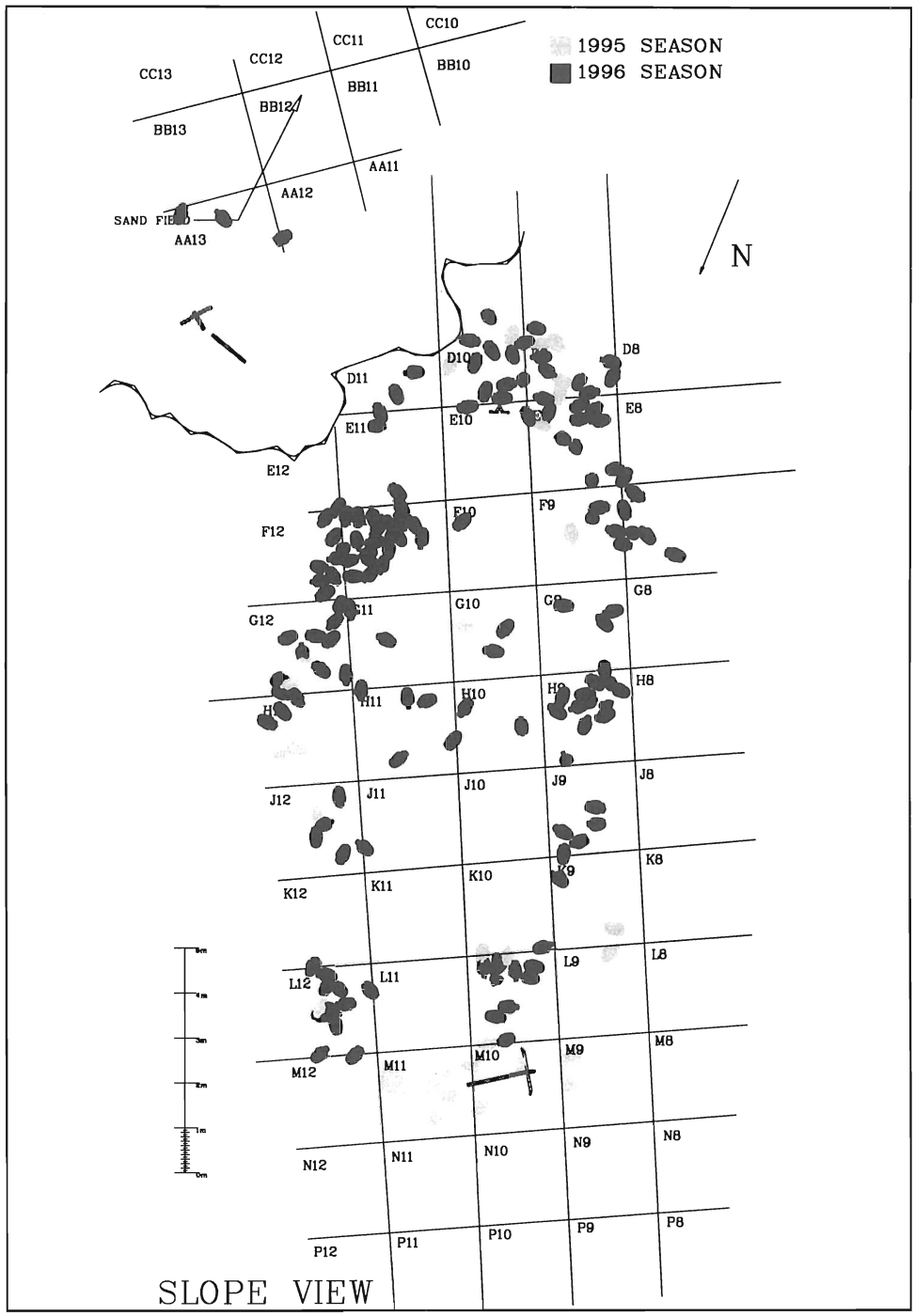
The Bozburun Byzantine Shipwreck Excavation: 1996 Campaign

by Frederick M. Hocker and Michael P. Scafuri

When two of the excavation staff drove into the camp at Selimiye in February, 1996 for an inspection trip, they were a little surprised to see that the landowner, Durmuş, had planted the entire field in chick peas, carefully driving his ox-drawn plow between the houses and outbuildings we had constructed in 1995. They also saw that a heavy storm earlier in the winter had blown down three of the five dormitories. A trip to the dive platform on that cold, raw day revealed little damage there, although someone had tried to pry the cover off the big Mercedes generator.

All of the damage was easily repaired in May, once we returned to the Bozburun wreck for the second season of excavation. The three dorms were all re-erected in a day, a new dormitory and a conservation/registration shed were built, the boat dock and dive platform were slightly enlarged to make them safer to use, and Murat Tilev continued to enlarge the shade built over the recompression chamber and high pressure compressors. By the time the excavation finishes, he should have the entire camp under one roof, like the Grand Bazaar in Istanbul. Our crew, including graduate students from Texas A&M, Bilkent (in Ankara), and Istanbul Universities as well as "old hands" who have worked on INA projects since the Serçe Limanı excavation and earlier, were poised for a long, productive season.

During the 1995 season, we had explored the extent of the



Site Plan: M. P. Scafuri

Fig. 1. *Bozburun Byzantine shipwreck site plan for 1996.*

site, which first appeared as a mound of amphoras 20 meters long at the base of an underwater cliff. We completed the initial topographic mapping of the site, and began the excavation of two trenches across the main amphora mound, one at the top of the slope (approximately 30 meters deep) and one at the bottom (35 meters). These trenches had revealed that under the broken and jumbled material of the upper, visible layer, the cargo was in better shape, and that the upper end of the wreck was probably the stern. An anchor uncovered at the bottom of the site was probably one of the two bower anchors kept ready for use near the stem. It seems that the other bower anchor may have been cast in desperation, but only succeeded in turning the vessel around to crash stern-first into the rocks of the Küçüven Burnu cliffs sometime in the ninth century AD.

Our goals for the 1996 season focused on the upper half of the site, where there was more broken material, but also where the small finds typically found in the stern are to be expected. We hoped to remove much of the debris from this area and expose the intact lower layers of the cargo, and to reveal at least a small part of the hull remains, to assess their condition. We also planned to investigate a large sand field on the ledge immediately above the main amphora mound. Amphoras and other wreck material visible in the rocks above this ledge suggested that more wreck material should be buried in the sand.

Over twelve weeks in June, July, and August, a staff averaging 28 divers executed 2,189 dives, including acclimatization and orientation dives. Most divers spent 30 minutes on the bottom once or twice a day, although a few divers whose air consumption and cold tolerance allowed it worked for 40 minutes at a time. To reduce the risk of decompression sickness (DCS), divers decompressed on pure oxygen at 6 meters for up to 35 minutes, depending on the depth and duration of the dive.

A large part of the season was spent in removing the upper layer of sediment and cultural material from the site. This layer consists almost entirely of amphoras tumbled out of their original positions in the hold and the broken remains of amphoras. By the close of the season, we had cleared the upper layer from approximately 40% of the site. In the process, we recovered over 140 whole or nearly whole amphoras (fig. 1), an even larger number of partial amphoras, and thousands of sherds (nearly a ton in weight). Beneath this material, the whole amphoras of the lowest original layer are still in place, marching down the slope on the starboard side of the hold like columns of soldiers (fig. 2). Farther to starboard, the spillage resulting from the collapse of the side of the hull extends deeper into the sand and farther out than originally thought. To port, the stacking pattern is less orderly, but the angle at which the amphoras lie indicates that the hull came to rest on its starboard bilge, so the port side was unsupported until it collapsed and the cargo there was not locked in place by accumulating sand. We did not remove any of the stacked amphoras, as we believe that they protect a large area of intact hull remains. Instead, we concentrated on clearing the sediment from between the jars and mapping them in preparation for lifting in a later season.

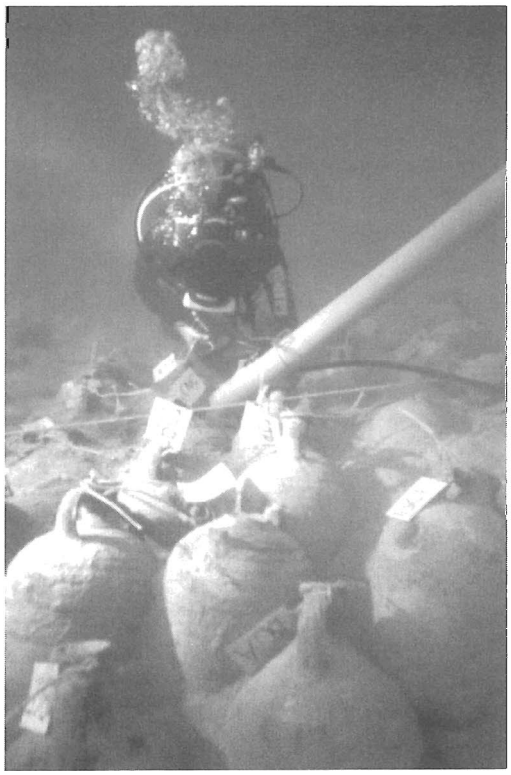


Photo: D. Frey

Fig. 2. *A diver works with an air-lift to uncover the rows of neatly stacked amphoras.*

The removal of the upper layer did expose two areas of hull remains. At the upper end of the site, hard against the face of the ledge at the base of the cliff, an assortment of eroded, disarticulated timbers was discovered. Few of these preserved much original surface, although a pair of large iron bolts probably indicate the location of the after end of the keel. In the middle of the site, among the stacked amphoras, an area of well preserved, coherent structure was carefully cleaned by Faith Hentschel, one of our most experienced excavators. Individual timbers beneath amphoras raised from other areas of the site indicate that the preservation of the bottom of the hull is extensive, and that parts of the starboard side survive at least toward the upper end of the site.

Excavation in the large sand field just above the amphora mound produced only a few whole and nearly whole amphoras. Although the sand is over 0.5 meters deep in most places, it is relatively sterile, suggesting that the stern of the wreck did not come to rest on the ledge, but just below it. The amphoras found in the sand, like those in the rocks, probably spilled out of the ship as it sank.

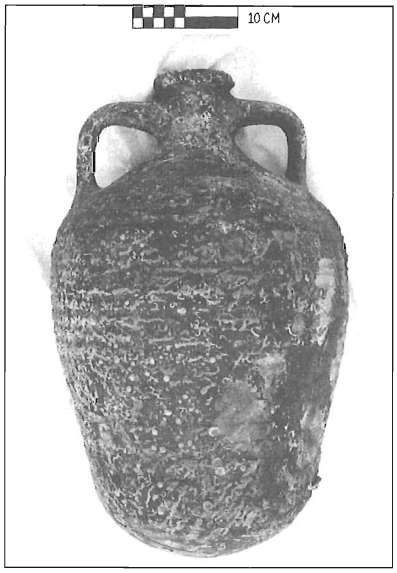
We currently estimate the original number of amphoras between 1,500 and 2,000. Many of these are now broken, and a number, perhaps 100–200, were removed by sponge divers and other visitors before excavation began. Nearly 200 whole jars and parts of at least 300 others have been recovered during the excavation. At the end of the 1996 season, we counted approximately 500 whole or nearly whole jars still lying on the seabed. Another 100–200 may still be buried in the sand or covered by other amphoras. There is not yet a definitive typology for Byzantine amphoras between the eighth and eleventh centuries, largely due to the absence of well dated examples from land sites, so our working classification system is constantly undergoing revision. After the 1995 season we had identified two basic classes of amphoras, but the greater number of jars recovered in 1996 has allowed us to refine this typology somewhat. We have also become aware of the wide range of variation in details and inconsistent quality of production displayed by these crudely made containers.

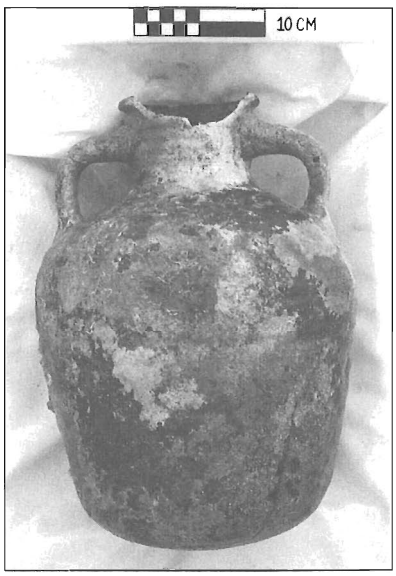
The first class (fig. 3), which is by far the most common, consists of several related types. All have ovoid bodies with short, conical necks, heavy rims, and generally L-shaped handles of elliptical section. There is a great deal of variation in rim profile, handle section, and surface treatment of the bodies, from smooth to deeply ribbed, but the dimensions and general shape are fairly consistent. Many of the jars are lopsided or indented from handling while the clay was still wet, and they were often not fired very carefully, so many of the bodies are very crumbly and fragile. Similar jars have been found at kiln sites in the eastern Crimea, which was a distant but important outpost of the Byzantine Empire in the years when the Bozburun ship was trading. The sites producing these kinds of amphoras have been dated to the ninth and early tenth centuries.

The second class of amphoras (fig. 4), shorter and broader, with flat bases and wide necks, remains just as enigmatic now as it did at the end of the 1995 season. No exact parallels have yet been found, but amphoras on medieval sites other than kilns are often extremely fragmentary and are not usually reconstructed. We know from the wreck that these amphoras break up into very small sherds that make recognition of particular forms difficult.

A third class (fig. 5) provisionally identified in 1996 is similar to the first class, but is generally larger, with a taller, cylindrical neck and a less pronounced rim. The handles are also distinctly different, and Christine Powell, who is studying the amphoras as the subject of her dissertation at Texas A&M, believes these jars should be distinguished from those of Class 1. Very close parallels are also known from the eastern Crimea, but from different kiln sites dated to the eighth and ninth centuries. We hope that neutron activation analysis of the fabric will provide a more certain identification of the origins of the clay.

The attribution of any of these amphoras to specific kiln sites is tentative, as insufficient work has been done on amphora production centers outside of the Balkans and Crimea. At least one Italian kiln of the early ninth century was producing very similar jars, and amphoras of the basic ovoid form of Classes 1 and 3 are widely known from Middle Byzantine contexts (see the article by Arthur and Auriemma in this issue for later examples). In addition, there is ample evidence from both before and after this period that amphoras were reused as transport containers, sometimes extensively, so the origin of the containers may have no direct relationship





Photos: A. Lessmann

Fig. 3 (top). *Class 1 amphoras, by far the most common type at Bozburun, all have an ovoid body shape but are composed of many various permutations of individual features.*

Fig. 4 (center). *Class 2 amphoras are less common and are shorter and broader, with a flat base and wide neck.*

Fig. 5 (bottom). *Class 3 amphoras are the smallest group but the largest in size.*

to the origin of the cargo. There is as yet no clear evidence that the Bozburun amphoras were reused, but the cargo is far from homogenous and the majority of whole amphoras still await recovery.

Several amphoras recovered in 1996 still had their stoppers sealed in place with pitch (fig. 6). Some of the stoppers were of pine bark and others were carved tile fragments; stoppers of both materials have also been found loose on the site. There is always a certain amount of excitement on an archaeological project when a sealed container is found, and legends abound of workmen digging in the cities of Europe finding Roman wine and drinking it, but there is rarely anything recognizable left in containers found by archaeologists. Alas, such was the case with our corked amphoras. They were full of mud, just like the amphoras with open mouths. Fortunately the mud often preserves solid remains of the contents, and there has been recent success in analyzing faint residues of wine and other liquids absorbed into clay containers. Nearly all of the intact amphoras recovered thus far have produced grape pips, and one held over 400 seeds, so the primary cargo is confirmed as wine... if not particularly good wine. One amphora was full of olives, but this find is from the stern, and may represent provisions rather than cargo.

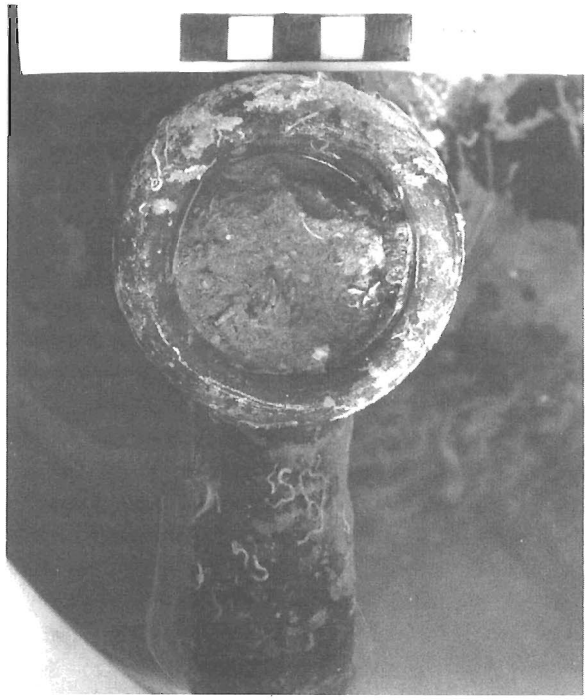
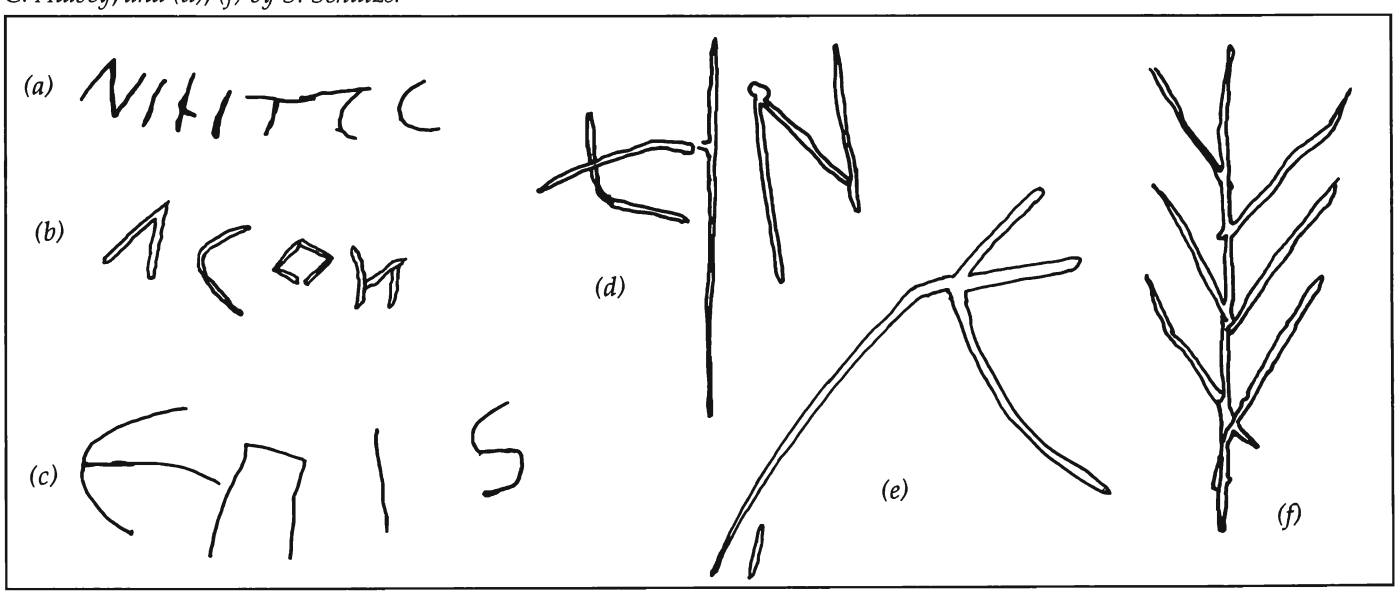


Photo: F. Hocker

Fig. 6. *An amphora stopper still firmly in place after a thousand years on the sea floor.*

Many of the amphoras are marked with graffiti, probably indicating ownership (fig. 7). Two full names can be found, Nicetas and Leon, as well as a range of abbreviations, christograms, and symbols that may be tally marks. Several jars are marked with a symbol that may be a pine tree or palm frond. Similar symbols have been found on amphoras from Crimean sites, but the same design was scratched in chimney tiles at monasteries in Greece well into the Late Byzantine Period. At least two jars are marked "ΕΠΙΣ," which may an abbreviation for the Greek word for "bishop," suggesting a Church connection.

Fig. 7. *Examples of graffiti. Several complete names such as NIKITAS, "Nicetas" (a), from the 1995 season and LEON (b) were exposed after careful cleaning. EPIS (c) is a possible abbreviation for "Episcopos" (bishop), while XN (d) could be an abbreviation for "Christ {is} the victor." Several monograms were found and some of these could possibily be church-related inscriptions (e). A number of graffiti were tree or leaf shaped (f). All drawings are 75% of original size. Drawings: (a) by C. A. Powell, (b), (c), (e) by C. Atabey, and (d), (f) by S. Schulze.*



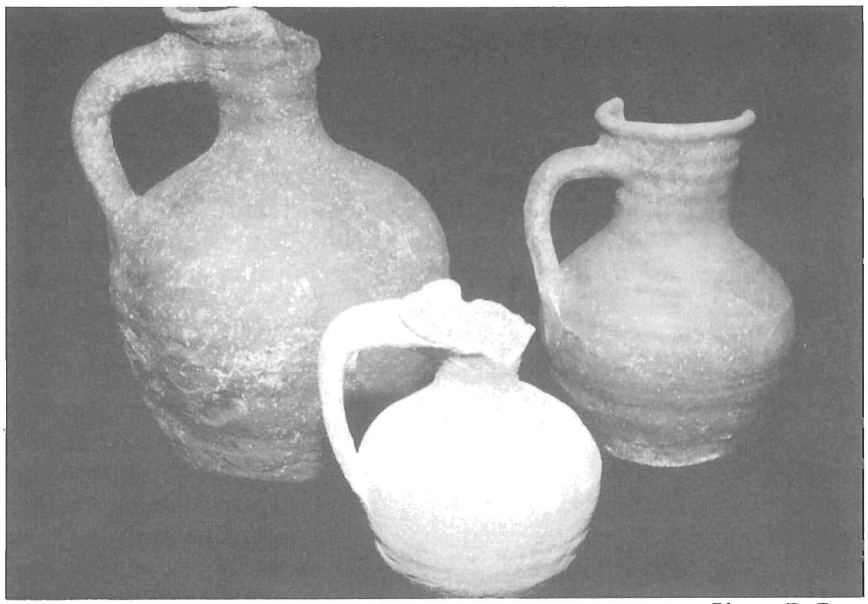


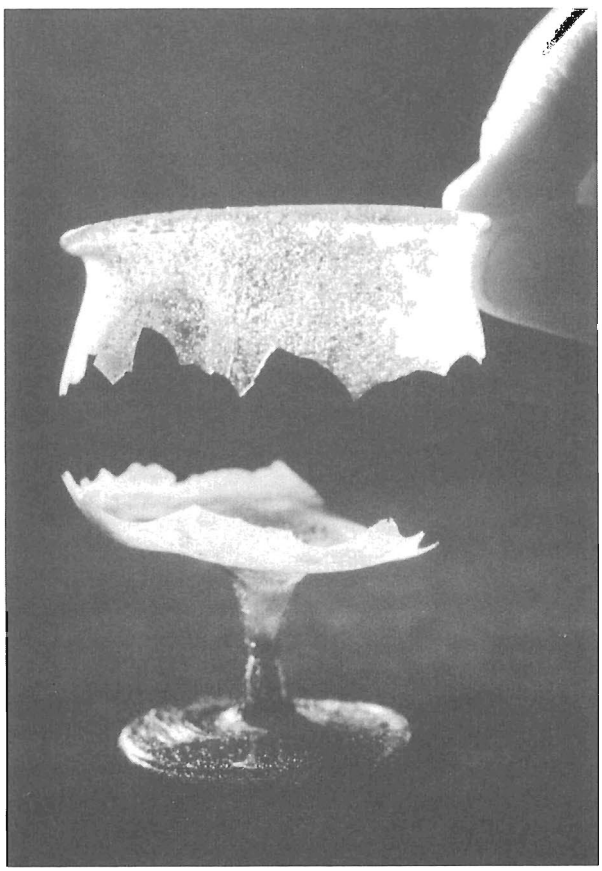
Photo: D. Frey

Fig. 8. *The nearly complete coarseware pitchers were of varying sizes, shapes, and fabrics.*

Fig. 9 (below left). *A blue-green glass goblet was a surprising find.*

Fig. 10 (below right). *A fragmentary copper jug of common Byzantine form.*

In addition to the amphoras, a wider range of other finds were recovered in 1996. Most of these were domestic objects from the stern. Three nearly complete coarseware pitchers (fig. 8), all of different sizes, shapes, and fabrics, were recovered from one small area in square F 11. The two smaller of these had fallen down in between the amphoras at the edge of the intact rows, and lay against the side of one of the ship's frames. A fourth pitcher, found in 1995, was found on the other side of the site, but is of the same general type. All were probably for use on board ship. Large sets of pitchers were found on both the Yassı Ada and Serçe Limanı ships in contexts indicating that they were part of the ships' inventories. The forms of these pitchers are common among the domestic pottery of the eastern Mediterranean, and very difficult to trace to any particular region. However, one pitcher carries an incised, wavy line similar to decoration found on a contemporary pitcher of the same basic form from northern Iran. In



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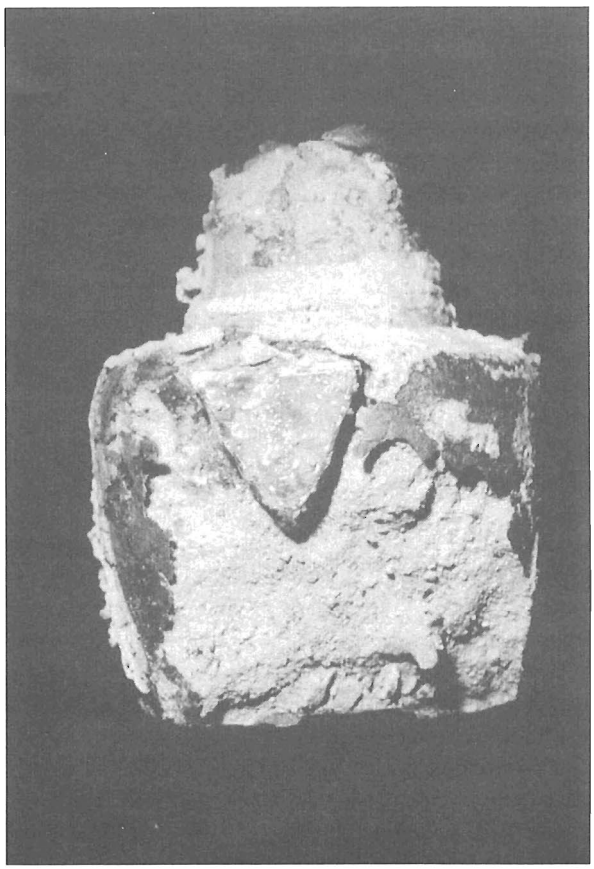


Photo: D. Frey

addition to the pitchers, fragments of bowls, plates, and cooking pots have also been found in the stern near the possible remains of a stone-tiled hearth.

One of the more surprising finds in 1996 was a small goblet of blue-green glass in square E 10 (fig. 9). Although broken into two non-joining pieces, the shape can be reconstructed. Glass stemware is a rarity on Mediterranean shipwrecks, but this piece may be the personal possession of a member of the crew or a passenger. The vessel type, which is sometimes described as a lamp, is common in non-maritime contexts from the Roman and Byzantine worlds.

Other finds include a fragmentary copper jug (fig. 10) of common Byzantine form (one very similar was found on the seventh-century Yassı ada ship), lead fishnet and line sinkers (probably intrusive), and a large number of concretions, mostly of fasteners. A few tools can be identified, including what are probably a double-headed felling ax and a smaller ax or hatchet. Such tools are relatively common finds on Mediterranean shipwrecks and are only a small part of the assemblage of carpenter's and foraging implements to be expected on board a ship.

The sediment in which the more imperishable finds are buried is also full of organic remains, especially twigs, oak leaves, and acorns. At first, we wondered if these were evidence of brush dunnage, as was commonly carried in ancient and medieval ships, but the plant remains were distributed too evenly throughout the sand and mud to be clearly associated with the wreck. They did match the scrub oaks growing abundantly on the slopes above the site, and so were doubtless carried into the water by runoff. The same is probably true of two goat or sheep teeth found loose at the upper end of the site–the last remains of an animal that met its end on the rocks.

The largest find from the 1996 season was the ship itself. In addition to the fragments recovered from the upper end of the site, an area of approximately 2 square meters of coherent hull remains was exposed in square H 11, probably forward of amidships (fig. 11). Although the amount of structure examined was relatively small, it did include the keel (with a scarf), four frames, three strakes from the starboard side, one strake from the port side, a heavy stringer, fragments of two ceiling strakes, and the extremely fragmentary remains of what may have been a keelson (fig. 12). Except for the keelson and one of the ceiling strakes, these remains were all in excellent condition (for a Mediterranean wreck), with crisp edges, tool marks, and relatively little teredo infestation. The timbers are all fastened together with iron nails and bolts, and there is no sign of mortise-and-tenon joints (although none are expected in a ship of this date). The keel and planking are of white oak (*Quercus* sp., probably *Q. ilex* or holm oak, the only large white oak growing in quantity in the eastern Mediterranean or Black Sea basin) with the frames, stringer, and ceiling of pine (*Pinus* sp.). This choice of materials is a little surprising, as other archaeological evidence suggests that oak was not commonly used for structural timbers in Mediterranean ships before the late Middle Ages, and that hardwoods in general were preferred by Mediterranean shipwrights for frames, with softwoods more commonly used for planking.

One aspect of the site that continues to intrigue us is its location. The wreck is not on any major sailing routes, but is well up into a deep bay and near the entrances to three of the larger medieval settlement areas on the peninsula. All were considered worthy of defense in the troubled times of Middle and Late Byzantine administration. The ship may have been carrying wine to supply one of the garrisons or to trade, or it may have been driven into the shelter of the bay by weather or pirates. It is more than likely that the ship was

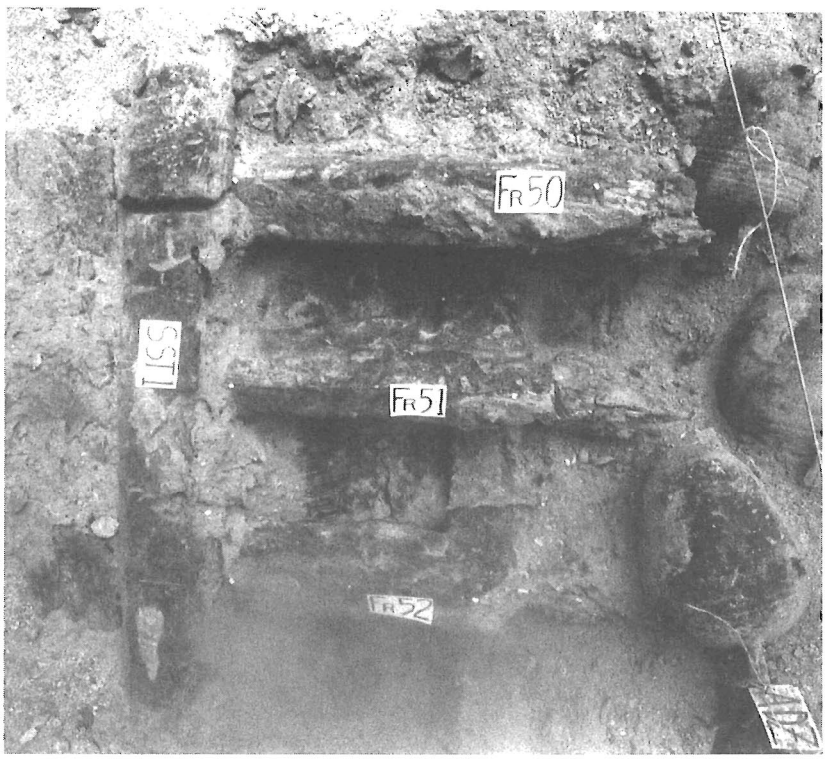
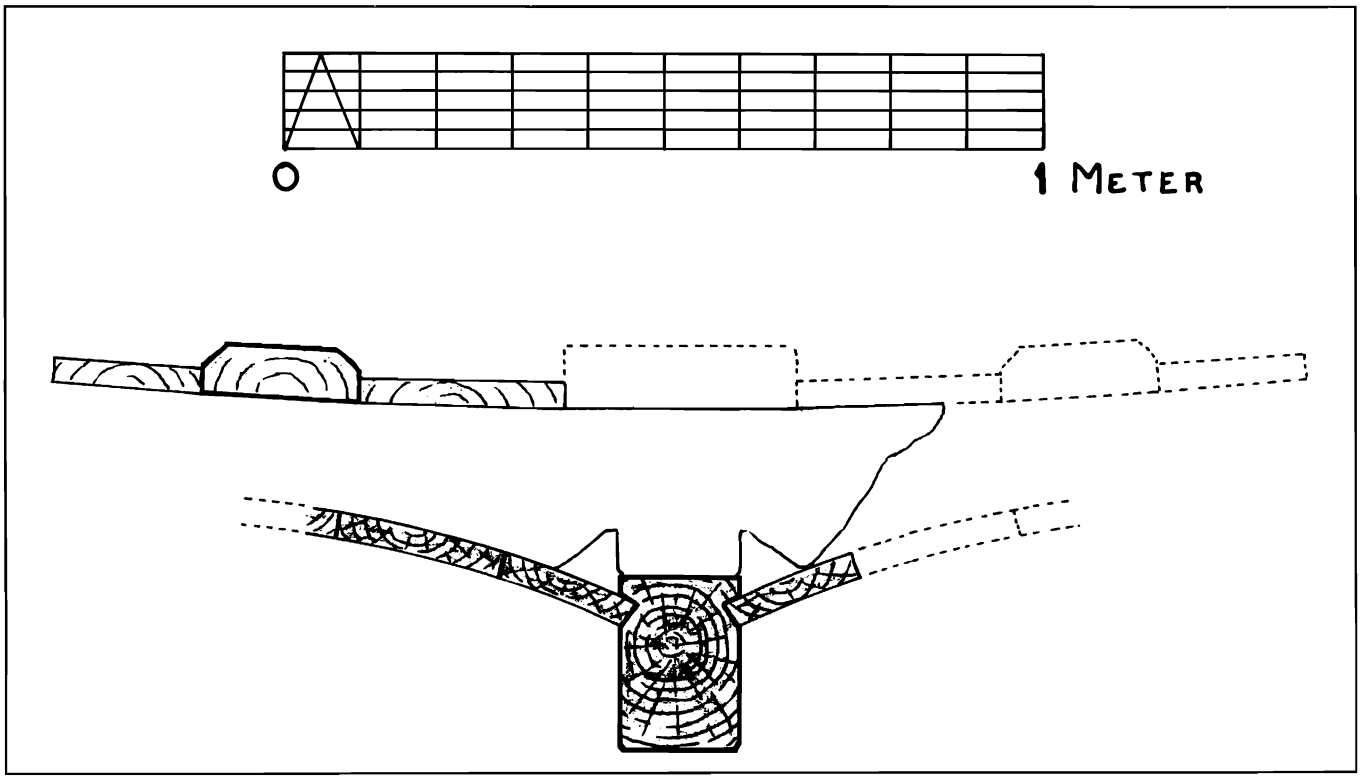


Photo: F. Hocker

Fig. 11. *Hull remains exposed during the 1996 season. Three of the four heavy frames are clearly visible, as is a stringer running over them.*



Drawing: F. Hocker

Fig. 12. *Schematic section of the hull elements observed in 1996.*

bound for Selimiye (then known as Hyda or Hyla) or passing the entrance to the harbor when it was lost. Winds are usually out of the north to northwest during the sailing season, but can veer rapidly into the northeast early in the season. This could easily push a ship entering the harbor toward the rocks, although it would still be relatively easy to turn away and run down the channel back toward the Aegean, so an additional factor is probably involved. We were ably assisted in the evaluation of the local landscape by Dr. Jennifer Moody, of Baylor University, who visited the area with her colleagues and students as part of a field school in archaeological survey she taught in July.

The proposed work in 1997 at Bozburun will concentrate on recovery of the lower layer of stacked amphoras, exposure of a larger area of hull remains, and commencement of large-scale excavation in the lower parts of the site, where there is much less broken material. Field walking of the surrounding area will continue in an attempt to define the contemporary maritime cultural landscape. It is hoped that two more seasons will see completion of the excavation phase, which may include recovery of the hull remains for more detailed study and conservation.

Acknowledgments. The authors wish to thank the Directors of the Institute of Nautical Archaeology, the J. E. Smothers Foundation, Mary and Richard Rosenberg, Hazel and Ron Vandehey, Chatten Hayes and David Steinberg, Ann Duwe, Judy McNeil, and MARES S.A. for financial and in-kind support of the 1996 excavation campaign. Thanks also are due to Marie and Frank Ricciardone for transport services. The excavation was carried out under a permit issued by the Turkish Ministry of Culture, General Directorate of Monuments and Museums; the Ministry was represented in the field by Mr. Erhan Özcan. The contributions of Dr. Jennifer Moody and her team have already been mentioned. The authors also wish to acknowledge the assistance of Doreen Danis (galley pottery), Gregory Gidden (Crimean archaeology), Janalyn Gober (timber usage), Tonka Ostoich (glass), and Christine Powell (amphoras), whose research papers for a graduate seminar in medieval Mediterranean seafaring at Texas A&M University provided much useful information concerning many aspects of the material recovered during the 1996 season.

Field Conservation at Sadana Island, 1996

by Howard Wellman

INA-Egypt's 1996 excavation season at Sadana Island yielded more than 1500 registered artifacts and bulk finds of porcelain, earthenware, copper alloy, and various organic materials. All this material was excavated, raised, and given preliminary conservation during the eleven-week field season. The ship wrecked in the second half of the 18th century on this site near Hurgada represents a previously unstudied form of Red Sea trading vessel.

Conservation should be a major concern on all marine excavations, since artifacts can suffer greatly from the radical change of their environment. Waterlogged organic materials can dry out quickly, causing irreparable cracking and shrinkage, while the pressures of salt crystallization can literally explode ceramics. The effects of the change from anoxic waterlogged conditions to oxygen-rich, dry conditions were only increased by the desert conditions at Sadana Island. Daytime temperatures usually reached 88-100° F, while the drying effects of almost constant winds were increased by relative humidity that ranged from about 20-45% (except in the conservation tent, where it usually seemed to exceed 90%!). The problems were compounded by the high level of salts in the Red Sea (and, by extension, in the artifacts), which is estimated to be about 6-8% more saline than typical ocean water.

Aims

The conservation team consisted of INA-Egypt staff conservator Howard Wellman and Tanja Roskar, a volunteer on leave from the conservation unit at the University of Trondheim, Norway. Our aims at Sadana Island were to mitigate the effects of the environmental changes, while enabling the archaeologists to obtain initial data from the artifacts that could affect the ongoing excavation. Most of the conservation could be described as "First Aid," though some of it was definitely aimed at reducing the amount of work that would have to be done later in the Alexandria

Photo: H. Wellman

Fig. 1. *Team members building the artifact storage tanks on the beach at Sadana Island.*

Conservation Laboratory for Submerged Antiquities (see *INA Quarterly* 23.2).

Stabilization was the first concern. The artifacts had to be kept wet to prevent damage by shrinkage or salt crystallization. This was accomplished by building two brick and concrete storage tanks where the objects could be held, and where artifact cleaning could take place (fig. 1). These tanks were filled by the rising tide, with the occasional boost from a bucket brigade.

Physical support was given to delicate or decayed materials in order to minimize the possibility of mechanical damage once the artifacts were removed from the support of the water. Stabilization also factored into our plans for packing the objects for transport across 700 km of desert and urban roads to their new home at the National Maritime Museum in Alexandria. Various plans and schemes for "containerization" of the various objects were tested in order to make the packing units as durable and resistant to physical shock as possible, while still maintaining the moist environment needed by the objects.

Our second concern was to reveal as much information about these objects as possible so that the excavation team would be able to use freshly excavated objects to guide the ongoing interpretation of the site. Most objects were cleaned of obscuring calcareous concretion, but only enough to expose diagnostic forms and decorative elements ("investigative cleaning"). Removing massive concretion also aided the aim of stabilization, since it could reduce an artifact's weight and volume by 100-200%, making it easier and safer to handle and pack. This also allowed the conservators time to inspect each object more closely, identify potential conservation problems, and make notes for future treatments. Conservation records were kept on all the objects processed on site.

The team photographers were then able to produce black-and-white photographs of every registered artifact for the excavation catalog and the official Egyptian Supreme Council of Antiquities' site register. The illustrators and cataloguers also benefitted, since it allowed them to better judge the special characteristics of each object. The conservation notebooks proved to be critical in maintaining inventory and tracking lists of all the artifacts as they passed through photographers', catalogers', registrars', and illustrators' hands.

Another conservation aim was to increase the general knowledge of the excavation team about conservation ideals and techniques, and show them how conservation could be a forward-looking part of any excavation, and not just a mopping-up exercise. To this end, INA-Egypt's staff conservator gave lectures on the nature of archaeological materials and their decay, how this relates to the nature of the site deposits, and how conservation deals with those problems. Techniques of "minimal intervention" and understanding the nature of the materials were stressed. Practical lessons in conservation techniques were part of the everyday routine as volunteers came and went in the conservation tent.

Restrictions and Assets

As in all field projects, conservators at Sadana Island faced significant restrictions on their ability to perform as much treatment as they would have liked. That is one reason we focused primarily on stabilization and investigative cleaning. Time is always a factor on excavations, and with 1500 objects to be processed, it was not feasible to spend as much time with each object as we could have wished. Our greatest restriction was the lack of fresh water. All the camp's water was trucked in, and there was simply not enough for us to begin the standard desalination procedures that would have allowed us to begin drying objects prior to transport.

We were, however, blessed with several bits of good fortune: first and foremost, we had a large group of very enthusiastic volunteers to help us with the most tedious parts of the cleaning and recording. At the height of the season, up to seventeen students and archaeologists could

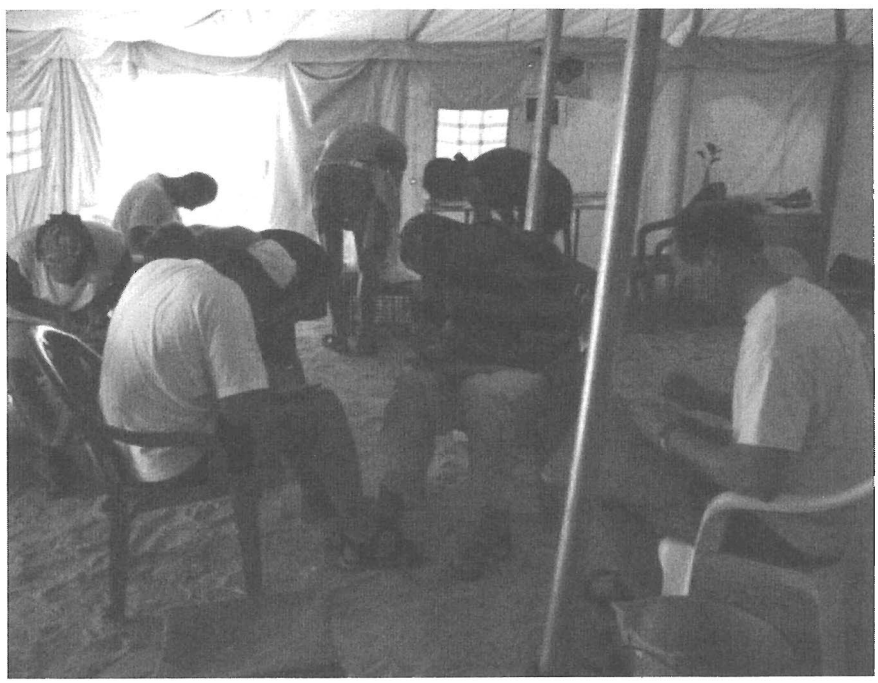


Photo: N. Piercy

Fig. 2. *Volunteers at work in the conservation tent.*

be found in the conservation tent (an airy 6x10m tent), cleaning, photographing, cataloguing, and illustrating objects (fig. 2). Several volunteers with special experience could be found in the holding tanks at all hours using air-scribes to remove the larger masses of concretion. Douglas Haldane and Emad Khalil especially put in heroic hours battling the concretion on the 750 earthenware water jugs (*q'ulal*) that threatened to fill the tanks to overflowing. Meanwhile, the archaeobotanical crew under Dr. Cheryl Haldane was swamped by bags of *q'ula* contents that had to be floated and sieved.

Techniques

Most of the work done at Sadana Island used very basic techniques of mechanical cleaning and support. The lack of fresh water prevented the use of chemical cleaning and stabilization methods that require extensive washing afterwards. As noted above, the gross removal of concretion was performed with air-scribes (fig. 3), while the final cleaning for illustration and photography was done with scalpels. In the course of the summer, the conservators trained approximately twenty-five volunteers and archaeologists in basic mechanical cleaning techniques for earthenware, porcelain, glass, and copper. The more delicate materials such as organic remains and inscribed or painted surfaces were handled by the conservators.

Photo: H. Wellman

Fig. 3. *INA-Egypt Deputy Director Emad Khalil using an air-scribe to clean an earthenware jug.*

A subsidiary part of cleaning was the removal and sieving of vessel contents. Although the *q'ulal* were assumed to have been shipped empty as cargo, they had filled with sediment and small fragments of the vessel's organic cargo. By emptying each jar, their weight was not only significantly reduced, but the archaeobotanical team found examples of hazelnuts, nutmeg, coriander, cardamom, and coffee beans among other things. These delicate organic materials were stored in sealed jars full of sea water for transport to the laboratory.

Many of the copper alloy vessels (pans, basins, caldrons and trays) were highly corroded and very fragile. For these objects particularly, cleaning was considered of secondary importance to physical support. The artifacts were bound and supported with strips and pads of polyethylene foam, sometimes lashed to rigid supports. This allowed the objects to be handled for photography and transport.

The packing scheme for transport was adapted from the successful plan devised the previous year by Douglas Haldane. Artifacts were packed in plastic perforated crates with sufficient foam padding and wet wrapping to prevent physical damage. These crates, plus basins of objects that could not be removed from water, were then stacked onto the Project's Landrover and a flat-bed truck loaned to the Project by Arab Contractors, Inc. A plastic bubble was created by lining the truck bed with polyethylene sheet and wet polyurethane foam mattresses, on which the crates were stacked. The rest of the plastic sheet was then wrapped over and around the stack of crates and basins, and lashed down and sealed tight (fig. 4). In this way, a humid environment was provided that lasted for the entire fourteen-hour drive from the site to Alexandria, where the crates were unloaded into the storage tanks at the National Maritime Museum.

Small and delicate objects such as tobacco pipes, porcelain coffee cups and waterlogged organic materials were "containerized" in one-liter plastic sealable boxes with interior padding. These were then sealed into plastic trash bags and placed in cardboard boxes. These boxes could then be placed in the truck, outside the plastic bubble, where more care could be taken for their disposition. They were transferred directly to the main laboratory building for more immediate care, rather than being placed in the main storage tanks with the bulk of the finds.

Not all the excavated materials were raised to the surface or transported to Alexandria. After the thrill of finding the first eight waterlogged coconuts wore off, it was decided that the other thirty were probably better off

Photo: H. Wellman

Fig. 4. *Crates of artifacts packed on board the Landrover "Edwin," ready to be sealed into their plastic sheet "bubble" before transport to Alexandria.*

remaining on the site for future recovery, rather than risking the trip to Alexandria. Once proper treatments for these unique finds have been designed, we can consider lifting the remainder. They were bagged with their identifying context labels, placed in a hollow in the sand, covered with inverted crates, then covered with plastic sheeting and sand.

Other materials, such as *q'ulal*, rope, and the ship's timbers also remain. These were all cached at the end of the season by various means. A length of rope, too delicate to lift without further care and thought, was carefully fastened down to the sand and timber substrate by spreading nylon mosquito netting over it, and pinning the net down with sharpened bicycle spokes. A notice about the fragile object below was stitched to the netting, and the whole was covered with sand, polyethylene sheet, and more sand. It was hoped that this combination would both create anoxic conditions necessary for the rope's survival, and deter sport divers from interfering with it.

Achievements

In a thrill-packed, stress-filled eleven weeks, the conservators and team members at Sadana Island managed to process, pack, and deliver safely over 1500 artifacts and bulk finds. In the process we were able to identify future project needs, and plan some interesting conservation research projects. The conservators were able to satisfy the curiosity of team members about different aspects of conservation, and perhaps guide one or two towards university courses on the subject. We also proved that conservators can in fact spend far more time in the water than anyone else, and develop far more interesting infections and rashes.

Acknowledgments. The 1996 Sadana Island Shipwreck excavation was supported by generous donations from the the Amoco Foundation, John and Donnie Brock Foundation, the Institute of Nautical Archaeology and George F. Bass, Danielle Feeney, His Royal Highness Prince Khalid Ibn Sultan, Uwatec/Dynatron, Harry Kahn, Richard and Mary Rosenberg, British Gas Egypt, ScubaPro, and Lucien D'Hondt, Banyan Medical Suppliers, DHL, Kodak-Egypt, Scubadoo Diving Center, CitiBank of Egypt, Arab Contractors, and numerous other donors. Significant work, both in excavation and conservation, was done by a hard-working team of volunteers, INA-Egypt staff, members of the Egyptian Supreme Council of Antiquities, and the Egyptian Navy. I personally want to thank Tanja Roskar, Melissa Zabecki, Julie Eklund, Louise Fisher, David Harrison, Emad Khalil, Adel Farouk, Meredith Kato, and Jan Borg for their hard work and moral support. The directors of INA-Egypt and the Sadana Island Shipwreck excavation, Dr. Cheryl Haldane and Douglas Haldane, get my sincere thanks for putting up with endless questions and nitpicking.

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A Search for Italian Wine
Middle Byzantine and Later Amphoras from Southern Puglia

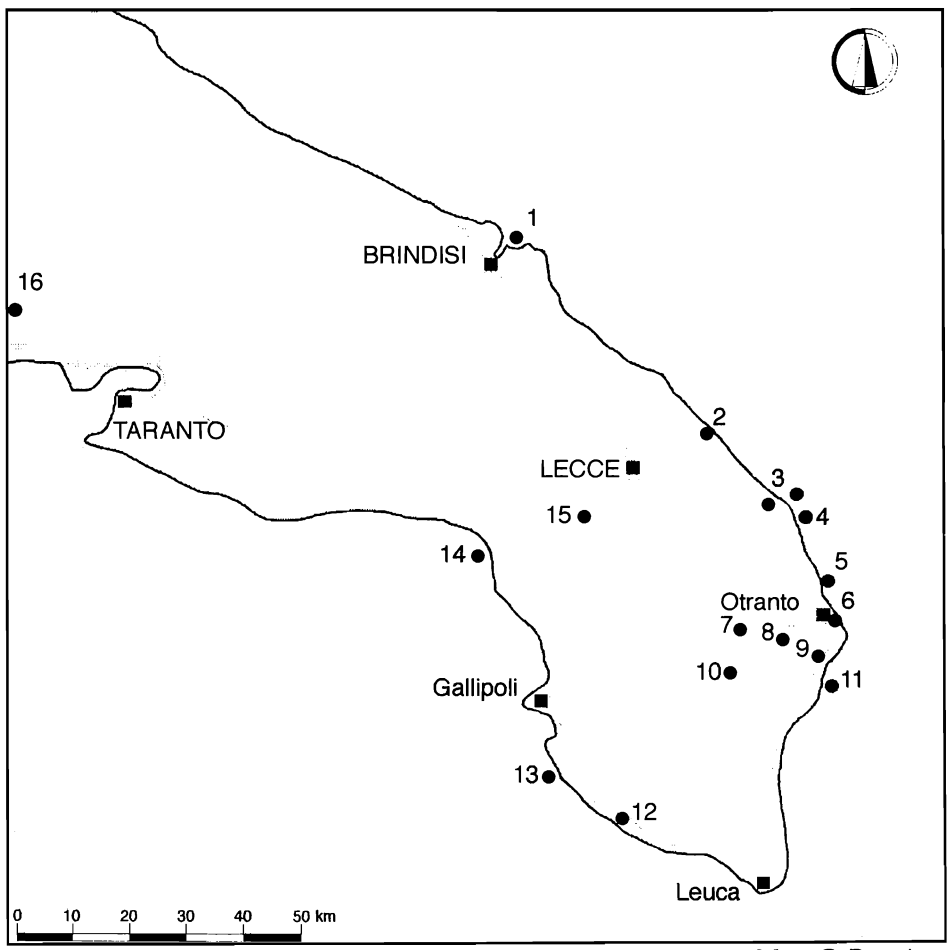
by Paul Arthur and Rita Auriemma, University of Lecce

The *INA Quarterly* of Spring 1995 described an interesting new venture of the Institute aimed at mapping the shipwrecks off the virtually unexplored coast of Albania *[Editor's note: internal factors in Albania have since led to the suspension of the project described in* INA Quarterly *22.1].* On the opposite side of the Adriatic, along the coast of Puglia, the University of Lecce has been working for a number of years charting wrecks and stray underwater finds. Many of these are of Roman date, though a few may be assigned to the lesser known medieval period. Amongst the finds are a number of locally-produced commercial transport amphoras that are also matched at various mainland sites.

Indeed, southernmost Puglia, commonly known as the Salento or heel of Italy (fig. 1), is one of the few provincial areas of the Byzantine empire where archaeological evidence for the production and exportation of surplus agricultural products is relatively abundant. Much of this material must have left Puglia through the port of Otranto (Greek *Hydrous*), the major Middle Byzantine town in the deep south, well-known for its cross-in-square plan Byzantine church of S. Pietro and its later Norman cathedral with a splendid mosaic floor depicting the tree of life, the months, and scenes from the Old Testament and from Classical and later legends. The accumulating evidence may suggest a relative well-being of the area in Byzantine times when compared to other parts of Italy. It is in this context that the export of an agricultural surplus in amphoras seems to fit.

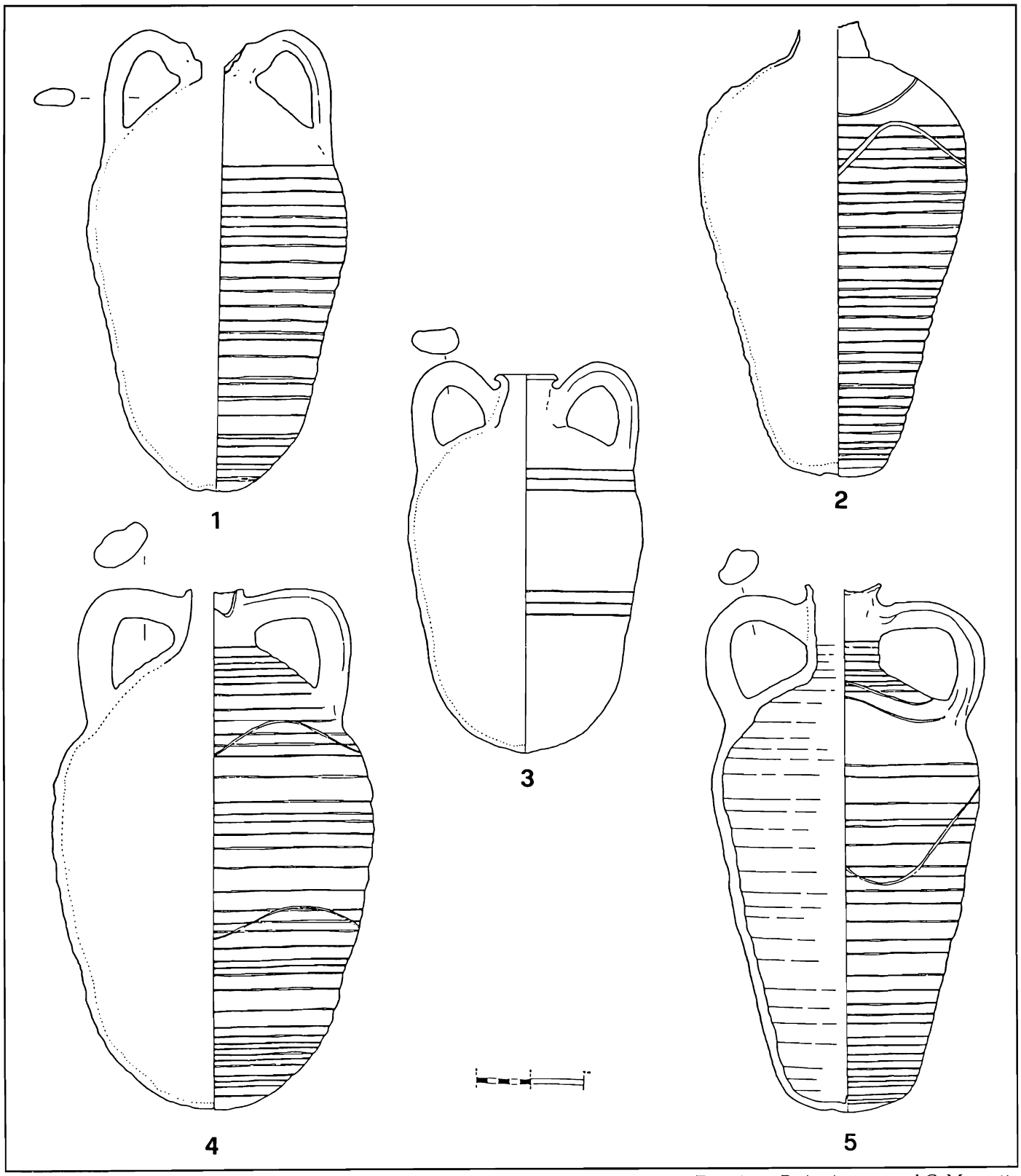
The material evidence for local Puglian amphora manufacture falls into two chronologically distinct groups:

1. The discovery in 1989 of a substantial kiln site for transport amphoras close to the port of Otranto, probably dating to the seventh and perhaps early eighth century A.D. Little is yet known about the distribution of these products (an example might come from the island of Aegina). Similar amphoras from the port of Ugento (Roman *Uxentum*) on the opposite, western, coast of Puglia, are in



Map: G. Ruggiero

Fig.1. *Distribution map of Middle Byzantine and later Puglian amphoras in the Salento. Key: 1. Brindisi (underwater find); 2. San Cataldo (underwater find); 3. San Foca (underwater find); 4. Torre dell'Orso (underwater find); 5. Torre S. Stefano (underwater find); 6. Otranto; 7. Anfiano, Palmariggi; 8. Centoporte, Giurdignano; 9. S. Giovanni Malcantone, Uggiano; 10. Quattro Macine, Giuggianello; 11. Porto Badisco (underwater find); 12. Racale, Ugento (underwater find); 13. Torre S. Giovanni, Ugento; 14. Porto Cesareo (underwater find); 15. Copertino; 16. Massafra.*



Drawings: R. Auriemma and C. Mazzotta

Fig. 2. *Middle Byzantine and later Puglian amphoras from 1. Torre dell'Orso; 2. San Foca; 3. Torre S. Stefano (see also fig. 4); 4. the Canale Pigonati wreck in the port of Brindisi; 5. the village of Quattro Macine.*

a different clay fabric and may have been produced near the latter site.

2. Excavations at Otranto in the 1980s and 90s, and at the abandoned village site of Quattro Macine since 1991, have revealed abundant amphoras of different forms to those cited above, in a distinctly local Puglian fabric, in contexts dating from the tenth/eleventh to the thirteenth century.

Thus, it can now be demonstrated that amphoras were produced in southern Puglia in the seventh and perhaps in the early eighth centuries, and from the tenth/eleventh century, and it is likely that the gap in our evidence will be bridged by future work. It is also likely that further cases of amphora production in medieval Italy will come to light, to complement both the Puglian evidence and recently recognized vessels manufactured near Naples and in both southern (around Agrigento-Gela) and north-western Sicily (Palermo-Trapani area) (fig. 2).

The purpose of this present note is to draw attention to the group of later medieval Puglian amphoras in the hope that it will aid their identification along the Adriatic coasts and elsewhere, so as to help define their distribution and assess their significance in Byzantine and medieval trade.

The basic vessel type is quite clearly of Byzantine tradition, and fairly close formal parallels may be found elsewhere. The Puglian amphoras, which seems to be present in two principal variants, are characterized by a ribbed body, tapering towards a rounded or slightly flattened base, short neck with a vertical or slightly everted rim, often cupped, and thick handles which rise above the rim. The handles of the later examples are distinctly peaked. The shoulders often bear a single deeply incised wavy line, sometimes more than one. The

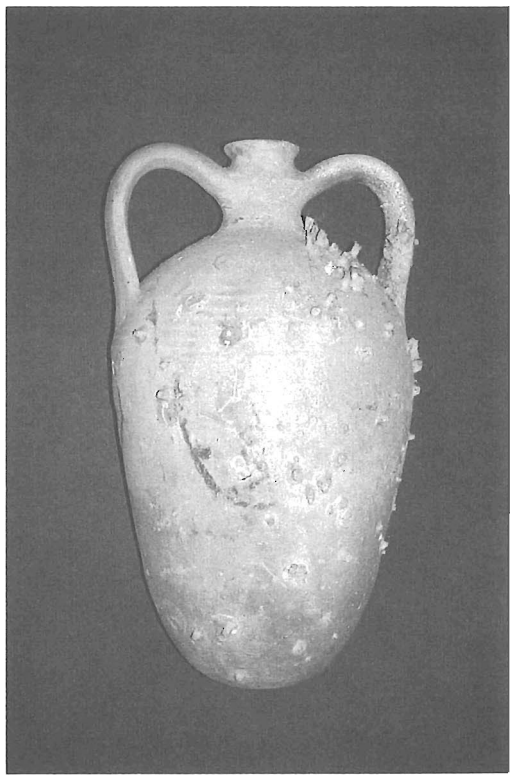


Fig. 3 (above). *Amphora from Porto Cesareo in the Museo Provinciale, Lecce.*

Fig. 4 (below). *Amphora from Torre S. Stefano (LE). See figure 2, number 3.*

Photos: R. Auriemma

principal clay fabric encountered is fairly well elutriated and generally off-white to pale red in color. Small limestone inclusions, occasionally fossiliferous, are somewhat reminiscent of fabrics encountered in Roman amphoras produced around Brindisi. The fabric variants suggest that more than one production site in southern Puglia was involved. Through it is still not certain what these vessels contained, both their form and the fact that they sometimes bear traces of a resin lining suggest wine.

As regards their dating, the earliest examples of the type so far recognized come from recent excavations by Francesco D'Andria at Otranto. There, associated ceramics suggest a date no later than the tenth century for the earliest appearance of the series. The latest examples, which do not appear to be residual, were found alongside Frankish coins, minted in southern Greece and dating to the late thirteenth century, in the fill of a pit excavated at the deserted medieval village of Quattro Macine, some 8 kilometers inland from Otranto. It has been suggested that the differences of the two main variants discussed above are mainly due to chronological factors, variant 1 being the earliest. However, given the relatively large time-span over which these vessels appear to have been produced, it is likely that in future we shall be able to create a more articulated typology that reflect a development of the vessels over the centuries.

Their quantitative distribution is at present heavily weighted towards Otranto itself, with a fair number coming from sites in its hinterland, from the deserted medieval villages of Quattro Macine and Anfiano, and from the monastic sites of S. Giovanni Malcantone and Le Centoporte. Further examples come from underwater sites around Puglia. On the western coast

they are known from the waters of Porto Cesareo, from near Racale and from the bay of San Foca, where a Roman fishing establishment has been excavated (fig. 3). It is interesting that San Foca of Sinope is an eastern saint, patron of merchants from the Black Sea and the Eastern Mediterranean. Other amphoras of the type come from Adriatic coastal sites including the bay of S. Cataldo, harbor of Lecce, Torre dell'Orso, Torre S. Stafano (fig. 4), Porto Badisco and probably from the wreck of Canale Pigonati, in the port of Brindisi, which has been dated through carbon-14 to between 1100 and 1300 by the Consiglio Nazionale delle Ricerche in Rome.

These underwater finds clearly show that the amphoras, with their contents, were intended for shipment. Indeed, at least one example appears to come from excavations in Venice (S. Lorenzo di Castello). Interestingly, in 1104, the Venetians had a trading contract with Otranto, to ship provisions from the town to Antioch in Syria. No certain examples have yet, however, been recognized overseas, though some likely candidates, whose fabrics need to be examined, may be cited. They include vessels from Sibenik in the former Yugoslavia, from Durres in Albania, and a possible example from the sea near Marseilles. Given, however, the rather persistent presence of eastern Byzantine glazed tanle wares with sgraffito decoration, principally from Corinth and other Greek areas, and of amphoras from further east, including the sea of Marmara (11–13th centuries), in archaeological contexts in and around Otranto, as well as evidence for exportation from southern Puglia to Greece of Brindisi-type protomaiolica (13th century), we believe that the identification of Puglian amphoras abroad is only a matter of time.

The ceramic evidence for east-west contacts was largely left by medieval commercial ventures, in which centers such as Amalfi, Venice, Genoa and Pisa played a leading role. The amphoras examined in this paper suggest that southern Puglia, through Byzantine and Norman times, may also have played a rather significant part, which archaeology is helping to clarify.

Acknowledgments. We should like to thank Dott.ssa Maurizia De Min for information concerning finds from Venice and Afrim Hoti for those from Durres.

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Review

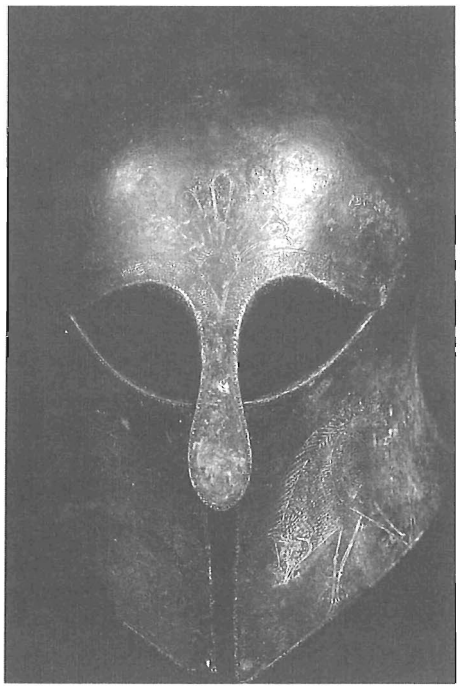
by Kevin Crisman.

The Archaeology of Ships of War, Volume 1 of the International Maritime Archaeology Series
Mensun Bound, Editor.
Oswestry, Shropshire: Anthony Nelson Publishers, 1995.
ISBN 0–9004614–52–2, 192 pages, softcover, £32.

International Maritime Archaeology Series

The Archaeology of Ships of War

Mensun Bound



The Archaeology of Ships of War and its companion volume *Excavating Ships of War* represent the proceedings of a two-day international conference held at Greenwich, England, on October 31 and November 2, 1992. As the titles of these works suggest, the theme of the meeting was warships—of every type, nationality, and period. This reviewer, anchored deep in the heart of Texas by teaching commitments, did not attend... but greatly regrets his absence. The table of contents of *The Archaeology of Ships of War* indicates that the conference brought together many talented archaeologists and historians who delivered papers on a wide range of topics.

In the Preface, series editor Mensun Bound provides a rationale for the archaeological study of warships, stating that the course of human history has been affected by naval vessels, both by the naval forces required to protect the world's maritime trade systems, and by the periodic clashes of warships that decide the fate of nations or empires. Bound believes that there is "no better expression of man's technological capability" than the warship, but that often-unreliable historical and visual records make it difficult to fully understand warship design, construction and operation. Archaeological study of warship remains, he contends, is our best approach if we are to understand the evolution of these vessels over the centuries. I fully agree with these sentiments.

What is baffling, however, is Mr. Bound's statement in the preface that "ships of war have not been an entirely respectable area of academic inquiry," and that they have received "scant regard ... as objects of serious study." While it is true that there are maritime scholars who find naval matters of little interest, there are a great many serious historians and archaeologists who have dedicated their careers to the study and publication of naval vessels. The shelves of the library here at Texas A&M University are heavily laden with books on warships, and maritime-related quarterlies such as *The Mariner's Mirror*, *The American Neptune*, or *The International Journal of Nautical Archaeology* feature articles on naval affairs or naval shipwrecks in nearly every issue. A large percentage of the restored historic ships to be found in the world's maritime museums are naval vessels. I simply cannot see any evidence that ships of war have been systematically slighted in favor of merchant craft.

The Archaeology of Ships of War is divided into three parts with a total of 24 papers. Part One, titled "Excavations and Interpretations," contains 13 entries, all but one of which discuss research on specific shipwrecks. The spectacular photo of a circa 600 B.C. Greek helmet on the publication's cover is somewhat misleading, for if your interest is in naval vessels pre-dating 1500 A.D. you will likely be disappointed by the limited attention given to ancient Mediterranean and Medieval-era wrecks. There is a definite slant toward the post-Medieval here. The two ancient warship entries include a brief survey report on the scattered wreck of a possible warship dating to the first century B.C. off the coast of Sicily and a discussion of rowing systems for ancient warships based on reliefs and vase paintings. Of the Medieval papers, one discusses the survey of a fragmentary wooden wreck of questionable date sunk off Sicily, while the second is a re-examination of the large clinker-built ship, identified as Henry V's great carrack *Grace Dieu*, that lies in the Hamble River on England's south

coast. The remaining nine entries in the "Excavations and Interpretations" section concern wrecks dating from the sixteenth to the nineteenth centuries, and provide a well-balanced selection in terms of vessel types, periods, and archaeological finds. For the sixteenth century there is a research update on the construction of the well-known Tudor warship *Mary Rose* and a paper describing a very promising English wreck, believed to date to 1592, off the Channel Island of Alderney. Seventeenth-century contributions include a report on a small but well-preserved Cromwellian warship, possibly the *Speedwell*, lost in 1653 off the Island of Mull in the Inner Hebrides, and a report by editor Mensun Bound on the guns and shot scattered on the seabottom by the wreck of the Danish 46-gun *Wrangels Palais* off the Shetland Islands in 1687.

The three eighteenth-century wrecks described in the first part could hardly be more dissimilar: the 90-gun man-of-war *Association*, lost with all hands in 1707 off the Scilly Isles in one of the worst navigational foul-ups in Royal Navy history; the little transport brig *Betsy*, scuttled during the British debacle at Yorktown in 1781; and a Spanish sail-propelled "floating battery," one of ten heavily-timbered ships that attempted (quite unsuccessfully) to batter British Gibraltar into surrender in 1782. Two famous wrecks from the nineteenth-century, the H.M.S. *Thetis* (wrecked off Brazil with treasure in 1830) and the highly-successful Confederate raider C.S.S. *Alabama* (sunk off Cherbourg in 1864), nicely round out the list of warships examined in Part One of the publication.

Part Two, titled "Ordnance," has three papers on shipboard guns, including an excellent typology of wrought-iron swivel guns, a summary of armament mounted on English East India Company ships, and a discussion of ordnance recording practices using the Dutch East Indiaman *Mauritius* as an example. Part Three of *Archaeology of Ships of War*, titled "Construction, Reconstruction, and Preservation," contains eight papers on topics such as wooden warship building practices, the restoration and maintenance of four eighteenth- and nineteenth-century Royal Navy ships (*Victory*, *Trincomalee*, *Warrior*, and *Gannet*), and current issues in historic ship restoration. The award for "most provocative paper" must certainly go to "Too many preserved ships threaten the heritage," the entry by Colin White, Head Curator of the Royal Naval Museum. In it, White points out that while everyone likes the idea of restoring and displaying old ships, by trying to save too many large ships museums are blindly committing themselves to enormous maintenance costs that will consume all money available for collections management and research. White calls on museums and maritime preservation groups to coordinate their approach to ship restoration and combine this with a realistic appraisal of the number of ships that can be supported by shrinking preservation funds.

This volume was carefully edited and thoughtfully assembled. The papers were well-illustrated with appropriate photographs, maps, wreck diagrams, and artifact drawings, and most included endnotes and a short bibliography. Taken all-in-all, *The Archaeology of Ships of War* provides a useful summary of various ongoing naval archaeology projects around the world, and would be a good addition to any nautical archaeologist's bookshelf. It certainly deserves to be in the library of all self-respecting universities. Unfortunately, the high price for this softcover volume will likely be beyond the reach of many would-be buyers.

In the Lab

Conservation Lab Expands La Salle Conservation work

The "French Connection" of the Conservation Laboratory of the Nautical Archaeology Program at Texas A&M University has recently grown stronger. A press conference on February 14, 1997, revealed the existence of a major French-Texan historic and archaeological site, and the involvement of the Conservation Laboratory in that discovery. The lab was already conserving the finds from *La Belle*, the ship of René Robert Cavelier, Sieur de la Salle, recently excavated in Matagorda Bay. It has now received the first artifacts from the recent discovery near Victoria of Fort Saint Louis, La Salle's base and the first European settlement in Texas (fig. 1).

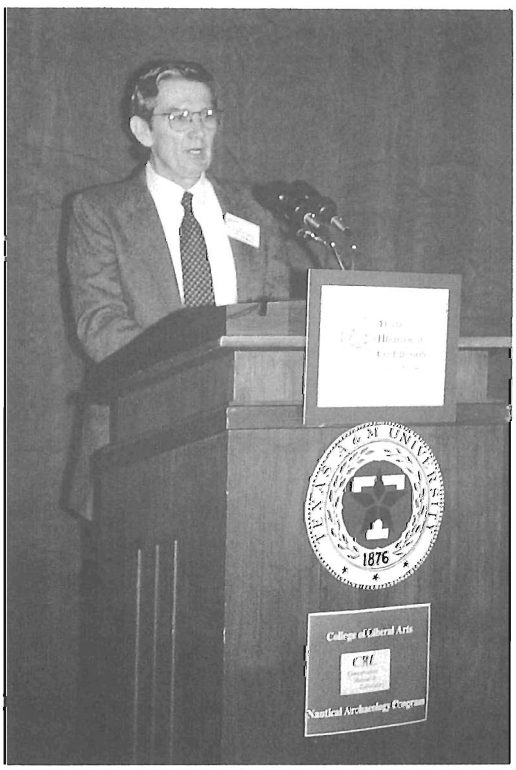


Photo: C. Powell

The first artifacts to be excavated were eight cast iron cannons (two large, three medium, and three small). These had been removed from La Salle's ship *L'Aimable* before it was lost in 1685, and used to fortify the settlement. The cannons were described, and buried on the site, by the Spanish explorer Alonzo DeLeon when he visited the abandoned French settlement in 1689. They remained hidden in the dense clay soil for 306 years, until a team of archaeologists from the Texas Historical Commission led by Executive Director Curtis Tunnell recovered them in October, 1996. The finding of the cannons was kept confidential until the February press conference in order to secure the site from looters and preserve it for future excavation.

The cannons will remain at the Riverside Campus in College Station for approximately one year while a team under the direction of Dr. Donny Hamilton conserves them (fig. 2). Once they are stabilized, the cannons will be permanently stored and displayed at a location to be determined.

The discovery of the cannons is just one more exciting chapter in the developing story of René Robert Cavelier, Sieur de La Salle. While plans are being developed to excavate and preserve Fort Saint Louis, the actual excavation of the La Salle shipwreck draws to a close. February and March 1997 will be dedicated to the dismantling, timber by timber, of the wooden hull and its transportation to Texas A&M's Conservation Laboratory in College Station, Texas. It is believed that the hull will produce approximately five hundred pieces that will be conserved and eventually reassembled.

The La Salle Shipwreck Project will be featured in full-length articles in both the *National Geographic* and *Smithsonian* magazines this spring.

Photo: C. Powell

Fig. 1 (above). *One of La Salle's cannon being lifted into a tank at the Texas A&M research laboratary for treatment by electrolysis, while three others await conservation.*

Fig. 2 (left). *Dr. Donny Hamilton announces plans for conservation of artifacts from the La Salle fort and shipwreck.*

Gelidonya Revisited by Jane Pannell

Artifacts from the 13th-century BCE shipwreck at Cape Gelidonya (excavated by Professor George F. Bass in the 1960s and revisited by INA in 1987–89) are undergoing further conservation and examination. With the exception of objects previously on display, all the artifacts from Cape Gelidonya have been stored much as they were left thirty years ago, in a tower in the castle that houses Bodrum Museum. The objects range from bronze tools and weapons to ceramics and copper ingots. All artifacts are now being located, and checked against both the original excavation notes and resulting publication. New storage facilities are being constructed and any conservation needs seen to.

Conservation, especially on material from underwater excavations, was a relatively new discipline when these artifacts were raised. Unlike the objects from the Bronze Age wreck at Uluburun, the Cape Gelidonya finds benefited only from a basic knowledge of the need for conservation. Considering this, however, the artifacts themselves, apart from some of the organic material, are in good condition. One particular fragment of basketry shows clearly the way it was manufactured (fig. 1). Further cleaning of the surface revealed a solitary seed tucked amongst the weave (fig. 2). Now a special mount is to be made for the basket, allowing it to be safely displayed and handled when necessary for further study. Newly restored artifacts from Cape Gelidonya will be exhibited in a purpose-built hall adjacent to the Uluburun shipwreck exhibition.

Working on the material from Cape Gelidonya has enabled one to review the history of conservation both generally and especially within the Institute of Nautical Archaeology. In the beginning, treatment was simply brushing off the sand and silt or rinsing in water, and storage usually meant a cardboard box. It is refreshing now to see not only how conservation itself has changed, but also how it has become an important part of any excavation that INA undertakes. The Institute's conservation area has progressed from a damp and drafty disused garage in the Bodrum Museum (where only basic tools and equipment were available, but used with a great deal of enthusiasm) to a purpose-built laboratory within the museum. The facility now boasts state-of-the-art equipment and chemicals needed to treat the ever-widening variety of material excavated. Students from all over the world are encouraged to come and spend time working on some of the finest archaeological material ever recovered. Conservation within the Institute of Nautical Archaeology will continue to play a major role in the preservation of history—furthering the knowledge of lives, technology, and trade of the past.

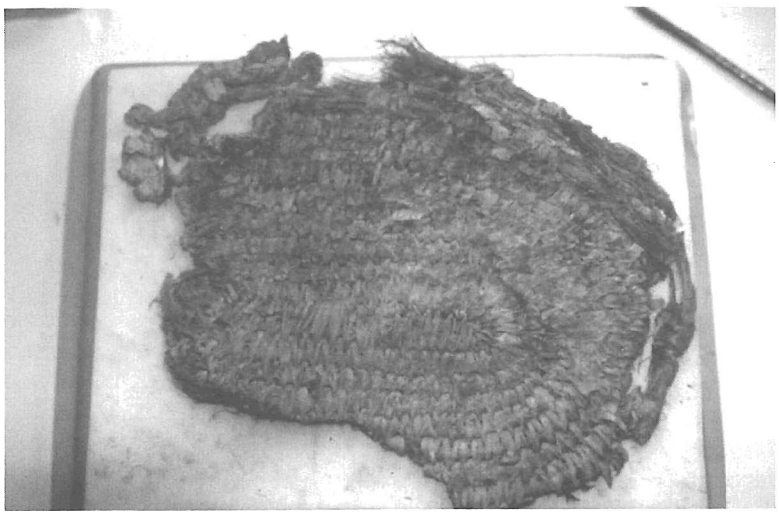


Photo: N. Piercy

Fig. 1 (above). *A 13th-century BCE basket fragment from the Cape Gelidonya shipwreck shown after cleaning.*

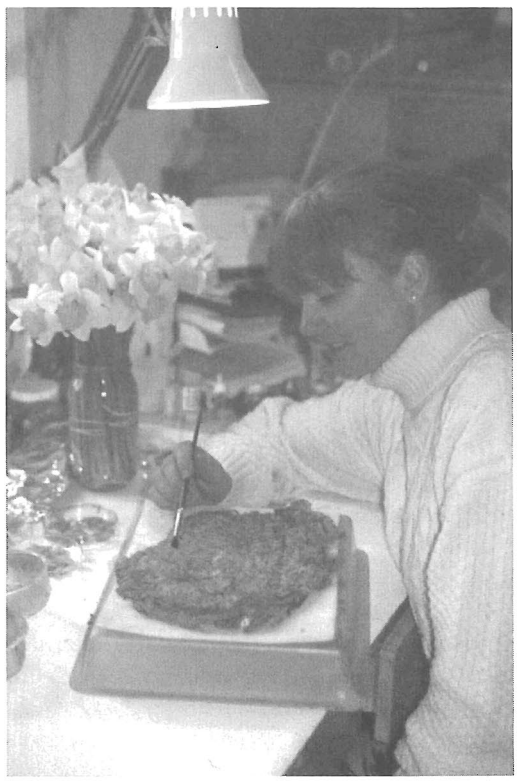


Photo: N. Piercy

Fig. 2 (right). *Head conservator Jane Pannell carefully cleans and restores the basket remains.*

News & Notes

Recent A&M Graduates

The *INA Quarterly* would like to congratulate the following recent graduates from the Nautical Archaeology Program at Texas A&M University who received Master of Arts degrees: George Indruszewski, Matthew G. Pridemore, Edward M. Rogers (all Spring 1996); William H. Charlton (Summer 1996); and David M. Grant (Winter 1996). In Summer, 1996, Jerome Lynn Hall became a Doctor of Philosophy; his dissertation was entitled, "A Seventeenth-Century Northern European Merchant Shipwreck in Monte Cristi Bay, Dominican Republic." Cemal M. Pulak became a Doctor of Philosophy in Winter, 1996; his dissertation was entitled, "Analysis of the Weight Assemblages from the Late Bronze Age Shipwrecks at Uluburun and Cape Gelidonya, Turkey."

Thanks Due to INA Contributors

The Turkish headquarters of the Institute of Nautical Archaeology continues to grow in Bodrum. INA wishes to express its thanks to INA members Jane and Jack Yates for a special gift to help furnish the new library building that should soon be built there. The core of the new library will be the Homer and Dorothy Thompson collection of several thousand volumes of books about classical archaeology, purchased for INA by the Friends of INA established in Portland, Oregon (about which more in a forthcoming number of the *INA Quarterly*). The Griffis Foundation is funding design and construction of a conservation laboratory there to honor the late Nixon Griffis, one of INA's Founding Directors. We also are grateful to Trimble Industries for providing a differential global positioning system without which our search for a Bronze Age shipwreck in the Bay of Antalya would not be possible.

INTRODUCTORY MARITIME ARCHAEOLOGY COURSE AT USTICA, SICILY

30 August - 8 September 1997

The INA Quarterly *has been asked to announce a course taught by a former graduate student in the Nautical Archaeology Program at Texas A&M University. The course is organized by the Italian archaeology journal* Archeologia Viva *with the support of the International Academy of Underwater Sciences and Techniques, and the Servizio Tecnico per l'Archeologia Subacquea of the Italian Heritage Ministry.*

You are invited to the Sicilian island of Ustica to follow an introductory course in maritime archaeology involving daily lectures in English and practical underwater dives, from 30 August to 8 September 1997. Ustica is a small volcanic island located in the Tyrrhenian Sea about 35 miles north of Palermo. It boasts a superb underwater landscape that includes one of the most important natural marine reserves in the Mediterranean Sea and a renowned submerged archaeological itinerary. Remains on land and in the sea testify to centuries of seafaring activities in the region.

The survey lectures on Mediterranean maritime archaeology, presented by Claire Calcagno*, include discussions on underwater survey and excavation techniques, key shipwrecks of the ancient Mediterranean, cargo remains, ancient ship technology and seafaring, conservation issues and coastal harbour studies. The eight guided dives to areas of archaeological and naturalistic significance are open to students with Open Water PADI certification or equivalent.

Course fees cover accommodation and half-board in lovely local hotels with excellent seafood, boat dives, tuition, air tanks and weights, and come to 1,500,000 Italian lire (approximately $935.00). Reduced rates apply to non-diving students (800,000 lire, or ca. $500.00) and traveling companions (650,000 lire, or ca. $400.000). Dive equipment may be rented on site (if reserved in advance).

Ustica can be reached from the Sicilian capital of Palermo by ferry (2 1/2 hours) and by hydrofoil (1 1/4 hours). You can fly directly to Palermo's international airport, or arrive in Rome and take a train to Palermo (overnight).

For further information and bookings, please contact: CORYMBUS VIAGGI, Via Massetana Romana, 56, 53100 Siena, Italy, tel: (39) (577) 271.654, FAX: (39) (577) 271.615.

* Ms. Calcagno is currently completing her doctorate in Central Mediterranean maritime archaeology at the University of Oxford. She can be reached at: Institute of Archaeology, University of Oxford, 36 Beaumont Street, Oxford OX1 2PG, England, FAX: (44) (1865) 278.254 or e-mail: claire.calcagno@merton.oxford.ac.uk

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