INA NEWSLETTER

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1990: The Year in Review

CONTENTS

The INA Newsletter is published quarterly.
Editors: Cheryl Haldane
Margaret Lynch

On the Cover: *Divers at Ulu Burun climb the slope of the north gully. Stone anchors lie in the foreground, and stacks of ingots spill down the slope. (Photo: D. Frey)*

CONTRIBUTIONS FROM MEMBERS ARE WELCOME. Do you have an experience you would like to share with INA members? A trip? A photograph? A museum or site you have been to? A news item or book review? A conference you have attended? A suggestion? We are interested in what you have to say. Send submissions and inquiries to: ***Editor, INA Newsletter, P.O. Drawer HG, College Station, TX 77841-5137.***

Written submissions should be limited to 1,000 words and are subject to approval and editing. ***Please clearly mark everything with your name and address*** *so we can return it to you. We cannot be responsible for items lost by the postal system, so please do not send original illustrations or photographs. Detailed format information available upon request.*

A Letter From the President

Dear Members,

As the articles in this issue relate, INA has had a busy year. Work has continued in Turkey. In Jamaica, the joint Texas A&M University/INA field school at Port Royal held its last excavation season, and the search for Columbus's caravels continued on the island's north coast. In 1991 we will embark on a new field school, directed by Kevin Crisman, in Lake Champlain, Vermont. Kevin will be documenting the Horse Ferry described in the Spring 1990 newsletter (17/1).

I wish to thank below our generous supporters who made our work possible in 1990. May I also urge all of you who have not already done so to respond to our campaign for endowment under the National Endowment for the Humanities Challenge Grant.

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The Search for Columbus's Caravels at St. Ann's Bay, Jamaica

by Jim Parrent, Paul Willoughby, Hawk Tolson, Marianne Franklin, and Derek Ryter

From October 3 to November 28, the Columbus Caravels Archaeological Project (CCAP, pronounced "sea-cap") led by Dr. James Parrent conducted an intensive survey of St. Ann's Bay, Jamaica, in search of two caravels abandoned there by Columbus in 1504. (For more information on the project and on the caravels, see *INA Newsletter* 16/4:16.) The project's headquarters in the Seville Great House, a plantation house built in 1745 and now a museum, look out over a bay dramatically changed in the last five centuries. When Columbus ran his ships aground in St. Ann's Bay, hardwood trees grew along the shore, several large Arawak villages populated the area, the bay was much deeper and pristine, and the sea teemed with fish. In 1503 five fresh water streams and rivers flowed into the bay. Today the trees are gone, replaced by mangroves and brush and an occasional coconut palm that survived the yellow blight of the past few years. Four of the streams have filled with silt and only flow during heavy rainfall. Gone too are the Arawaks, and few fish are to be found in the silt-congested waters. Fortunately, much of the beauty of the place has survived, and the local people are friendly and interested in the history of the area.

Because the bay has changed so much, archaeologists at the Institute of Nautical Archaeology brought in consultants from other fields to help in the search for the caravels. Geoarchaeologists and geologists from Texas A&M University and geophysicists from Florida Atlantic University and Weston Geophysical in Boston were key members of the survey crew.

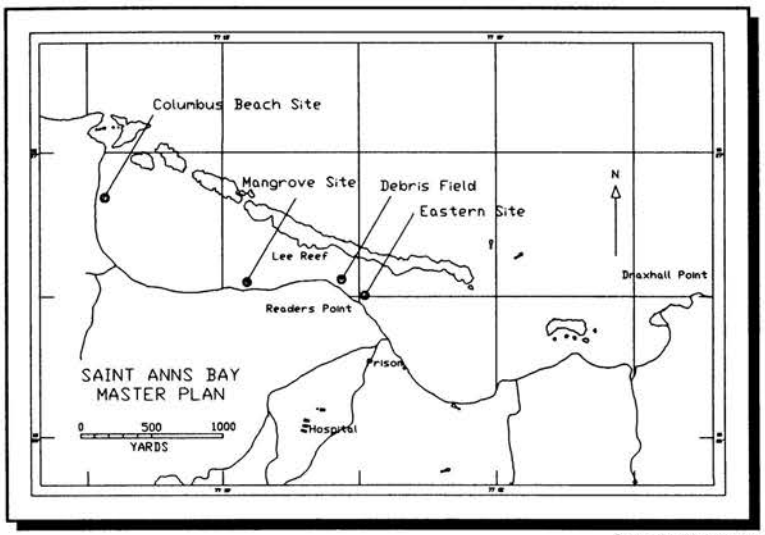
Photo: J. Parrent

Steven Schock shows Don Geddes and Bruce Heafitz a computer image of the seabed at St. Ann's Bay generated by his new sonar system.

Planning for the Columbus Caravels Archaeological Project began almost two years ago. Even with a proposed field season of only seven weeks, the logistical considerations for bringing crew, equipment, and special consultants from the United States to St. Ann's Bay, along with housing and transportation needs once on site, were considerable and complex. In addition to these factors, it was necessary to outline a search strategy prior to our arrival in Jamaica.

In the CCAP headquarters at Texas A&M University, project staff members retranslated, reread, and evaluated a variety of contemporary and modern source materials in an effort to select primary search areas in St. Ann's Bay where Columbus may have beached the *Capitana* and *Santiago*. Maps and charts of St. Ann's Bay ranging from modern to hundreds of years old were scrutinized and compared with aerial photographs. Experienced cruising sailors were given the facts of Columbus's predicament and asked how they would have dealt with it. All this information was combined to select what the crew believed were the most likely areas in which to begin the search for the lost caravels.

Historic documents indicate that the ships Columbus left in St. Ann's Bay were approximately 70 to 80 feet long and 21 feet wide. Under normal conditions the ships could have sailed in water about seven feet deep. Columbus's son Ferdinand states, "we ran them ashore as far as we could, grounding them close together board and board, and shoring them up on both sides so they could not budge; and the ships being in this position the tide rose almost to the decks." Ferdinand's statement suggests that the ships were beached in 8 to 10 feet of water (allowing for the distance between the deck and the water line). As for the ships' position relative to shore, Ferdinand states: "When we were thus fortified in the ships as strong as we could be, a crossbow shot from land, the Indians of that country, who proved to be kind and gentle people, presently came in canoes to barter their wares and provisions for our truck." Various



Plan: P. Willoughby

Figure 1. Master plan of St. Ann's Bay showing four possible locations for the Columbus Caravels.

interpretations of the distance of "a crossbow shot" have been offered. Some start at 300 feet while others go as high as 1,700 feet.

All of this information, coupled with our knowledge of other sixteenth-century shipwreck sites, indicates that the site should show itself as two distinct mound-like structures (the ballast piles) approximately in line with one another and about 20 feet apart.

At St. Ann's Bay detailed reconnaissance of the primary search areas preceded actual on-site investigation. Divers ran measuring tapes out from shore to examine the shape and condition of the seabed. Landmarks, historic and modern, were sought on shore. Lines of sight for survey equipment were chosen, checked, moved, and checked again. The on-site reality was matched against the picture given by charts, photographs, and historic accounts. Slowly and carefully, the crew broke the beach and offshore areas down into manageable segments, each with its own set of range markers. Within each area we can map our search patterns with considerable accuracy.

With our search grid fixed precisely upon the map of St. Ann's Bay, we could begin serious investigation of changes in the coast since Columbus knew it and commence the actual work of searching and sampling.

The greater part of St. Ann's Bay has been subjected to a considerable amount of sediment deposition over the past 500 years. A team of geoarchaeologists from Texas A&M conducted a study of the local geology to determine the approximate location of the shoreline in 1504. Test-pit excavations and cores were used to provided subsurface information which was then interpreted to reconstruct the shoreline history.

Following the compilation and interpretation of surface and subsurface data, the local geology was mapped and described in cross-section. The accumulation of marine sediment through surface runoff and hurricane surge seems to have resulted in considerable shoreline advancement. In the area of Readers Point, the center of the primary search area, the shoreline may have moved seaward as much as 400 feet, and to the immediate west perhaps as much as 200 feet. These ranges will be narrowed through ^{14}C dating of naturally occurring organic material, locating datable cultural material, and palynological studies.

As a consequence of sedimentation in the bay, we have little doubt that the remains of Columbus's last two ships are covered with several feet of sediment and not visible on the seabed. The CCAP survey strategy therefore has been oriented toward the use of remote sensing devices designed to detect materials beneath the surface of the seabed.

Traditionally, the magnetometer has been the instrument of choice in searches for sunken wrecks, but project personnel decided that on this site the metallic component is likely to be small. A search strategy combining both a magnetometer and subbottom profiler was judged more likely to detect the site. Land and submersible magnetometer surveys of both primary and secondary search areas were undertaken. In addition, the project was extremely fortunate in having access to the first production model of the most advanced subbottom profiling system yet produced.

This new "chirp" sonar system, developed by Steven Schock, assistant professor of ocean engineering at Florida Atlantic University, and Lester LeBlanc, professor of ocean engineering at the University of Rhode Island, proved to be our most useful survey tool. The device was loaned gratis to CCAP by Florida Atlantic University for three days and was accompanied by Dr. Schock.

This towable device emits variable frequency sonar pulses in a narrow cone toward the seabed. The strength and frequencies of the echoed signals, in addition to the "bounce-time" for each frequency band, are processed immediately by a computer. The final output is a graphic, sectional representation of the seabed and any materials beneath it, such as geological changes in the underly-

ing sediments or buried objects like ballast stones or ship's timbers. The processed information is stored on computer disks and printed out on paper as a permanent record.

Use of the subbottom profiler has allowed us to pinpoint three possible targets that may represent the remains of Columbus's ships. One, which we presently refer to as the Mangrove Site (see figure 1), is of particular interest.

On October 20th, not long after dawn, our Boston Whaler, crammed to the gunnels with sophisticated electronic equipment, crept across a belt of mangroves. On board, the crew, having slept less than eight hours in the past 48--in order to take advantage of every moment of daylight to use the chirp system before its return--and functioning largely on adrenalin, was on day three of the subbottom profiler loan period. Dr. Schock was keeping the unit switched on almost continuously, even when not running on the measured tracks, so as to gather as much data as possible. The cooperative effort was a chance for him to apply some unique field testing to the chirp, as well as an opportunity for CCAP to use a device unique in the world.

A set of runs had just been completed across an area known as Columbus Beach (see figure 1) where ballast mounds were sighted in 1982 during an earlier survey of the bay. The small boat moved toward a winding channel that crosses a stretch of mangroves between there and Readers Point. Schock turned on the chirp for the five to ten minutes remaining before the crew got into water too shallow for towing the sensor head. As the boat reached the first mangrove island, those watching the monitor were surprised by what they saw on the screen. The subbottom profiler computer display revealed a double "blip" indicating the presence of two adjacent mounds about four feet beneath the seabed!

A subsequent marine magnetometer survey yielded anomalies in the area of the chirp detections, and test excavations revealed the presence of a scattering of football-sized rocks that may represent ballast. Preliminary excavations in the area did not, however, yield any late fifteenth- or early sixteenth-century cultural materials. More excavation in the area will be required to determine with certainty whether or not the area represents shipwreck remains or a ballast dumping ground. The rocks are unlike any of those typically found in the area of St. Ann's Bay, so it seems unlikely that their occurrence stems from natural geological processes.

Probing with a steel rod in the area immediately surrounding the Mangrove Site revealed two other areas of rock-piles. Limited excavations in one of these areas has yielded ceramics and pipe-stem fragments that reflect a late seventeenth- or early eighteenth-century date. Core samples taken from the second area of these rock-piles yielded large quantities of charcoal, a burnt fish bone and ceramic fragments.

Two chirp detections were made in waters immediately seaward of one of our survey baselines (see the Debris Field and the Eastern Site in figure 1). The presence of ferrous materials in the area of the Debris Field has been confirmed by the marine magnetometer. A magnetometer survey of the eastern detection is planned. Both sites have yet to be examined physically. Thanks to the availability, affordability and versatility of modern CAD (computer-aided design) programs all CCAP survey areas are being mapped with a computer rather than by hand. This approach to mapping allows for the production of extremely accurate maps that can be reproduced at any reasonable scale with relative ease. CAD systems also allow for the production of three-dimensional images, something impossible to achieve with conventional hand-drafting techniques. The final product of our mapping efforts will be a single three-dimensional image containing all pertinent topographic, bathymetric, geologic, and geophysical data. By rotating this computerized image through the three spatial dimensions it will be possible to generate an infinite number of views of the various search areas.

The group of people who participated in the Columbus Caravels Archaeological Project in 1990 came from a variety of backgrounds but shared a strong sense of dedication to the project. Archaeologists from the Jamaica National Heritage Trust joined INA archaeologists and geoarchaeologists and geologists from Texas A&M University (TAMU); geophysicists Steven Schock from Florida Atlantic University and Vincent Murphy from Weston Geophysical loaned equipment and provided technical assistance on the survey A video production crew from KAMU (the PBS station at TAMU), reporters from the Houston Chronicle, *the London* Observer, *and a writer from* American Way Magazine *contributed labor as well as publicity. Peter Chermayeff of Cambridge Seven Associates and INA board members Bruce Heafitz and Donald Geddes worked with the survey crew, and Robert Lorton provided equipment. Local citizens worked long hours as cooks, housekeepers, watchmen and day laborers; men and women of Kaiser Bauxite, Air Jamaica, Jamaica Customs, the Jamaica Tourist Board and the Jamaica Defense Force Coast Guard provided support for the project. The Jamaica Land Valuation agency loaned a Land Rover and driver.*

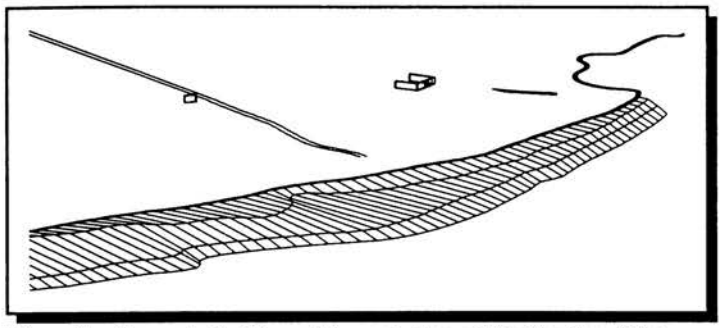


Figure 2. Computerized isometric projection of the Readers Point area showing the road, the coastline, the one, seven, and fifteen foot depth contours, and the remains of historic structures.

Before our arrival in Jamaica the generosity of colleagues in the Texas A&M University Civil Engineering Department enabled us to produce computerized maps. By using an electronic "tracing table," called a digitizer, we reproduced or "traced" the most recent map of St. Ann's Bay (the "master plan") into the computer. Figure 1 shows a view of the master plan.

One great advantage of using a CAD system for mapping is that you can freeze or display whatever information you desire. For example, figures 2 and 3 show two isometric projections of the Readers Point area. Figure 2 shows the road, the coastline, remnants of two historic structures, and the one, seven and 15 foot depth contours. The survey baselines, range poles, geoarchaeologists' coreholes ("T" designations) and test-pits ("P" designations) and the subbottom profiler Debris Field target (irregular shape at the bottom of the display) have been "unfrozen" or "thawed" in figure 3.

At the time of this writing, we are plotting and analyzing a large amount of data from our various anomalies. Each day we gather more. Investigation of our most promising targets is proceeding, with the same question uppermost in the minds of all: Have we found them?

Computer graphics: P. Willoughby

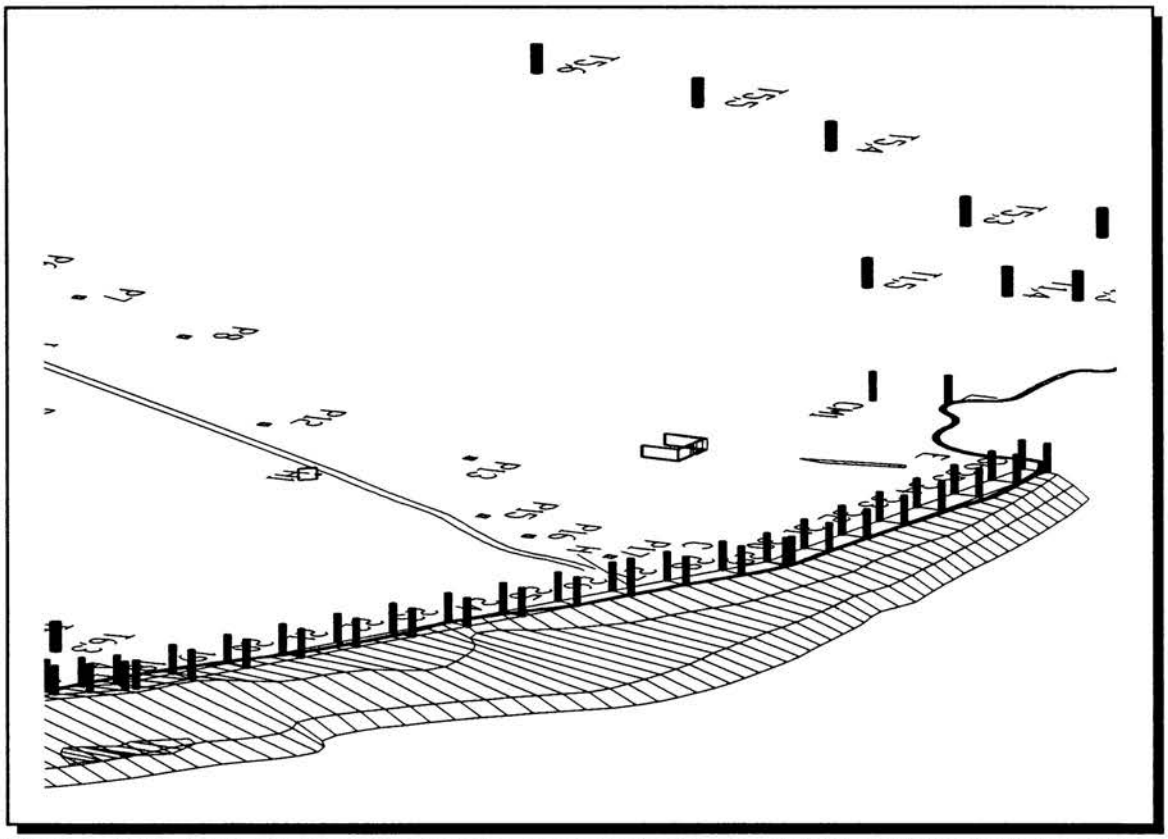


Figure 3. Same as figure 2 with survey range poles, geoarchaeologists' test cores and pits ("T" and "P" designations), and subbottom Debris Field target (irregular shape at bottom left) "unfrozen".

Ulu Burun: 1990 Excavation Campaign

by Cemal Pulak

The excavation of the Late Bronze Age shipwreck at Ulu Burun continues to reveal new information. The wreck is that of a 14th-century B.C. trading vessel, perhaps a royal one, that carried materials from at least seven cultures. Its cargo includes more than six tons of copper ingots, tin ingots, ceramic jars that once contained a ton of terebinth resin, logs of exotic and common woods, cobalt-blue glass ingots, olives, figs, pomegranates, various spices, elephant and hippopotamus ivory, beads of Baltic amber (also of faience, glass, agate, gold, bone), ostrich eggshells, tortoise shells, sea shell rings and scrap gold and silver. The wreck has also yielded bronze and stone weapons (swords, daggers, arrow- and spearheads, mace heads), and tools (axes, adzes, knives, razors, chisels, drills), Canaanite jewelry, Egyptian scarabs, a Mycenaean seal, Kassite, Assyrian and Cypriot cylinder seals, faience drinking cups, ivory cosmetic containers, pan-balance weights, fishing implements, and pottery from Greece, Cyprus and the Near East. Parts of the oldest seagoing hull yet discovered were uncovered, as were 24 stone anchors. Information from the site will contribute to a host of fields including the history of trade, seafaring, metallurgy, glass, metrology, shipbuilding technology, chronology, international relations, literacy, and even Homeric studies.

(Photo: S. Mark, V. Stewart)

Figure 1 *Divers extended the lower boundary of the excavation site to trenches lying 175 to 185 feet deep. Among artifacts found in the lower area was this bronze knife, its wooden hilt intact (KW 2896, length 37.1 cm).*

Between June 2 and September 2, the Institute of Nautical Archaeology completed its seventh excavation campaign on the Late Bronze Age shipwreck off Ulu Burun near Kaş in southern Turkey. During the season, excavators made 2,294 dives to between 140 and 185 feet, totalling 764 diver-hours on the wreck. This brings the grand total of dives made on the site to 12,542 and time spent on the bottom to some 4,016 hours--which is equal to a diver diving around the clock for nearly half a year without coming up for air.

As in previous campaigns, we focused our efforts primarily on excavating the site's shallower areas. Excavation in deeper parts of the site was also carried out and the recovery of copper oxhide ingots resumed.

Photo: D. Frey

Figure 2 More of the ship's hull was exposed during the 1990 season. Here, Cemal Pulak highlights mortise-and-tenon joints with white plastic discs. The keel (unmarked) is in the center with garboards to either side.

The site's upper slope area (see site plan in *INA Newsletter* 16/4:4), except where wooden hull members are preserved, had been excavated fully in 1989. Before abandoning this section completely, we decided to excavate the entire area down to bedrock to be as thorough as possible. Our efforts were rewarded when some deep sand pockets yielded artifacts including several glass beads, fragments of Cypriot pottery, and a unique bronze cup or jug handle. Just downslope of this area, the massive encrustation that has plagued us for several seasons continued to resist our attempts to chisel it free. It is now apparent that the encrustation comprises many more artifacts than we had thought. In addition to pottery sherds, a ceramic saucer-shaped lamp, ballast stones, an amorphous tin ingot, and two copper bun ingots, the area of the encrustation produced many lead fish-net weights, pan-balance weights, and other bronze artifacts including a spearhead and a well preserved bronze chisel.

The area below or downslope of the large encrustation forms a natural catchment for objects that had rolled or fallen down the steep slope. Along with those found during previous campaigns, several bronze caldron straps found here may indicate an array of bronze vessels just aft of the upper row of ingots at the time of sinking. Also found here were many faience beads, three complete and two fragmentary pilgrim flasks, a blank hematite scarab, an agate lentoid bead or seal blank, an ivory finial (endpiece of unknown function), two pan-balance weights of sphendonoid shape (one of hematite and the other of bronze), a stone spindle whorl, oil lamp fragments, Cypriot pottery (mostly Base-ring II bowls), ostrich eggshell fragments (not far from a previously raised complete ostrich egg), and four logs (one of ebony). Although the logs were all lying perpendicular to the keel, their shape and the lack of evidence for fasteners indicate, as with several similar logs found in 1989, that these pieces are neither hull nor furniture elements. The purpose of the non-ebony pieces is still not clear though it appears likely that they were on board as "spare parts" or raw material

for repairs.

The keel, garboards, and other hull planking, uncovered first in 1984, were further exposed (fig. 2). Upslope, the keel is in poor condition and tapers to an end near the southeast corner of the stone weight anchor resting directly over it. It appears to be in much better condition as it passes under the copper oxhide ingots and complete section measurements may be possible at this point. The garboards show a similar preservation pattern. Little planking survives on the starboard side, while the port planking is more extensive and appears to be in good condition as it disappears beneath the stacked copper ingots. Some pieces also pass under the downslope edge of the stone anchor without, however, reappearing on the upslope side. The true extent of the preserved hull will be known only after the anchors are removed and the stacked copper ingots fully excavated.

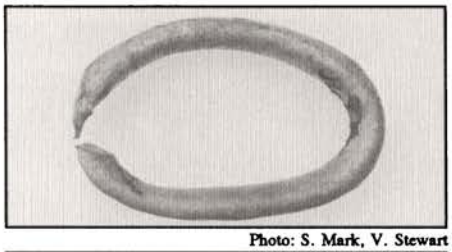


Photo: S. Mark, V. Stewart

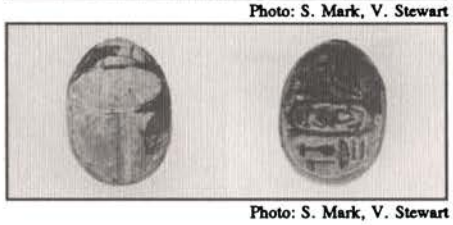


Photo: S. Mark, V. Stewart

Figure 3 (Top) Gold ring (KW 2830, length 4.8 cm) probably cast to approximate weight and cut to specific weight, then folded into a ring to facilitate storage.

Figure 4 Faience scarab with cartouche of Tuthmosis I (KW 2812, length 1.55 cm).

Although the southern side of the rock outcrop had been investigated mostly during the previous campaign, we had to clear the sand in this area to bedrock to ensure the recovery of every object. Additionally, the excavation of a small, previously untouched area was also completed. Surprisingly, this area proved to be fairly rich in small finds. Two bronze pan-balance weights (one in the form of a recumbent bull), beads of agate (also of other stone, glass and amber), a gold bar bent into a ring (fig. 3), bits of scrap metal, a well-preserved faience scarab with the cartouche of Tuthmosis I (fig. 4), and Cypriot pottery fragments (including a nearly complete White Shaved juglet) were among the objects found. It is likely that most, if not all, of the Cypriot pottery in this area spilled from one of the large storage jars, or pithoi, lying downslope, in deeper water.

Work farther downslope (southeast) continued in the vicinity of the deepest intact pithos. Because the pithos has yet to be chiseled free from the ledge on which it rests, and its sediment decanted for examination of possible original contents, only the scattered Cypriot pottery lying around and partly under it was excavated. Near its base we uncovered a most unusual stone object of unknown function (fig. 6). Opinions in the field ranged from its use as a ceremonial mace-head to a steelyard counterpoise; future library research probably will reveal its intended purpose.

A nearly complete pithos nearby, moved off the site in 1989 for later recovery, was also raised. Since the sediment from the pithos revealed no organic material it is likely that the pithos contained Cypriot pottery, as had at least two other pithoi on the wreck.

During the 1990 campaign, considerable effort was spent in the "ingot gully" to the north of the large rock outcrop. Here, we had stopped raising ingots in 1987

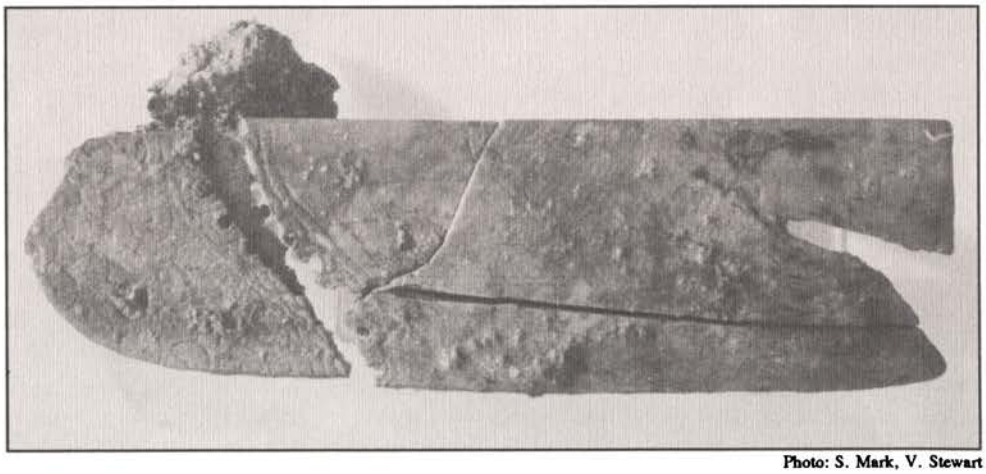


Photo: S. Mark, V. Stewart

Figure 5 Ivory wing (KW 2118, length 14.4 cm) for a duck-shaped cosmetics container. At least two such containers were aboard the Ulu Burun ship.

when we realized that some of the copper ingots were severely damaged from corrosion. Attempts to raise such ingots only resulted in the loss of much of the ingots' original surfaces. Over the next two years we experimented with several methods of consolidating ingots under water and eventually developed a technique by which damaged ingots could be freed and raised intact (see *INA Newsletter* 16/4:8, 17/3:10-13). In 1989 the method allowed for the successful recovery of more than a dozen damaged ingots, and in 1990, 50 more were raised without much difficulty. Resumed full-scale work on the ingot stacks now shows that our earlier estimate of 200 ingots should be raised to about 250.

Photo: S. Mark, V. Stewart

Figure 6 *Stone object of unknown purpose (KW 2742, length 19.4 cm).*

As before, excavation in and around the oxhide ingots revealed more Canaanite amphoras, bronze tools, an agate lentoid bead or seal blank, glass and faience beads, cobalt-blue glass ingots, tin ingots, three hippopotamus teeth (two incisors and a canine), and a carved ivory wing (fig. 5).

The ivory wing is of a different style than the wing found during the previous campaign (*INA Newsletter* 16/4:9, fig. 8), indicating a second cosmetics container. Cosmetics containers shaped like ducks, with pivoted wings for lids, are well known from the Syro-Palestinian coast and Egypt. Additionally, an ivory plaque with a pair of duck's feet carved on its upper surface (recovered farther downslope at about 180 feet) probably was the base for one of the containers. The plaque-base was most likely affixed to the duck-shaped body with long pegs for legs inserted into holes drilled at the heel of each foot. Preliminary research has failed to reveal other free-standing duck-shaped cosmetics containers in the eastern Mediterranean; thus far the Ulu Burun example appears to be unique.

Many tin ingots were uncovered in the northern gully. Those that were directly beneath and in contact with copper ingots had transformed into a homogeneous paste-like substance, presumably from galvanic corrosion. Others, however, had fared better and their original shapes could be discerned without difficulty. In addition to over a dozen tin quarter-oxhide ingots (ingots that were cast in the oxhide form but cut into quadrants in antiquity), we recovered two complete tin oxhide ingots and two rectangular slab ingots of tin (fig. 7). Although the last type is new for the site, we had anticipated its existence from cut sections found in earlier campaigns. The slab ingots bear several holes at their centers, presumably to facilitate their

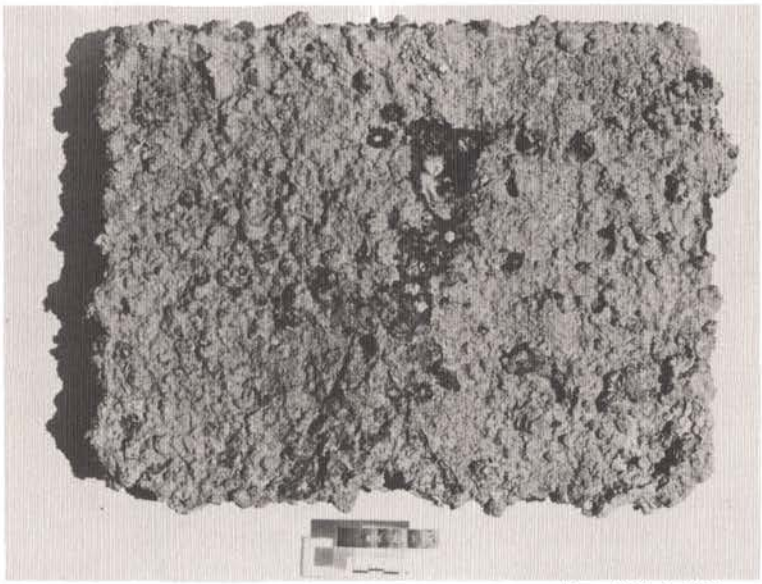


Photo: S. Mark, V. Stewart

Figure 7 *Rectangular tin ingot (KW 2911; length 41 cm, width 31.5 cm).*

lashing to backs of pack animals.

Removal of copper ingots led to the discovery of yet another stone weight anchor. With this new find the total anchor count has reached 24 (fig. 9). Although petrological studies of the anchors have yet to be made,

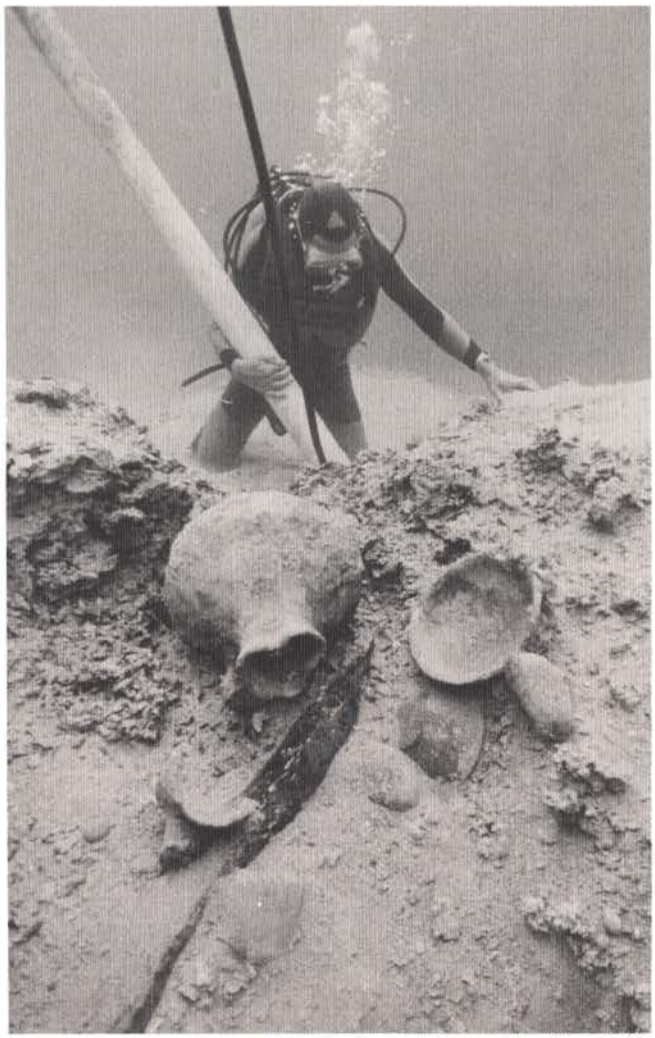


Photo: D. Frey

Figure 8 *A trefoil-mouthed pitcher, two bowls, and an ebony log were trapped by a natural rock ledge from rolling farther down the slope. The amphora neck fragment on the ebony log is of more recent, Hellenistic, date.*

cursory underwater examination of all anchors revealed three basic stone types. The two smallest anchors--possibly hawser weights or boat's anchors--appear to be made of a white, marble-like limestone, while the remaining are shaped from sandstone or limestone. The anchors will be sampled for laboratory analysis when all are raised. We hope that the results will tell us something about the source of the stone from which the anchors were made and, subsequently, the possible homeport of the Ulu Burun ship.

Archaeologists working at a depth of about 175 to 185 feet expanded the lower boundary of wreck spillage even further by excavating trenches downslope of the deepest artifacts exposed last year and on the two deepest ledges. Beyond these ledges the seabed descends with a 25 to 30 degree gradient, uninterrupted, as far as the eye can see. In the trenches, fragments of amphoras and other ceramic vessels, pieces of copper ingots, ballast stones, a bronze knife with its wooden hilt plate preserved (fig. 1), and a bronze lugged adze were found. Additionally, the shallower of the two ledges had trapped two ceramic bowls, a large trefoil mouth pitcher and an ebony log as well as several Hellenistic and Roman period artifacts, including an intact 1st-century B.C. amphora (fig. 8). One of the deepest objects uncovered is the base of a pithos. It is possible that this base is from a hitherto unknown pithos, but it is difficult to know the exact number of pithoi carried on the Ulu Burun ship before all such pieces are examined and assembled.

We anticipate completing the excavation of the Ulu Burun shipwreck in two more summer campaigns of three months each, although these campaigns might have to be extended to meet specific excavation requirements. We hope to complete the mapping and removal of more than 100 copper ingots, anchors, large storage jars, and other heavy items next summer. We do not plan to uncover, record and raise much of the ship's hull until the final campaign in 1992 to prevent damage to the fragile wood remains by excavators working on the wreck. Previous experience has shown, however, that unexpected finds might well demand an additional season, especially if new spillage material is found in deeper areas. Moreover, many of the small and more interesting objects are often found beneath the heavier and bulkier artifacts, all of which suggests that many pleasant surprises await removal of the tons of copper ingots and stone anchors.

Acknowledgements

The project was funded for the year by the INA Board of Directors and grants from the National Endowment for the Humanities, National Geographic Society, Texas A&M University, the Institute for Aegean Prehistory, and the Frederick R. Mayer Faculty Fellowship. Since

the inception of the project in 1984, Cressi-sub of Italy has continuously supported our work with significant concessions for the purchase of diving equipment. Shell of Turkey, Ltd. has, as on previous occasions, made generous donations of fuel, and Corning Incorporated has granted a much needed distilled-water still for use in our conservation facilities.

Under the overall directorship of George Bass, the 1990 team comprised Cemal Pulak, excavation director; INA staff Don Frey, Robin Piercy, Tufan Turanlı, and Murat Tilev; and physician David Perlman. The excavation would not have been possible without the participation and diligence of volunteer archaeologists Michael Fitzgerald, Faith Hentschel, Douglas Haldane, Michael Halpern, Christopher Monroe, Gökhan Özağaçli; Texas A&M University graduate students Jerome Hall, William Charlton, Jr., David Grant, Jerry Lyon, Samuel Mark, Claire Peachey, Edward Rogers, Mark Smith, and Valerie Stewart. Harun Özdaş, veteran volunteer of several years and now with the Bodrum Museum of Underwater Archaeology, represented the Turkish Department for the Protection of Cultural and Natural Resources. Back in Bodrum, Ulu Burun finds were conserved by Jane Pannell, assistants Erika Topolewska and Güneş Özbay, and drawn by Netia Piercy.

Photo: D. Frey

Figure 9 Stone weight anchors in the northern gully as seen from the deeper end of the wreck (east to west).

PORT ROYAL 1990: THE LAST EXCAVATION SEASON

by D.L. Hamilton

The final season of the joint Institute of Nautical Archaeology/ Texas A&M University excavation of the late seventeenth-century city of Port Royal, Jamaica, followed nine months of research, conservation, and analysis of the 1989 excavation material (see *INA Newsletter* 17/2). We returned to Jamaica in June, 1990, with another group of eager students enrolled in the annual Texas A&M University underwater archaeology field school.

In our final season, we planned to complete the excavation of Building 5 and of the ship sprawling across Building 4 while continuing to microfilm relevant records in the Island Records Office in Spanish Town, Jamaica. I am glad to report that the students and staff worked exceptionally hard and accomplished all our objectives, and then some.

We found Building 5 much as it was left in August, 1989, except for a mossy layer of marine growth covering exposed brick floors and walls. Within hours we were removing debris overlying the area designated as Yard 5. We started at the north end of this area and worked southward and then eastward across the backs of Buildings 5 and 4 where we found the brick-paved back yards of two other buildings which fronted Fisher's Row. Both of the new yards yielded cooking pots, bowls and pewter plates in addition to a massive layer of unidentified encrusted metal objects on the floor in front of the hearth of Yard 7. A wooden fence, now destroyed, separated Yard 5 from Yard 6, and a brick-lined cistern in the southeast corner of the yard may have been shared with Yard 7.

Now that the excavation of Building 4/5 is finished, it is clear that two distinct buildings share a common wall. Building 5 was the first building constructed in the area. In its final stage it consisted of four ground floor rooms and a walled, brick-paved yard (Yard 5). The original small, two-story building had two ground rooms with separate front doors opening onto a brick sidewalk on the street.

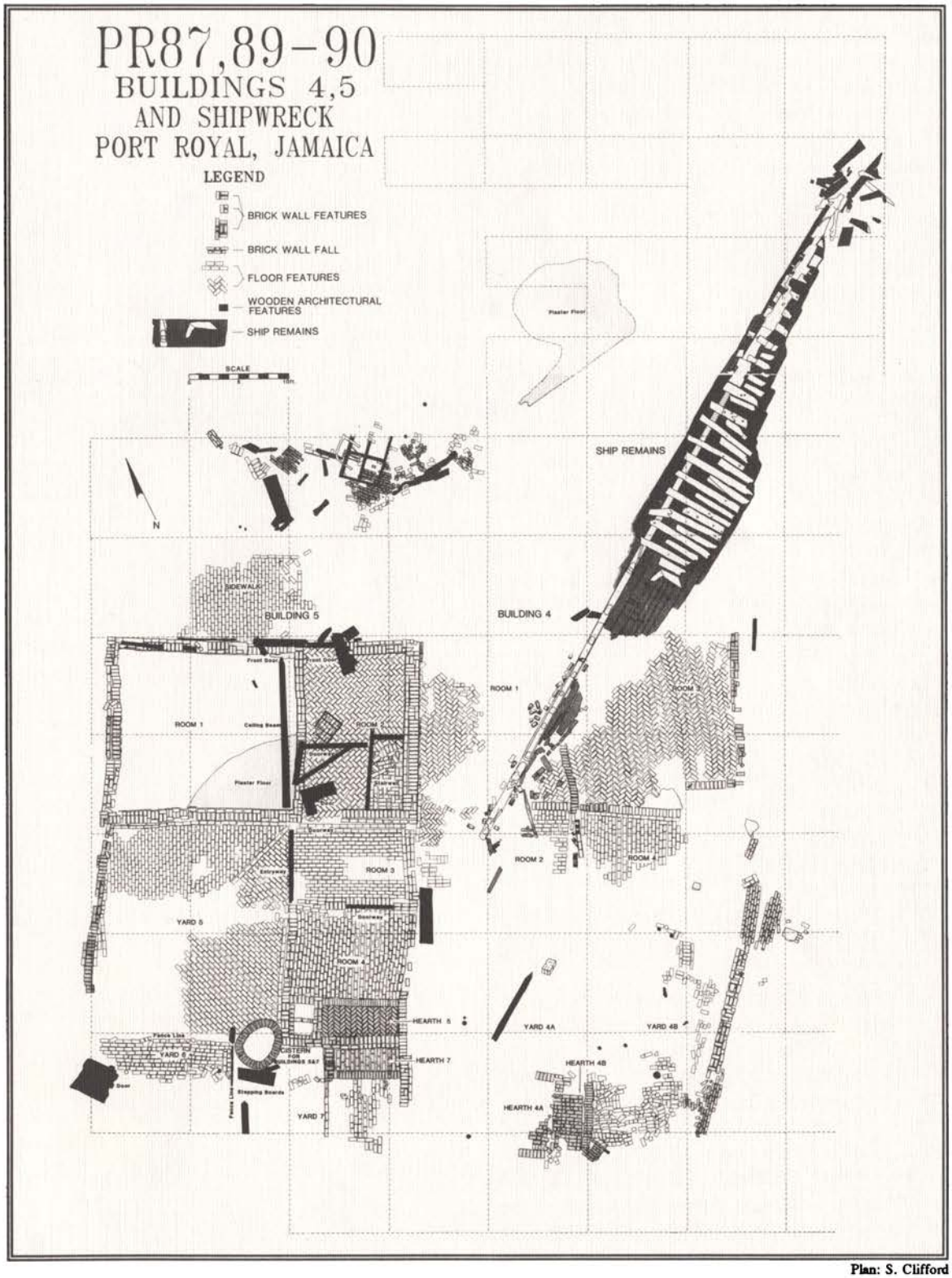
Room 1, the larger ground room, had a plastered floor and was connected to Room 2 by an interior door. Room 2 had a herringbone brick floor and the bottom wood frames of a stairwell leading to the second floor. The kitchen hearth at the back of the lot was probably constructed at the same time. Later, the hearth area (Room 4) was attached to the main building through an intervening room with a large entryway to the walled yard (Room 3). Both rooms were brick-paved.

Many of the artifacts--brass sieves, cast iron pots, iron skillets, ceramic bowls, pewter plates--found in Rooms 3/4 and Yard 5 are associated with food processing. Yard 5 also produced an unexpected and unique archaeological object when excavators recovered a handsome, three-legged *metate* (grinding stone) with a buzzard head, found concreted onto a cast iron cooking pot beside the north wall of the yard. Its *mano* (pestle) was the broken leg of another *metate* of the same design, both made by Arawaks.

The Arawaks were the original aboriginal occupants of Jamaica, but how this Arawak *metate* came to be found here is a puzzle because the Spanish exterminated the Arawaks long before the English captured Jamaica in 1655. Associated artifacts indicate that the *metate* was being used to process food at the time of the earthquake in 1692.

Questions about the occupants, purpose, and precise location of Building 5 continue to occupy researchers. We know the initials of the couple that lived there, and preliminary analysis of artifact distribution suggests that Room 1 was used to serve food to patrons while Room 2 functioned as the serving room (a room from which food is served). Room 3 was a food preparation room, and Room 4 was a cook room with an open hearth and ovens. Food was processed and cistern water was drawn in the yard. Although we have no data concerning the second floor, we assume that it held living quarters.

All the buildings excavated over the past 10 years have been located on the southwest side of Lime Street. Building 4/5, however, jutted over 40 feet into Lime Street and thus did not agree with any of the maps from



Plan: S. Clifford

that time period. Fortunately, we found evidence in two land plats that helped us to solve the problem. Building 4/5 was located on a narrow extension of Lime Street that does not show on most extant maps of the period.

Since Building 4 shares a common wall bonded with the other walls of Building 5, it is the younger. Building 4 is a much less substantial, one-story building with interior walls only one-half brick wide. Its interpretation is complicated by the remains of a ship that plowed through its front wall. Adding to the confusion caused by the ship, the earthquake badly disrupted the back area of the building.

I feel that Building 4 consisted of two independent sets of rooms. Rooms 1 and 2 represent one unit, and Rooms 3 and 4 represent the other. Each unit had its own hearth and yard at the rear of the rooms. The hearths were constructed as a unit, back to back. All the rooms are brick paved, but it is clear that the floor of Room 3 was originally plastered. On top of the plaster floor is a layer of ceiling plaster over which a herringbone brick floor was laid. This dislodged ceiling plaster and fractured plastered floor may be indicators of the 1687 earthquake which hit Port Royal.

We are in the preliminary stages of analyzing the ownership marks on the pewter in the rooms of Building 4 but have few leads on the identity of the occupants. Nor do we know what the functions of the two units were although this may change as encrusted metal objects are processed and identifying documents are found.

While the excavations were being conducted on Building 4/5, Sheila Clifford, with the assistance of Marianne Franklin and Jessica Harvey, excavated the ship with the exception of a small area of the collapsed stern. The ship, with a keel length of about 75 feet, heeled over onto its port side as it came to rest after crashing, bow first, through the front walls and floors of Building 4. There is no ballast associated with the ship, and the evidence continues to suggest that the ship wrecked during the 1692 earthquake.

Photo: A. Flanigan

This metate *(approximately 11 inches high and 10 inches wide), found during the 1990 excavation season, poses a mystery for archaeologists. Made by Arawaks, the original inhabitants of Jamaica who had disappeared long before the English occupation of the island, the* metate *was in use at the time of the 1692 earthquake.*

A decade is a long time to spend on a single excavation, and the time has come to end the INA project at Port Royal. Facing us now is a five-year backlog of artifacts awaiting conservation and hundreds of documents that need to be read.

Photo: D. Hamilton

Richard McClure, Artifacts Officer, Jamaica National Heritage Trust

I will miss the many friends I have made in Jamaica. I want to single out for special comment Mr. Richard McClure, the Artifacts Officer of the Jamaica National Heritage Trust. Richard worked with the project on a daily basis each season and continued to do things for the project through the rest of the year. All the students who have worked with him over the years have looked to Richard for guidance as much as they did me. He was the one they went to when I was underwater, and he was the one I went to when I could not identify some ceramic sherd or if I had any questions. He knows more about the artifacts from all of the Port Royal excavations conducted by Link, Marx, Mayes, Priddy, Museum of London, and INA than anyone. He has assisted immeasurably all of the students who have written theses on Port Royal. Richard's knowledge of the history, archaeology, and artifacts of Port Royal is shared willingly with all who ask. His interest and enthusiasm is genuine, and it is infectious.

Richard was so interested in what we were excavating that he could not be satisfied with our descriptions. This summer, he had to see for himself the cistern, now underwater, but from which water was drawn so many years ago, and the "ship that came to dinner" at approximately 11:30 A.M. June 7, 1692. The things I will miss most as the summer of 1991 rolls around are seeing and working with Richard. His friendship is one of the highlights of my decade of research at Port Royal. His contributions and devotion to the research on Port Royal are incalculable. I, like all who have excavated at Port Royal, am personally very much in his debt, and I am the better person for it. I want to take this opportunity to thank him for all that he has done for me and for everything that he has contributed to whatever success we have had in our excavations and research at Port Royal.

D.L. Hamilton

The Port Royal Project would like to thank the Kaiser Aluminum Company and the Jamaica National Heritage Trust for their continued assistance in 1990.

Yalıkavak 1990

by George F. Bass

In 1963, Turkish sponge-dragger Mehmet İmbat netted the bronze statue of a tunic-clad African youth, at a depth approaching 300 feet, just off Yalıkavak on the northwestern tip of the Halicarnassus Peninsula.

İmbat's discovery led to remarkable technical advances not only for nautical archaeology, but for the ocean sciences in general. Before 1963 was out, for example, I had ordered, for the University Museum of the University of Pennsylvania, the construction of a two-person submarine specifically designed to locate and explore the wreck that had yielded the statue, but which lay too deep for normal diving. The result, the *Asherah*, was the first private research submarine ever purchased in the United States, before the better known *Alvin*, *Aluminaut*, and others. We tested her in Turkey during the summer of 1964 and, with a U.S. Navy grant and the expertise of current INA Research Associate Donald Rosencrantz, invented a system of mapping the seabed in three dimensions from a submarine by stereophotogrammetry. The system was soon common on research submarines used for other marine sciences.

Mehmet İmbat holds the bronze statue he pulled from the sea in 1963. The African youth, now cleaned and conserved (far right), resides in the Bodrum Museum.

Courtesy Mehmet İmbat

To tend the *Asherah* we brought to Turkey on loan from the U.S. Navy a T-boat named *Virazon*. The *Virazon* now belongs to INA and is used for both excavations and surveys. We were not yet ready in 1964, however, to use the *Asherah* at Yalıkavak.

By 1965 a second bronze netted off Yalıkavak, a figurine of the goddess Fortuna, had joined the African youth in the Bodrum Museum. Each had been snagged by a *kangava*, a Turkish invention consisting of a metal axle with metal wheels that is towed by cable over the seabed by a boat above. The axle drags a chain behind it to break off sponges that are collected in a following net also attached to the axle.

With bearings provided by the two sponge-boat captains, we spent the summer of 1965 searching in vain for the wreck that had yielded the bronzes. We used a towed, one-person submersible called a Towvane, provided by current INA Director Nixon Griffis, and an underwater television system. The spongers' directions were simply not precise enough to allow us to spot the wreck visually.

By 1967 we were ready to try again. This time, again with a U.S. Navy grant, we would search while evaluating two newly designed side-scanning sonar systems. Able to search paths 1,500 feet wide, instead of the short distances we could see by eye from a submersible or by television, a sonar belonging to the Scripps Institute of Oceanography spotted what appeared to be a wreck in the area that had yielded the two statues. Heavy seas and technical difficulties prevented us from viewing the sonar target from the *Asherah* immediately,

but in the meantime the second sonar unit we were to test, from EG&G International, picked up the same target.

By the time the sea had calmed, there were only two days remaining for the survey. I had already returned to teaching at the University of Pennsylvania, leaving Claude Duthuit in charge of the search, and the rest of our volunteer staff now had to return to their regular jobs. With Turkish archaeological commissioner Yüksel Eğdemir at the controls, and Donald Rosencrantz as engineer, the *Asherah* dived twice on the wreck. Visibility was limited to only a foot and a half, but they could make out and photograph the amphoras of a large ancient shipwreck.

We planned next to mount a mechanical arm on the submarine, to allow us to air-lift sand from around the wreck, but those were the last dives *Asherah* ever made for archaeology. It was not technical difficulty which overcame us, but the cost of the liability insurance the University of Pennsylvania demanded we buy. We sold the *Asherah* just as we were realizing her full potential.

Photo: D. Frey

In the summer of 1968, using precise bearings taken from shore, we examined the wreck once more. Larry Joline headed a small team that lowered a television camera onto the wreck and took dozens of photographs of the television monitor as the camera was towed back and forth over the site. Not surprisingly the cargo was mainly amphoras; the ship that once carried the famous Antikythera Youth, a bronze statue now in the National Museum of Greece, had also carried amphoras. I thought that if two statues had stood high enough on the Yalıkavak wreck to have been caught by *kangava* chains, perhaps one or two more might be visible. A single photograph taken of the television monitor showed a pitcher and cylindrical objects that seemed non-ceramic, but that was all.

Frustrated by not being able to learn more about the wreck, Claude Duthuit and I sought help from Henri Delauze, president of COMEX of Marseille, a world leader in diving and diving technology. Delauze made an astounding offer to us: he would lend us all the equipment and divers necessary for helium-oxygen saturation dives on the wreck, including a personnel transfer chamber, a deck chamber and gas mixers. He apologized that he did not have at that time a vessel in the eastern Mediterranean to lend us. Alas, we archaeologists did not have the funds to charter a vessel large enough to support all of the COMEX equipment.

That was almost the end of the story. More than two decades passed, during which time we formed INA and went on to other things. We did learn that a third bronze statue, that of a nude youth leaning forward with his outstretched arms bent at the elbows, had been raised from the wreck and smuggled out of Turkey in a truckload of oranges. The police were never able to prove a case against the sponger who did this, but several people in

George Bass is greeted by Henri Delauze as he leaves the Remora *after his dive. At left, the* Remora, *a one-person tethered submarine, on the stern of the* Minibex.

Photo: D. Frey

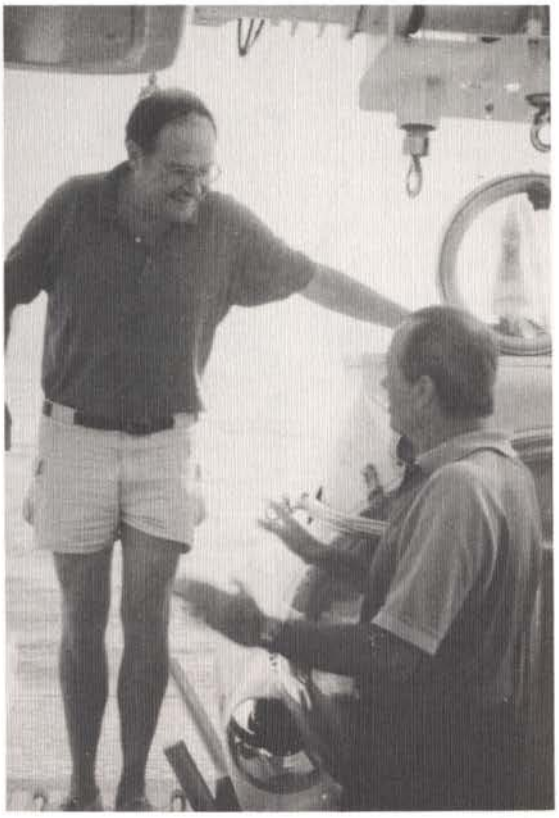


Photo: D. Frey

Bodrum saw the statue and described it.

In 1990, Claude asked if he could approach COMEX again. When he and Don Frey visited Marseille, Henri Delauze said that he would come to Turkey, at his own expense, with his research vessel *Minibex*, bringing a one-person submarine and a remotely operated vehicle (ROV), both outfitted with color television systems. He would also be prepared for deep helium-oxygen dives, and would fly a team of professional divers to Turkey if warranted.

Minibex arrived in Turkey in early October, after being delayed slightly by Aegean gales. The INA staff in Turkey, joined by Donald Rosencrantz on leave from his job as a civilian engineer with the U.S. Navy, were anxious to learn what else the wreck held.

Using our 23-year-old shore bearings, Delauze positioned *Minibex* approximately over the ancient wreck. He then descended in *Remora*, a one-person, tethered submarine that follows *Minibex* as a remora follows a shark. The rest of us watched four monitors on the bridge of the *Minibex*: one showed us what Delauze was seeing on his sonar screen as he searched for and homed in on the wreck; one showed a profile of the seabed directly below us; another the precise track of the *Minibex* as it moved back and forth above *Remora*, making minute adjustments in its position by means of thrusters; and one showed the floodlit seabed itself.

It was easy for us to realize that the sonar on *Remora* had picked up the wreck when a black mass surrounded by orange and yellow specks appeared against the bright blue background of the sonar monitor. We listened to

the speakers as Delauze directed the captain to move the *Minibex* ever so slightly, this way or that, while the black mass grew larger. And then amphoras, dozens of amphoras, came into view, the orange and red sponges on them brilliantly lit by *Remora*'s floodlights.

For hours Delauze traveled from one end of the wreck to the other, with everything he and we saw being video-taped. As in 1967, visibility was extremely poor, limited to about six feet. When he returned to the surface, however, Delauze was able to report that he had viewed 95% of the site without seeing another statue or part of a statue. We decided that to bring helium-oxygen divers for just a few days under such conditions would not justify the expense, and canceled their trip only hours before they were to fly to Turkey.

Delauze next "flew" the ROV over the site, watching and video-taping amphoras and other ceramics. We saw and examined one object that might have been bronze, with a green patina on one end.

Next morning, after a brief course in how to pilot the *Remora*, I went down to examine the wreck. I could adjust my depth with one switch, and with another could turn the little submarine left or right.

It had now been a couple of days since the gale subsided, which might explain why the visibility had improved remarkably overnight. Instead of only a few feet, I could see the entire wreck laid out before me, an impressive and coherent mound of amphoras. This made it easy for me to direct the captain of the *Minibex* to move me slowly from one end of the site to the other in parallel runs: "On a bearing of 270 degrees, move 20 meters," I'd say.

Instead of setting my depth below the surface, I set my height above the seabed at two meters. As parts of the wreck rose about one and a half meters out of the sand, this meant that I floated close above the amphoras, looking down through my knees as they passed just below me. Sometimes I turned this way or that to get a better view of some object, but during an hour I saw nothing more that looked like bronze.

On this, my deepest dive ever, I thought I would be apprehensive. Instead, it was the most magical dive I have made in my thirty years of examining ancient wrecks. Sitting in a plastic hemisphere, I had a far better view of the seabed than is possible with a diving mask. The only sound was the slight whir of a fan in the carbon-dioxide scrubber. I could control three floodlights to get the best views of what lay below me. And, warm and dry, I could converse easily with those above watching the TV monitor.

Cemal Pulak followed me down. With his uncanny powers of observation, he spotted pitchers and pots that I had missed, but everything we saw is on video-tape for later, leisurely examination. He thought that the amphoras were mostly first-century B.C. Koan types.

Delauze and his team were prepared to spend up to two weeks with us, but we had learned that the Yalıkavak wreck was not going to give up its secrets so easily. Are there more statues, hidden under the sand? There may be dozens. Or there may be none. Only one amphora was visible on a Hellenistic wreck we once explored at Serçe Limanı, but removal of a layer of sediment during full-scale excavation revealed two hundred more! To conduct a full-scale excavation nearly 300 feet deep is beyond our current means.

Still, the Yalıkavak wreck has drawn us back again and again since 1963. One day it will surely draw us back once more.

Photo: D. Frey

This bronze statue of the goddess Fortuna was netted in 1965 by a sponge-dragger.

News & Notes

J. Richard Steffy, INA faculty member and professor emeritus at Texas A&M University, was named American Institute of Archaeology Anna Marguerite McCann-Robert D. Taggert Lecturer in Underwater Archaeology for 1990. He delivered lectures featuring his reconstruction of the 4th-century B.C. Kyrenia ship to AIA societies in Toronto and Ottowa-Hull, Canada.

*****

INA President **Robert K. Vincent, Jr.** joined an astronaut and an astronomer at opening ceremonies for the Science Olympiad II held in November in Dallas. He explained nautical archaeology as a profession to students from more than 100 schools who had gathered to meet science professionals from many fields.

During November, he also gave a presentation on the search in Jamaica for two of Columbus's caravels to members of the Brazos Valley Museum in Bryan, Texas.

*****

Ships and Shipwrecks of the Americas: A History Based on Underwater Archaeology, edited by **George F. Bass**, INA's archaeological director, received yet another favorable review, this one by Calvin Cummings of the National Park Service in *American Antiquity* (55.3, 1990).

*****

The Archaeological Institute of America has published the 1991 **Archaeological Fieldwork Opportunities Bulletin** which lists current and ongoing archaeological programs with openings for individuals interested in learning about archaeology and who wish to become actively involved. The **Bulletin** is available (prepaid) to AIA members for $10.50 and to non-members for $12.50. Orders should be addressed to: AIA, 675 Commonwealth Ave., Boston, MA 02215.

*****

Jim Parrent and the INA/Texas A&M team searching for the Columbus caravels in Jamaica were featured in an article in **The Observer**, a London newspaper. The article was highlighted on page one of the November 4, 1990, issue and provided readers with both the history of the caravel beaching and a synopsis of the search project.

*****

We note with regret the passing of **Melvin M. Payne**, chairman of the National Geographic Society, in October. Mr. Payne served as scientific leader of the society for several decades and had offered a great deal of support to the Institute during his

tenure as chairman of the society's committee for research and exploration.

*****

The third volume in the Nautical Archaeology Series of Texas A&M University Press is scheduled for publication in March. Edited by Lionel Casson and **J. Richard Steffy**, *The Athlit Ram* is fully illustrated with detailed drawings and photographs to complement expert studies on all aspects of the ram from bronze-casting methods and metallurgy to the use of the ram, and the ship that backed it, as a maritime weapon of war.

*****

Cheryl Haldane, a Nautical Archaeology Program Ph.D. candidate, was awarded the 1991-92 Harriet Pomerance Fellowship for Aegean Bronze Age Archaeology by the Archaeological Institute of America. She plans to use the award to continue her research on the nature of archaeobotanical remains from the Ulu Burun shipwreck. The American Research Institute in Turkey also named her an Honorary ARIT Fellow for the duration of the project.

Nautical archaeology graduate student **Edward M. Rogers** was awarded a Jordan Fellowship by the Texas A&M University Jordan Institute for International Awareness. With funds from the fellowship, he plans to study ancient and modern maritime culture in Egypt; he will visit museums, especially the national maritime museum in Alexandria, and shipyards in Egypt and intends to see the ship construction relief of the Tomb of Ti, which is the focus of his master's degree thesis.

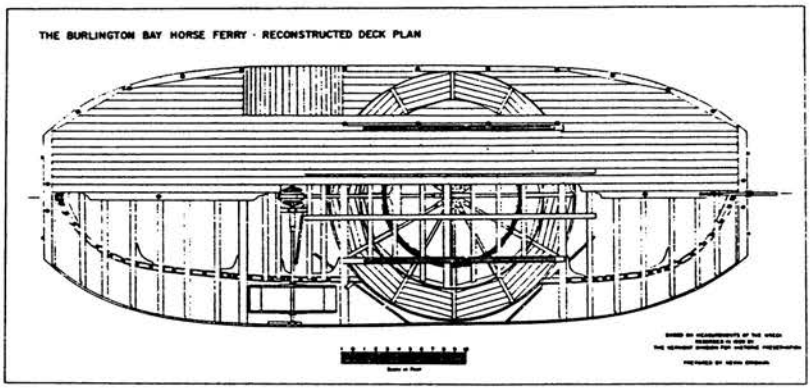
1991 Texas A&M University/INA Nautical Archaeology Field School

The 1991 Texas A&M University Nautical Archaeology Field School moves from Port Royal, Jamaica, to Burlington Bay, Lake Champlain, Vermont where Dr. Kevin J. Crisman, assistant professor in the Texas A&M Nautical Archaeology Program, and Arthur B. Cohn, director of the Lake Champlain Maritime Museum, will lead a five-week-long excavation of a horse-powered ferry boat.

The Burlington Bay boat is the only example of a horse ferry that has been located and archaeologically documented. The innovative and unusual 63-foot-long vessel incorporated a horizontal turntable mechanism and sidewheels and was based upon a design patented in 1819. Although the name of the ferry and period of her service have not been determined, documentary and archaeological evidence suggest that she was built in the late 1820s or during the 1830s and saw several years of use before sinking. She now lies upright under 50 feet of fresh, relatively clear water.

The field school would enroll up to 12 graduate and undergraduate students from June 3 to July 5 in a program consisting of classroom lectures on lake history, wooden ship design and construction, archaeological procedure, excavation and recording; and examination of other archaeological remains of wooden steamships, sailing craft, and canal boats.

Any individual interested in participating in the field school is urged to contact Dr. Kevin Crisman (c/o INA, P.O. Drawer HG, College Station, TX 77841; telephone 409/845-6697) as soon as possible.



WISH LIST

INA often needs items for its projects. Any donations of equipment listed below would be most appreciated:

Nikonos II & III Cameras
Any 35 mm camera equipment

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