The 1994 INA/CMS Joint Expedition to Tantura Lagoon, Israel
Tantura Lagoon, Israel
“A Cove of Many Shipwrecks”

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Shelley Wachsmann

The Recanati Center for Maritime Studies
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Patricia Sibella

In the Field

Profile: Harry C. Kahn II
Gregory Gidden

The articles in this issue describe the field work conducted at Tantura Lagoon, Israel by a joint team of INA and Israeli nautical archaeologists. With this edition, we hope to familiarize our readers with the techniques of excavation and preliminary analysis, including hull mapping, ceramic analyses, and organic studies, used on virtually all INA projects. Note that the term “Byzantine period” used throughout this issue refers to the years between A.D. 324 and 638, ending with the Moslem conquest of Byzantine Palestine.

On the cover: Michael Halpern clears sand from the newly discovered portion of a hull that had been torn apart and scattered across Tantura Lagoon. Photo: S. Breitstein.

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

The INA Quarterly was formerly the INA Newsletter (vols. 1-18).  Editors:  Elizabeth Greene
David J. Stewart
The 1994 INA/CMS Joint Expedition to Tantura Lagoon

By Shelley Wachsmann, Meadows Assistant Professor of Biblical Archaeology

...about midnight the sailors suspected that they were nearing land. So they took soundings and found twenty fathoms; a little farther on they took soundings again and found fifteen fathoms. Fearing that we might run on the rocks, they let down four anchors from the stern and prayed for day to come...

In the morning they did not recognize the land, but they noticed a bay with a beach, on which they planned to run the ship ashore, if they could. So they cast off the anchors and left them in the sea. At the same time they loosened the ropes that tied the steering-oars; then hoisting the foresail to the wind, they made for the beach. But striking a reef, they ran the ship aground; the bow stuck and remained immovable, but the stern was being broken up by the force of the waves... the centurion... ordered those who could swim to jump overboard first and make for the land, and the rest to follow, some on planks and others on pieces of the ship.


So writes St. Paul concerning the wreck off Malta of the Roman grain ship on which he was being escorted to trial in Rome. Such events must have been common in antiquity.

Indeed, underwater surveys along Israel’s Mediterranean coast suggest that a shipwreck might be found for every 50–100 meters of coastline explored (fig. 1). This is not the result of a biblical ‘Bermuda Triangle.’ Their presence is simply the result of the law of averages. Israel’s sea lanes were among the most traversed routes of antiquity. Of the many ships plying this route, a certain percentage sank.

For a ship’s hull to be preserved it must be rapidly buried in sediment after reaching the seabed. Unfortunately for nautical archaeologists, most ships that sank along Israel’s coastline in antiquity suffered a fate similar to the vessel of St. Paul. They were often stranded and beaten to pieces by the waves, perhaps aided by coastal scavengers who plundered them. Of their hulls nothing remains; their passing is recorded solely by the scatterings of cargos that litter the seafloor. Only in regions where the coastline offered some protection—an island, a peninsula or a bay, for example—could ships that sank be buried rapidly under the moving sands that carpet this coast.

Dor is one of the most imposing tels (ancient habitation sites) in Israel. It was founded ca. 2000 B.C. Since that time, with a few short gaps in occupation, the tel, or its immediate vicinity, has been inhabited. Immediately south of Dor stretches Tantura Lagoon, a narrow bay that served as a natural anchorage (fig. 2). Combining four millennia of virtually uninterrupted maritime activity with geological conditions favorable to shipwreck preservation, Tantura Lagoon invites nautical archaeological research.

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Fig. 1 (left): Map of the Mediterranean coast of Israel in the region of Dor/Tantura Lagoon.

Fig. 2 (below): Map of Tantura Lagoon and Tel Dor. The shipwreck and cargo are spread out between Tafat Island and the shore.
After a storm in 1983, my colleague, Kurt Raveh, and I were conducting a routine survey dive in the lagoon when I happened to touch something 'spongy.' Looking down, I realized that my fingers had grazed the protruding tip of a ship's frame that was otherwise entirely buried. Hand fanning revealed strakes, frames and ceiling planks. Intact jars, as well as large quantities of sherds, dating to the Byzantine period (A.D. 324–638) lay atop the planking. We did not have the opportunity to investigate the area thoroughly at this time as other shipwrecked cargos revealed by the same storm along the Carmel coast required our immediate attention. By the time we could return to the hull, it had disappeared again beneath the sand.

In 1985, I returned to Dor with Kurt, Stephen Breitstein and Yossi Tur-Caspa of the Recanati Center for Maritime Studies (CMS) at Haifa University and a team of British divers from the Nautical Archaeology Society led by Valerlie Fenwick. We examined another part of a ship-wreck, once again associated with quantities of identical Byzantine ceramics. Most of our efforts were spent trying to move a sandbank that had settled over the site. We opened an area of the hull only the size of a small coffee table.

In the fall of 1994, I returned to excavate the shipwreck that had so long eluded examination. Following George Bass’s philosophy of cooperation with archaeological institutions of host countries, INA joined forces with the CMS to conduct the excavation as a joint, multi-year study. Last October, we began our search for the hull timbers and Byzantine pottery in Tantura Lagoon.

Coastal construction and a significant influx of sand in the lagoon during the years since the hull’s discovery made relocating the hull somewhat problematic. To determine the specific location of the hull, buried two meters beneath the sand, we began excavating test trenches in our target area. Although we all felt stymied by our initial failure to find hull remains, ultimately the excavation of these trenches proved serendipitous. Through them we gained our first overview of the positioning of artifacts beneath the sand. We discovered a 'flow' of Byzantine artifacts extending along a north-south axis that we followed for 60 meters. In our fourth trench, we found the timbers studied in 1985. Until that time, I had been convinced that those timbers and those revealed in 1983 were portions of a single, coherent, hull.

I was wrong. As we enlarged the area around the timbers we found that they ended abruptly at all sides. The entire section consisted of a few ceiling planks and some frames that had been ripped from a hull. These timbers lay upon a thick matrix of pottery dating primarily to the Byzantine period. The surrounding area is rich in organic materials and the spilled contents of amphoras, some of which were collected for palynological analysis (fig. 3).

Employing a hydraulic probe, we began to search for additional parts of the hull, following the general line of the pottery flow (fig. 4). With this method, we located two lead-filled stocks from wooden anchors. The second anchor stock lay directly upon a mass of Persian period (sixth-fourth centuries B.C.) torpedo and 'basket-handle' jar sherds. While lead parts from wooden anchors are not uncommon in the Mediterranean and Black Seas, the wooden portions of these anchors rarely survive. The earliest datable lead pieces appear in the late sixth
Fig. 5 (left): *It looked like someone had boarded up the seabed.* Photo: S. Breitstein.

Fig. 6 (right): *The ship had clearly suffered a severe fire at some point prior to its sinking. Similar charring was recorded on the ceiling planking found in 1985.* Photo: S. Wachsmann.

century B.C.; their use continued to about the mid-second century B.C. As these artifacts did not pertain to our primary objective, both were mapped, recorded and reburied *in situ* for future retrieval and study. Our search for the Byzantine hull continued.

On November 2nd, the probe team found two adjacent wood anomalies at the north of the ‘flow’ line. Deepening this area, expedition team members began to uncover planks neatly aligned on the seabed terminating on their northern side with a large timber. No frames were visible. At first glance it all looked rather strange. Texas A&M University undergraduate student Chris Lee, who was working in the area, described it aptly.

“It looks like someone’s boarded up the seabed,” he told me (fig. 5).

Until the day we found the remains, we had been enjoying ideal weather and glass-smooth seas. Now, quite suddenly, we were chased out of the water by a freak lightening and rain storm. All work on the site ceased.

After the stormy weather abated, we enlarged the trench, revealing a significant portion of the hull. The keel and a post (either the stem or stern of the vessel) continued for over six meters. Its southern side survived up to about the turn of the bilge. The hull lay on an approximately northwest-southeast axis. At the latter extremity the keel had been snapped off cleanly, as if it were a match stick. Dislocated timbers continued to the southwest. Virtually the entire northern portion of the hull had been torn away at the keel.

On the surviving southern side, the hull bore further witness to the forces that had torn it apart. Chris’s ‘boards,’ it transpired, were strakes from which the frames had been ripped away in a zipper-like effect, taking along any superstructure and cargo. Only near the post were several frames still in place. Discolorations indicated framing positions, some of which contained concretions of the iron nails that had once held the planking to the frames; in others the nails had accompanied the frames, leaving behind only holes in the strakes. Directly upon the strakes lay sherds of Byzantine ceramics.

We discovered that the hull had been deeply charred intermittently; similar charring appears on the ceiling planks found in 1985 (fig. 6). Did the ship sink as a result of a fire on board? As yet we are unable to determine when in the ship’s history the fire occurred. At present, all we can say for certain is that the fire happened prior to the sinking of the vessel and that the charring may have weakened the structural integrity of the hull. Nor can we yet ascertain the fire’s cause. Was it the fault of a careless cook, a lightening bolt, or perhaps due to damages sustained in battle? Hopefully, future investigation of the pattern of charring will elucidate this matter.

Whether or not the sinking was an immediate result of the fire, this ship clearly saw a traumatic end. There is virtually no wave action inside the cove, even during stormy weather. What might have torn her apart and have spread her cargo and hull across the lagoon like a deck of cards?

The only scenario that seems to explain the evidence is that the ship sustained severe damage and began breaking up, perhaps while still in the open sea. Possibly the ship grounded, like St. Paul’s ship, and was battered by the waves before it reached the lagoon. If so, the current inside the lagoon during a storm could account for the dispersal of the hull fragments and cargo. During storms, water rushes into Tantura Lagoon between the islands cre-
ating a powerful current that today, because the lagoon is closed in the north by a sandbar, flows from north to south. Considering their state of preservation, the ship and its cargo must have been buried rapidly after sinking.

Our curiosity about the vessel and its mysterious fate was only compounded as we began to study the construction of the hull. All indications suggest that at least up to the seventh century A.D. ships were built with mortise-and-tenon joinery, although this ancient method was slowly being replaced with a more frame-oriented construction. The shipwrights of the seventh-century A.D. Yassada ship, for example, aligned the vessel's strakes with unpegged mortise-and-tenon joinery. We fully anticipated finding a similar arrangement in our shipwreck's construction. During the limited time available to us, we studied the keel as well as all exposed strake edges for such joints. We were unable to find a single one. This, together with other constructional characteristics, suggests a later date for the hull than that which we assumed from the Byzantine pottery in the area. Indeed, the vessel's construction displays close parallels to the eleventh-century A.D. Serçe Limanı hull.

This enigma led us to consider other scenarios. We wondered whether there were two shipwrecks: one that sank in the latter part of the Byzantine period and scattered its cargo across Tantura Lagoon, and a second that wrecked in the same location several centuries later and then had Byzantine pottery washed into it. Such a scenario, although unlikely, is not impossible due to the dynamic energy within the bay during storms. Because of the apparent discrepancy in date between the Byzantine pottery and the techniques used in the hull's construction, it was clear that we needed an additional method for dating the hull. We still pondered these questions when, on November 12th, the weather turned nasty again.

For weeks, the westerly storms continued relentlessly. Every time the sea seemed to subside, a new weather front would enter the area, raising the waves again and precluding work in the sea. Local newspapers claimed this to be the rainiest November in the past fifty years. One evening the storm became so severe that the water washed up the beach as far as the sea-van container that served as our shore base, requiring us to anchor it to the shore to ensure that the waves did not carry it away. Thanksgiving came and went with no let-up in the weather. Finally, on December 6th, fine seas prevailed. The waves had buried the hull almost to water level with a sand bar. With four days remaining, we moved the sand and continued our preliminary study of the hull.

I now noticed that some of the Byzantine sherds lying directly on the hull were stuck into what appeared to be mastic, the putty like material—now rock hard—that the ship's builders had placed between the frames and planking. It seems unlikely that the sherds could have become embedded in the mastic after the ship sank. Here, then, was a strong archaeological clue that the Byzantine period pottery found on the hull did indeed belong to it.

Additionally, we removed sections of the keel for dendrochronological and radiocarbon testing. The dendrochronological sample proved inconclusive. The three radiocarbon tests, carried out on a single piece of wood, however, chronologically matched two previous ones done on the timbers found in 1983 and 1985. All three hull portions were dated to ca. A.D. 415–530, agreeing with the Byzantine date derived from the pottery.

In the upcoming field season, the expedition will focus on a thorough study of the known hull fragments and on locating additional hull parts and cargo that may yet remain beneath the shifting sands of Tantura Lagoon. Only future study may resolve the enigmatic discrepancy between the dates given to the hull by the pottery and radiocarbon on the one hand, and the construction techniques used by the ship's builders on the other.

As Patricia Sibella points out below, in addition to ceramics of the Byzantine period we uncovered pottery—sometimes in quantities—belonging to other chronological horizons. These sherds range in date from the Middle Bronze Age II (ca. 2000-1550 B.C.; in biblical terms this is probably the time of the Patriarchs) to the Late Iron Age (eighth-
sixth centuries B.C.—the period of the Divided Monarchy—and the Persian period (sixth-fourth centuries B.C.—the time of the Return to Zion from the Babylonian Exile and the establishment of the Second Temple). Two Iron Age amphoras assigned to the eleventh-tenth centuries B.C. (about the time of David and Solomon), which I discovered during my previous IDAM surveys, add an additional chronological weave to this 'cove of many shipwrecks.'

We witnessed, then, numerous indications of Tantura Lagoon's archaeological abundance. One example in particular comes to mind. During the last days of the excavation we discovered that the ship's keel lay directly upon the upside-down hewn stone stock of a wooden anchor, creating a rare stratigraphical sequence on the sea bottom (fig. 7). Stone stocks were used from the late seventh to the mid fourth centuries B.C. Thus, the stock predates the hull by about a millennium. A rope lies pressed between the two, spanning the centuries. Whether the rope belongs to the stock, or to the hull, remains unclear.

In a small section excavated adjacent to the stock and beneath the level of the keel, we found a layer of Late Iron Age or Persian period sherds. These were mixed together with ballast stones of non-local origin, similar to those found on the late fifth century B.C. Ma'agan Michael shipwreck. These findings raise the possibility that another, earlier, hull may lie nearby.

Whether or not this is the case, one thing is absolutely certain—Tantura Lagoon will continue to surprise us.

Acknowledgements.
The Tantura Lagoon Expedition is a joint project of the Institute of Nautical Archaeology at Texas A&M University and the Recanati Center for Maritime Studies at Haifa University. This research was made possible by the philanthropic support of the following individuals: Mr. and Mrs. Harry C. Kahn, II of Philadelphia, Dr. and Mrs. Samuel J. LeFrak of New York, and Mr. and Mrs. John L. Stern of Los Angeles. Additional funding was provided by the College of Liberal Arts and the Office of the Vice President for Research and Associate Provost for Graduate Studies of Texas A&M University and the National Geographic Society. Thanks also to Mr. Edward O. Boshell, Jr. for his involvement and support of INA Israel.

The collaboration between INA and CMS has benefited both institutions as well as the individuals involved in the Tantura Lagoon project. Special thanks to George F. Bass and Avner Raban for working out this inter-institutional agreement, as well as to Frederick M. Hocker, INA's new president, and Yossi Mart, the incoming Head of CMS, for continuing the process. Thanks also to Stephen Breitstein, Yaakov Kahanov, Itzik Dagan and William H. Charlton for their assistance in making this research a reality.

The success of the first field season was largely due to the dedication and perseverance of the staff, many of whom assisted in preparations before we went into the field. My special thanks are due to the members of the excavation team: Kyra Bowling, Vaughn Bryant, Stephen Breitstein, Norine Carroll, William H. Charlton, Asaf Giveon, Eli Hadad, Michael Halpern, Yaakov Kahanov, Tal Kesar, Tony Lachud, Andrew Lacovera, Chris Lee, Eyal Bar-Maimon, Tommi Mäkelä, Taras Pevny, Carmela Shimony, Patricia Sibella and Claude Tibi (fig. 8).

Numerous archaeologists were consulted on various aspects of the excavation. They liberally gave of their time and knowledge. In addition to those contributing articles for this issue of the INA Quarterly, I note, with appreciation, the valuable advice given the expedition by the following scholars: Trude Dothan, Bracha Goz, Barbara Johnson, Ayelet Lewinson-Gilboa, Robert Merrillees, Peter Kuniholm, Ephraim Stern, and Ella Werker. Ehud Galili and Yaakov Sharvit of the Israel Antiquities Authority's Marine branch were frequent visitors to the excavation. I appreciate their support, help and pointers.

A kibbutz is a type of collective settlement, unique to modern Israel. The expedition was based in beautiful Kibbutz Nahsholim. A more delightful base of operations is difficult to imagine. All the team members benefited greatly from the warmth and kindness extended to us by all of Nahsholim's members, who endeavored to help us in myriad ways. Special thanks to Tammi Yitzchaki and the rest of the folks at the Nahsholim Guest House who did everything possible to make our stay both productive and pleasurable. I am also indebted to Ziv Gilboa for his enthusiastic support of the project, to the staff of the Center of Nautical and Regional Archaeology, Dora (CONRAD) for their hospitality, and to Kurt Raveh for his assistance in locating the hull fragment that we had worked on together in 1983.

I also thank the following individuals: Yitzchak Cohen, director of the Dor Holiday Village; Shlomo Nachmani and his staff at the Express Garage in Haifa for voluntarily keeping our pumps, which were quite literally the heart of the excavation, in good working order, and to Pat Clingenpeel for keeping the expedition well supplied with surgical syringes used in attaching labels to the hull's timbers.

The expedition benefited from National Geographic Explorer's loan of a camcorder and underwater housing. I also thank Frederick Campbell and Ronald M. Bural of Archaeoquest.
Video Productions for their considerable time and effort in turning this rough footage into usable material.

Administrative support to a project in the field from a distant office is often a tedious, a difficult and a time-consuming task. I thank Claudia LeDoux, Becky Holloway, Patricia Turner and Clyde Reese for their assistance.

My appreciation also goes to INA Quarterly editors, Elizabeth Greene and David Stewart, for their considerable skill, time, and effort, which are reflected in these pages.

I am grateful for the Meadows Assistant Professorship of Biblical Archaeology, a position that permits me to carry out this research in Tantura Lagoon; for this I thank George F. Bass, The Meadows Foundation of Dallas, the Institute of Nautical Archaeology, and Texas A&M University.

Suggested Reading

Dahl, G.

Raban, A.

Stern, E.

The Recanati Center for Maritime Studies
by Stephen Breitstein

In 1960, a small group of divers founded the Israel Undersea Exploration Society (IUES) to conduct the first systematic survey of underwater archaeological sites, establish guidelines for resource preservation, and encourage public interest in the value of underwater archeological research. Eleven years later, the directors of the IUES proposed the establishment of the Center for Maritime Studies (CMS) as a means to offer academic training for marine archaeologists and historians in Israel. The CMS, along with the Department of the History of Maritime Civilizations, opened in 1973. The curriculum of this department is based on an interdisciplinary approach to the study of maritime activity. It offers students the opportunity to pursue classes in marine history, archaeology, geography, biology, geology, and geomorphology, as part of an M.A. degree program.

The CMS serves as the field research unit for faculty and students of the Department of Maritime Civilizations and for research staff indirectly connected to the department. In 1973, the CMS established a workshop to serve as a base for marine operations. This facility, known as the University Maritime Workshop (UMW), was built at the National Maritime Museum in downtown Haifa. Today, the UMW is the most advanced and best equipped diving center in Israel. It is operated by a small, but dedicated staff that develops, maintains and adapts a broad range of equipment for many research purposes. The Workshop conducts field operations during about 150 days of the year and devotes the remaining working days to equipment development, maintenance and training. Workshop personnel have invested significant thought into making nearly every system “portable” so that their services may be available to any research site in the field. The role of the UMW has been to develop and maintain the logistic and operational systems required by the research objectives of the faculty and students in the Department of Maritime Civilizations. Since 1973, the Workshop staff has provided the operational support for nearly 50,000 hours of dive time at countless sites.

CMS research staff have conducted surveys and excavations in dozens of sites along the Mediterranean and Red Sea coasts. The list of sites studied includes Achziv, Akko, Shikmona, Athlit, Ma'agan Michael, Caesarea, Ha-
The discovery of the Persian period shipwreck at Ma'agan Michael led to the development by the workshop staff of new technology for efficient and cost-effective excavation in very shallow water. Notable among several developments was the use of a "sandbag retaining rampart," installed by divers around the wreck site. This greatly reduced the flow of sand onto the site and significantly reduced the time needed to uncover and remove the wreck from the sea. The operational experience gained at the Ma'agan Michael site will be applied to the Tantura Lagoon project. It was the success of the Ma'agan Michael excavation that encouraged Shelley Wachsmann to initiate INA's collaboration with the CMS (fig. 1). The Tantura Lagoon project is a fine example of the type of logistic support the University of Haifa's Maritime Workshop can place at the disposal of nautical archaeologists anywhere in Israel.

Stephen Breitstein is the director of Operations of the CMS and Head of the University Maritime Workshop staff. He received his B.A. and M.A. degrees in History from UCLA and has had extensive commercial diving training. He is a veteran diving instructor and serves as the diving officer for most CMS field work.

A Preliminary Study of the Hull Remains
by Yaakov Kahanov and Stephen Breitstein

The preliminary study of the hull wood from the first season of renewed excavations in Tantura Lagoon suggests some exciting possibilities for historical ship construction theories. As far back as the fourteenth century B.C., as evidenced by the Uluburun shipwreck, ancient Mediterranean ships were constructed shell-first using pegged mortise-and-tenon joints. The shell-first hull building tradition continued throughout Greek and Roman times. Although both the fourth- and seventh-century A.D. Yasslada vessels provide evidence for the beginning of the shell to skeleton transition in the Mediterranean, neither was built frame-first. At present, the earliest convincing evidence for frame-first construction is provided by the 11th century A.D. Serçe Limani wreck. The Tantura Lagoon shipwreck, however, may represent an earlier example of this construction method. Further excavation and study are needed to confirm the preliminary late Byzantine period date for the Tantura Lagoon vessel. If the ship does indeed date to this time frame, and if future investigations reveal no mortise-and-tenon joints, it will be the oldest frame-first vessel known in the Mediterranean region.

For the 1994 season, our task was to relocate and re-survey portions of the hull previously discovered by Shelley Wachsmann. Six different areas were studied; in two of them (Trenches IV and VI), about 60 m apart, divers discovered shipwreck timbers and pottery. The pottery
One of the two frame timbers to which the ceiling planking is attached is quite well-preserved, while the other exists only as a fragment. The well-preserved timber is 10 cm wide and 15 cm thick and is curved to match the shape of the hull. It contains a limber hole at one end, indicating that it is probably a floor timber. Both frame fragments are made of hard, brown wood.

In Trench VI we discovered part of the keel connected to one of the end posts, a knee, five deteriorated frame fragments, and at least eight planks. Our study of this area was interrupted by a three-week-long storm, severely limiting our recording time. For that reason, we concentrated our efforts on the keel, post, and frames (fig. 2).

The keel and post assembly is preserved to a length of 6.47 m. It contains two scarfs, the first a hook scarf at a point 3.5 m from the end of the post. The second scarf may have connected the post to the keel, but this is not yet certain, as the details are still hidden behind the garboards and beneath the sand. On average, the keel is approximately molded (high) 18 cm and sided (wide) 11 cm; these relatively small dimensions suggest that this was a small vessel. No sign of a rabbet was found along the keel, nor was there any sign of a garboard attachment to the keel. There is no false keel.

The post (we cannot be certain whether it is a stern or stem post) awaits positive interpretation, but appears to be made from two pieces. An outer piece, perhaps a gripe, was molded (thick) only 6 cm on average; an inner post, apron, or knee provided the rest of the thickness. The post was sided about 9 cm. A rabbet, into which the ends of the planking could be terminated more securely, commenced 13 cm beyond the post/keel scarf and continued forward and upward for an unknown distance.

Five eroded frame fragments were found and numbered consecutively from east to west. We measured frame 1 (the longest) and part of frame 3 as representative samples. On average, the frames were molded approximately 12 cm and sided 7.5 cm. Frame 3 appears to be made out of two timbers, although the frame might have been broken into two pieces after the ship sank. No remnants of frames have yet been found to the north of the keel, where they were cut or broken off flush at the north face of the keel (fig. 3). The remaining frames continue southward for about 1.3 m. Center-to-center distance between the surviving frame fragments is about 30 cm, and concretions from nails at 30 cm intervals along the keel mark the positions of frames that have disappeared. Each frame was apparently attached to the keel by one iron nail.

Fig. 1: Two planks and two floor timbers were identified in Trench IV. Evident in the drawing are nail holes marking probable frame positions, and the charred appearance of the ceiling planks at their northern extremity.
The floor timbers have a 1 cm recess cut into their undersides so that they could be fit over the keel. Square limber holes 4 cm in diameter cut into the floor timbers allowed water to circulate in the bottom of the hull. A cursory examination of frames 4 and 5 shows that they are curved in a manner that gives the impression of poor quality wood or wood that suffered considerable damage.

Remnants of eight planking strakes were found to the south of the keel and one was found to the north; additional small pieces were discovered at the east end of the trench. The ends of both the starboard and port garboards were found near the post. In some places we found the holes left by the nails that connected the planks to the frames, three holes in each strake. The planks are fairly narrow, with widths varying between 11 and 21.5 cm. Typical plank thickness is 2.5 cm.

As with the fragments from Trench IV, signs of fire can be seen everywhere, especially on the east side. Near frame 3, we identified remnants of a yellow substance smeared on the inner surfaces of the planks. This may have been a resin or similar oily, protective material. Near the connection of planks to this frame we also noted a putty which looked as if it served to glue the planks to the frame. We have found no evidence of mortise-and-tenon joints, frame-to-futtock scarfs, or plank scarfs, although some plank widths varied.

In conclusion, significant hull remains lie near and beneath Byzantine pottery. This vessel seems to lack any signs of mortise-and-tenon joints and suggests frame-first construction. The general picture of the wreck site gives the impression that the vessel suffered extensive damage during or after the sinking. The surviving wood itself is well preserved. Only a small amount of teredo damage can be seen and there are no signs of barnacles. The frames are attached to the keel by means of one nail each. Planks are narrow and thin and are connected to each frame with several iron nails.

There are good reasons to believe that the timbers found in Trenches IV and VI belongs to the same wreck. The planks have similar dimensions and color, the frames

Fig. 2: Preliminary plan of the hull section uncovered in Trench VI.

Fig. 3: Floor timbers 1 (left) and 3 (right). Note the square limber holes cut into them, which allowed water to flow freely in the bilge.
How Old is the Shipwreck from Tantura Lagoon? The Radiocarbon Evidence
by Yisrael Carmi and Dror Segal

Timbers from the Tantura Lagoon shipwreck have been dated by radiocarbon analysis. This method is applicable to any archaeological material that contains carbon, such as wood. Radiocarbon, or carbon-14, is a very minor constituent of carbon in the environment; of the three isotopes of carbon, the most abundant is carbon-12. Once created, radiocarbon participates in the ongoing carbon cycle in the environment. It is assimilated in plants by photosynthesis from the atmosphere. As long as a plant is living and inhaling carbon dioxide, the ratio of carbon-12 to carbon-14 atoms in it remains constant. When a plant dies, however, this dynamic equilibrium process stops and there is no further exchange of carbon between the plant and the environment. The radiocarbon clock begins to tick.

Radioactive carbon-14 decays at a stable rate in its transformation to non-radioactive nitrogen. In the atmosphere, and in living organisms that continuously exchange carbon with the atmosphere as part of their biological life processes, the number of carbon-14 atoms remains approximately constant. When an organism dies, however, as occurs when a tree is cut for its wood, the biological exchange process stops and decay of carbon-14 proceeds without replenishment from the atmospheric supply. For any radioactive isotope, it is possible to measure its half-life, or the time it would take for one-half of the radioactive atoms in a sample to decay to a stable form. The half-life of carbon-14 is 5,700 years. Analysis of the ratios between carbon-14 and carbon-12 content within an archaeological sample can provide meaningful dates for organic materials.

Five separate radiocarbon tests were performed on wood samples from timbers discovered in Tantura Lagoon in 1983 (RT-686A), 1985 (RT-801), and 1994 (RT-2162, 2163, and 2164). The final three tests analyzed wood from a large splinter removed from the lower edge of the keel of the hull in Trench VI. The age of the shipwreck, averaged over these five measurements, is 1620±25 ybp (years before present). The following dates were obtained from the five samples:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Years Before Present (YBP)</th>
<th>Calendric Age (AD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT-686A</td>
<td>1590±110</td>
<td>380-605</td>
</tr>
<tr>
<td>RT-801</td>
<td>1640±120</td>
<td>260-290 (11%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>320-550 (89%)</td>
</tr>
<tr>
<td>RT-2162</td>
<td>1695±45</td>
<td>268-280 (11%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>330-415 (89%)</td>
</tr>
<tr>
<td>RT-2163</td>
<td>1600±45</td>
<td>425-530</td>
</tr>
<tr>
<td>RT-2164</td>
<td>1575±45</td>
<td>440-540</td>
</tr>
</tbody>
</table>

For samples RT-801 and RT-2162 there are two possible calendric age ranges with unequal weights (in parenthesis) due to twists in the calibration curve. The two ranges are not combined because, in both cases, one of the ranges has a very low probability in comparison to the other.

The average date provided by carbon-14 analysis for the Tantura Lagoon timbers suggests that the timbers were cut between A.D. 415-530. Thus, radiocarbon dating furnishes a fifth or early sixth century date for the shipwreck at Tantura Lagoon, and further confirms the theory that the scattered timbers in the lagoon belong to a single wreck.

from both sites are also similar and are spaced the same distance apart. Moreover, the method of attaching the planks to the frames is the same in both areas and at both sites, the wood is charred.

As stated above, we believe that the Tantura Lagoon hull remains represent a small vessel that sank, perhaps in the aftermath of a fire. Carbon-14 testing has dated this shipwreck to the late Byzantine period (see box above). This date is supported by the finds of Byzantine pottery in and around the hull. Further analysis is still needed, but if this date is accurate it raises fascinating possibilities for refining our knowledge of ancient hull construction. INA professor emeritus J. Richard Steffy has suggested that the date for the introduction of frame-first construction should be moved back. The shipwreck at Tantura Lagoon may provide the first concrete evidence for this suggestion. It may be the earliest seagoing ship yet found in the Mediterranean that was built without mortise-and-tenon joints. It apparently predates the Yassiada seventh-century shipwreck, in which there are still some unpegged mortise-and-tenon joints. We look forward to recording the hull in more detail during the coming seasons of excavation (fig.
Fig. 4: Team member Andrew Lacavera cleans and records the portion of the hull discovered during the 1994 campaign. Note that frames are missing from the hull planking in the foreground.

4). Only after detailed recording is complete will we be able to say for sure whether this enigmatic vessel is indeed the oldest known ship constructed without mortise-and-tenon joints in the Mediterranean.

Acknowledgements. We wish to thank Kyra Bowling for her part in collecting field data on the hull and for her assistance in the preparation of the illustrations.

The Ceramics
by Patricia Sibella

During the 1994 season, we excavated six trenches (I-VI) of varying size through the thick sand that blankets Tantura Lagoon. In the course of these soundings some 140 m² of sea bed were excavated to approximately 2.5 m beneath sea level, the depth at which the two hull sections studied in 1994 lay. Significant amounts of pottery from various periods were discovered, suggestive of the cove’s rich maritime history. In all, we recovered and recorded 413 ceramic sherds.

Of this pottery, I examined 79 sherds and seven fragmentary, but nearly complete, Palestinian bag-shaped amphorae dating from the later part of the Byzantine period. These were left in situ for later removal. The majority of the ceramics discovered represent well-known amphora types ranging in date from Middle Bronze II (ca. 2000-1550 B.C.) to the Late Byzantine period. The following is a preliminary evaluation of this material.

One of the first surprises of the excavation was the recovery of two Middle Bronze II sherds of Cypriot White Painted Ware with decorative patterns (fig. 1). The Persian period (538-332 B.C.) is represented by two amphora types widely distributed from northern Palestine to the eastern Mediterranean shores including Cyprus, Rhodes, and southern Anatolia. The first is a descendant of an Iron Age II jar (1000-586 B.C.; fig. 2: A). It is characterized by a biconical body that tapers to a pointed base, and a neckless mouth consisting of a thick, straight sided rim. Broad,
straight shoulders form a sharp angle with the body, and a pair of ear-handles are attached from the shoulder to the upper body. The Tantura Lagoon examples have the high and wide waist, typical of jars from the sixth to fourth centuries B.C. One fragmentary example still retained its mud-like bung in place (fig. 3).

The second amphora type is represented only by a toe and the upper halves of two separate jars (fig. 2: B). Large basket handles are attached to the shoulder, extending well above a short neck capped by an everted rim; the cylindrical body tapers to a stump toe. Although basket-handled jars range in date from the seventh to the fourth centuries B.C., the Tantura Lagoon examples seem to belong to the later types. That this jar appears to be contemporaneous with the first type may suggest that both are part of the cargo of a yet undiscovered shipwreck in the lagoon.

Fig. 3: Bung of a Persian amphora, associated with a wooden anchor stock.

Many vessels, including three types of amphoras, date to the Byzantine period. Of the amphoras, the most frequently encountered type is the Palestinian bag-shaped transport jar (fig. 2: C). It has a lengthy history, beginning as early as the second half of the first century B.C. and continuing up to the eighth century A.D. The jars may possess a variety of rim profiles and fabrics, the latter ranging from sandy-buff to reddish, to gray with a reddish core. Main features include a collar rim, narrow sloping shoulders, ring handles on the upper part of the body, a rounded bottom, and combing on the exterior of the body. The combing patterns may be due to the use of combs with different profiles. Some late examples have white-painted decoration of criss-crossing wavy and curled lines (fig. 4). They are found on virtually every site in Palestine in great numbers. Outside Palestine, they have been found west of the Black Sea, on land and under water in Turkey, Egypt, North Africa, Cyprus, and Greece. The Tantura examples, with their buff-red fabric, represent a type that occurs in southern Palestine in the later centuries of the Byzantine period, differing from those found in northern Palestine, which have distinctly carinated shoulders and grayish fabric.

The majority of the amphora sherds are lined with pitch or resin, suggesting that some originally contained wine. An incomplete amphora from Trench III was filled with an unidentified organic material. A second bag-shaped amphora of buff-reddish fabric from Trench IV contains an unidentified brownish, semi-liquid substance. Contents of both jars have been sampled for analysis, the results of which are pending.

A second Byzantine amphora type, commonly known as the Gaza jar, has a cigar-shaped body, ear-handles on its
rounded shoulder, a small everted rim, and a pointed base, which in some examples may be somewhat flattened (fig. 2: D). The smooth fabric is thick and light-brownish grey to buff-brown in color. The body is combed on the shoulder, with some examples showing prominent zones of combed lines alternating with widely-spaced blank regions; combing may also cover the lower body and base. This type has been found both on land and under water in the entire Mediterranean basin, including France, Spain, north Africa, north and west of the Black Sea, other areas such as Nubia, and as far north as England. While the general shape dates from the third to the late sixth centuries A.D., those from Tantura are of the latest types. They almost certainly were used for transporting the acclaimed white wines of Gaza and Ashkelon, the fame of which may have been due more to the wine’s use in non-culinary purposes than for its taste. In A.D. 324, when Emperor Constantine proclaimed Christianity as the official religion of Byzantium, pilgrims flocked to the Holy Land in quest of relics and souvenirs; for them, Gaza wine was a popular commodity. Fifth- and sixth-century writers from the western Mediterranean and Constantinople praised the wines of Gaza; Gregory of Tours related its use for the Eucharists in Lyons. Gaza wine also was sought out for its medicinal properties.

The upper half of yet another amphora type was found in Trench I (fig. 2: E). This type, representing the second most common jar on the seventh-century A.D. shipwreck at Yassada, has an hourglass-shaped body, a long neck, a thickened rim with a slightly convex profile, a rounded base with a small central button, and crudely fashioned, double-ridged handles extending vertically from below the rim to the shoulder. The body is covered with pronounced ridges. A red dipinto is painted on the shoulder of the Tantura example (fig. 5); dipinti also have been found on examples from Carthage and Istanbul (Sarac;hane). This type is the most common and most widely traveled amphora class of the sixth and seventh centuries. Outside of the Mediterranean, it is found in Nubia, the Black Sea and England. Cyprus or Asia Minor (more specifically the region of Antioch) have been proposed as its source.

Several amphoras show signs of reuse. Three Palestinian bag-shaped amphoras from Trench IV have damaged rims, almost certainly caused when their stoppers were pried out. One jar contained fig and grape seeds and an olive pit embedded in its resinous lining. We hope that future study will reveal whether these seeds are intrusive or represent remains of the jar’s previous contents.

The only amphora stopper found in the excavation, made from a bag-shaped-amphora sherd, had been fashioned into a roughly circular shape. This method of sealing is well attested on the Yassada Byzantine wreck, where 165 such stoppers were recovered. The near absence of amphora stoppers at Tantura suggests that the jars probably were sealed with perishable materials.

A shallow, flat-based, conical jar lid (fig. 6) with a high central knob similar to two found on the Yassada seventh-century shipwreck may have served as a cover to a large-mouthed jar. Another close parallel for these lids comes from the seventh-century A.D. deposit at Sarac;hane in Istanbul.

Only three sherds of Byzantine fine wares, ranging in color from light brown to light orange and covered with a
red slip, were discovered; all came from Trench I. Two are from globular vessels, while the third belongs to a deep, open bowl. The last sherd is incised with a pair of intersecting parallel lines made while the clay was still soft.

Four fragments of an Eastern sigillata plate came from the southern end of Trench IV. Their buff-colored, well levigated fabric is red-slipped on both surfaces. Plates of this type are common throughout the eastern Mediterranean during the sixth to seventh centuries, and probably are of Syrian origin. Also found were two deep dishes with straight sides, beveled rims, and a pair of twisted and uplifted horizontal handles, which date them to the end of the sixth century. Known as casseroles, these pots were used to improve the flavor of pre-cooked foods by simmering, and for stewing and steaming meats and vegetables.

We found a total of sixteen pantile fragments in Trenches I and III. Their fabric varies from sandy buff to orange in color, and rims display a rectangular or rounded profile. If these tiles are associated with the shipwreck found in nearby trenches, they may have been used for a roof over the ship’s galley, as is reconstructed for the seventh-century ship at Yassiada.

The unstratified nature of the Tantura Lagoon material creates problems in interpretation. At times, we found objects separated in time by as much as two and a half millennia lying alongside each other, making it extremely difficult to understand the excavated material. Byzantine pottery, however, predominated in every trench, and constituted approximately two-thirds of all uncovered sherds. The bulk of the remaining pottery dates to the Persian period. Trench IV, which yielded the smaller hull section, was the only area where complete or nearly-complete bag-shaped amphoras were found. Trench V yielded mixed materials varying in date from the Middle Bronze II, Persian, and Byzantine periods. The assemblage from Trench VI, which contains the major hull section, presents the same confusing occurrence of both Persian and Byzantine material. Although both the bulk of Persian and Byzantine finds appears to represent a homogeneous assemblage of mostly transport jars, at this early stage of investigation it is nearly impossible to ascertain whether they belong to two or more shipwrecked cargos. The several small Byzantine sherds found embedded in the mastic on the ship’s hull, however, suggest that the seemingly homogeneous and closely dated Byzantine ceramics (comprising primarily amphoras and galley wares) are associated with the Tantura Lagoon wreck. If such is the case, then we have before us a unique opportunity to document the cargo of a specific ship that sank as the Byzantine period was coming to a close in the Holy Land.

Suggested Reading


Déroche, V. and Speiser, J.M. Eds. 1989 Recherches sur la céramique byzantine. BCH Supplément XIII.


Patricia Sibella is an independent research archeologist specializing in ancient ceramics. She has worked on INA projects since 1991, most recently as the Staff Ceramicist for the Tantura Lagoon Expedition.
Rope was used on ancient ships for all manner of work: tying, and binding, securing cargo, raising sails, and lowering the anchor. The cordage carried and used aboard seagoing vessels would have varied greatly in size and style, from small string to large, hawser-sized rope. Most ancient shipwreck sites in the Mediterranean, however, have yielded only small fragments of rope, providing few hints about the types of cordage the ships would have carried. The recent excavation of the Ma’agan Michael shipwreck, dating to ca. 400 B.C., only a few kilometers south of Tantura Lagoon, presented unusually good preservation of rope and other organic materials and has given a much truer picture of the types of cordage a ship’s rope locker would have contained. It was with this knowledge that I anticipated the excavation at Tantura Lagoon, hoping for similar preservation of rope on the Byzantine period shipwreck remains there.

We discovered rope remains in two of our excavated trenches in Tantura Lagoon: two interesting concentrations in Trench IV, as well as two individual pieces near the keel in Trench VI. Although storms prevented us from completely excavating any of the rope, we were able to retrieve two samples, one loose piece from each trench, for submission to Carmela Shimoni of the Israel Fiber Institute for species identification. Knowing the species of plant from which a ship’s rope was made may aid in determining the ship’s route of travel, and possibly even its origin. The species identification testing had not been completed in time for this publication.

On the south side of Trench IV we discovered a particularly interesting concentration of rope (fig. 1). Covering an area approximately 30 cm by 50 cm were a number of short lengths of rope 40 mm in diameter that appeared to be parts of rope coils, possibly stored inside a straw basket. Woven straw basket material adhering to a rock adjacent to the rope may continue down and under the rope. This woven material was held in place by what may be hardened resin spilled from broken amphoras and similar to that discovered in other areas of Trench IV.

On the northern side of Trench IV we discovered short lengths of rope in two different sizes, 12 mm and 30 mm in diameter, intertwined and apparently wrapped around what appeared to be straw matting. One piece appeared to end in a part of a knot. The rope in this area may have been used to secure breakable items, possibly amphoras that were padded with straw matting.

In Trench VI, wedged between our shipwreck’s keel (dated by radiocarbon tests to the fifth of early sixth centuries A.D.) and a stone anchor stock from about a millenium earlier, was a piece of rope approximately 25 mm in diameter, but of undetermined length (see p. 6, fig. 7). Not until we are able to remove the hull remains will we be able to determine this piece’s length and, more interestingly, its context. Is it associated with the Byzantine hull, or the earlier stone anchor stock? In Trench VI we also found a piece of 18 mm diameter rope approximately 50 mm in length resting in open sand on the northeast side of the post, near the ends of the burned planking.

In future excavation seasons we hope to learn much more about the rope in Tantura Lagoon, and perhaps find examples of the knots used to secure these ropes. Few knots from ancient times have been found, even fewer references to specific knots occur in ancient literature. Any knots we are able to find in Tantura Lagoon will contribute to a little known aspect of seafaring in this period.

**Suggested Reading**

Charlton, W.H.


Smith, H.G.


William H. Charlton is a Nautical Archaeology Program graduate student at Texas A&M University and INA’s Divemaster. His M.A. thesis will be titled, “Rope and the Art of Knot-Tying in the Seafaring of the Ancient Eastern Mediterranean.”
Preliminary Pollen Analysis of Sediments Collected from Tantura Lagoon
by Vaughn M. Bryant

Fossil pollen found at the shipwreck site in Tantura Lagoon, Israel, may provide a wealth of information about the sunken ship, its cargo, and perhaps even its original home port. All of this is possible because pollen and spores are dispersed in great quantities and their airborne mixture becomes a plant "fingerprint" of each specific locale. In addition, other pollen often becomes incorporated with the seeds or fruits of a plant when those products are picked and stored for later use. Other reasons that pollen studies prove useful is that certain plants tend to grow best in specific geographical locations, thus their pollen and spores become the dominant types found in the "fingerprints" of those regions. Pollen and spores are also very durable, and can remain preserved for millions of years in some types of sediments.

During the summer of 1994, I examined six pollen samples that had been collected in Tantura Lagoon during the 1980's from the innermost bottom portion of Persian period ceramic vessels. Preliminary indications from that analysis suggest that at least some of the fossilized pollen in those vessels may represent the remnants of decomposed organic materials originally stored in them.

I discovered that most of the pollen and spores in those samples was poorly preserved, and the overall total amount of fossil pollen was very low. Neither of these aspects surprised me because pollen preservation is not always ideal in some types of marine environments. Also, I found that many of the pollen types in these initial samples came from plants that produce very durable pollen types, or from plants that produced pollen grains that are so uniquely distinctive in shape and design that even if they become highly degraded, they are still recognizable. Both of these findings, combined with the low number of different pollen types, suggest that fossil pollen preservation in the lagoon environment is marginal at best. Nevertheless, I am hoping that even the presence of small amounts of pollen may give us some preliminary information about the ship's cargo.

Some of the fossil pollen types we found in those first few samples included: fir (Abies); pine (Pinus); oak (Quercus); a variety of different grasses (Poaceae), including some from cultivated cereals such as wheat (Triticum) and barley (Hordeum); sumac (Rhus); olive (Olea); grape (Vitis); willow (Salix); hornbeam (Corylus); plantain (Plantago); several types of umbells (Apiaceae), weedy plants that also include certain types used for food and spices; composites (Asteraceae), including at least three types of dandelions; and several types of chenopods (Chenopodiaceae), weedy plants that grow well in disturbed areas and trash dumps often found near harbors (figs. 1, 2). In addition to the pollen, some of the same ceramic vessels also contained grape seeds and olive pits, confirming that at least these two food types may have been stored in some of the ceramic vessels as either cargo or food and drink for the crew.

The initial pollen studies of these samples are not complete, yet they show the potential for recovering data from this type of study. Based on this realization, I traveled to Israel in November of 1994 to assist the excavation crew in identifying and collecting additional samples for continued fossil pollen studies from the wreck site.

A number of new fossil pollen samples were collected from the inside portions of ceramic jars, and from pitch or resin that was adhering to various ceramic containers found during the excavation. When I returned to Texas A&M University, we began processing the new samples.
in hope of finding fossil pollen that might provide additional clues about the wreck site and its contents. Our analysis, however, has been hindered by a new set of perplexing problems. All of the samples collected during the 1994 season contain tiny particles of resin or terebinth, that have proven difficult to dissolve or remove from the samples. To date, we have not succeeded in removing enough of this debris to analyze the remaining fossil pollen. We remain hopeful that this is only a temporary setback and that the problem soon will be resolved.

At present we are continuing our study of the pollen recovered in the original set of samples, we are searching for new ways to dissolve or remove the resins from our 1994 samples, and soon we will begin examining other types of botanical samples collected from the wreck site. We are hopeful that these studies will be able to provide another avenue of data for understanding the sunken wreck, its cargo, and perhaps even its port of origin.

Suggested Reading

Bryant, V.M. and R.E. Murray

Haldane, C.

Haldane, C.

Notes on the Architectural Marble
by Patricia Sibella

During the 1994 expedition, a number of marble architectural elements were uncovered together with the Byzantine pottery in Tantura Lagoon. This is hardly surprising.

Following the adoption of Christianity as the state religion of the Roman Empire by Constantine the Great, churches became an important architectural form. As Christianity spread and received official recognition, many churches were erected. When possible, they were adorned with architectural elements. During the Byzantine period, ships sailed to near and far horizons, transporting marble in their hulls for churches. Judging by the number of marble wrecks (Mahdia, Crotone region, Marzamemi, St. Pietro, and Methone, near Izmir) found in the Mediterranean, it is clear that architectural elements were a cargo item during the Byzantine Period. As marble is not found naturally in Israel, all of it had to be imported, primarily if not entirely, by ship.

Identifying the sources from which marble components were quarried can provide valuable information about trade patterns, as well as for economic studies and art history. Determining these sources is not easily done, however. Visual inspection may be deceptive, particularly if the marble is weathered. Furthermore, marble specimens with identical or nearly identical characteristics may originate from different quarries. Several methods of scientific analysis must be employed to determine the origins of marble. These include petrographic, geochemical, and isotopic analysis, as well as electronic resonance testing. Any one of the methods alone is insufficient to allow us to assign marble to a particular source.

Fig. 1: Marble architectural fragments.
As research has only begun on the marble we uncovered in Tantura Lagoon, the following comments should be considered a preliminary overview of the material.

Marble architectural elements were uncovered in three different trenches: a broken column, column base, and two fragments of mosaic pavement were found in Trench III; Trench IV contained another fragment of pavement and a slab (see p. 4, fig. 3); Trench VI contained two slabs and four small fragments. One of these is probably a piece of a panel. The other three are unidentified thus far (fig. 1). The slabs are the most generic type of marble product. Those from Tantura are made of fine, white marble with dark-blue, longitudinal veinings.

The column is in two pieces measuring 93 cm and 1.04 m in length and 22 cm in diameter (fig. 2). It is of a fine marble with well-polished surfaces. The quality of the marble, which is white with faint gray veins, may indicate that it was quarried on the island of Proconnesus, in the Sea of Marmara near Istanbul, but this is far from certain. Similar columns may be seen in the entrance to the Church of the Holy Sepulchre in Jerusalem.

The column base is approximately 45 cm in diameter and is composed of a coarser, gray marble. During the Byzantine Period, marble elements were often transported in an unfinished state and completed on site. However, a similar base from Ephesus (St. John) in Turkey seems to have been used intentionally in its rough, unfinished state, either to emphasize a contrast with its well-polished shaft, or to suggest a particular aspect evoked by the toolmarks.

We also found fragments of mosaic pavement consisting of white, gray, and ivory-colored tesserae set in a grayish mortar made of two distinct layers. The first, or upper layer, is the setting bed and is composed of fine plaster with few visible inclusions. The second layer is coarser. The tesserae are of average size, and are set level with the bedding plaster.

The marble that we uncovered may derive from structures on shore, or on one of the islands enclosing the lagoon as, for example, must be the case with the fragments of mosaic pavement. However, the column and base were found together with the Late Byzantine ceramics near Trench VI, where the main section of a ship’s hull was uncovered. This would argue for the marble having been carried by the ship. Also, two of the marble slabs were found with this hull, and another slab was associated with the hull fragment in Trench IV. Many of the elements do not appear to have been used, further supporting the possibility that they were brought by ship.

A Christian basilica was located northeast of the lagoon. This edifice sat on the main coastal road and served as a way station for pilgrims traveling from Egypt to Syria and Anatolia. It was erected in the fourth century and completely rebuilt at some point in the Byzantine Period; the marble from the lagoon could be related to either the original construction or reconstruction of this structure.

Plans for the next field season include raising of selected marble elements for more detailed study. Samples will be taken and submitted for scientific analysis. It is hoped that information derived from this will enable us to identify the source or sources for the material, and contribute to the overall picture of marble trade during this period.

Suggested Reading


Photo: K. Bowling

Fig. 2: Marble column and base found in Trench III
Bozburun Project
This summer, INA will conduct the first season of a multi-year project to excavate a ninth-century A.D. vessel near Bozburun, Turkey. INA President Fred Hocker will supervise this excavation, with long-time INA staff member Sheila Matthews as Assistant Director under the overall direction of George Bass, who discovered the site in 1973. The first part of the season will be spent conducting a pre-disturbance survey and mapping the site. Afterwards, excavation will begin, using Direct Survey Measurement (DSM) and computer-aided drafting to record the location of each artifact.

INA staff members Don Frey, Robin Piercy, and Tufan Turanh will join the excavation team, as will INA adjunct professor Faith Hentschel and hyperbaric specialists David Perlman and Tommy Love. Turkish archeologist Nergis Gunsenin of Istanbul University will bring several of her students to assist in the excavation. Bilkent University archaeology students Tugba Tanyeri and Cagda~ Oralkan, and Istanbul University student Ozlem Buyuran will also work in the field. Texas A&M University graduate students will be well represented by Bill Charlton, Clive Chapman, Jaynie Cox, Gregory Gidden, David Johnson, Brian Jordan, Christine Powell, Matthew Pridemore, Jeff Royal, Michael Scafuri, David Stewart, and Steven Thornton, from the Nautical Archaeology Program, and Georgia Fox, from the Department of Anthropology.

Bodrum Museum
Cemal Pulak, INA Vice President and Mr. and Mrs. Ray H. Siegfried II Graduate Fellow, will direct a six-month research program devoted to the material from the Bronze Age shipwreck at Uluburun. Archaeologists Michael Fitzgerald, Faith Hentschel, Patricia Sibella, Mark Smith, and Nautical Archaeology Program student Edward Rogers will continue the documentation and study of the wooden hull remains, Canaanite amphoras, copper oxide ingots, and pan-balance weights.

George Bass will continue his work on the glass from the eleventh-century Ser<;e Liman wreck with an international team of archaeologists. Fred van Doorninck will also be in Bodrum studying the amphoras from the Serçe Limani shipwreck.

Nautical Archaeology Program graduate students Glenn Greene and Taras Pevny, and INA benefactor John DeLapa will continue their work on the replica of the seventh-century shipwreck discovered at Yassıada.

Sadana Island Excavation
Under the direction of Cheryl and Douglas Haldane, INA–Egypt will begin the excavation of a seventeenth-century shipwreck in the Red Sea. The wreck, discovered during INA–Egypt’s Red Sea Survey in 1994, contains a diverse cargo that includes Chinese porcelain, glass case bottles (used for liquor), and numerous examples of coarseware ceramics. The excavation team will comprise a joint staff of American and Egyptian archaeologists. Texas A&M Nautical Archaeology Program graduate students Elizabeth Greene (Assistant Director), Alan Flanigan, Layne Hedrick, Peter Hitchcock, and Christopher Stephens will accompany Egyptians Emad Khalil, Ashraf Hanna, Sameh Ramses, Mohammed Sayed, Moham-med Mustafa, and Mohammed Mah-rous el Moselhy, who will be the conservator. Kendra Burnett and Netia Piercy will serve as illustrators for the project. Marston Morgan, of the American University in Cairo, will also join the team.

After the excavation season, which will run from June through the end of August, all raised artifacts will be taken to the Alexandria Maritime Museum for conservation. The new conservation laboratory for water-logged materials has been jointly planned by the Supreme Council for Antiquities and INA–Egypt, with the assistance of architects from Bechtel (fig. 1). A $24,999 grant requested from the Egyptian Antiquities Project (funded by USAID) will support the cost of creating storage, treatment, and documentation facilities on museum grounds.

Whitehall Project
In July of 1995 a five-week field school on Lake Champlain will explore the remains of two War of 1812 vessels sunk near Whitehall, New York. These vessels, a 75-foot U.S. Navy gun-
boat, or “row galley,” and the 16-gun Royal Navy brig *Linnet*, participated in the decisive Battle of Plattsburgh Bay on September 11, 1814. The project will be co-directed by Kevin Crisman and Arthur Cohn, and will be assisted by Texas A&M University students Erika Washburn, Steven Butler, Eric Emery, and Erich Heinold. The project is being jointly sponsored by the Institute of Nautical Archaeology, Texas A&M University, the Lake Champlain Maritime Museum, the University of Vermont, the Vermont Division for Historic Preservation, and the U.S. Navy Department’s Legacy Program.

**Albanian Coastal Survey**

INA Research Associate Peter van Alfen will join a team of Albanian and American archaeologists and marine scientists in a survey of the southern coast of Albania this summer. The American contingent of the project is headed by former INA director Sumner Gerard and Dr. John Gifford of the Rosensteil School of Marine and Atmospheric Sciences at the University of Miami.

**Monte Christi Shipwreck Project**

Archaeologists from the Pan-American Institute of Archaeology (PIMA) will return to Isla Cabrita off the northeastern coast of the Dominican Republic to participate in the fifth field season of the Monte Christi Shipwreck Excavation. Texas A&M Nautical Archaeology Program Ph.D. candidate Jerome Hall will be accompanied by Program graduate Tina Erwin and students Anne Lessmann, Greg Leibrand, and Richard Wills, who will return as excavation director. Texas A&M University Anthropology student Courtney Carter will also join the team.

**Cape Neddick River Project**

This summer, graduate student Stefan Hans Claesson, from the Nautical Archaeology Program at Texas A&M University, will excavate a late eighteenth-century fishing schooner in the tidal flat of Cape Neddick River in Southern Maine (fig. 2). Due to the accumulation of sediment in the river and harbor of Cape Neddick, hundreds of years of maritime history have been preserved. Results of the Cape Neddick River Project will be presented to the public at the Old York Historical Society in York, Maine on July 25, 1995.

(continued from page 23)

part of a vision for greater INA involvement in Israel. At the same time, he is enthusiastic about the growing diversity of INA projects and hopes to see the trend continue.

Harry’s interests are not limited to nautical archaeology. He is a collector of Chihuly glass sculpture, as well as African art, a collection of which he donated to Grinnell College. He and Joan are involved in several museums and art centers and are currently leading the drive to build a major cultural center in southeastern Pennsylvania. They support local hospitals and nursing homes, have created a foundation to assist victims of accidents and disaster, and opened a home to help support displaced older women.

As George Bass notes, “They define kindness for others.”

—Gregory Gidden

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Profile: Harry C. Kahn II

To talk about underwater archaeology with Harry Kahn of the INA Board of Directors is an exhilarating experience. Even through the phone line, across 1500 miles, his palpable enthusiasm can sweep you up. Harry, as he repeatedly requested I call him, describes himself as someone who wants to “try to make things happen.” Over the past 23 years his support and energy have helped INA grow into a world-class research institution.

Harry Kahn’s interest in underwater archaeology goes back decades. Following Explorers Club meetings, Harry, Jacques Cousteau, and long-time friend James Dugan, who wrote for Cousteau, would gather with their wives for late-night talks about underwater exploration (Ruth Dugan has been a member of INA since its inception). In 1960, Harry attended a lecture on archaeology presented to an organization of Philadelphia businessmen by George Bass, a new doctoral student at the University of Pennsylvania. They chatted briefly. Shortly thereafter their paths crossed again at a party given by David Stith, Dr. Bass’s instructor in the diving course he was taking in preparation for his first underwater project, at Cape Gelidonya, Turkey, a site discovered by Peter Throckmorton. For his work in Greece and Italy that followed, Peter needed a research vessel, and Harry Kahn helped finance Peter’s purchase and overhaul of Stormie Seas, a beautiful sailing vessel. Harry’s commitment to nautical archaeology was confirmed.

Twelve years after first meeting George Bass, Harry attended another lecture given by George, this time on underwater archaeology. Harry enthusiastically offered his support to further George’s research and was surprised to hear that George was planning to form a private institute of nautical archaeology. Invited to the fledgling institute’s initial organizational meeting in the spring of 1973, Harry was elected a founding member of its board of directors.

Harry has contributed much more than financial support; he has freely shared his infectious positive attitude with the institute and its archaeologists in the field.

“Always love to see Harry and Joan at our projects,” Dr. Bass told me when I interviewed him for this profile. “You just don’t meet nicer or more supportive people.”

Harry and his wife Joan have traveled around the globe to visit INA projects— to Mombasa in Kenya, and to Serçe Limanı and Uluburun in Turkey. Most recently he traveled to Israel to visit the Tantura Lagoon project, which forms the subject for this issue of the INA Quarterly, and which is of special interest to him.

Harry had been looking forward to diving on the shipwreck. Unfortunately, his visit fell during a period of stormy weather and rough waves that prevented any work in the sea. Nevertheless, his good cheer prevailed. During his stay, he exchanged more luxurious accommodations at the nearby kibbutz guest-house, preferring to remain close to the project team and share their rather Spartan quarters, located in one of Kibbutz Nahsholim’s old children’s houses.

“As we could not dive on the site because of the weather,” Shelley Wachsmann relates, “we could only show him the video footage we had shot of the portion of the hull that had just been discovered before the storm struck. After coming all that way, he never complained. But he was visibly moved by what he saw on the screen.”

Harry had met Shelley Wachsmann, INA’s project director in Israel, at a board meeting in Dallas in 1994. They soon developed a warm personal friendship.

“Harry is now a full-fledged partner in our intellectual adventure at Tantura Lagoon,” Shelley says. Recognizing the tremendous potential for nautical archaeology in Israel, Harry’s interest in the Tantura Lagoon project is
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