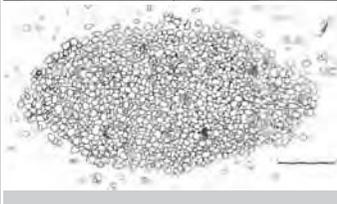
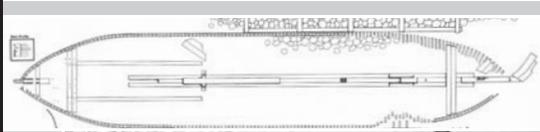


2008 Projects and Research

INSTITUTE OF NAUTICAL ARCHAEOLOGY

# THE INA annual







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The Institute of Nautical Archaeology is a non-profit organization whose mission is to continue the search for the history of civilization by fostering excellence in underwater archaeology.

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**2008**

## **Research Associates**

INA's research associates and affiliated faculty hail from all over the world. They include senior scholars and associated faculty from other universities as well as emerging scholars—graduate students—mostly drawn from the ranks of the Nautical Archaeology Program at Texas A&M University. This diverse, multi-disciplinary and highly specialized group of people continue to further our prime directive—to bring history alive through the scientific means of surveying, excavating, conserving and, where possible, preserving shipwrecks. Everyone on the team is passionate about what they do and has incredible knowledge, skills and field experience. Their biographies reveal a glimpse of the extraordinary work that has been accomplished and demonstrate how dedicated each is to their craft. We applaud them and thank all for their contributions to INA and to nautical archaeology.

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# With Thanks...

The Institute of Nautical Archaeology acknowledges and thanks the generous donors, sponsors, friends and partners who made its work in 2008 possible.

For many years, the Institute of Nautical Archaeology has benefited from the support of major partners who make a substantial difference to what the Institute is able to deliver.

Since 1974, INA's headquarters in the United States has been located at the College Station campus of our principal partner, Texas A&M University. Through the University, and in particular through the College of Liberal Arts, and the Department of Anthropology, the Nautical Archaeology Program and the Center for Maritime Archaeology and Conservation (CMAC), and with the assistance and partnership of the Texas A&M University Foundation, INA directors raised and donated funds that the University matched to create the Nautical Archaeology Program's endowed chairs and fellowships that are now held by some of the world's top nautical archaeologists. The Nautical Archaeological Program, through its faculty and students, have been the primary means by which INA projects have been carried out through the decades. INA is also fortunate to work with the Texas A&M University Press, which through its publishing program, and with the specific support of the Ed Rachal Foundation, has been able to create the premiere publication series in nautical archaeology in the United States, if not the world.

INA has also been supported for many years by the RPM Nautical Foundation which works to survey important waters and provides INA with the opportunity to excavate significant sites they encounter. INA also recognizes the Turkish Institute for Nautical Archaeology (TINA), another major partner, strong ally and friend. This partnership in particular underscores the importance of Turkey and its significant nautical archaeological heritage to the work of INA. Other major partners include countries and states that grant INA researchers both permission and the privilege to work on sites under their jurisdiction.

INA's 2008 donors are recognized on pages 100 and 101 of this publication. For more information on supporting INA, visit [inadiscover.com](http://inadiscover.com) or contact the INA office.

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To learn more about the continually growing record of projects undertaken by INA over nearly five decades of exploration, go to [inadiscover.com](http://inadiscover.com).



**Jim Delgado**  
**President & CEO**  
**Institute of Nautical Archaeology**

## 2008 in Review: A Report from the President

**FIG 1**  
Working from 2 sponge  
boats off Cape  
Gelidonya during the  
summer of 1960.  
INA Archives.



Founded in 1973, the Institute of Nautical Archaeology is in its 36<sup>th</sup> year of operation in 2009, and approaching the 50<sup>th</sup> anniversary of the first scientific archaeological excavation of a shipwreck under water at Cape Gelidonya. When journalist/adventurer Peter Throckmorton arrived in Bodrum in the spring of 1958 to write about Turkish sponge divers, he learned of many ancient wrecks as he gained the divers' confidence. Throckmorton visited most of them, diving on what he later said were up to a hundred wrecks. He also visited an underwater excavation off Albenga, Italy, where six divers worked on a Roman wreck, supervised by archaeologists who remained on the deck and did not dive. Important discoveries were being made elsewhere in the Mediterranean, and in the U.S., and pioneering explorers interested in archaeological discovery were diving, but no one had completely excavated a shipwreck under water.

Archaeology of sorts was happening in the sea, but archaeologists were seen to be on the sidelines, and with most archaeologists not being divers themselves, they were dismissed, Throckmorton said, by Jacques Cousteau as "impractical pedants." All that changed in 1959, when Throckmorton was guided to a Bronze Age wreck at Gelidonya, the "cape of the

swallows,” and then returned to the U.S. to solicit help to excavate the wreck before it was lost forever to divers seeking to wrench up and sell its cargo of ancient copper and bronze for scrap.

Professor Rodney Young of the University of Pennsylvania Museum introduced Throckmorton to a promising graduate student, George F. Bass, in December 1959. Together, with a \$10,000 grant from the University Museum, they organized an expedition to Gelidonya, raising additional funds, and recruiting a crew that included a young diver from France, Claude Duthuit, who had earlier worked with Throckmorton. They headed off to Turkey in April 1960. There they assembled their equipment, adding essentials that their limited budget could not support with visits to an Army surplus yard. “Our army training in scrounging,” said Bass (he and Throckmorton were both veterans) “suddenly seemed as important as any academic courses we had taken.” What followed was a further test of people, equipment and the capacity of the human heart to endure hardship in order to achieve the best of what we are capable of as human beings.

The three-month long excavation at Cape Gelidonya, working from two sponge boats (Fig. 1) and a narrow beach camp hemmed in by high cliffs, was hard work and the beginning of a new era (Figs. 2 and 3). It was the first archaeological excavation of a shipwreck in its entirety, with archaeologists and archaeological technicians who worked under the water. The wreck, which had already seen initial despoliation by divers who had taken some of its ancient bronze cargo to melt down and sell, was now studied, surveyed, and carefully excavated. The artifacts were studied and the results were published after seven years of painstaking analysis. History was not only recovered, it was made.

What began on that beach and in the waters off Cape Gelidonya 50 years ago was the beginning of archaeology under water—an important distinction as noted by George Bass because it was more than “underwater archaeology.” It was the beginning of scientific practice in a submerged environment. In the end, what was done at Gelidonya and all other sites under water since 1960 is all about the use of technique, method and theory—simply stated, what we call archaeology, to answer questions about humanity’s past.

What George Bass, Peter Throckmorton, Kemal Aras, Hakki Gültekin, Claude Duthuit, Nazik Göymen, Frederic Dumas, Honor Frost, Joan du Plat Taylor, Ann Bass, Wlady Illing, Nixon Griffis and the other pioneers who worked at Gelidonya did was to forever change the way wrecks and archaeological sites under the water should be worked on. What George Bass did was to forever change archaeology. His meticulous study of the wreck, and publication of the results, was literally like tossing a pebble into the sea that in time grew into a tsunami. Hundreds of archaeologists have now been trained in universities, and work in the field in the world’s oceans, lakes and rivers.

Hundreds of shipwrecks, drowned ports, lost cargoes and prehistoric sites have been scientifically excavated, studied and the results published around the world. Academic programs, including one of the first in the world, founded in 1976 by Dr. Bass, Dr. Frederick Van Doorninck and J. Richard Steffy at Texas A&M University, as well as programs at East Carolina University, Indiana University, the University of Southampton, Flinders University, St. Andrews University, Södertörn University



**FIG 2 top**  
George Bass and Peter Throckmorton working in the makeshift “lab.”  
INA Archives.

**FIG 3 bottom**  
The Cape Gelidonya camp during the summer of 1960.  
INA Archives.

and other schools now train the next generation of nautical archaeologists. The Nautical Archaeology Society (NAS) trains a growing number of avocational archaeologists who make immeasurable contributions.

Archaeological preserves, marine sanctuaries, national and state parks all preserve and make shipwrecks accessible to the interested public. Professional journals, books, popular media in print, film and the Internet bring the results of archaeological work under water and on nautical sites to an ever growing audience of scholars and the interested public. There are a number of associations, institutes and societies that work around the world on shipwrecks, archaeology under water, and on maritime studies.

That being said, there is only one truly global organization dedicated to the preservation, excavation, study and publication of the results of archaeological work done to the highest standard under water, and that is the Institute of Nautical Archaeology. Since our founding, INA and its members, associates, students and affiliated faculty have worked on more than 160 projects in nearly every ocean, in major lakes, and off nearly all continents. These have been cataloged by Dr. Bass in a landmark series of books. Hundreds of scholarly and popular articles have been published. An impressive shelf of dozens of books, almost all published in partnership with Texas A&M University Press, have shared the results of that scholarship.

What is paramount is continuing to conduct surveys, assessments, excavations, and to continue the process in the laboratory through conservation

and analysis as we interpret the results and then share them. In 2008, the Institute of Nautical Archaeology, in conjunction with Texas A&M University's Nautical Archaeology Program, Indiana University, Flinders University, the Waitt Institute for Discovery, and the RPM Nautical Foundation, was a participant, partner, or supporter of 21 archaeological projects around the globe in the United States, Canada, Bermuda, Panama, Turkey, Spain, Egypt, Lebanon, Israel, Cyprus, Japan, and Vietnam. Thirteen of these were ongoing projects from previous years, and eight were new initiatives.

Off Cartagena, Spain, excavation on a 7<sup>th</sup>-century BC Phoenician shipwreck commenced in the summer. As you will read in this edition of the INA Annual, the initial dives on the site yielded well-preserved elephant tusks with Phoenician inscriptions, amber and ceramics, a stone altar or memorial stone, and more. At Kızılburun, on the Turkish coast, the excavation of a Roman period stone carrier laden with marble column drums paused for a season of laboratory work and analysis. In Istanbul, the land-filled ancient port of Constantinople was excavated by Istanbul University, Istanbul Archaeological Museums, and an INA team, yielding as of 2009, thirty-four preserved hulls of ships from the 7<sup>th</sup> through the 11<sup>th</sup> centuries AD as well as many other amazing finds. The final season of work in Oklahoma's Red River recovered the last pieces of machinery from the oldest river steamer wreck yet excavated, the 1830s paddlewheeler *Heroine*, lost carrying supplies to a frontier fort, in partnership with the Oklahoma Historical Society. In Japan, the

second season of survey and excavation of the site of a tragic 1890 shipwreck of the Ottoman naval frigate *Ertuğrul*, lost on a diplomatic mission to Japan, again involved a joint Turkish-Japanese team.

Surveys included the work of the RPM Nautical Foundation off the coasts of Albania and Sicily, with several key discoveries of hundreds of sonar targets and dozens of wrecks and a bronze ram from an ancient warship. A deepwater survey of the ancient sea lane between Crete and Egypt searched for lost ships and cargoes, including those of the Minoans. A survey by Brock University at Kekova Adası in Turkey photo-documented an Iron Age wreck discovered during an earlier INA survey. Cyprus' ancient shores were again the setting for a survey of shallower water sites, seeking shipwrecks, lost stone anchors, discarded amphoras and other remains from maritime activity. The retreating shores of the Dead Sea in Israel were again the setting for a comprehensive survey of emerging cultural remains. A ground-penetrating radar survey at Dashur, Egypt searched for boat pits and buried craft of the pharaohs, seeking sites as amazing as the famous Cheops ship at Giza. A survey off the coast of Panama with the Waitt Institute for Discovery documented 500 years of maritime activity and a wide range of sites including a drowned village, fortifications and shipwrecks at the mouth of the Chagres River. One of those wrecks appears to be from a 1671 attack on Panama led by notorious pirate Captain Henry Morgan.

Another survey and test excavation took place off the coast of Puerto Rico and examined an 18<sup>th</sup>-century wreck. In Lake

Ontario, bordering Canada and the United States, the final season of a multi-year survey assessed the maritime cultural landscape of this historic lake. Farther north, in Canada's Yukon Territory, a comprehensive survey of wrecks associated with the Klondike Gold Rush (1896–1901) and the opening of the northern frontier continued and discovered the intact wreck of the steamer *A.J. Goddard*.

Other studies examined individual wrecks. The potential site of an early shipwreck was the subject of a survey of Bermuda's wreck-filled waters. The survey re-established the position of the significant 16<sup>th</sup>-century wreck, *Warrick*, which is now available for excavation. In Spain, at the National Museum of Underwater Archaeology, a student began the analysis of the fragmentary timbers of a Phoenician coastal vessel, which was recovered by Spanish archaeologists from a site known as Mazzaron I. In Bermuda, the timbers from an early wreck, previously excavated at the Western Ledge Reef, were documented and reconstructed on paper by two other talented Nautical Archaeology Program students from Texas A&M. In Panama, with support from the Waitt Institute for Discovery, the final season of documentation, analysis and survey was completed on an 1865, American-built iron craft, *Sub Marine Explorer*, in Panama's Pearl Islands. In Vietnam, a collaborative project with Flinders University documented two well-preserved wooden anchors from the 18<sup>th</sup> century, pulled from the mud outside Hanoi, and assessed the site of an AD 1288 naval battle, where Khubilai Khan lost hundreds of ships, for future

survey.

In addition to the ongoing and essential work at INA's Bodrum Research Center, a comprehensive assessment of the iron concretions from the Bozburun excavation took place at the Griffis Conservation Laboratory (Fig. 4), and globular amphorae from the Yassı Ada excavation were again part of an ongoing re-analysis. In the archives of Venice, digging of another sort, through unpublished manuscripts added to our knowledge of Renaissance shipbuilding in this center of Mediterranean trade and culture in another INA supported project. Final analysis and publication of the results of several projects continued, including the Civil War blockade runner *Denbigh*, the Mombasa wreck, *Santo Antonio de Tanna*, wrecks of the War of 1812, major contributions on the Uluburun wreck and its artifacts for the Metropolitan Museum of Art's catalog for the "Beyond Babylon" exhibition and the much-anticipated second volume on the Serçe Limanı wreck, this one focusing on its glass cargo, which was completed in 2008 and published in 2009 to high acclaim by Texas A&M University Press.

All of these projects were made possible by the generous support of partners, sponsors, and donors, volunteers, and the permission of and permits granted by the various nations and states where the projects took place. Also key to the success of these projects and INA's ongoing work is our endowment, managed by the INA Foundation and built up with generous gifts. INA and the various project directors and participants offer their thanks to all of those who made 2008's work in the field, in the laboratory, and at the computer possible.



**FIG 4**  
Griffis Conservation  
Lab, Bodrum.  
Photograph by James  
Delgado, 2008.



left to right

Mark E. Polzer  
Institute of Nautical

Archaeology

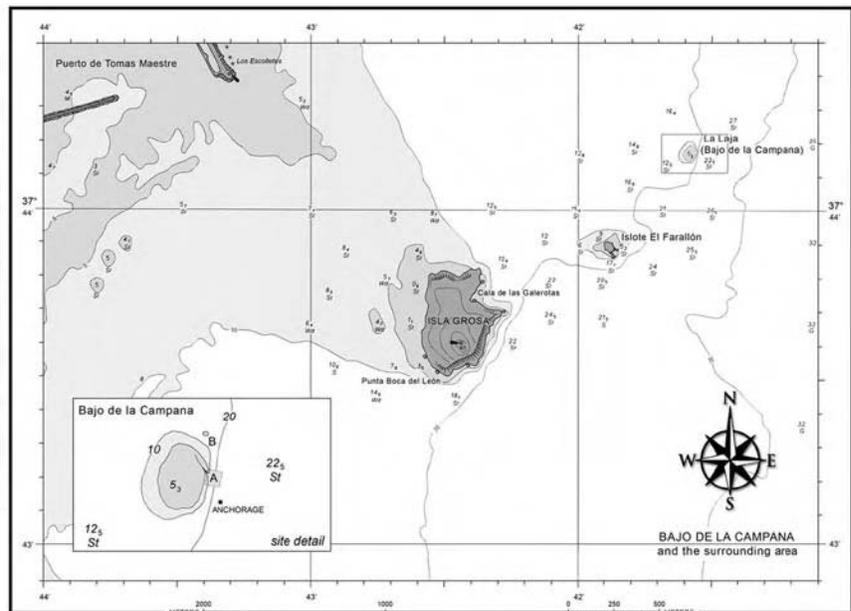
Juan Pinedo Reyes  
Institute of Nautical  
Archaeology

## Phoenician Rising:

Excavation of the Bajo de la Campana Site Begins



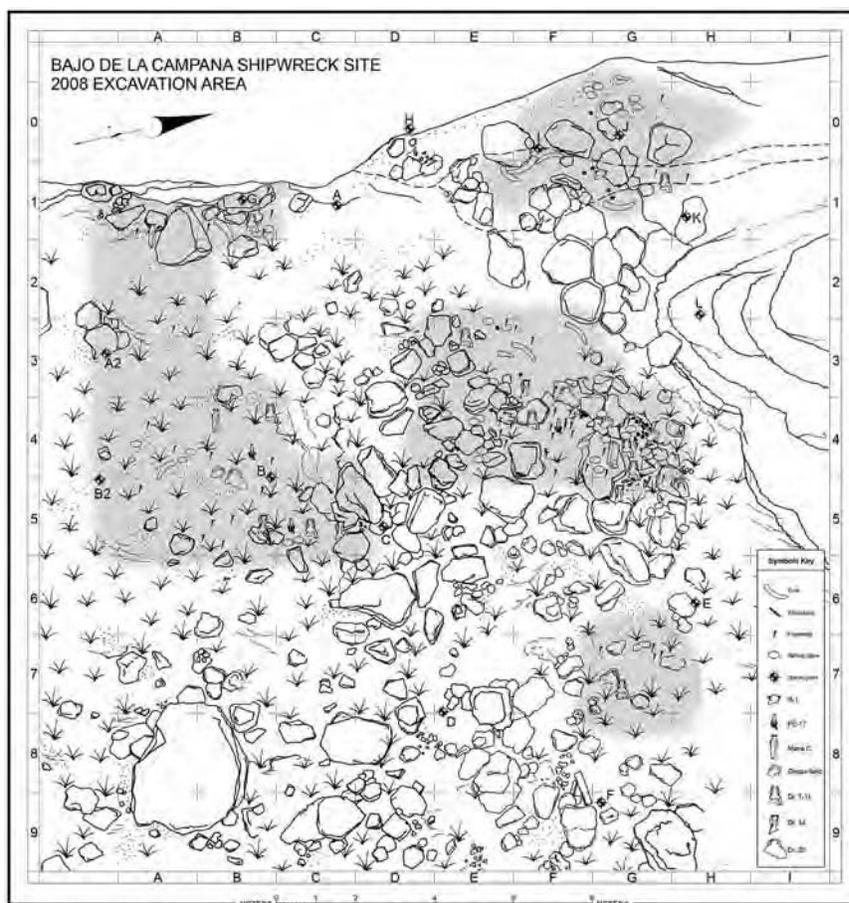
**FIG 1**  
The location of Bajo de la Campana and the shipwreck site.  
Maps by M. Polzer.



Excavation of the Bajo de la Campana ancient shipwrecks site began in the summer of 2008, following a successful survey of the area the year before.<sup>1</sup> The site is situated off La Manga on the southeastern coast of Spain, approximately 40 km northeast of Cartagena (Fig. 1). The area of investigation (designated area “A”) covers approximately 20 x 20 m at the base of the eastern face of the shoal of La Laja (Fig. 2). Our primary goal for this initial campaign was to excavate the Phoenician wreck, which has

<sup>1</sup>The results of the 2007 survey were reported in M. E. Polzer and J. Pinedo Reyes (2008). “Phoenicians in the West: The Ancient Shipwreck Site at Bajo de la Campana, Spain.” *INA Annual 2007*, 57–61.

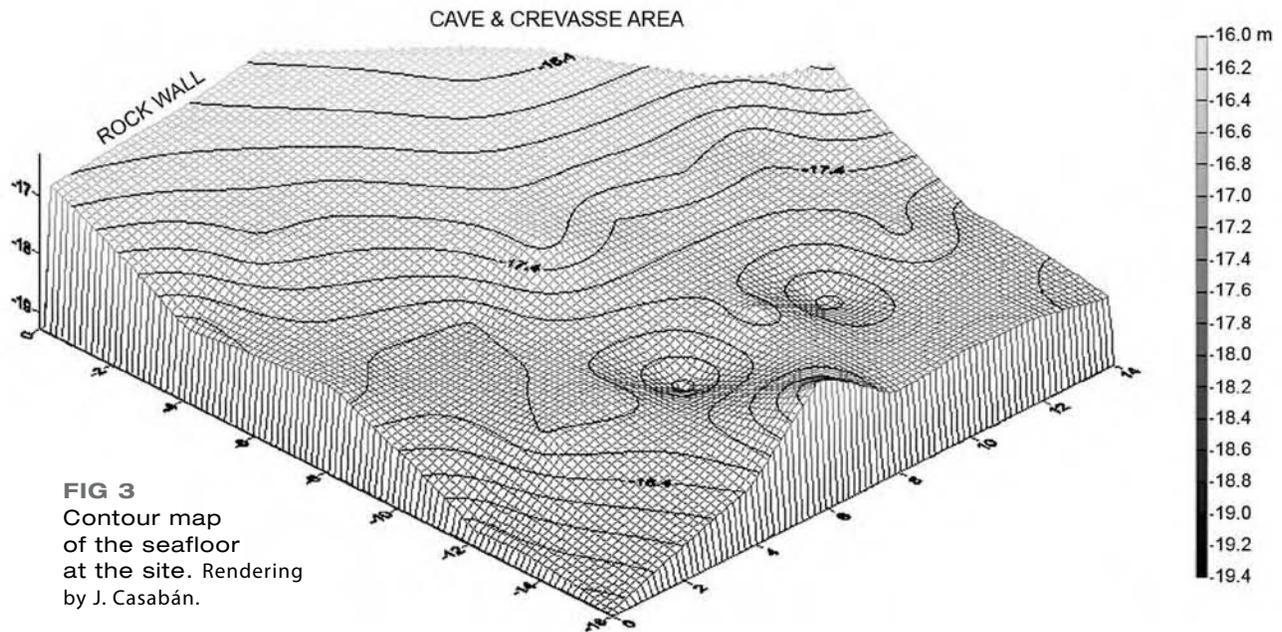
**FIG 2**  
The 2008 site plan,  
Area A. Drawing by M.  
Polzer, J. Casabán, W. van  
Duivenvoorde.



yielded material datable to the late 7<sup>th</sup> or early 6<sup>th</sup> centuries BC. We expected to recover material from a 2<sup>nd</sup>-century BC Punic and 1<sup>st</sup>-century AD Roman shipwreck as well, as results of the survey had indicated.

Our international team this year consisted of archaeologists and graduate students from Spain and the United States, Turkey, the Netherlands, Sweden, England, France, and Australia, and we partnered again with the Museo Nacional de Arqueología Marítima (MNAM) and its associated Centro Nacional de Investigaciones Arqueológicas Submarinas (CNIAS) in Cartagena. Diving began on July 5, with the team first making its acclimation and site orientation dives, after which the site work got underway.

During the first week of diving, team members cleared large boulders, rocks, and *Poseidonia* grass from areas of the site to be investigated. Our survey had identified the “cave” at the base of the shoal wall and grid sectors F/G4 as prime target areas for Phoenician material, and so we focused on the north and west sides of the site (Fig. 2). Other divers began setting up a 2 x 2-m rope grid over the site and installing control point targets for mapping purposes. Once this work was completed, team members measured in all the control points using metric tapes, and established their relative positions in three dimensions using Site Recorder™ to process the data. We utilized both direct survey method (DSM) and photogrammetry to map complete and diagnostic artifacts, processing the latter with PhotoModeler®. The positions of non-diagnostic fragments were located to within a 12.5 x 12.5 cm area using quartered grid quadrants. The team also took offsets from the shoal wall to map the gradient of the seabed at the site (Fig. 3).



**FIG 3**  
Contour map  
of the seafloor  
at the site. Rendering  
by J. Casabán.

After the site was prepared, the team installed four airlifts and began excavating. Air for the lifts was supplied by a rented compressor housed in our excavation boat, *Soneya*, which we anchored over the site all day while diving was ongoing. Once an exposed object was mapped successfully, it was raised and transported to the excavation house where team members recorded and accessioned all the artifacts and kept them in temporary wet storage until they could be taken to the MNAM conservation laboratory in Cartagena.

A rental house in La Manga served as expedition headquarters. It is located about a 10-minute drive from the Puerto Tomás Maestre marina, where we docked our boats and kept our dive gear and excavation equipment in a construction container. Dive teams shuttled back and forth between the marina and excavation house with equipment and artifacts in two rented expedition vans.

The expedition spent a total of 53 days in the field and operated on a 6-day diving schedule, with one day off each week for rest and off-gassing. Unseasonably erratic weather and strong easterly winds, known locally as *Levante*, prevented us from diving almost the entire third week and an additional 4 days during the last couple of weeks of the season. All diving was within non-decompression limits, which at site depth limited our bottom time to approximately 50 minutes per dive. Expedition members made a combined 526 dives to the site and spent a total of 437 hours working under water with no reportable accident or injury. The team hosted numerous guests from Spain and abroad throughout the summer, many of whom enjoyed one or more dives to the site. The summer was highlighted by a special INA Directors' visit early in the season that included President James Delgado, Chairman Donald Geddes and his wife Marilyn, Treasurer Clyde Smith and Paula Michaels, board members Lucy Darden, Curt Dunnavan, Charlie Garrison and Lisa Guzzetti, and friends Steve and Phyllis Brady, Dave and Cheryl Hadley, and Beth Hart. The team also enjoyed a special visit from INA director Claude Duthuit, who

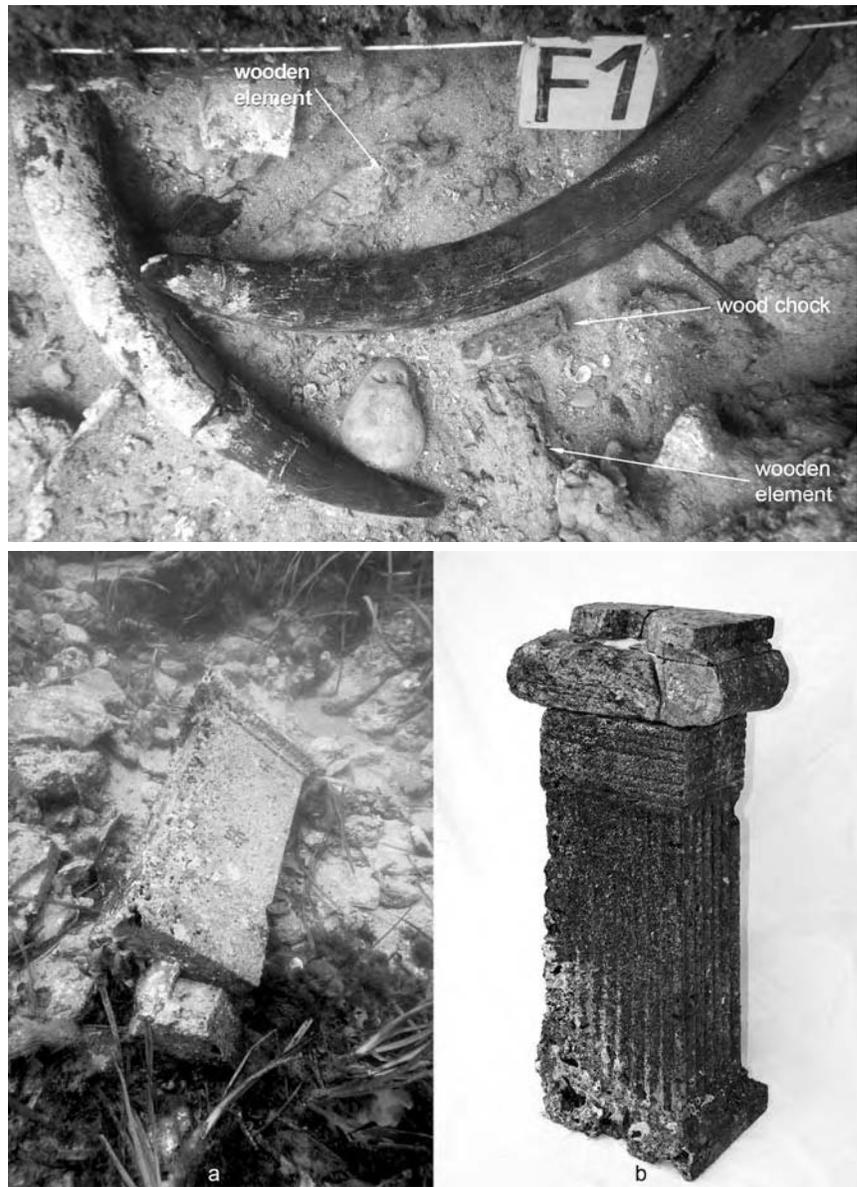
lived and dived with us for a week in August, and regaled us all with fascinating stories from the early years of INA.

Over the course of five weeks, the team investigated 20 grid sectors, which represent about a quarter of the total site area (Fig. 2, shaded areas). The sectors along the southern edge of the site (A–C) were excavated down to bedrock. Other areas, however, remain under excavation, including sector G4, which was dug more than a meter deep and continued to yield numerous objects of Phoenician origin, but also Punic and some Roman as well. The cave proved to be a rich source of Phoenician material and indications are that there should be much more beneath the rocks and sediment in the area extending from the mouth of the cave to G4 and in the shallower areas of the crevasse. A quick survey was conducted in sectors G7/8 to determine whether the wreckage in G4 continued that far and beyond. Some ceramic material and wooden structure were found

buried just below the surface. The wood, which includes iron fastenings, may well be hull remains of either the Punic or the Roman wreck, but more investigation is required to be certain.

The week before the team began closing down the site, we uncovered a group of five large elephant tusks buried at the mouth of the cave in sectors E1/F1. These tusks, along with the 10 raised during the summer, the 4 recovered during the 2007 survey, and another 13 in the Museum's collection from previous decades, bring the total count of tusks from the Phoenician cargo to 32. Two of the tusks are oriented rather vertically, such that most of their lengths extends down into the sediment. In the process of exposing the tusks to better inspect them, some wooden structure came to light (Fig. 4). Unfortunately, the weather turned against us one last time and no further investigation was possible. When we finally were able to return to the site, we reburied the tusks and wood and all other exposed sectors of the site under layers of sandbags, loose sand, rocks, and large boulders. The wooden elements are intriguing and, even should they prove to be something other than hull structure, indicate that there should be good hull preservation beneath the seabed.

On the very first day of site work, team members removed a large boulder from sector G4 only to reveal a well-preserved limestone pedestal lying beneath it (Fig. 5).<sup>2</sup> The assembled pedestal stands



**FIG 4 top**  
Tusks and wood assemblage in sector F1. Photograph by M. Polzer.

**FIG 5 bottom**  
Stone pedestal (a) in situ upon being exposed, and (b) after being raised, partially cleaned, and reassembled. Photographs by H. Brown.

<sup>2</sup>The stone was identified by Alex Bevan at the Department of Earth and Planetary Sciences of the Western Australian Museum.

71.6 cm tall and has a stepped base with a rectangular plinth measuring 21.5 x 32.3 cm. The pedestal shaft is fluted on three sides and has an 11-cm wide course of horizontal banding at the top. Crowning the shaft is a volute capital that is held in place by a lead dowel projecting from the top of the shaft. A rectangular abacus sits atop the capital and has a rectangular opening in its center to receive whatever object the pedestal was designed to hold. As yet, this object has not been revealed.

The Phoenician wreck yielded not only the largest number of objects, but the greatest variety as well. Ceramic sherds come from at least two Vuillemot type R-1 western Phoenician amphoras that are similar to examples associated with the Mazarrón shipwreck.<sup>3</sup> This type is datable to the 7<sup>th</sup>–6<sup>th</sup> centuries BC and was typically produced in the areas of southern Spain and North Africa around the Strait of Gibraltar.<sup>4</sup> Other pottery finds include fragments of a tripod bowl and mortarium, an *unguentarium* (small flask for perfumes, oils, or ointments), a small jar and mushroom-lipped jug, and various coarseware bowls and plates. The two jars may help narrow the date of the wreck to within a few years of 600 BC.<sup>5</sup>



**FIG 6**  
Stone rod believed  
to be a whetstone.  
Photograph by M. Polzer.

Other objects recovered from the wreck include the aforementioned 10 elephant tusks, 28 small tin ingots and the first two copper ingots so far from the wreck, hundreds of small galena (lead ore) nuggets, pinecone scales, pieces of dunnage, and numerous large, round ballast stones. The team also discovered several interesting personal items belonging to the crew: a tiny stone cube that may be a gaming piece, a light-green stone rod believed to be a whetstone (Fig. 6), and a small lump of what looks to be obsidian. The stone rod is worn at both beveled ends and bears scratches of possible Phoenician graffiti on its surface. The team also found several double-ended wooden combs, though they appear to be cargo rather than grooming items used by the crew.<sup>6</sup> Evidence for foodstuffs, whether as cargo or for shipboard use, includes pine nuts, acorns, hazelnuts, and olives. From the ships themselves the team found over 100 metal fastenings, fragments of lead sheathing (the largest piece coming from the cave and measuring 70 x 30 cm), and a small octagonal wooden chock. We cannot yet assign the fastenings and sheathing to a specific wreck, but since the use of lead sheathing predominated in the Hellenistic/Republican period, the material most likely comes from the Punic wreck.<sup>7</sup>

Three types of transport amphoras were recovered from the Punic wreck: fragments from one to three Punic-Ebusitana type 17, two Carthaginian Mañá C forms of uncertain subtype, and five Greco-Italic amphoras. The PE-17 and Greco-Italic jars probably carried wine, whereas the Mañá C amphoras likely contained olive oil produced in North

<sup>3</sup> V. M. Guerrero Ayuso and B. Roldán Bernal (1992). *Cátalogo de las ánforas prerromanas*, 144, 163 fig. 33; B. Roldán Bernal and M. Martín Camino (1989). “Aportación al conocimiento de la presencia fenicia y púnica en litoral del sudeste peninsular.” In *Crónica del XX Congreso Arqueológico Nacional, Santander*, 355–62. Zaragoza.

<sup>4</sup> Guerrero and Roldán op. cit. (previous note), 184.

<sup>5</sup> G. Maaß-Lindemann (1999). “La cerámica de las primeras fases de la colonización fenicia en España.” In *La cerámica Fenicia en Occidente: Centros de producción y áreas de comercio: Actas del 1 Seminario Internacional sobre Temas Fenicios, Guardamar del Segura 21–24 noviembre de 1997*, edited by A. G. Prats, 129–48. Valencia.

<sup>6</sup> All of the combs were found in association with a tusk. Similar examples, but of ivory and more elaborately decorated, reside in the collection of the Hispanic Society of America (G. E. Bonsor, 1928. *Early Engraved Ivories in the Collection of the Hispanic Society of America*. New York).

<sup>7</sup> F. Hocker (1995). “Lead Hull Sheathing in Antiquity.” In *Tropis III: Proceedings of the 3rd International Symposium on Ship Construction in Athens 24–27 August 1989*, edited by H. E. Tzalas, 197–206. Athens.

Africa. Other pottery present in this assemblage includes a Punic casserole and small plate and fragments of Campana-A fineware.<sup>8</sup> The team also recovered a surprising number of amphoric remains from the Roman ship: pieces of 15 Dressel forms 7–11, commonly associated with garum (fish sauce) and other fish products, five Dressel forms 14 and one form 20.

All of the artifacts were deposited at the MNAM conservation laboratory in Cartagena and are currently undergoing desalination. Once this is completed, much cleaning, consolidation, and mending remains before a full and accurate accounting can be made of the material, especially of the ceramic vessels. Archaeological drawings and photographs for both study and publication must be made of all complete and diagnostic objects. Furthermore, all of the various materials need to be sampled for identification and analysis. This process, and study of the material, is well underway, as is planning and preparation for continuation of the excavation in 2009.

### Acknowledgements

We are extremely grateful to the Region of Murcia for their continued enthusiastic support of this project, and for permitting the archaeological investigation and maritime operations. We are also most appreciative of our friends and partners at the Ministry of Culture of Spain and its Museo Nacional de Arqueología Marítima and Centro Nacional de Investigaciones Arqueológicas Submarinas, who provided logistical and archaeological support throughout the season, despite their preoccupation with the completion and opening of their spectacular new museum, ARQVA, in Cartagena. Financial support for this first season of excavation was provided by generous grants and donations from the National Geographic Society's Expeditions Council, INA directors Lucy Darden and Claude Duthuit, David Hadley and the Fidelity Charitable Gift Fund, and the Center for Maritime Archaeology and Conservation (CMAC) at Texas A&M University. Nautical Archaeology Program (NAP) professor Deborah Carlson provided us with a digital camera and underwater housing, which made possible our use of PhotoModeler® for site mapping. Luis Manzano Diaz, director of the Puerto Tomás Maestre marina in La Manga, again kindly provided us with slips for our boats and space to set our dive gear and equipment storage container. We are especially grateful for the excellent team that we had the privilege of working with this year, which included returning team members Wendy van Duivenvoorde, curator at the Western Australian Maritime Museum, and University of Southampton maritime archaeology graduate student Christin Heamägi. New additions included Spanish archaeologists Enrique "Quique" Aragon, who stayed on long after the fieldwork was over to organize and finish cataloguing the raised artifacts, Jose Luis Casabán, and Javier Rodriguez Pandozi; Dutch heritage consultant David Bouman; NAP student Heather Brown; Michael Halpern, a 9-year alumnus of INA's Uluburun shipwreck excavation in Turkey; University of Thessaloniki

archaeology student Domniki Kavatziki; French archaeologist Marie-Pierre Jézégou, from the Département des Recherches Archéologiques Subaquatiques et Sous-Marines (DRASSM) in Marseilles; Victoria Millership, administrator for the Hampshire & Wight Trust for Maritime Archaeology in Southampton; Cassandra Philippou, maritime archaeologist with Heritage Victoria, Australia; Eduardo Roa from the Vasa Museum in Stockholm; and long-time INA-BRC staff member Murat Tilev. MNAM-CNIAS archaeologists Ana Miñano Domínguez, David Munuera Navarro, and José Rodríguez Iborra once again took turns working with us in the field; and our excavation and dive boats were captained admirably by Pedro Angel Sanchez Conesa and Javier Marichalar Somoza. Finally, special thanks are due Annun Ponce Albendea, who facilitated all of our work by preparing and coordinating all project logistics and serving as interpreter, assistant, and general liaison for us all throughout the year—our debt to her is immense.

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<sup>8</sup> Form A is the earliest type of Campana ware, which remained in circulation from about 200 BC into the 1<sup>st</sup> century AD (J. W. Hayes, 1997. *Handbook of Mediterranean Roman Pottery*, 37–9. London).



**Donny Hamilton**  
 Texas A&M University/INA  
**Deborah Carlson (with U5 wood)**  
 Texas A&M University/INA

*with contributions by Kim Rash, John Littlefield and Mike McGlin*

## Kızılburun 2008:

– Shipwreck Research at the Bodrum Center



**FIG 1**  
 Kim Rash with anchor assembled.

Since 2005, an INA team under the direction of Donny Hamilton and Deborah Carlson has been uncovering the remains of a late Hellenistic shipwreck that sank off the coast of Turkey at Kızılburun. The ship was transporting a cargo of newly-quarried monumental column parts in white marble when it went down very probably in the 1<sup>st</sup> century BC. After three seasons of excavation, we elected to make the summer of 2008 a study season dedicated to researching some of the numerous whole and fragmentary wood, ceramic, and metal artifacts raised from the site and currently being conserved at INA’s Nixon Griffis Lab in Bodrum.

Kim Rash, a veteran of the 2006 and 2007 Kızılburun shipwreck excavation seasons who was featured recently on the cover of *Archaeology* magazine, spent the 2008 study season casting and researching the metal concretions (Fig. 1) from the Kızılburun wreck for her M.A. thesis at Texas A&M University: “The first step in assessing metal objects is to x-ray



**FIG 2**  
Double axe before casting and x-ray.

(Fig. 2) them in order to gather as much information as possible prior to removing the hard outer shell of marine concretion. This shell develops over time as the iron corrodes and reacts with the chlorides in the water and sand in which it the object is immersed. The metal artifacts from Kızılburun have been submerged for more than two millennia, meaning the iron has vanished completely, leaving only a cavity surrounded by the concretion shell. This shell serves as a natural mold for casting a replica: epoxy resin is poured into the cavity and allowed to harden, then the concretion can be chiseled free. The hardened epoxy replica represents an accurate facsimile of an object that would otherwise be lost forever. My research has revealed five important iron tools or pieces of equipment among the concretions from Kızılburun: the head of a double axe, an axe-adze (Fig. 3), a tool for removing nails, a chisel, and one of the ship's anchors (Fig. 4). The anchor is particularly important given its context on a ship carrying at least three other composite anchors—wooden anchors with lead stocks. The presence of both anchor types together on the same ship reflects an important transition from the use of wooden anchors to the

introduction of iron anchors and eventually the complete replacement of the former by the latter.”

Texas A&M graduate student John Littlefield, who will join the Kızılburun excavation team in 2009, spent the 2008 study season researching the wooden timbers for his M.A. thesis; this meant weeks recording and examining numerous fragments for construction details in an effort to determine how the Kızılburun ship was built: “Most of the wood remains are sparse and fragmentary, largely because they were positioned directly under the eight large column drums that were moved off-site in 2006 and 2007. The weight and pressure of the 6-ton marble drums over two millennia compressed the wood to the point that thickness measurements are only occasionally feasible; yet these same conditions aided in the preservation of the wood by isolating it from bacteria and teredo worms that might have otherwise completely devoured it. My initial analysis has revealed several construction-related details such as the size and spacing of mortise-and-tenon joints, plank scarfing techniques, and the dimensions and fastening patterns of internal transverse timbers. These features suggest ‘typical’ Greco-Roman ship construction methods, but a

**FIG 3** right  
Axe-adze before and  
after casting.

**FIG 4** far right  
Kim assembling  
anchor for casting.



**FIG 5**  
Mike McGlin in French  
Tower.

final assessment can be made only after the excavation resumes in 2009. In the meantime, samples of more than two dozen timbers have been sent to Nili Liphshitz at Tel Aviv University in Israel, who has determined that some of the transverse timbers were made of ash (*Fraxinus excelsior*.)” Mike McGlin, who joined the Kızılburun excavation as a volunteer in 2007 and is now pursuing post-baccalaureate work in Classics at the University of North Carolina-Chapel Hill, was given the task of sorting and cataloging hundreds of ceramic sherds (Fig. 5), from transport amphoras to bowls, lamps, and cooking pots: “The pottery sherds represent a diverse mix of vessels from various locations around the Mediterranean, including the Adriatic, the Black Sea, Egypt, and especially East Greece. Pieces with diagnostic features such as handles and toes were isolated first, but there were so many non-diagnostic body sherds that I became proficient in identifying the various ceramic fabrics based on color, wall thickness, and clay composition. One question that continued to surface is whether the presence of numerous Italian ceramics—including transport amphoras and cooking pans—could indicate the ship’s last voyage originated in a western port.” Mike also assisted archaeological director Deborah Carlson



**FIG 6**  
Marmara Drum.

with photography of transport amphoras in the Bodrum Museum of Underwater Archaeology.

For three days in August, the 2008 study season team embarked on a brief field trip to Marmara Island (ancient Proconnesus) to see the ancient quarries where the Kızılburun marble cargo originated. The trip took us first to Istanbul, where Cemal Pulak kindly gave us a tour of the most recent discoveries from the Theodosian Harbor at Yenikapı; Deborah also had the privilege to meet with Turkish archaeologist Nuşin Asgari, who has spent her career researching the marble quarries of ancient Proconnesus. From Istanbul we ferried across the Sea of Marmara to Bandırma, to Avşa, and finally to Marmara Island, where marble quarrying is still a major industry. But despite the intensive modern exploitation, one can still glimpse traces of ancient activity, like a cracked and abandoned 350-ton column drum (Fig. 6).

When not in residence in Bodrum, Deborah traveled to the Temple of Apollo at Claros near Izmir to meet with French architects Didier Laroche and Jean-Charles Moretti, who are studying the architectural remains of the temple. Comparative analysis of the unfinished drums from Kızılburun and the finished pieces at Claros suggests a strong probability that the Kızılburun column was destined for Claros; Deborah and her colleague William Aylward of the University of Wisconsin-Madison will present the results of their research in a forthcoming issue of the *American Journal of Archaeology*.

The 2008 Kızılburun study season was an essential and productive pause in the ongoing excavation of this interesting ancient shipwreck; our team will return to the site in 2009 for what is expected to be the final season.

left to right

**John Pollack**  
Institute  
of Nautical  
Archaeology

**Doug Davidge**  
Yukon  
Transportation  
Museum

**Robyn Woodward**  
Institute  
of Nautical  
Archaeology



## Yukon River Survey 2008

The Yukon River Survey continued its multi-year mission to document the numerous and well-preserved historic steam boats of the Yukon Gold Rush. The highlight of this field season was the discovery of a significant and undisturbed wreck—*A.J. Goddard*. Additionally we made further progress in both our understanding of the types of hull construction used in western Canada, and the range of sites along the Yukon River.



**FIG 2**  
Tim Dowd  
(Historic Sites, Yukon  
Government), Chris  
Atkinson (TAMU NAP)  
and the *Carolina* skiff  
on Lake Laberge.  
Photograph by John  
Pollack, June 2008.

### Field Program

The annual field project was conducted in June 2008 under permit from the Yukon Government. This year our objective was a low-water search of the Thirty Mile Section of the Yukon River. The narrow, rocky canyons of the Thirty Mile claimed more than thirty vessels in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries and to date only INA has conducted field work in this region.

The INA team included John Pollack (Project Director), Doug Davidge (Yukon Transportation Museum), Robyn Woodward (INA Board of Directors), and Chris Atkinson (TAMU graduate student). This year the Yukon Government participated via Tim Dowd (Operations Manager, Heritage Sites Branch) and provided a 21 foot riverboat. In the course of a week, the team traversed 235 km of wilderness and progressively moved north from Deep Creek on Lake Laberge, down the Thirty Mile section of the Yukon River to a takeout point at Carmacks (Fig. 2).

The trip was surprisingly productive. Four sites were located, including the most important underwater discovery in the Yukon for decades. On the first day, less than a week after the ice went out on Lake Laberge, we unexpectedly located a small (15.2 m) steel-hulled sternwheeler, *A.J. Goddard*, lying upright in 11 m of water at the northern end of the lake. At the time the find was simply a large target noted while calibrating electronics. Its identity was confirmed later that summer when Doug Davidge returned to the location first with a drop camera, and later with an ROV. The small vessel lies upright on the bottom and it is intact except for the pilot house. The boiler, engines, sternwheel, and hogging system are undamaged.

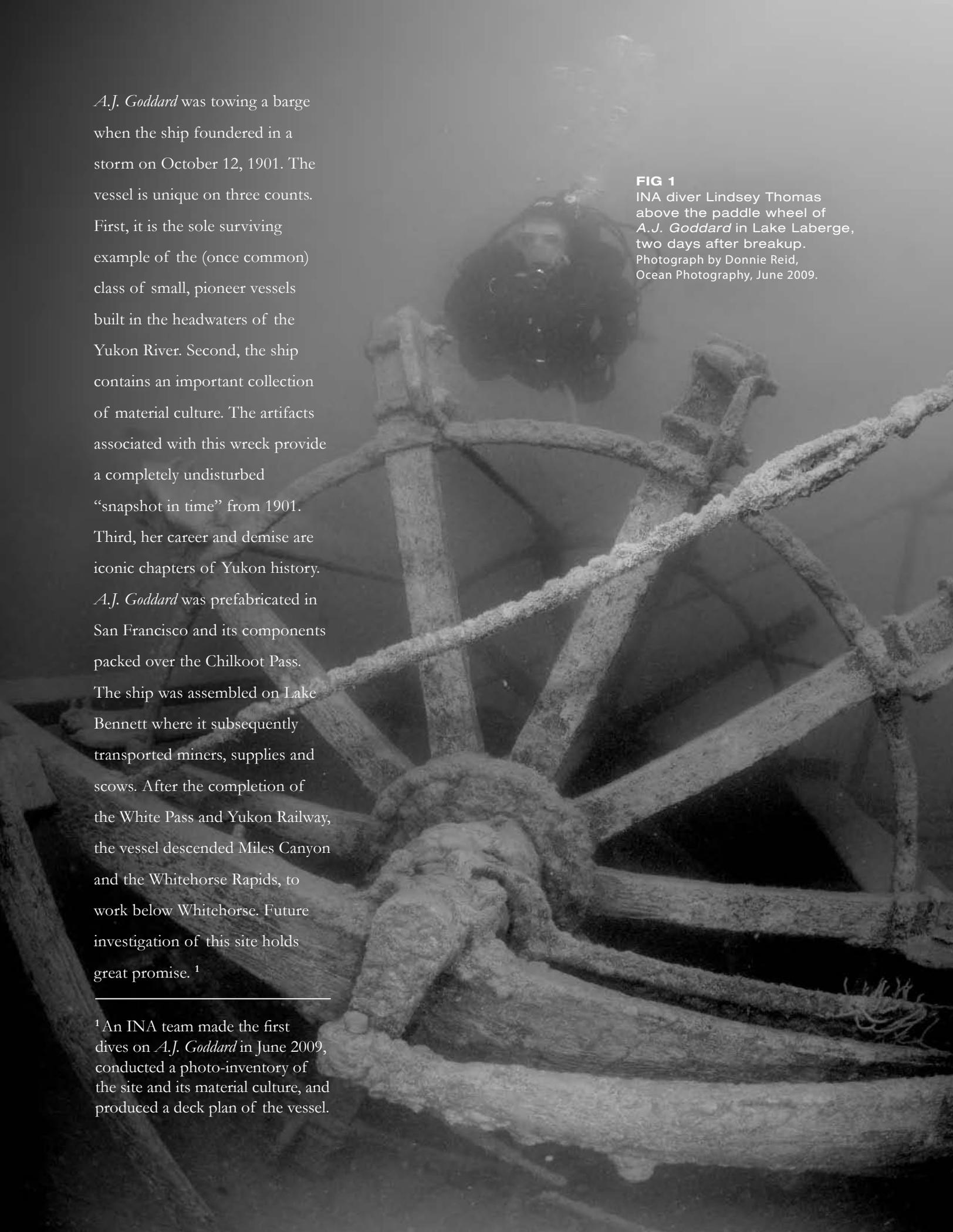
*A.J. Goddard* was towing a barge when the ship foundered in a storm on October 12, 1901. The vessel is unique on three counts. First, it is the sole surviving example of the (once common) class of small, pioneer vessels built in the headwaters of the Yukon River. Second, the ship contains an important collection of material culture. The artifacts associated with this wreck provide a completely undisturbed “snapshot in time” from 1901. Third, her career and demise are iconic chapters of Yukon history. *A.J. Goddard* was prefabricated in San Francisco and its components packed over the Chilkoot Pass. The ship was assembled on Lake Bennett where it subsequently transported miners, supplies and scows. After the completion of the White Pass and Yukon Railway, the vessel descended Miles Canyon and the Whitehorse Rapids, to work below Whitehorse. Future investigation of this site holds great promise.<sup>1</sup>

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<sup>1</sup> An INA team made the first dives on *A.J. Goddard* in June 2009, conducted a photo-inventory of the site and its material culture, and produced a deck plan of the vessel.

**FIG 1**

INA diver Lindsey Thomas above the paddle wheel of *A.J. Goddard* in Lake Laberge, two days after breakup. Photograph by Donnie Reid, Ocean Photography, June 2009.





Leaving the first find, we reached the northern end of Lake Laberge and scraped through shoals to enter the Thirty Mile. Three additional wreck sites were located over the next several days.

The first site was found above water a short distance downstream of Lower Laberge. An assemblage of machinery from a small (20 m), unidentified sternwheeler was strewn over the cobbles. (Fig. 3) Two horizontal engines, the paddle shaft, pitman arms, eccentric linkage arms, an air pump and an abundant scattering of fastenings lay exposed. The boiler and all evidence of the wooden portions of the hull and superstructure were missing. While it is possible the ship burned, no evidence of fire was found on the site.

A day later we camped near a prominent and deeply incised S-shaped meander—the U.S. Bend—further to the north. From camp the team travelled a short distance down river to an area to where the surrounding hills matched a historic photographic taken shortly after the 37.1 m, 1898 wooden-hulled sternwheeler *James Domville* was wrecked in 1899. Doug Davidge used this photograph to land the team within 15 m of a scattering of spikes, drift pins, and other fastenings associated with a large vessel. A search in the forest above the high water mark yielded small ship timbers and tongue-and-groove planks from a sternwheeler’s superstructure.

Atkinson, Pollack and Davidge made 13 drift dives down through the fast, 1 m-deep water just offshore of the metal debris field (Fig. 4). The remains of *James Domville* consisted of the lower hull and stern; no superstructure, deck beams, or machinery were present. Hull planking and frames, a cylinder timber, and lengths of steam pipe were partially buried in cobbles. It was difficult to observe the wreck due to the speed of the current, but a diver could hold onto pipes and engine bolts and remain in place for a brief period of time. The water was too swift to survey the site by conventional baseline techniques. Documentation of *James Domville* consisted of photographs of shore material, and video images captured using an underwater pole camera to record the hull, frames and timbers (Fig. 5).



**FIG 3 top left**  
The engine and paddle wheel components of a small, unidentified sternwheeler near Lower Laberge. Photograph by John Pollack, June 2008.

**FIG 4 above top**  
Chris Atkinson exits the river after “drifting” in a 6 knot current, over the wreck of the 1898 sternwheeler *James Domville*. Photograph by John Pollack, June 2008.

**FIG 5**  
Doug Davidge (Yukon Transportation Museum) and Chris Atkinson use a pole camera to search for shallow water wreckage at the 1902 sternwheeler *La France* site. Photograph by John Pollack, June 2008.

Further downstream, we searched for the 30.4 m, 1902 wooden-hulled sternwheeler *La France*. Again the river was too swift and shallow to put our sidescan fish in the water, but an hour's search yielded iron debris on the exposed cobbles on the outside of a meander (Figs. 6 & 7). The metal was a portion of hull sheathing and a strap, and the primary wreck site was discovered 250 m downstream at the mouth of a small creek. Burned tongue-and-groove planking from the superstructure lay in the brush above the high water mark, and on the cobbles lay a length of hog chain and associated turn-buckle, a hog post cap, and a massive piece of metal resembling a bow guard. This wreck was reported raised and burned in the spring of 1911, as a navigation hazard.

Again drift dives were conducted, but little was found except for several steam pipes and an upright, round timber buried in the cobbles. If present, the hull is buried under cobbles and gravel near shore. The river becomes deeper (>2.0 m) off-shore and hull remains may be exposed at depth, but the current will be prohibitively swift.

Moving steadily north, we left favourable water on the Thirty Mile to encounter flood conditions north of the junction of the Teslin and Yukon Rivers. A total station survey was planned for the giant (64.1 m) wooden-hulled sternwheeler *Klondike* but the wreck was engulfed by swift brown water, and even approaching the wreck was dangerous (Fig. 8). Flood conditions extended another 130 km downstream to our next search area—the 44.7 m, 1898 wooden-hulled sternwheeler *Columbian*. We managed to locate scattered debris on shore near Eagle Rock, including a suspected keelson in a log jam. It is likely this material is associated with the 1906 explosion and fire on this vessel. A precise location was not possible given conditions, but we have narrowed the search to a specific area, and there is an excellent chance the site of this infamous accident can be located at the next low-water visit.<sup>2</sup>



**Fig 8**  
Flood conditions and standing waves at the wreck of the 1929 sternwheeler *Klondike*. This vessel was one of the largest stern-wheelers to work on the Yukon River. Photograph by John Pollack, June 2008.



**FIG 6 top**  
Robyn Woodward locates wreckage from the 1902 sternwheeler *La France*. Photograph by John Pollack, June 2008.

**FIG 7**  
Chris Atkinson and the bow guard from the 1902 sternwheeler *La France*. Photograph by John Pollack, June 2008.

<sup>2</sup> Historic river charts at the (U.S.) Library of Congress confirm the wreck of *Columbian* is at the same location.

At this point our riverboat had been grounded repeatedly, damaging both the leg and prop, and we were low on gas. Since conditions at both the *Klondike* and *Columbia* sites prevented further work, the river trip was cut short. Gear was sorted in Whitehorse, and four of the team drove to West Dawson, some 530 km to the north. Chris Atkinson was toured through the “boneyard” of seven vessels to show him its potential for a graduate thesis, and we spent a day discussing priorities for further work (Fig. 9).

### Ancillary Projects and Publications

In addition to the field work in the Yukon, a number of other projects are underway. A hull documentation and mapping project was initiated on 49.3 m, 1898 *Moyie*, at Kaslo, BC. *Moyie* is a composite (steel-and-wood) hulled sternwheeler and a lengthened sister ship of *Tyrell* now located at West Dawson. *Moyie* is being used as a test-bed for the hull documentation methods to be applied at West Dawson, and to document the construction of the three composite-hulled sternwheelers built in Western Canada. Robert Turner, Curator Emeritus of the Royal BC Museum in Victoria, has provided substantial assistance with archival research. One discovery on this vessel is the use of a secondary, low-profile hogging system contained completely within the hull. This secondary system is located entirely below the main deck, and it is not present on shorter *Tyrell*. We believe this system was added by either the designers or the shipbuilders when the vessel was lengthened by 6 m, and the hull’s increased L/B and L/D ratios became a concern.

Work continues on a database of Western Canadian sternwheelers. Affleck (2000) and other authors have generated extensive lists of more than 1,000 vessels. Information on the Yukon and Alaskan vessels has been digitized and we are extending this work to the British Columbia fleet. This database will allow the Survey to search the list of known ships when an unidentified casualty is encountered, and it will be possible to explore trends in ship design among different regions.

Our publication strategy is two-tiered. First, each season of work is documented in a thorough file report as per the permit conditions of the Yukon Government. This approach ensures that the loss, departure or death of key staff is not an irrecoverable event. Additionally, we have begun to present and publish material through the Society of Historical Archaeology and the resultant ACUA proceedings.

There were four publication and website products from 2008.

- The annual file report to the Yukon Government (Pollack et al 2009).
- The Heritage Sites Branch requested a summary of the known wrecks and hulks. Twenty-two documented sternwheeler sites were described and summarized in a report entitled *A Catalogue of Historic Sternwheeler Wrecks and Hulks in the Yukon* (Pollack 2008).
- A detailed report on our 2008 work was posted on the Royal Canadian Geographical Society website at [http://www.rcgs.org/programs/research\\_grants/research\\_grants\\_2008\\_yukon.asp](http://www.rcgs.org/programs/research_grants/research_grants_2008_yukon.asp) in addition to print coverage in their October 2008 issue of *Canadian Geographic*.



**FIG 9**  
Inside the hull of *Julia B.*  
at West Dawson.  
Photograph by John Pollack,  
June 2008.

- The Survey's findings to date have been summarized in a paper that was subsequently given at the January 2009 meeting in Toronto and is now in-press as a paper in the ACUA Proceedings associated with that meeting.<sup>3</sup>

Given the wealth of sites and possible projects, a strategic plan for the next five years was presented to, and approved by, the INA Archaeology Committee in December 2008. Plans for 2009 include a Phase One initiative at the *A.J. Goddard* site, and a Phase Two project at West Dawson, where we will document one of two wooden-hulled king-post vessels. West Dawson will continue to be a priority of the Survey for a number of years, as the seven ships in the “boneyard” contain a wealth of comparative information. Additionally, hull documentation will continue on the composite-hulled sternwheeler *Moyie* at Kaslo, BC. Future papers will document on the range of hull designs and mechanical systems used among the sternwheelers of Western Canada, and investigation of significant sites such as *A.J. Goddard*.

### Acknowledgements

The 2008 program was possible due to the generosity of the staff of the Yukon Government, the Yukon Historic Resources Fund, the Royal Canadian Geographical Society, the Kootenay Lake Historical Society, and individual members and donors to INA and the Vancouver Maritime Museum. Our thanks to the field participants for their hard work and dedication, and to Dr. Jim Delgado and Dr. Kevin Crisman for their continued support and advice.

### Suggested Reading

Affleck, E. L. (2000). *A century of paddlenwheelers in the Pacific Northwest, the Yukon and Alaska*. Alexander Nicolls Press, Vancouver, BC.

Pollack, J. (2008). *Catalogue of Historic Sternwheeler Wrecks and Hulks in the Yukon*. File report for the Heritage Branch, Yukon Government Whitehorse.

Pollack, J., D. Davidge, and R. Woodward (2009). *A Summary Report for the 2008 Yukon River Survey*. File report for the Heritage Branch, Yukon Government Whitehorse.

Pollack, J., R. Woodward, S. Koepnick, C. Velazquez, D. Devine and D. Davidge (2008). *The Yukon River Survey—2007*. File report for the Heritage Branch, Yukon Government Whitehorse.

Pollack, J. and R. Woodward (2006). *A reconnaissance of shipwrecks located on the Yukon River between Lake Laberge and Carmacks—July 2005*. File Report to Yukon Territorial Government for Permit 05-01.

Pollack, J. and R. Woodward (2006). “A reconnaissance shipwreck inventory on the Yukon River.” *The INA Quarterly* 33:2, 23–24.

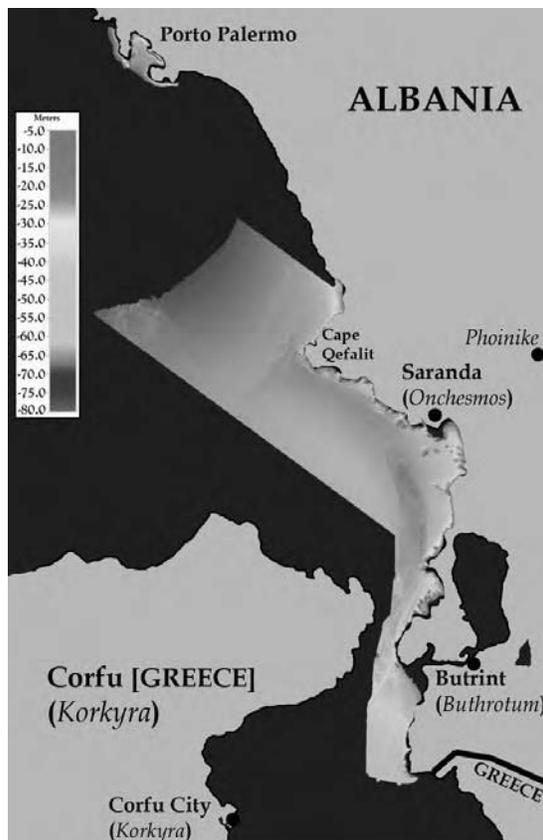
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<sup>3</sup> The January 2010 SHA conference at Amelia Island has accepted a Yukon River Symposium at which 5 papers by various INA authors will be presented.



**Jeff Royal**  
 Co-Director  
 Archaeological Director  
**RPM Nautical  
 Foundation**

## Albanian Coastal Survey Project: 2008 Field Season



**FIG 1**  
 Surveyed area at the completion of the  
 2008 field season. Map by J. Royal.

On the heels of an enlightening, educative, and successful inaugural expedition, the 2008 field season of the Albanian Coastal Survey Project proved equally rewarding. Multibeam survey of the shoreline continued northward and included Porto Palermo, while diver investigation addressed selected areas of the shoreline. RPM Nautical Foundation (RPMNF) provided equipment, personnel, and funding to carry out the project and worked in partnership with the Instituti i Arkeologjisë (Albanian Institute of Archaeology-AIA) as well as the Ministry of Culture and Tourism. Directed by Dr. Adrian Anastasi (AIA) and the author (RPMNF) the project received crucial assistance from Auron Tare of the Butrint National Trust, Dr. Neritan Ceka (AIA), and Dr. Nicolle Hirschfeld of Trinity University. Dr. Hirschfeld's participation included the ongoing assessment of the Butrint I wrecksite, an early 3<sup>rd</sup>-century BCE amphora carrier, as a potential INA excavation project. The Ministry of Defense made generous contributions to the project in the use of their naval base at Saranda. Additionally, the Waitt Institute for Discovery provided financial support for several dive volunteers and Dr. Hirschfeld.

A two-month period of July and August were slated for both phases of the project. The naval base at Saranda served as the operational center for both multibeam and diver operations, as RPMNF's vessels and dive support containers were provided dockage and storage space. The survey began at Albania's southern border with Greece in the 2007 field season with a goal to move systematically northward and complete a multibeam

survey of the seafloor between the 25 and 120-m contour. By the end of 2008, the completed multibeam survey area reached past Saranda to Kakomea Bay just north of Cape Qefalit; a point approximately 37 km from the southern border (Fig. 1). An additional area of multibeam survey was conducted in, and on the outer portion of, Porto Palermo, and included efforts to fill gaps from 2007. Much of the survey was limited to the midpoint of the Corfu Straits, approximately the 80-m contour, which was typically a few kilometers from shore. However, north of Corfu the survey reached out to the 100-m contour to areas over 10 km offshore. The diver investigation was conducted in selected spots along the shoreline south of Saranda where divers reached the 35-m contour. As dive operations are less efficient, only small sections of the shoreline in the survey area were completed. For both phases of the expedition, the sediment outflow of the Butrint River was an obstacle in that the heavy deposits have buried cultural deposits near its mouth.

Anomaly verification by the ROV in deeper waters along with the diver investigation discovered during the 2008 field season resulted in a total of nine wrecksites, two significant artifact concentrations, and numerous random finds. Five of the wrecksites were modern, while the remaining four were from the Greek and Roman eras. Although there were over 50 anomalies remaining at season's end, these will be a reassessment of many anomalies located in areas with verified geologic formations and where mud-mounds formed by the prevailing currents were discovered.

All five of the modern sites are ships or other material from the 20<sup>th</sup> century, four of which are likely associated with military craft. A WWII-era minesweeper located several kilometers outside the Butrint River mouth has buried to a significant degree due to the sediment outflow of the river. RPMNF detected this vessel during the 2007 field season and the Waitt Foundation was provided with its coordinates in order to test their ROV and recording capabilities. Its steel structure is relatively well preserved and many construction features remain visible. It is possible this wreck is the 1000-ton HMS *Regulus* reported sunk by a mine in the Corfu Straits on January 12, 1945. *Regulus* was an *Algerine*-class minesweeper built in 1943 that measured 235 feet in length and had a beam of 35.5 feet. Investigation of another deposit resulted not in a ship but rather the landing craft carried by a likely WWII-era military ship. Two armored transport vehicles were located 60 m apart from one another and approximately 3 km off Cape Qefalit. Both vehicles lay upside down and are covered in netting; these nets are snags from fishing in the area. Their engine blocks, chassis, and large tires are all clearly visible. Photographs sent to the Imperial War Museum in the United Kingdom indicated the tires and vehicle attributes are consistent with those of WWII British military vehicles. Although unknown, it is possible these vehicles were part of the British invasion forces at Kakomea Bay. Also off Cape Qefalit, and near to the armored vehicles, rests a metal wreck that carried 50-gallon metal drums and large tires as part of its cargo. These tires are of similar dimensions and type to those found on the armored vehicles. It is not possible to firmly date such a wreck based on this material alone, but the nature of this material in conjunction with the nearby WWII-era material argue for a similar period.

The remains of two warships are also among these modern-era sites. At the entrance to Porto Palermo a small warship of circa 30 x 7.5 m sits at a depth of 77 m. Its metal hull and decks are relatively well preserved, yet the ship is buried in the heavy sediment endemic to this natural harbor.

Its large stack at midships and single large gun situated at the bow, with a possible stern placement as well, indicate a vessel that operated during the first decades of the 20<sup>th</sup> century. Another modern find was the remains of a metal hull replete with scattered tableware, many large and small concretions, and other unidentified objects; the type and nature of the deposit is yet undetermined.

One of the more immediate findings from the previous season's fieldwork was a high representation of material from ancient Corinth and Korkyra (modern Corfu) in this area. The Butrint I wreck discovered that same season highlighted the significant presence of Corinthian amphoras from the Archaic through Hellenistic periods. Conspicuous is the lack of finds from other areas of Greece, or for that matter, the greater eastern Mediterranean. The 2008 field season underscored these findings as three of the four ancient wrecks discovered were laden with Corinthian material, and the majority of amphora concentrations and random finds were also of Corinthian origin.

Investigation of a mound situated only a few kilometers off Cape Qefalit revealed the remnants of a merchantman's cargo. The site is dominated by a c. 15 x 6-m ovoid mound of sandy mud, approximately ½ meter high with a scatter of amphoras protruding from its surface. Approximately 8 to 10 of the amphoras appear intact, many of these buried with their mouths protruding out of the mud. The majority of the remains are of amphora portions and large sherds scattered about. Undoubtedly the drag nets used in this area damaged the wrecksite over time. After a systematic imaging fly-over of the site to produce a plan, one intact amphora

was identified for retrieval in order to provide identification and a date range (Fig. 2). Once taking the amphora's position on the site with the ROV, a small amount of mud was removed from directly around its buried base. Once sufficiently freed from the sediment, the amphora was retrieved and field recorded onboard *Hercules*. This squat, globular amphora was of Corinthian form B produced from the characteristic yellow-hued fabric associated with ceramic production at this ancient city. Its shape and attributes indicate a date in the late 6<sup>th</sup> to early 5<sup>th</sup> century BCE.

Another wrecksite discovered in shallow water south of the Butrint River mouth had similar Corinthian amphoras as the previous wreck. Unlike the deeper wreck, however, this wrecksite sits upon shoreline rock that receives large wave and storm churning, as well as rock tumble from the adjacent hillside. Consequently the amphoras here are badly damaged and broken in many small fragments covering an area of about 20 m<sup>2</sup>, with several sherds noted buried under rock tumble. Most of the exposed fragments are covered with growth and it was common to encounter sherds fused into the surrounding rock (Fig. 3). Fortunately, several intact upper portions and bases were available for analysis that indicate a Corinthian cargo of a date between the late 6<sup>th</sup> to mid-5<sup>th</sup> century BCE.

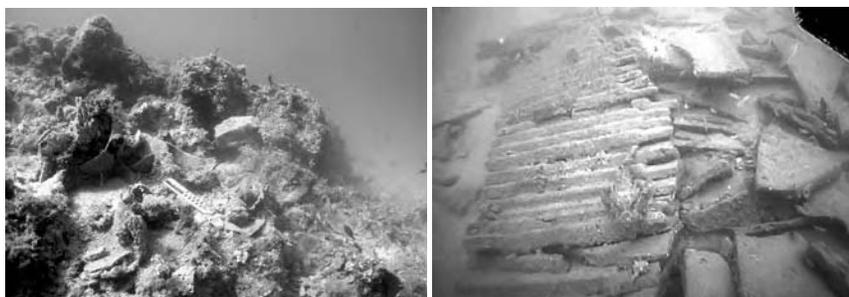
An interesting deeper wreck found over 7 km off Cape Qefalit remains in good condition despite its exposure to fishermen's drag nets. The reason for its comparatively good condition is in large part due to its cargo of roofing tiles (Fig. 4). Instead of individual amphoras that can separate as a wreck degrades and settles, this tile cargo is stacked and forms an interlocking and compacted deposit. Once partially buried in the sand it forms an integrated deposit resistant to displacement. Both pan and cover tiles are present in the cargo that extends some 15 m in length and 6 m in width. Fewer than 10 amphoras were noted in the investigation of the site, and the majority of these were located on one end of the deposit. A full video recording was made of the site that will assist in producing a site plan. A single fragmented pan tile lying at the edge of the site was removed for examination. Its flange angle and dimensions are characteristic of Greek types and the yellowish-brown color of the clay indicates Corinthian manufacture (Fig. 5). Corinth was widely renowned in the ancient world for its high quality tiles, these being used in large-scale construction across the Aegean. Additionally, one intact amphora at the edge of the site and one upper portion of an amphora lying circa two meters off the site were collected for identification (Figs. 6–7). Both collected amphoras are variants of type Corinthian A; at least one Corinthian B type amphora was also noted on the site. Each of the collected Corinthian A and observed Corinthian B types from the site are consistent in form with those of



**FIG 2**  
Corinthian B amphora of the late 6<sup>th</sup>–early 5<sup>th</sup> century BCE (AB08 AF-0001). Photograph by J. Royal.

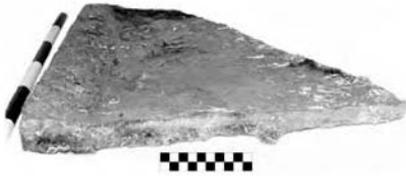
the 4<sup>th</sup>-century BCE. Interestingly only one of the collected amphoras possessed the yellow-colored fabric typical of Corinthian origin. The other had a reddish-brown paste associated with ceramics produced on Korkyra; a find congruent with the recent discoveries of kiln sites on Corfu that produced amphoras of Corinthian form. The mix of finds on a wreck located here transporting building materials further north highlights the regional economic integration of the northern Ionian and southern Adriatic coastal communities.

While Corinthian A and B types were among the random finds along this southern shore, there were at least two small concentrations of Corinthian amphoras in the area south of the Butrint River mouth opposite



**FIG 3 far left**  
A concentration of sherds among, and fused into, the rocky shore. Photograph courtesy of RPMNF.

**FIG 4**  
A cargo of roof tiles, many of which remain in their stacking pattern. Photograph courtesy of RPMNF.



**FIGS 5-7** left to right  
Corinthian pan tile fragment  
(AB08AG-0002).

Smaller variant of a Corinthian type A amphora found exposed on the tile wrecksite (AB08AG-0003).

Upper portion of a Corinthian A amphora found just off the tile wreck (AB08AG-0001).



Photographs by J. Royal.

Corfu. Each of these two artifacts concentrations has 7–10 amphoras, several of which are buried to varying degrees; however, in neither case were large concentrations detected from limited hand probing into the sand. One of these deposits consisted of all Corinthian B amphoras of 3<sup>rd</sup>-century BCE form; thus, it is possible that a wrecksite lies buried here or in the vicinity upslope. The second deposit has greater chronological diversity, ranging from the 5<sup>th</sup> century BCE through the Roman Imperial period, and includes both Corinthian types some of which may be Korkyran in origin, along with Roman variants. It appears this deposit is also buried to some degree; although not characteristic of a wrecksite, such mixed deposits are usually formed by jetsam from vessels waiting at a natural shelter or anchorage.

This high representation of Corinthian, and to a lesser extent Korkyran, evidence for material shipped through the Corfu Straits northward speaks directly to Corinth's economic involvement in this region. The inhabitants of the coastal lands from the northern

Ionian portion of Greece through southern Croatia associated themselves at different periods with the kingdoms of Illyria and Epirus. Here Greek city-states vied amongst themselves for economic advantage in part through trade relations with established cities, and through the foundation of colonies in areas with desired resources and/or markets. Although independent, Greek colonies frequently maintained special economic and political ties with their founding cities, which was often demonstrated, for example, by their mimicking of the founding city's coinage.

Colonization efforts by Corinth extended from Sicily to the southern Adriatic, and include the foundation of Korkyra (modern Corfu City) as well as Epidamnus (modern Durres) and Apollonia in Albania. Over time these colonies blossomed into cities whose wealth and power both supported, and yet sometimes rivaled, Corinth. Present evidence for Corinthian type amphoras on shipwreck sites, and at numerous land sites, are correlated with the location of Corinthian colonies along with the overseas routes connecting them (Fig. 8). Most of these shipwreck sites date to between the 2<sup>nd</sup> and 4<sup>th</sup> centuries BCE. Prior to this survey, excavations on Corfu, and at Apollonia, Durres, and a few other Albanian sites provided the primary evidence for the distribution of both Corinthian amphora types in the Adriatic. Hence, the emerging maritime evidence for the robust, and nearly exclusive, shipping of Corinthian goods in the S. Adriatic-N. Ionian emphasizes the particularity of trade relationships and the resultant economic integration of the region. Furthermore, the two wrecksites with late 6<sup>th</sup>/early 5<sup>th</sup> century BCE Corinthian cargos provide some of the earliest direct evidence to date for such overseas exchange. It is envisioned that the Albanian Coastal Survey will continue to provide maritime evidence for long-distance exchange in Corinth's economic sphere, as well as other cities and states of the greater Adriatic, and possibly wider Mediterranean, region.

Among the single amphoras scattered both along the coast, and in deeper, offshore waters, were numerous ceramic examples from across the Roman era. Among these were some of the most common amphora types found in this part of the Mediterranean, which included Greco-Italic and Lamboglia 2 variants dating to the Republican period as well as

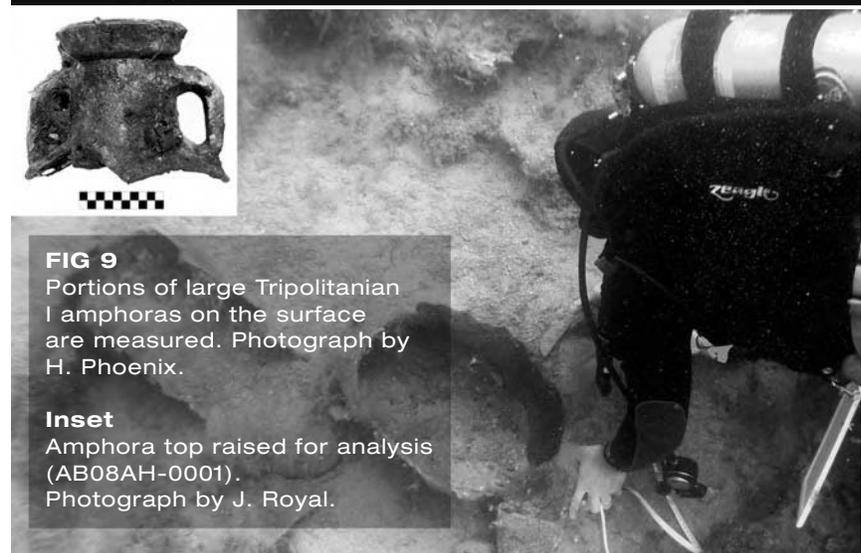
Imperial Dressel 6 and Late Roman 2 types. In addition to the many random finds, the survey recorded the cargo remains of a Roman shipwreck located south of the Butrint River's mouth. The site's surface is comprised of around five nearly intact portions and numerous large sherds partially buried in the sandy slope (Fig. 9). All of the amphoras observed on the site, as well as a neck-rim-handle fragment raised for analysis, appear to be of type Tripolitanian I (Fig. 9 inset). These large, cylindrical amphoras were over 1 m in length and produced during the 1<sup>st</sup> and 2<sup>nd</sup> centuries CE to carry olive oil from North Africa. Research on fabric analysis indicates that this amphora type was primarily produced in two areas, modern Tunisia and Libya; on initial field analysis, the fabric of the raised fragment corresponds to the former. Beyond a local North African trade, evidence for the overseas distribution of Tripolitanian I amphoras comes primarily from the Eastern Mediterranean and Italy.

Submerged material evidence from the Albanian Coastal Survey Project directly advances our understanding of exchange, inter-regional relationships, and sea routes for this historic, and still relatively unknown, area of the Mediterranean world. Amphora and other ceramic evidence from the survey attest to overseas trade from the 6<sup>th</sup> century BCE through Rome's expansion and extended rule of this area and into the Byzantine era. This growing body of archaeological data will further assist in research of the ancient through medieval and modern periods of history. Intensive

investigation of specific sites, such as the Butrint I wrecksite under consideration by Dr. Hirschfeld for excavation, will increase our knowledge and open new lines of inquiry. Another positive and important outcome of the project is the growing involvement by Albanian and other students. Particularly gratifying for the Albanian students is their role in the protection and study of their nation's cultural heritage. As we move into the 2009 season, RPMNF endeavors to expand the scope of this region's investigation by initiating similar projects in the neighboring countries of Montenegro and Croatia.



**FIG 8**  
Association of known shipwreck sites with primarily Corinthian amphora cargoes and Corinthian colonies. Map by J. Royal.



**FIG 9**  
Portions of large Tripolitanian I amphoras on the surface are measured. Photograph by H. Phoenix.

**Inset**  
Amphora top raised for analysis (AB08AH-0001). Photograph by J. Royal.

Jeff Royal

Archaeological Director **RPM Nautical Foundation**

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Director **Montenegrin Coastal Survey Project**

## Exploring the Shores of Ancient Illyria



**FIG 1**  
Some of the major cities in the Illyrian region. Map by J. Royal.

There are compelling aspects for working in the eastern Adriatic-northern Ionian Seas for an archaeologist. Besides the relatively little archaeological research performed in the waters south of Croatia, the length of this coast was once home to the ancient Illyrians. This amalgamation of tribes formed a sometime loose state whose people were the ancestors to today's inhabitants of Albania, Montenegro, and Croatia. The confederation of chiefdoms forming what is first regarded as the Illyrians began to coalesce around the 13<sup>th</sup> century BCE, and became a prominent political force by the 5<sup>th</sup> century BCE. Their rise brought them into contact with the expanding number of Greek settlements and eventually their incorporation into the Roman state.

Among many cities either founded or overtaken during the Illyrian era of pre-eminence were Skodra, a seat of many Illyrian kings, and Byllis in Albania, as well as Risan in Montenegro (Fig. 1). As Illyrian power rose, Greek cities along the coast came under their sway as far south as Butrint; although Alexander briefly checked Illyrian independence until his death. Reinvigorated entering the 3<sup>rd</sup> century BCE, Illyrian attacks on Greek coastal cities and Adriatic shipping fueled their re-emergence as a regional power. The legendary Queen Teuta moved the Illyrian capital to Risan, some 20 km inland, as Risan and Kotor Bays (Boka Katorska) offered a safe port (Fig. 2) for preying Liburnia. From here Illyrian raiding at sea became a significant enough threat to force a Roman reprisal. After an eventful reign of three years, Teuta abdicated as part of the settlement with Rome in 227 BCE. Eventually, the growing power of the kingdom of Epirus and further forays into Illyria by the Romans at the end of the 3<sup>rd</sup> century and into the 2<sup>nd</sup> century BCE helped

weaken, and eventually fracture, the Illyrian confederation. Although it succumbed to Roman forces, the cultural construct of Illyria survived as the province of Illyricum formed in 125 BCE. By 77 BCE, Dalmatia was folded into the Roman province and the incorporation of the final Illyrian territories was completed by 59 BCE. Tiberius crushed a last rebellion by Illyrian tribes in 6 CE three years later and under Imperial rule the province flourished with many cities growing in prominence as Illyrian culture was woven into the fabric of the Roman world. Although a reconfiguration in early 2<sup>nd</sup> century CE left former Illyria segmented into the provinces of Dalmatia, Macedonia, and southern Pannonia, under Diocletian much of the southern Balkans through Macedonia, Greece, as far as Crete became the Prefecture of Illyricum.

Through the 2008 field season in Albania, the discovery of numerous shipwreck and artifact finds carrying Corinthian goods established this city as one of the foremost in the Greek settlement efforts along the shores of Illyria. Little is known, however, about colonization efforts and the nature of trade north of Apollonia. Maritime evidence of Roman trade from southern Albania is also present, to a lesser extent relative to Greek evidence, but does indicate widening Mediterranean contacts. Although the cities that rose to prominence during the Roman period remain further north, in the current 2009 field season a 4<sup>th</sup>-century CE shipwreck carrying N. African amphoras has been discovered just south of Porto Palermo (Fig. 3).

The opportunity to initiate a survey of the Montenegrin coast in 2009 was especially gratifying in that it expanded the exploration of this ancient and historically rich



**FIG 2**

View of Boka Katorska from atop the medieval fortress above Kotor, ancient Risan was situated around to the right in the bay. Photograph by Jeff Royal

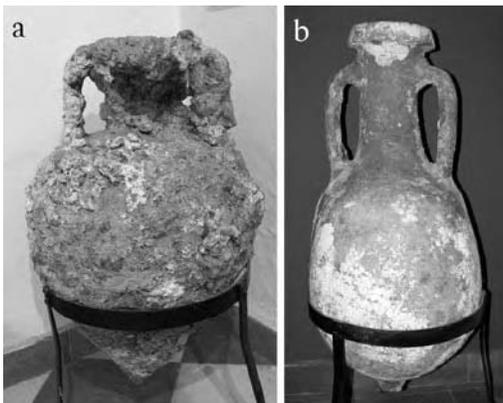
coast. Although ongoing, the inaugural field season of the Montenegrin Coastal Survey Project has already produced interesting results as work progresses from Boka Katorska to the coastline at the northern border with Croatia. The project was conducted in conjunction with Regional De-Mining Center headed by Mr. Veselin Mijajlovic and the Center for the Protection of Cultural Heritage, under the Ministry of Culture and Tourism. Examination of earlier finds along with new discoveries indicates great promise for the project.

Evidence of Corinthian as well as early Italic and Roman trade are noted in finds from Boka Katorska displayed in the local Kotor Maritime Museum (Fig. 4). These Corinthian wares date to the 4<sup>th</sup> century BCE, the final period of a forceful Greek presence in this quarter. Two shipwrecks on the outer coast discovered during the project's current operations include a late-Republican wine carrier and a large tile carrier probably of Imperial date. The Roman merchantman transporting wine came to rest over 2 km from shore (Fig. 5). All of the observable amphoras, representing at least two stacked layers, are consistently Lamboglia 2 type amphoras produced along the eastern Italian coast between the 2<sup>nd</sup> and 1<sup>st</sup> centuries BCE. Although some of the amphoras appear displaced from dragnets, most remain in their relative position to one another that suggests they settled based on their stacking pattern. The mound height and exposed tops indicate more layers of amphoras lay buried. The other, nearby wrecksite did not have amphoras observed on its uppermost remaining layers. Rather, both pan and cover tiles comprise a large shipment on what must have been a vessel of significant dimensions (Fig. 6). These tiles are in several stacks, many of which are now positioned vertically. The pan tile's c. 65 x 45-cm dimensions and flanges at an angle of 90° are characteristic of Roman manufacture during the Imperial era. Remains of Roman occupation in Kotor and Risan are evident; in particular the recently preserved mosaics in Risan, occupied by the Romans in 165 BCE, that are within the remains of a 2<sup>nd</sup>-century CE villa. Moreover, this section of coast witnessed substantial Roman colonization efforts (Fig. 1). An Illyrian heritage is not lost on the coastal inhabitants of Albania and Montenegro, and in at least a broad sense, provides a degree of common



history. Their shared story remains as one of the few links that bind the peoples of the eastern Adriatic. As with all RPM Nautical Foundation projects a primary goal is to assist host countries with the location, identification, and archaeological study of submerged cultural resources along their coasts. Current efforts on seas once associated with Illyrian piracy and plunder aims to prevent the modern plunder of these submerged cultural resources.

An additional goal particular to the Albanian and Montenegrin projects is forging a modern link between the people based on archaeological exploration of their mutual history. With connections now forming with scholars and government representatives in Croatia, it is hoped that the exploration of the ancient Illyrian coast will expand to its full potential.



**FIG 3 left top**  
Roman wrecksite of primarily African type 3 amphoras along with some LRA2 variants in Albania. Photograph by H. Phoenix.



**FIG 4 left (a-d)**  
Amphoras at the Kotor Maritime Museum; a, c, and d - Corinthian type B amphoras; b - Lamboglia 2 type amphora. Photograph by J. Royal.

**FIG 5 bottom left**  
Wrecksite with a cargo of Lamboglia 2 amphoras in Montenegro.

**FIG 6 bottom right**  
Roman roofing tiles forming a large wrecksite in Montenegro. Photographs (Figs. 5 and 6) courtesy of RPMNF.





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## Butrint I Shipwreck Excavations: A Collaborative Effort

In the course of their first season of surveying the southern coast of Albania in 2007, the RPM Nautical Foundation discovered (among other things) a deposit of about forty amphoras, probably the remains of a shipwreck (currently designated as “Butrint I”). Jeff Royal identified the amphoras as dating to the 3<sup>rd</sup> century BCE, originating from Corinth or a Corinthian colony. The following summer, the Waitt Institute of Discovery (WID) sent a team of three divers (Derek Smith, Liz Smith, and Joe Lepore) to explore the feasibility of excavating the site. At George Bass’ suggestion, Nicolle Hirschfeld, a graduate of the Nautical Archaeology Program and now teaching at Trinity University (San Antonio), was invited to assume leadership of that scouting expedition. Nicolle’s Nitrox training was paid for from a fund set up by Claude Duthuit to promote fieldwork in Albania; WID funded all other aspects of the expedition. Nothing could have been accomplished without the active help of Auron Tare, Director for the Promotion of Cultural Heritage, Culture, Tourism and Economical Development for the Capital of Albania, and long an advocate for archaeology, including underwater archaeology, in Albania. Dr. Adriani Anastasi, professor at the University of Tirana and the Director of the Department of Underwater Archaeology, Institute of Archaeology, is our collaborator and the official government representative for all underwater projects, including the Butrint survey. Finally, we could not have managed without Ardiola Alikaj, our translator and general helpmate. She is just finishing her graduate studies in the department of archaeology at Tirana University.

Two weeks before our scheduled start date, *Plan B*, WID’s research vessel, was suddenly unavailable. WID’s plan B—the hiring of a local boat as a base of operations—was also cancelled at the very last minute by Auron Tare, because he worried that this would precipitate looting of the wreck (after our departure). It is thanks to the generosity of George Robb and the RPM crew that we were able to proceed with the mission. George kindly

allowed us to use their RHIB and scheduled us for the first dives each morning, when the water was smoothest. The WID/INA team had 3½ mornings (18, 20, 21, 22 Aug.) of diving, 2 dives of 20-30 minutes each. Our objective was a reconnaissance of the site found by RPM the previous summer, in order to determine whether and how to excavate it.

The site is located approximately 50m off-shore, scattered down and along a steep, silt-laden incline. Approximately forty amphoras are visible, fanning from the uppermost visible amphora (at ca. 30') to a spread of approximately 50m at about 75'. Most of the amphoras lie at this depth, collected against and around a rock ledge. The fact that substantially preserved amphoras protrude up from the silt even far upslope suggests that that thick layer preserves considerable material within it. On the other hand, intensive scouting revealed no traces of amphoras at any significant distance below the ledge.

The visible amphoras are all at least large pieces, the majority are more than half intact and many are even more fully preserved. As Jeff Royal noted, most of the amphoras are a Corinthian B/Corcyraean type (large and small variants) dating to ca. 285–260 BCE. He also identified several potential production areas (Corinth, Corfu, perhaps Apollonia). The large number of amphoras of a single type, their fairly intact condition, and their seabed distribution suggest that this is a wreck—not a jettison—site.

The only non-ceramic find was a removable lead anchor stock lodged on a boulder of the rock ledge, in the midst of the densest

accumulation of amphoras. Given the other intrusive material on the site and the fact that the stock was found on the boulder (rather than directly in and among the amphoras that had accumulated around the boulder), the association of this stock and the wreck amphoras is not absolutely certain. If the stock does indeed belong with the wreck, Jeff notes: “Considering there are few examples of this type of removable lead anchor stock, particularly in a well-dated context, this find associated with an early 3<sup>rd</sup>-century BCE amphora cargo is important to the study of anchor technology and development in the Hellenistic–Early Roman period.”

Unless there is substantial wood under the silt, this wreck should take only 1 to 2 seasons (depending on the scale of excavation) to document and excavate. Its limited extent and the probability that the bulk of finds will consist of ceramics (i.e. relatively easy to conserve) make it an optimal project for “getting our feet wet” in Albania.

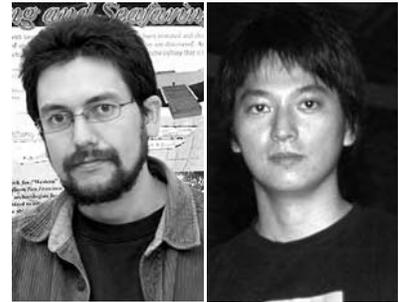
The wreck is interesting historically, for it promises to add information not attested in our Atheno-centric literary sources. Corinth’s geographical position assured it an economic and political importance in every age of Greek history, including the Hellenistic period, but no Corinthian narrative has survived. Instead, we must piece together Corinth’s story from snippets in foreign authors and from its widely distributed ceramic exports. Dr. Neritan Ceka, one of the pre-eminent figures in Albanian archaeology, was quite excited about the amphora pulled up from Butrint I (by RPM in 2007) because it fits into a larger pattern

of increasing numbers of these amphoras found in Albania. What was Corinth’s agenda along the western shores of Epirus and farther north? This wreck is a part of that puzzle. Jeff Royal suggests that the amphoras on the Butrint I wreck might be associated with Pyrrhus’ expeditions to southern Italy and Sicily. Pyrrhus was a king of Epirus and Macedon during the period of the Butrint I wreck and a fierce (if ultimately unsuccessful, hence the term “Pyrrhic victory”) enemy of Rome. Excavation of the wreck may provide evidence to corroborate Jeff’s theory. In any case, it will certainly illuminate Corinthian involvement in the greater Hellenistic world.

Another catalyst for excavation is that the wreck is in imminent danger of being looted. As mentioned above, Auron Tare is so concerned about this that he decided to turn down WID’s proposal to use a boat rented from the local fishermen as a base of operations. Even so, several fishermen passed by us daily during our week of RHIB-diving on the wreck and doubtless have noted the spot as a place of interest. Its depth should shield it from casual looting, but the burgeoning tourism and nascent diving activities along the coast surely will not keep this known location safe from prying exploration for long.

Finally, there is the potential to contribute positively to a modern story. Excavation of the 3<sup>rd</sup>-century shipwreck could be a catalyst in training and assisting Albanians to discover and manage their maritime archaeological resources. The Butrint coastline is littered with the wrecks that history and topography indicate should be there. They are still largely

undisturbed by divers. Liz Greene was awarded a Fulbright to come to Albania more than a decade ago, to explore the possibilities of underwater excavations. The time was not right. But now it is. The country is politically and economically stable and the incipient tourism market is growing logarithmically. Saranda—across the straits from Corfu and the nearest tourist-friendly town to the UNESCO World Heritage Centre archaeological park of Butrint—is an example of the speed and scale of this fast growth, and of its damages. Within five to ten years, the Albanian coast will be jammed with tourists, including divers, and the now relatively non-commercial boardwalk of Saranda will be packed with hawkers selling tickets for day-boat excursions. We envision excavation of the Butrint I shipwreck as a training ground not only for students affiliated with the Nautical Archaeology program or Trinity University, but especially for Albanian students of archaeology and conservation who will become the protectors of the country's maritime cultural heritage. INA has the foresight to participate in and encourage this vision. Excavations begin summer 2011.



left to right

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## Northern Vietnam Anchor Documentation and Assessment

In the fall of 2007, Vietnamese archaeologist Dr. Vu The Long asked for assistance in identifying the origins of possible anchors from China that were raised by local fishermen on the Red River of Northern Vietnam. Dr. Long thought the anchors might be from the Mongol invasion of Vietnam in 1288 and knowing of Randall Sasaki's work on the Mongol-Chinese shipwrecks in Takashima, Japan (a previous INA Project), Dr. Long believed that Sasaki might be able to identify the anchors. Both Dr. Long and Sasaki agreed that the potential of bringing INA to the region would be a valuable asset in archaeological research, and so INA's first preliminary archaeological survey plan in Vietnam was organized. The purpose of this project was to record and identify the anchors, as well as conduct a preliminary survey assessing the possibility of locating shipwrecks related to the Mongol invasion of Vietnam. In 1288, the invasion ended in a climactic battle on the Bach Dang River, the main ancient channel to the Red River, connecting Hanoi and the gulf of Tonkin. Here at low tide, the Vietnamese forces secretly planted wooden stakes, essentially sharpened trees, to lure, trap and finally destroy the invading Mongolian fleet (Fig. 1).

The Bach Dang River, the main route for the Mongol naval forces attacking the Dai Viet capital in 1288, was the site of another invading fleet's loss. It is interesting to note that battles were also fought in 938 and 981 against Chinese invaders who sought to establish firm control over Vietnam. The area where the battles were fought is still generally known and some stakes have been discovered, including a number that have been studied by Vietnamese archaeologists. Nevertheless, little is known regarding the distribution pattern of these stakes and no comprehensive survey using either remote sensing technology, or any large scale mapping of the battle site has been conducted. For this reason, it was determined that the team might be able to assist Vietnamese archaeologists in mapping and locating additional wooden stakes, and possibly, locate a shipwreck,



**FIG 1 Stakeyard** Photograph by Randall Sasaki, June 2008.

**FIG 2 inset**  
**Owner of the anchors with Anchor No. 1 pictured here in his home.** Photograph by James Delgado, June 2008.

or shipwrecks from the period, ideally from the battle, a naval encounter about which we know very little. This year's preliminary survey was supported by RPM Nautical Foundation, and was able to organize a team with a large variety of participants. Together with Dr. Long from Vietnam, Dr. James Delgado, Claude Duthuit, George Belcher, and Randall Sasaki joined from INA, while Dr. Mark Staniforth and Jun Kimura came from Flinders University in Adelaide to be a part of this project in 2008.

### Summary of Work

In May 2008, an international team from INA and the Maritime Archaeology Program at Flinders University conducted a preliminary survey. The purpose of the survey was to record the two wooden anchors and to assess the archaeological potential for a further survey at the battle site on the Bach Dang River. The two wooden anchors (No.1 and No. 2) are stored in a private house in

Hanoi (Fig. 2). To determine the historical significance of the two anchors, photographic recording, offset measurements, and material sampling were conducted.

Anchor No. 1 (Fig. 3) is a single arm anchor and the length of the shank is about 6 meters. It is unfortunately deteriorating. Anchor No. 2 (Fig. 4) has double arms and it is in better condition than Anchor No. 1. Anchor No. 2 has a shank length of 5.9 meters. The two anchors include metal flukes on the ends of the arms. Wooden tenons joining the arms and shank were observed. By making small, rough models of the anchors during the survey, the pattern of the ropes used to fix the arms to the shank were carefully reconstructed. For material analysis, a piece of wood from the shank of each anchor and a portion of fibers from ropes were collected with permission from the owner of the anchors.

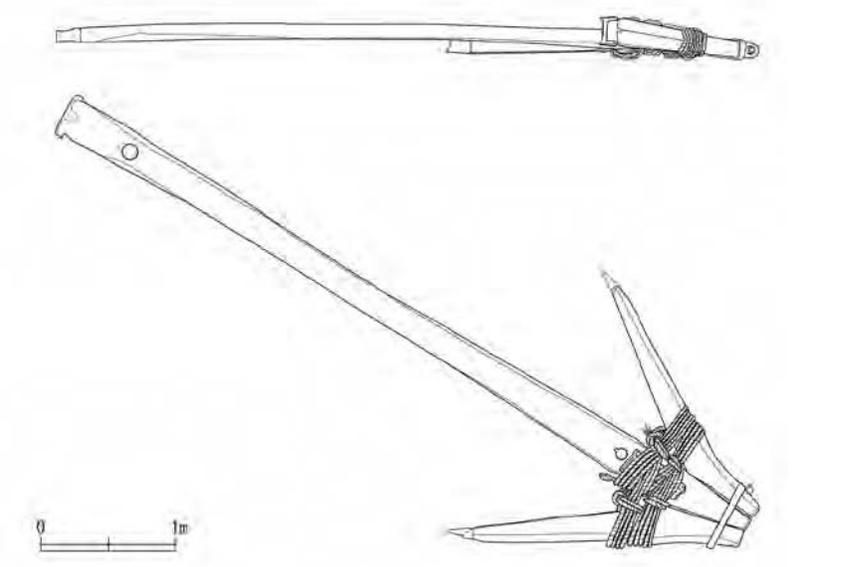
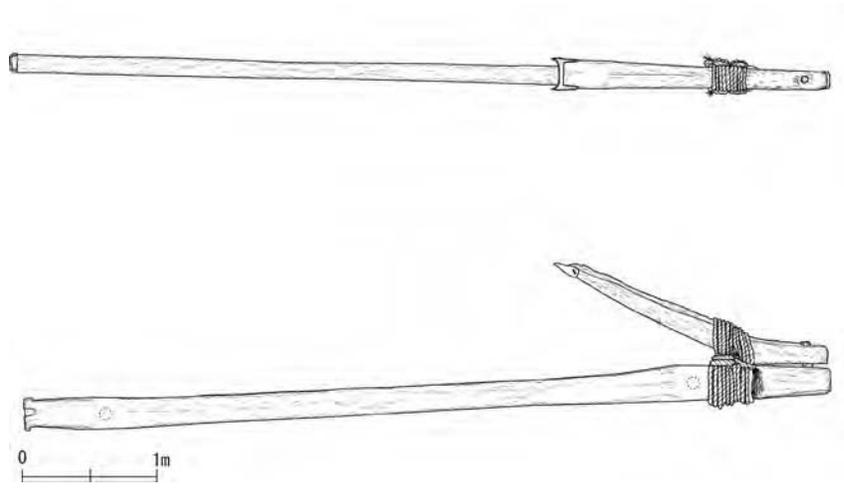
The two anchors have been compared with wooden anchors recovered from the site of the

Mongol invasion of Japan in 1281, the Takashima Underwater Sites and the two types of anchors are not similar. Further post analysis continues in order to determine the origin of the two anchors. Scholars such as C.R.G. Worcester and Joseph Needham demonstrated the importance of the study of wooden anchors in their encyclopedic work of Chinese ships. (Worcester 1971; Needham 1971.) The same can be said for other Asian anchors. One of the most important resources for Vietnamese anchors is a naval architectural drawing of a local Vietnamese vessel depicted on "*Souvenirs de Marine* (1882–1908)", which includes the image of its wooden anchor. A picture scroll dating to the early 17<sup>th</sup> century, *Tosen no Zu* now stored in Japan's Matsuura Historic Museum, is probably the most accurate resource to provide the dimension and configuration of wooden anchors used for ships of East and Southeast Asia origin. (Oba 1974) A wooden anchor recovered from

one shipwreck in Thailand waters may be a comparative resource as archaeological evidence. As a result of historical research and comparative study, it was concluded that the anchors do not date back to the time of the Mongol Invasions, a period known as the Yuan Dynasty in China, but later and was perhaps built in Southeast Asia. In addition to comparative study, the C14 analysis of the wood samples indicate 17<sup>th</sup> to 18<sup>th</sup> century as the origin of these anchors. The fibers from the rope are assigned a preliminary identification of coconut husk. The wood sample from Anchor No. 1 was identified as being from the Sapindaceae family and the sample from Anchor No. 2 as being from the *Dialium* sp. of the Fabaceae family. The results therefore suggest the two anchors were built in Southeast Asia from local materials.

The second major part of the project consisted of visiting the museums to record and analyze wooden stakes in their collections, conducting a preliminary field investigation to survey the general topography and to assess the archaeological potential of the battle site, and finding local archaeologists (and institutions) that might be inclined to become partners in a project to survey, excavate and study the stakebeds from the battle and any associated shipwrecks.

As previously noted, the general areas where the battle took place is known, and some wooden stakes protrude from rice fields where the river channel existed in the past (Fig. 5). Several institutions, including the Institute of Archaeology (of Hanoi) conducted excavations in the area starting in 1958, when a number of wooden



**FIG. 3** top to bottom  
Anchor No. 1. Drawing by Jun Kimura.

**FIG. 4**  
Anchor No. 2. Drawing by Jun Kimura.

**FIG. 5**  
Wooden stake protruding from rice field.  
Photograph by Randall Sasaki.





**FIG. 6**  
Mural of the Battle of Bach Dang at the Hanoi History Museum.  
Photograph by James Delgado.

stakes were recovered from the site. It is these stakes that are now being displayed at several museums in Vietnam. The team visited the National Museum of Vietnam History (Fig. 6) and the Military History Museum (Fig. 7), both in Hanoi, and the local museum near Bach Dang in Quang Ninh province. The stakes there were briefly analyzed with photographs and drawings. Some stakes were difficult to record in detail because they are now museum displays (Fig. 8). The team learned that additional stakes are stored at the Institute of Archaeology, as well as timbers that may perhaps be part of a large wooden artifact, perhaps a vessel.

The team traveled to the stakebeds to survey the area on foot (Fig. 9). One area excavated by the Institute of Archaeology has been preserved and is open to the public. It is not known to which period these stakes belong, and there is conflicting written evidence



**FIG. 7** left top  
Stakes displayed  
in Military History  
Museum. Photograph  
by James Delgado.



**FIG. 8** left bottom  
Bach Dang City  
Museum. Photograph  
by Randall Sasaki.

regarding how and where these stakes were planted. We traveled on foot around the area to see if we could locate additional stakes. The composition of the soil in the area showed little disturbance and the ancient channel of the river we believe can be assessed by a specialist in geoarchaeology to identify the ancient river channel and additional areas where stakes and shipwrecks from the battles should be.

There were several positive outcomes from this initial phase of the project. We located several wooden stakes protruding out of the middle of rice fields (Fig. 10). The locations of these poles were recorded using GPS. Local archaeologists have asked residents not to disturb these poles, and with the help of both the archaeologists and residents (Fig. 11), we will be able to locate and map these and other wooden stakes in the area. Another positive result was the identification and documentation of local shrines and monuments erected in the area to commemorate the battles. More survey of these structures may also aid in identifying the possible location of the battle site(s) based on local memory and legend.

The last days of the project were used to establish partnerships with the local archaeological communities and locating additional information on previous archaeological research on the Bach Dang River site. The Institute of Archaeology of Hanoi, as the national organization that directs archaeological projects in Vietnam, was another new partner to emerge from this phase of work. The Institute has been considering promoting the study of maritime archaeology in Vietnam, and welcomed a return to Vietnam

to work in this area to develop not only a project but to help build Vietnam's internal capacity to conduct this type of work. As a result of the work in 2008, intensive survey is planned for coming seasons supported by the National Geographic Society/Waite Institute of Discovery. As with 2008, the survey of 2009 is a collaborative project consisting of members from Texas A&M University, Flinders University, University of Southampton, and the Institute of Archaeology of Hanoi. The result of 2009 will be available in the next issue of *The INA Annual*.

### Bibliography

- Delgado, J. P. (2009). *Khubilai Khan's Lost Fleet: In Search of a Legendary Armada*. University of California Press, Berkeley.
- Hiên, Lê Năng (2003). *Three Victories on the Bach Dang River*. Culture-Information. Publishing House, Hà Noi.
- Needham, J., P. Y. Ho., G. W. Lu., and L. Wang (1971). "Civil Engineering and Nautics." *Science and Civilization in China, Volume 4: Physics and Technology Part 3*. Cambridge University Press, Cambridge.
- Oba, O. (1974). "Scroll Paintings of Chinese Junks which Sailed to Nagasaki in the 18<sup>th</sup> Century and Their Equipment." *Mariner's Mirror* 60.
- Vice-Admiralty Paris, (1882). *Souvenirs de marine*.
- Worcester, G. R. G. (1971). *The Junks and Sampans of the Yangtze*. Naval Institute Press, Annapolis.

**FIG 9** opposite top  
Randall Sasaki and  
Jun Kimura  
documenting  
stake at Gen Yiang.  
Photograph by James  
Delgado.

**FIG 10** inset  
Locating a stake.  
Photo by Randall Sasaki.

**FIG 11** bottom  
Villager points out  
stakes at Gen Yiang  
to Dr. Vu The Long  
and George Belcher  
Photograph by James  
Delgado.







with Contributions by Rhonda K. Robichaud and Steven Bilicki

left to right  
**James P. Delgado** INA  
**Frederick Hanselmann** Indiana University/INA  
**Dominique Rissolo** Executive Director Waitt Institute for Discovery

# A Submerged Cultural Resource Reconnaissance

Mouth of the Río Chagres and Approaches in the Republica de Panamá



**FIG 1**  
 Detail from the Tallis map of Panamá (1851), showing the location of the Río Chagres and the village of Chagres. James Delgado Collection.

Between January 23 and 31, 2008, a team of archaeologists and scientists from the Waitt Institute for Discovery and the Institute of Nautical Archaeology, joined by the crew of the research vessel *Plan B*, conducted a non-disturbance survey for submerged cultural resources off the mouth of the Río Chagres in Colon Province, in the Republica de Panamá. The work was conducted under the terms of an archaeological permit issued on January 21, 2008 by the Instituto Nacional de Cultura. The project was supported by the Waitt Institute for Discovery, of La Jolla, California.

The area surveyed during this project lies on the Caribbean side of the Isthmus of Panamá, in the center of the country and approximately seven nautical miles (nine kilometers) from Colon and the entrance to the Panamá Canal. The prominent feature is the

mouth of the Río Chagres, which emerges from the isthmian jungle to drain into the Caribbean. The project area lies immediately offshore of the 12,000-hectare San Lorenzo Protected Area and the Castillo de San Lorenzo, a national historic site, and, since 1980, a UNESCO World Heritage Site (Larson 2002). The waters off the Castillo de San Lorenzo, as well as the associated land sites, have attracted professional archaeological attention as well as interest from treasure hunters.

## Historical Summary

The submerged cultural resources of the mouth of the Río Chagres, as a collective group of sites and remains, form a significant maritime cultural landscape along with the site of the village of Chagres and the Castillo de San Lorenzo. This maritime cultural landscape also includes the natural resources of the area, such as the *Morro* or Peñon on which the Castillo rests, the sandbars and beaches at the river's entrance, Lajas Reef, and the river's channel itself—all of which influenced and were impacted by the human activities that have occurred here over the last 500 years.

Maritime activity in the project area commenced in the prehistoric period as human settlement along the banks of the Río Chagres introduced watercraft for transportation and for harvesting fish and other aquatic resources. The first European encounter with the river was in December 1502, when Spanish explorer Christopher Columbus' fourth and final expedition anchored a short distance from the mouth of the river at a place the local natives called *Huiva* (probably modern Limon Bay) (Morison 1942:620–621).

Following Columbus' voyage, other 16<sup>th</sup>-century explorers entered the mouth of the river (Fig. 2), but none ventured very far up it, as fallen trees and debris clogged the river. It was not until a 1527 expedition by Hernando de la Serna, who made the trip by canoe, that explorers determined that the river was navigable (Anderson 1911:302). In February 1534, after two subsequent surveys of the river, the Crown ordered the



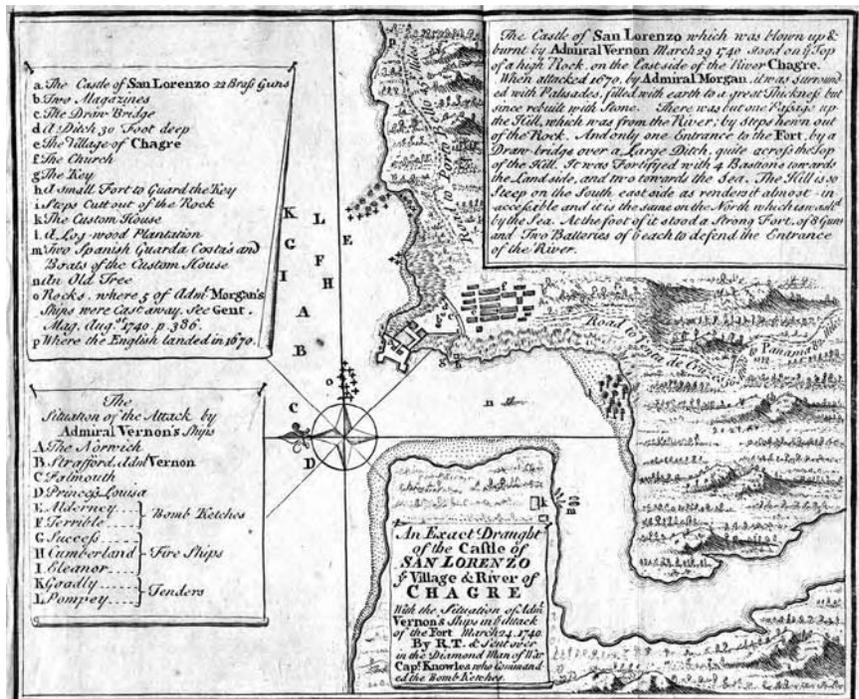
**FIG 2**  
Mouth of the Rio  
Chagres. Photograph  
by James P. Delgado,

Governor of Panamá to spend one thousand gold pesos on clearing the river and erecting a warehouse for goods at the point where the river met the sea (Anderson 1911:302). The river then became a partial highway across the Isthmus of Panamá (Ward 1993:57–58). The Chagres was a means for water transportation of goods to and from Panamá City on the Pacific, and that port's connections via sea to South America, Mexico and Spain's Pacific possessions in the Philippines.

The river was both a strategic asset and liability. In 1534, King Filipe II of Spain ordered the fortification of the river's mouth. The river was not fortified, however, when English buccaneer Francis Drake sailed up the river to attack the town of Cruces in 1571. Fortification of the entrance began in 1597–1599 with the construction of a water-level battery, built to plans prepared by military engineer Bautista Antonelli. That fort, named el Castillo de San Lorenzo el Real de Chagre, was first fitted with guns in 1626.

The Castillo de San Lorenzo de Chagres would go through four separate incarnations. The first was the 1597–1599 water battery, ruined and subsequently abandoned after a pirate attack in 1656. It was replaced with a star-shaped earthwork and wooden-palisaded fort atop the *Morro* or cliff (Ward 1993: 170). That fort was destroyed in 1671 by forces under the command of buccaneer Henry Morgan. Rebuilt as a three-tiered stone fortress in 1677–1680, San Lorenzo gave rise to an associated village, Chagres, in the 1680s. The fort was again destroyed by a punitive British raid in 1740 by Admiral Edward Vernon (Fig. 3). The third and final fort, constructed within a decade of Vernon's raid, is the source of the ruins currently on the site (Figs. 4 and 5). By the time the third fort's construction, Spain had abandoned the Chagres as a route for trans-shipment of treasure, and the area around the fort declined. At this time, as well, a map of the mouth of the river and fort showed a logwood

**FIG 3**  
Map of Chagres, showing the Castillo, the position of Vernon's fleet and the attack of 1740, and Lajas Reef, where 5 of Adml. Morgan's ships were cast away," from the Gentleman's Magazine, August 1740. INA Collection, Gift of G. Donald Geddes III.





plantation off the village of Chagres—a logical enterprise since the logwood trade with Britain via the West Indies was one of the few potentially lucrative trades available to locals with the end of goods coming down the river from Panamá City. At that time, Chagres served largely as a backwater port and a point for illicit smuggling carried on by British mariners from Jamaica collaborating with Panamá City merchants (Bancroft 1887:491). Jamaica dominated British West Indies trade with Central America throughout the 18<sup>th</sup> century (Hinckley 1963:109) and was the only major link between Chagres and the outside world after 1780.

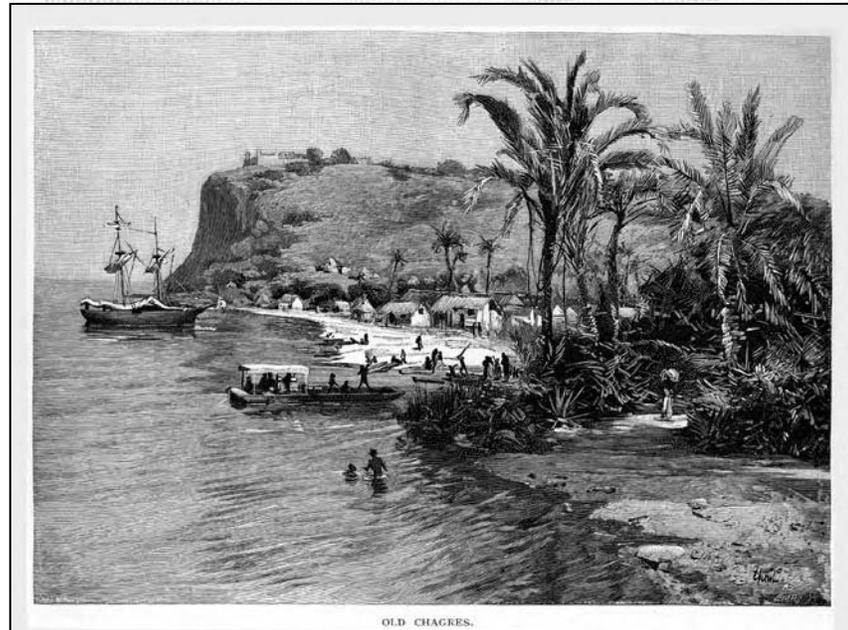
After the illicit trade declined, regular trade continued through the early 19<sup>th</sup> century, although at a greatly diminished level, declining further following Panamá's independence from Spain in 1819 as part of Bolívar's Gran Colombia, and later as part of New Grenada (Colombia). The town remained a backwater of maritime activity until the California gold discovery of 1848 and the subsequent "Gold Rush" of 1849–1855 (Fig. 6). The selection of Chagres as a steamer port-of-call influenced its selection as the port that gold-seekers bound to California would arrive at after

**FIG 4** above  
Entrance to the  
Castillo de San  
Lorenzo. Photograph  
by James Delgado.

**FIG 5** inset  
Castillo de San  
Lorenzo, detail  
from an 1851 map of  
Panamá.  
James Delgado Collection.

1848. By 1849, Chagres, and a new, neighboring settlement, “Yankee” or “American Chagres,” catered to the needs of arriving gold seekers who stopped briefly enroute to Panamá City via the old water and land route via the Chagres and Cruces, as well as returning “49ers” from California who caught steamers anchored off Chagres for the voyage north to New York.

**FIG 6**  
Chagres,  
just before  
the California  
Gold Rush,  
circa 1848.  
James Delgado  
Collection.



The construction of the Panamá Railroad from 1849–1855 gradually shifted traffic to the modern port of Colon, and by January 1855, when the railroad finally reached Panamá City, Chagres again declined into a backwater. Ironically, the original railroad route was to have run from Chagres to Panamá City, but the low water of the river during the summer and transportation problems shifted the interest of the Panamá Railroad Company to Colon in March 1850 (Perez-Venero 1978:67). After that, as the railroad ventured farther across the isthmus, Chagres’ fortunes as a port declined, and then died.

In 1911, Chagres was described as a “sleepy settlement of a few hundred people, containing a modern church and a public school” (Anderson 1911:8). Around the same time, visiting journalist Willis J. Abbott described Chagres as fronting “a bay perhaps a quarter of a mile wide” and as “a native village of about fifty huts with an iron-roofed church in the center” (Abbott 1913:79). By that time, the United States had established Fort Sherman, several miles distant, on the shores of Limon Bay, to help guard the approaches to the Panamá Canal, then under construction. The U.S. demanded the site of Chagres, so the Government of Panamá acceded to American demands, and a new village site, Nuevo Chagres, was created. By the time of the First World War, Chagres was abandoned, ending the occupation of a site inhabited for at least centuries, if not millennia. Subsequently, the site of Chagres and river mouth, occupied by the U.S. Army, remained an active, and occasionally fortified military reservation until 1999. Following the U.S. withdrawal, the area and the waters around it became a protected area.

## Project Area as a Maritime Cultural Landscape

The significance of the river and this area is both national and international, as recognized by an early 20<sup>th</sup> century historian; “for four centuries the Chagres has been the bond of union between the two great oceans of the world, the way between the East and West, the key to the portal of the South Sea” (Anderson 1911:7). Another historian called it “the world’s most valuable river,” calculating value on its role as the source of the Panamá Canal’s fresh water, but also noting its rich history, including “seeing more gold” than all the world’s other rivers combined (Minter 1948:3, 5). This broad-based assessment of the Chagres’ history reflects the essential truth that while there are key events in the history of the project area, such as Columbus’ visit, the establishment of the Castillo de San Lorenzo, the pirate attack of 1671, the subsequent British assault of 1740, and the inrush of shipping and people during the California Gold Rush, the flow of human history here, like that of the river itself, is strong and reflects an essential continuity of purpose. We propose to contextualize that history—as represented in the physical record—as a “maritime cultural landscape.”

The concept of the maritime cultural landscape is at its most basic level the combination of archaeological resources related to maritime activity, whether they are on land and in or on the water. A maritime cultural landscape can encompass shipwrecks, and associated sites on shore, such as lighthouses, fortifications, docks and wharves, warehouses and shipyards, but it can also include “the natural geography...the details of roads, coasts, routes, harbours, (e. g. the steepness, shallow banks) and the directions of prevailing currents and winds” (Westerdahl 1991 and Westerdahl 1998:2).

The concept of the maritime cultural landscape provides an ideal framework for assessing the diverse and extensive collection of structures, sites and material culture of the project area. Collectively, the natural features, human modifications, structures, and associated remains such as discarded materials, and shipwrecks not only represent, but also tell the story of five centuries of maritime activity in and around the entrance to the Río Chagres. There is also a very real possibility, with the inclusion of pre-Columbian sites known to exist in the project area, to extend the scope of study and interpretation of the Chagres maritime cultural landscape to a 1,000 to 1,500-year span. While some aspects of that history are of particular significance, it is important to note that all aspects, and all traces of that history, as represented in the archaeological resources, have significance as a complete and collective record of maritime activity in one of the world’s most significant focal points for shipping, Panamá, and in particular, the entrance to the Río Chagres.

## Potential Archaeological Resources in the Project Area

The waters off El Castillo de San Lorenzo and the sites of Chagres and “Yankee Chagres” have been known to contain a variety of submerged cultural resources for decades, although a professional archaeological assessment of those resources was not undertaken, recommendations for such a survey have noted the potential for materials lost or discarded in the water as well as shipwrecks. A detailed archival search has apparently yet to be conducted to assess the total number of potential shipwrecks in the project area.

In addition to the shipwrecks, the river bottom should also contain a wide array of material culture associated with the settlements of both Chagres and the later “Yankee Chagres,” including landing sites, discarded materials from the settlements, items disposed of in the water, including ballast, anchors, and debris from ships as well as lost cargo or personal items. It should also be noted that the sites on land of both Chagres settlements would also be present in the archaeological record. Even the short temporal span of “Yankee Chagres” (1850–1855) would leave a substantial archaeological record given the large number of visitors who passed through the settlement, albeit even if measured in terms of discarded alcoholic beverage bottles in a trash dump.

## Treasure and Relic Hunter Reports

Treasure hunter Robert F. Marx reported in 2004 that he had discovered the remains of Morgan’s ships in 1954, had recovered materials from them, and later returned to find the wrecks had been removed in 1970:

In 1954, when I was a diver and salvage expert in the U.S. Marine Corps, I was in Panama for a short time and looked for the *Oxford*. I had, as a guide, a copy of an old manuscript with a chart showing the position where all five of Morgan’s ships were wrecked in 1670. The reef, with waves breaking over it, was easy to find and so were vestiges of the pirate wrecks embedded in it...I spent an exciting five days digging in the reef and discovered many artifacts from Morgan’s ships... Eighteen years passed before I was

able to return to Panama with a salvage vessel to explore Morgan's wrecks further. Anticipation turned to disillusionment when I found nothing but deep holes in the coral reef where salvors had used explosives to dislodge the cannon and anchors. (Marx 2004:136)

Reports and discussions with locals document the removal of a large number of artifacts removed from the waters off the Castillo de San Lorenzo and taken abroad for sale to collectors. Discussions with local residents confirmed that materials including bottles, ceramics and coins were recovered from the beaches and shallow waters off the Castillo and Chagres town sites during the period of the American military occupation, especially after the introduction of scuba diving in the 1950s.

### Archaeological Observations

The survey crew initially conducted a reconnaissance of the river entrance to look for obstructions and to measure soundings in the area. Diving later during the project determined that the bottom in the area is a mix of sand and bottom sediments of mud/clay matrix running from the river with a hard rock/coral reef formation (Lajas Reef), rocky shoreline and one outcropping from the shoreline in the area of the Castillo de San Lorenzo.

The survey located three distinct remote sensing features: 1) a large acoustic feature of natural composition associated with numerous magnetic changes from below the Castillo de San Lorenzo; 2) a multi-component magnetic anomaly on the north-west of the river's opening; 3) and a smaller multi-component magnetic anomaly below Lajas Reef.

Diver assessment identified one shipwreck site at Lajas Reef with features consistent with a 17<sup>th</sup>-century shipwreck and one probable 19<sup>th</sup>-century iron anchor and a 19<sup>th</sup>-century bottle. Diver assessment revealed a scatter of 18<sup>th</sup> and 19<sup>th</sup>-century artifacts but no visual features that were diagnostic vessel features off the Castillo de San Lorenzo, but it is probable that shipwreck material and other cultural remains are represented by the magnetic data. Additional anomalies inside the river mouth may represent additional shipwrecks or buried structures from ca. 1942–1945 military use. Features consistent with the military use of the area were observed in the shallows of the river bank.

Additional material culture was identified by diver and snorkel survey off the former Chagres town site and beneath the Castillo de San Lorenzo (Fig. 7). This material and its relationship to the maritime cultural landscape, as well as preliminary assessment of the anomalies and what one identified shipwreck may represent are reviewed in the discussion that follows.

### Resources Likely to be Associated with Morgan and the 1671 Attack

Archaeological survey of the waters off Castillo de San Lorenzo did not find any remains in the waters off the fort from the 1671 attack and destruction of the fort. The fort destroyed in 1671 was a wooden palisade, and any archaeological remains of the structure if they exist would lie beneath the layers of subsequent fort construction.

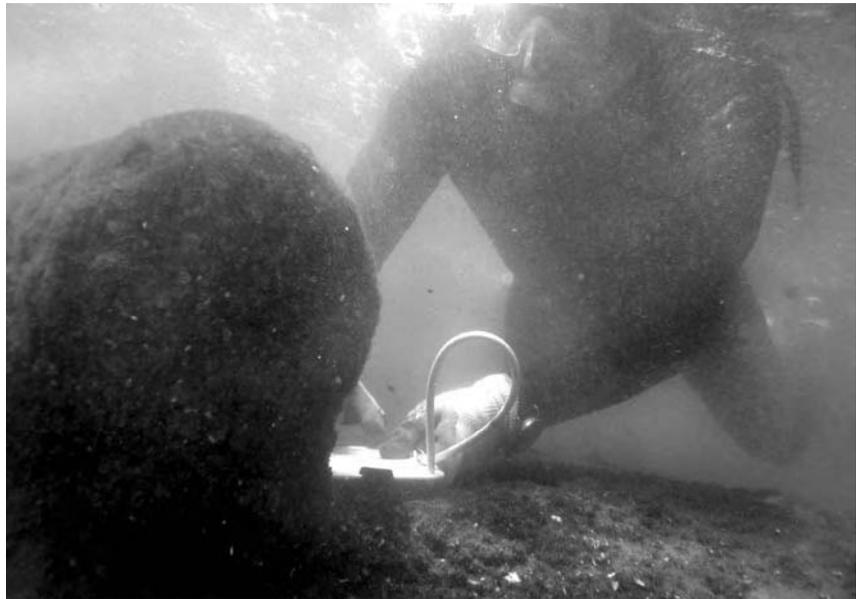
Survey of Lajas Reef confirmed reports of guns and anchors, the former seemingly related to the loss of some of Morgan's ships (Fig. 8). The most notable artifacts were eight iron cannon of various (small) sizes. Visibility, current and surf conditions varied each day, and the guns were not all sighted or mapped until the final day of the survey. The guns are all small weapons, all heavily concreted. There is little discernable taper. While more definitive identification of the guns is not possible unless they are removed, cleaned and put through conservation, the following general observations can be made:

Table: Cannon Dimensions

Cannon	Length	Muzzle Diameter	Muz. Circ.	Breech Diameter	Br. Circ.	Trunnion Diameter	Trun. Circ.
1	33"	5.5"	18"	under rock			
2	42"	4.9"	16"	9"	Concreted	1.56"	
3	56"	6"	24"	10"	29"		
4	38"	4"	16"	10"	30" *		
5	33"	5"	12"	10"	Concreted		
6	40"	9"	22"	1'3"	32"		
7	25"	8"	17"	10"	24"		
8	24"	8"	u/a	u/a			
* with concretion							

**FIG 7** right  
Cannon discovered  
in shallows beneath  
the Castillo de San  
Lorenzo.  
Photograph by Dominique  
Rissolo.

**FIG 8** below  
Gun on Lajas Reef.  
Photograph by Fritz  
Hanselmann.



### Discussion/Conclusions on the Cannon

The eight cannon noted here lie in close proximity to the magnetic anomaly previously noted which suggests that a shipwreck lies at this edge of Lajas Reef and is buried adjacent to it in bottom sediments. The size and shape of the cannon, despite concretion and the probability that their exposed environment on the reef has apparently rolled and damaged them, suggests that cannon #s 1, 5, 7 and 8 are small shipboard guns of the 16<sup>th</sup> to 17<sup>th</sup> centuries. They would be breech-loading swivel guns of the less than one pound range. Rail-mounted, these were anti-personnel weapons that could be loaded with shot or grape for close-in fighting.

This style of weapon was developed in the 16<sup>th</sup> century, and remained in use both on naval and merchant vessels through the 17<sup>th</sup> century, although Lavery (1987) notes they were obsolete on English vessels by the 17<sup>th</sup>

century although a 1707 wreck, *Association*, included French-manufactured guns of the type, indicating ongoing French use of swivel guns (Lavery 1987:104). This type of gun reentered service in the 18<sup>th</sup> century (ibid.) Tucker (1989) states that the typical swivel gun of the 18<sup>th</sup> century varied between 34 and 36 inches in length, 1.5 to 1.75 inches in bore, and utilized shot that weighed either .50 or .75 pounds (Tucker 1989:98).

The guns at Lajas Reef fit within those ranges. Gun #5 is within a few inches and may be a slightly larger swivel gun. The sizes and shapes of the other guns suggests smaller weapons, perhaps in the 3-pdr. range or less, and of types that in English use were termed “murderers,” “minions,” “falcons” “falconettes,” and “port-pieces,” which were 16<sup>th</sup> and 17<sup>th</sup>-century guns considered obsolete in English use by 1635, although some may have continued in use later into the century (Lavery 1987:103).

The type of gun, the date range, and the location of the weapons on Lajas Reef suggest a shipwreck of the 16<sup>th</sup> to 17<sup>th</sup> century, and the possibility of an association with the known wrecks of Morgan’s ships in 1671. Salvor claims that the wreck of Morgan’s *Satisfaction* of 1671 was found by them on Lajas Reef may relate to these guns and/or other artifacts. There is clear evidence of salvage activity on the reef that corroborates that salvage activity has taken place in close proximity to these weapons.

### Evidence of Salvage Activities on the Reef

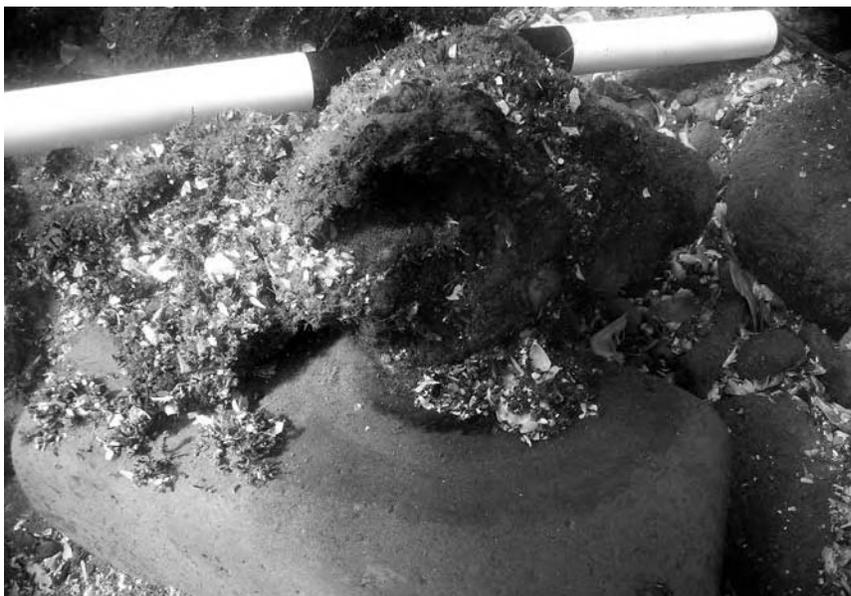
During dives on Lajas Reef, a number of areas were observed where the reef surface had been subjected, at some time in the recent past, to blasting and digging. The extensive nature of some of the areas confirms accounts of treasure hunting activities in this area, and hints at as of yet undetermined damage to the archaeological site of the apparent 16<sup>th</sup> to 17<sup>th</sup>-century shipwreck site on and immediately off the reef.

As to what this damage to the reef indicates in regard to the wreck of *Satisfaction* or other wrecks on Lajas Reef is that salvor accounts of the presence of these vessels and the recovery of artifacts from them is accurate and that considerable damage to the sites, at least in regard to those that once were on the reef, has occurred. However, it is important to reiterate that cultural materials and a probable shipwreck remain next to the reef, as indicated by the presence of the magnetic anomalies in the sand at the southwest end of the reef in close proximity to the exposed cannon. Given the temporal range of the guns, it is also likely that the wreck is a contemporary (17<sup>th</sup>-century) vessel and therefore could represent the wreckage of one or more of the ships from Henry Morgan’s fleet.

### Resources Likely Associated with Vernon’s 1740 Attack

Survey activities directly off the Castillo de San Lorenzo documented an array of material in the shallows directly beneath the fort’s walls. This included ceramic tile and brick, cut stone, cannon, balls and shells, ceramic sherds and glass shards. The survey of the waters beneath the fort was not comprehensive but rather was a two-day reconnaissance of the area intended to assess the presence and probable association of any material culture in the shallows.

Some of the cut stone and brick are attributable to fallen materials from the current (1762) fort. Other building material observed on the site appears to be from the fort, destroyed in 1740 during the English attack. This includes broken and loose brick and stone that lies compacted in the shallows that are associated with iron concretion and damaged iron cannon, shot and shell (Fig. 9). Two cannon were found at the tip of the point, close to the documented location of a water battery destroyed by Vernon in 1740. These guns lie in an area sufficiently off the cliff that suggests they were deliberately deposited as the result of the demolition of the water battery. What this suggests is that the material in the waters off Castillo de San Lorenzo represents a more or less undisturbed remnant of the “battlefield” of 1740.



**FIG 9**  
Brick and associated mortar shell fragment in the shallows below the Castillo, possibly 1740 battle debris. Photograph by Fritz Hanselmann.

### Resources Associated with the Settlement of Chagres, 1680–1849

Off the fort, and directly in front of the original site of Chagres, a wide array of material culture sits in waters ranging from one to three meters in depth. This area was noted in maps dated 1762 as being the site of a logwood plantation. A curving mud bank, discernable by sonar, roughly approximates the outer boundary of the plantation as delineated in that map. In the middle of the logwood plantation, as delineated on the map, a gap is depicted. The position of this gap is the approximate location of a rock feature observed in 2008. We believe that this is a feature of the original “embarcadero” of the settlement of Chagres, and at some period the rocks were placed out into the water to facilitate access between vessels anchored or moored in the river channel and the settlement. The majority of the material culture spotted in the shallows appears to be from the Gold Rush (1849–1855) period. However, two fragments of majolica (Fig. 10), and two broken ceramic *botijas*, as well as fragments of what appear to be 18<sup>th</sup>-century bottle glass were noted in a snorkel survey. None of these materials were recovered.

## Archaeological Resources Associated with the Gold Rush Period (1849–1855)

Diver and snorkel survey of the waters at the river mouth, as well as isolated finds on Lajas Reef date to the 19<sup>th</sup> century, and most appear to relate to the Gold Rush activity at Chagres. The most prominent of these artifacts is a small, single anchor of the Admiralty pattern style, which is lodged on the western end of Lajas Reef in close proximity to the cannon. One palm, exposed on the reef, and the end of the stock, with its ring, are missing. This may be from erosion or the loss of the anchor on the reef. The anchor was not measured or drawn due to heavy surge conditions. The anchor is probably not of the same period as the guns, and may be a snag from one of the many Gold Rush era vessels said to have anchored off San Lorenzo and driven toward shore by the wind and heavy seas. Documentation and further analysis of the anchor is necessary. Additional Gold Rush-era material culture included an intact black glass bottle noted in a crevasse in the reef, broken black glass bottles, and two ceramic fragments observed off the Chagres town site (Fig. 11).

## Military Use (1915–1999) and the Second World War (1939–1945)

At the Castillo itself, a concrete searchlight mount on the parapet of the Castillo de San Lorenzo, overlooking the river, is most probably a First World War (1917–1918) installation. The most obvious Second World War period installations noted during the survey were two concrete pillboxes

off the old Chagres embarcadero. The shallows offshore from the two pillboxes included a number of expended rounds (bullets) as well as cartridges, including some that were unfired. Other military remains include the probable mounts for the Second World War pontoon bridge that crossed the mouth of the Chagres.

Given the late nature of the U.S. Army materials (in terms of the long history of the site), it would be an easy conclusion to identify them as intrusive features, especially if their installation impacted or destroyed archaeological remains of the site's earlier history. However, the U.S. fortifications and structures represent a continuation of the historical use of the river as a strategic waterway, and while smaller, and of less impressive visual impact as the Castillo de San Lorenzo, they nonetheless are an important part of the maritime cultural landscape at the mouth of the Chagres, and historical archaeological resources in their own right.

## Conclusions

The approval of the permit by INAC is greatly appreciated, as is the privilege and opportunity to work in Panamá. The survey of the project area was made possible entirely by the support of the Waitt Institute for Discovery and the crew of the R/V *Plan B*, as well as the support of the contributing scientists and scholars (Fig. 12).

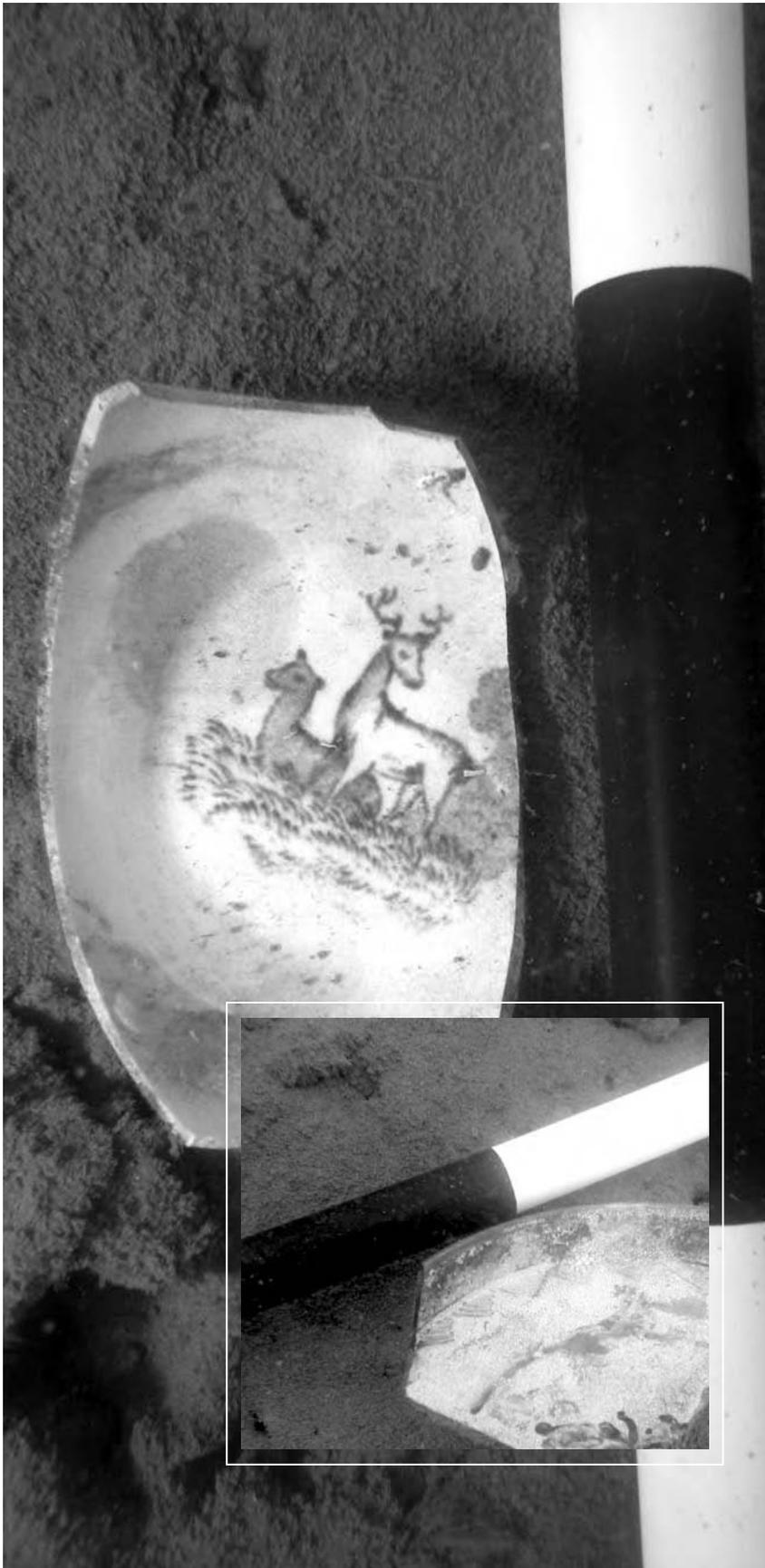
The WID/INA Chagres survey was the first comprehensive assessment of submerged cultural resources at the river's mouth, in an area that is a UNESCO World Heritage Site, a National Park, and an Ecologically Protected Area. The survey documented a wide

array of material, ranging from shipwrecks, landings, submerged ruins, and discarded material culture—in short, a maritime cultural landscape that forms the basis for a first-ever assessment of this magnitude not only in Panamá but in all of Central America. The historical and archaeological significance of the area has been known and documented for decades. This project has extended that understanding and the scope of the sites into the waters that lie off the fort and the river.

What also emerges from the survey is a strong sense of how the project area is a “maritime cultural landscape.” The features on land—the Castillo de San Lorenzo, the Chagres town sites, and the American military fortifications—all relate to the surrounding coastline, the river mouth, and the river itself, as both a geographical feature and as a highway for people and goods.

The exceptional significance of these sites is enhanced by the probable identification, and the first apparent archaeological assessment of remains associated with Morgan's 1671 attack and the subsequent “Sack of Panamá.” Years of archaeological work at Panamá Viejo, the city destroyed during Morgan's attack, has yet to yield conclusive evidence of the activities of the “pirates” or traces of the attackers other than the burned-out ruins of the old city. A definite Morgan site, if verified by further assessment and testing, would be a singularly significant and noteworthy discovery.

Widespread evidence of looting and damage to the sites, including the Lajas Reef wreck(s) was noted during this survey. The potential significance of the sites and the clear evidence of depredation and damage would also make this a



**FIG 10** left  
Decorated ceramic  
fragment, 19<sup>th</sup> century,  
documented during  
survey of river bed  
near the site of  
Chagres, likely  
associated with the  
California Gold Rush.  
Photograph by Lance  
Milbrand.

**FIG 11** inset  
Majolica fragment  
documented off site  
of the Village  
of Chagres.  
Photograph by Fritz  
Hanselmann.

**FIG 12** above  
R/V *Protector* departs  
from Chagres dock  
for survey operations.  
Photograph by Lance  
Milbrand.

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noteworthy and important site. Documentation of the damage would aid the cause of cultural resources management and preservation—what has happened at the mouth of the Chagres provides a concrete example of the difference between treasure hunting and looting as opposed to scientific work and preservation.

There is clearly a sufficient resource base, despite the damage, to justify an ongoing archaeological field school and years of surveys and excavations that would yield significant results.

## Sources Cited

- Abbott, Willis J. (1913). *Panama And the Canal In Picture and Prose*. Syndicate Publishing Company, London, New York, Toronto, Havana, Buenos Aires.
- Anderson, Dr. C. L. G. (1911) (Subsequent editions 1938, 1944). *Old Panama and Castillo Del Oro*. North Rover Press, New York.
- Bancroft, Hubert Howe (1887). *History of Central America, Vol. III: 1801–1887*. The History Company, San Francisco.
- Earle, Peter (1981). *The Sack of Panamá: Captain Morgan and the Battle for the Caribbean*. Thomas Dunne Books, New York.
- Hinckley, Theodore C. “The Decline of Caribbean Smuggling.” *Journal of Inter-American Studies* 5:1, January 1963, 107–121.
- Larson, Leslie F. (2002). *Panamá’s Caribbean Treasure: The San Lorenzo Protected Area*. CEASPA, Panamá.
- Lavery, Brian (1987). *The Arming and Fitting of English Ships of War, 1600–1850*. Naval Institute Press, Annapolis, Maryland.
- Marx, Robert F. with Jenifer Marx (2004). *Treasure Lost at Sea: Diving to the World’s Great Shipwrecks*. Firefly Books, Buffalo, New York.
- Minter, John Easter (1948). *The Chagres: River of Westward Passage*. Rinehart & Company, Inc., New York and Toronto.
- Morison, Samuel Eliot (1942). *Admiral of the Ocean Sea: A Life of Christopher Columbus*. Little, Brown and Company, Boston.
- Perez-Venero, Alex (1978). *Before the Five Frontiers: Panama From 1821–1903*. AMS Press, New York.
- Tucker, Spencer (1989). *Arming the Fleet: U.S. Navy Ordinance in the Muzzle Loading Era*. Naval Institute Press, Annapolis, Maryland.
- Ward, Christopher (1993). *Imperial Panama: Commerce and Conflict in Isthmian America, 1550–1800*. University of New Mexico Press, Albuquerque.
- Westerdahl, Christer (1991). “The Maritime Cultural Landscape,” *The International Journal of Nautical Archaeology* 5–14.
- Westerdahl, Christer (1998). “The Maritime Cultural Landscape: On the Concept of the Traditional Zones of Transport Geography.” Retrieved March 1, 2008, from <http://www.abc.se/~pa/publ/cult-land.htm>

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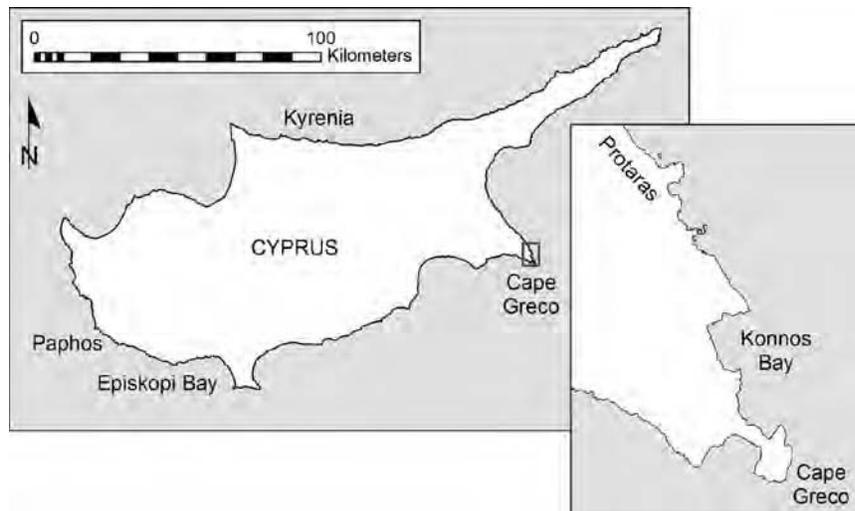
# Eastern Cyprus Maritime Survey

– A Preliminary Report on the 2008 Field Season

Since 2003, the Institute of Nautical Archaeology has undertaken annual underwater surveys along the southern coast of Cyprus. Work during the first few years emphasized, in particular, shallow-water investigations in and around Episkopi Bay, just offshore from the ancient Greco-Roman site of Kourion (see Leidwanger and Howitt-Marshall 2006). Since 2006, however, work has focused on the island’s southeast shore, around the precarious Cape Greco and just north toward the seaside resort town of Protaras (Fig. 1).

From mid-August to mid-September 2008, a small team of archaeologists and students undertook a month-long season of underwater diving survey in this region with the support of the Department of Antiquities, Cyprus. Four weeks were dedicated to shallow-water investigations, with diving and recording operations conducted from the Thetis Foundation’s 53-foot vessel *Thetis-Kypros* (Fig. 2). The majority of the season was devoted to the site of a Roman shipwreck discovered in 2007. This important cargo

**FIG 1**  
Maps of Cyprus and the Cape Greco survey area showing areas of interest (inset).



of ceramics, representative examples of which were raised for drawing and then re-deposited, lends insight into regional provincial commerce during the early Roman period. A second site, located just this season and preliminarily evaluated by photography in situ, merits more comprehensive documentation in the future.



**FIG 2**  
The Thetis Foundation's 53-foot *Thetis-Kypros* provided the dive and work platform for the 2008 field season.

### A Roman Shipwreck Near Protaras

The most important site currently known in the area, the shipwreck near Protaras formed the primary focus of the 2008 field season. The limits of the site were established and a preliminary plan initiated in which just over half the spread of cargo was mapped using Site Recorder 4 in tandem with a photomosaic (Fig. 3). Dating around the early 2<sup>nd</sup> century AD, the site is divided unevenly into two major areas separated by over 10 m and covering a total area of at least 50 x 30 m. Additional remains extend some distance further, and will be the focus of a second season in July and August 2009. The information presented here is preliminary, particularly in light of future work aimed at finishing the mapping and documentation.

The site lies in shallow water—less than 10 m deep—not far offshore from the southern edge of Protaras. The wreck's proximity to the coast raises the possibility that the vessel was either nearing its destination, or



**FIG 3**  
Sarah Kampbell and Nicole Cassano record a concentration of ceramics near one edge of the wreck site.

was engaged in short-haul coasting commerce. The forceful onshore winds and swift currents pushing out to sea very likely played a key role in both the sinking of the ship and the subsequent dispersal of its cargo. If indeed the vessel ventured too close to the reefs and rocks near shore, strong currents would have pulled it quickly out to sea as it sank the few meters and spilled the contents of its hold across the rocky seabed.

The primary cargo consists of an extensive—if scattered and disturbed—semblance of transport amphoras of three or four general types. In the course of mapping approximately half of the site in summer 2008, surface counts of diagnostic rims, bases and handles revealed at least 51 jars, all broken, with more likely buried in the sand and crevices of the reef. While a total count must wait until 2009, it is possible that the area holds twice this number. The shallow depth and accessibility of the site suggest that additional remains very likely have been removed in recent times.

By far the largest group of ceramics, comprising nearly two thirds of the amphoras recorded to date in the cargo, is of a well-known regional form, Agora M54 or “Pseudo-Cos en cloche,” representing a late derivative of the Koan tradition, notable for its distinctive double-barreled handles (Fig. 4, right). The jars have a marked carination near the midsection, steeply rounded shoulders, a simple rim with no neck, and a peg toe. Although jars with handles in this general profile were manufactured throughout the Mediterranean in the early Roman period, this particular form has been linked to production centers on the neighboring mainland in Cilicia (Empereur and Picon 1989,



**FIG 4**  
Examples of an Agora M54 amphora top (right) and a top from the poorly known amphora group (“Hof Hacarmel” type, left) from the cargo assemblage.

231–232), on the southern coast of modern day Turkey. Given the proximity of the two regions, it is hardly surprising that the type is prevalent in Cyprus in contexts of the mid-1<sup>st</sup> to mid-2<sup>nd</sup> century AD, including the Roman provincial capital at Paphos (Hayes 1991, 93–94).

Over a quarter of the amphoras thus far recorded in the assemblage appear similar to Gauloise 4 jars, a type originating in Mediterranean France and well-known in western contexts from the latter 1<sup>st</sup> century into the 3<sup>rd</sup>, but markedly less common on Cyprus and in the east Mediterranean in general (Laubenheimer 2001). The Gauloise 4 form exhibits a generally ovoid body, a conical neck with a thickened and rounded rim, flat strap handles, and a ring base (Fig. 5). Several intact bases documented on the seabed and raised for study revealed thick remains of pitch, potentially indicative of a wine content.

This preliminary identification was based on observations made underwater when the site was first discovered late in the summer 2007 survey season. Upon raising several samples to the surface in 2008, however, it appeared that what seemed like a generally uniform group actually included not only Gauloise 4 jars, but other examples distinguished by several small morphological features and a drastically different fabric pointing to an entirely different producer (Fig. 6). Their fabric, in fact, is close to that of certain Late Roman 1 jars of several centuries later, and may indicate that forms similar to Gauloise 4 were manufactured in the northeast Mediterranean, perhaps in the area of Cilicia. Despite the few local imitations, however, the majority of jars of this type does appear to be Gaulish in origin, which provides the best date for the wreck as a whole around the early 2<sup>nd</sup> century AD.

A final group of amphoras is of a rather unusual type with few known comparanda, all of which are from Cyprus or the Levantine coast and unfortunately lack secure dates. The jars are characterized by a wide cylindrical neck with a minimally articulated rim, very thick bifid handles, and simple rounded knob toe (Fig. 4, left). A small assemblage of the type was reported off the coast of Israel at Hof Hacarmel, where Raban associated them contextually with artifacts that he could date in the 4<sup>th</sup>



**FIG 5**  
An example of a Gauloise 4 amphora from the cargo assemblage.

century (Raban 1969–1971, 68 fig. 4). Whether or not the series continues into late antiquity, as Raban suggests, it is now apparent that the form begins by the early 2<sup>nd</sup> century. Examples from several sites in the north Sinai have been attributed by Arthur and Oren (1998, 198 fig. 4.6 and 203) to north Syrian manufacture. Although no origin can be suggested with any certainty, a workshop within the northeast Mediterranean seems likely based on the type’s limited geographical distribution.

It is perhaps worth noting that the revised identifications and origins of the different types of ceramics discussed here, in many instances, could only be made safely once the samples were raised for more detailed study on the surface. Thanks to the support of the Department of Antiquities, ceramics could be lifted from the site, and were subsequently re-deposited in their original findspots. Where possible, this option provides a viable solution for maximizing the data gleaned from survey, shedding more light on the site and finds than is typically possible with visual survey in situ, while avoiding the long-term issues of conservation and storage.

### Konnos Bay

Brief investigations just north of Cape Greco in Konnos Bay resulted in the discovery of a small site of concentrated ceramics mixed in the crevices among the shallow boulders near shore (Fig. 1). The finds are primarily amphoras, including some that appear similar to the Gauloise 4 and imitation jars from the shipwreck near Protaras. Though lack of time prevented fuller investigation, the location was noted and limited photographic recording of the finds was carried out in situ. Future survey in 2009 will revisit the site to determine both its extent and nature and to begin a preliminary recording of the remains.

### Preliminary Results and Plans for the Future

Little else remains of the vessel that wrecked near Protaras; a few fragments of roof tiles may indicate a ship’s cabin at one end of the scatter. Where the ship was heading is unclear, but its location in shallow, near-shore waters, and the Roman presence along this stretch of coast

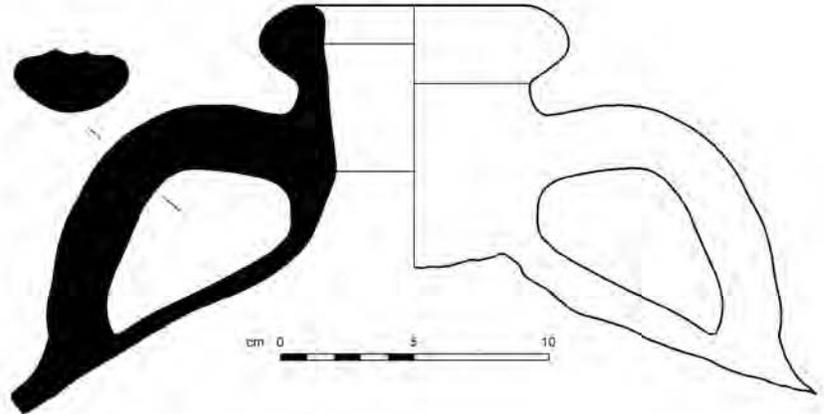
suggest that either the vessel was nearing an intended port-of-call, or else engaged in short-haul coasting trade. The Augustan geographer Strabo (14.6.3) locates somewhere along this coast the settlement of Lefkolla, a town that has not yet been positively identified through survey or excavation. Though scattered, the shipwreck’s remains may provide significant insight into the long-distance and regional commercial connections of this quiet island province during the height of the *pax Romana*.

Perhaps as much as half of the wreck remains to be explored, which will help shed light on this mix of international and regional products, including the details and perhaps origin of the small but problematic group of “Hof Hacarmel” type amphoras. While it seems reasonably clear from their pitch linings that the Gaulish amphoras carried wine, what might the others have contained? Wine seems a likely product too for the jars that imitate this Gaulish form, as well for the group of “Koan-style” amphoras, since this region was similarly famous for its vintages. Rauh (2004, 335) has recently suggested that the phenomenon of various Cilician imitations catered to those unable or unwilling to purchase the authentic product for a higher price. If so, what might the appearance of authentic wine from Gaul alongside these “imitation” or “Gaulish-style” products imply about the availability and marketing of agricultural goods in the Roman East? Was it the reputation, or simply the recognizability, of produce from Gaul that inspired vintners and potters to make packaging in this style? What role might the shipwrecked merchantman near Protaras have played in marketing different

qualities and types of wine to different consumers? Continued mapping and study of the ceramic remains on the surface of this new wreck, and perhaps the material from Konnos Bay as well, may shed more light on these and other questions. Surely this small cargo's intriguing mix of amphoras hints at complex and well-developed mechanisms for marketing different products, and perhaps different qualities, to different consumers and tastes.

### Acknowledgements

The Eastern Cyprus Maritime Survey's 2008 field season was undertaken by kind permission of the Department of Antiquities, Cyprus and its former Director, Dr. Pavlos Flourentzos. Financial support was provided by the University of Pennsylvania's Niarchos Program for the Promotion of Hellenic Culture and its Graduate Group in the Art and Archaeology of the Mediterranean World, the University of Pennsylvania Museum's Kolb Foundation, and RPM Nautical Foundation. As has been the case for several seasons now, invaluable logistical support on the island was again provided by the Thetis Foundation, including use of *Thetis-Kypros*, for which thanks are due to Mr. Adonis Papadopoulos and Ms. Anna Demetriou. In addition to the author, the 2008 crew included Nicole Cassano, Jeff England, Mustafa Fahl (captain), and Sarah Kampbell. Additional thanks go to Elizabeth S. Greene, Sebastian Heath, Mark Lawall, Patrick Monsieur, Archer Martin, and Andrei Opaïț, each of whom provided keen insights and helpful discussion about the finds and their implications.



**FIG 6**  
An example of a Gauloise 4 amphora imitation raised for documentation.

### References

- Arthur, P. and E. Oren (1998). "The North Sinai Survey and the Evidence of Transport Amphorae for Roman and Byzantine Trading Patterns." *Journal of Roman Archaeology* 11, 1998: 193–212.
- Empereur, J. Y. and M. Picon (1989). "Les régions de production d'amphores impériales en Méditerranée orientale." In *Amphores romaines et histoire économique*, 223–248. Collection de l'École française de Rome 114. Rome.
- Hayes, J.W. (1991). *Paphos*, Vol. 3. *The Hellenistic and Roman Pottery*. Nicosia.
- Laubenheimer, F. (2001). "Le vin Gauloise de Narbonnaise exporté dans le monde romain sous le Haut-Empire." In *20 Ans de recherches à Sallèles d'Aude*, edited by F. Laubenheimer, 51–65. Besançon.
- Leidwanger, J. and D. S. Howitt-Marshall. (2006). "Episkopi Bay and Beyond: Recent Collaborative Fieldwork and New Prospects on Cyprus." *INA Quarterly* 33:2, 13–22.
- Raban, A. (1969–1971). "The Finds from the Undersea Site of Hof Hacarmel." *Sefunim* 3, 62–69.
- Rauh, N. K. (2004). "Pirated Knock-offs: Cilician Imitations of Internationally Traded Amphoras." In *Transport amphorae and trade in the Eastern Mediterranean. Acts of the international colloquium at the Danish Institute at Athens, September 26–29, 2002*, edited by J. Eiring and J. Lund, 329–336. Monographs of the Danish Institute at Athens, Vol. 5. Athens.

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## *Warwick*

### 2008 Survey Results on a 17<sup>th</sup>-century English Galleon

#### Abstract

This paper describes a preliminary survey of the race-built galleon *Warwick*, which wrecked in Castle Harbour, Bermuda, during a hurricane in 1619. *Warwick* was not only a prime example of late 16<sup>th</sup>-century Elizabethan warships, but also of the vessels that played a fundamental role in supplying the English settlements in North America in the early 17<sup>th</sup> century. Based on our currently limited knowledge of English galleons in general and race-built types in particular, properly studying this wreck presents an unparalleled opportunity. Remarkably, about 70 ft. of the starboard hull is preserved from just above the keel to an upper deck and will be scientifically studied during planned excavations.

#### Introduction:

##### The Wrecking and Rediscovery of *Warwick*

The historical significance of the galleon *Warwick* cannot be over-emphasized. This ship not only has the potential to increase our understanding of late 16<sup>th</sup>-century shipbuilding technology, but also shines as a prime example of a vessel that was used to transport English settlers to early North American colonies. Belonging to the Earl of Warwick, the ship was chartered by the Virginia Company to transport goods and colonists to Jamestown and Bermuda.

On 20 October 1619, *Warwick* made a scheduled stop in Castle Harbour to deliver Nathaniel Butler, the new governor of Bermuda, to acquire provisions, and to offload some of the cargo and settlers. While preparing to leave for Jamestown at the end of November, a hurricane struck the island, driving *Warwick* into the rocky cliffs of Waller's Bay and sinking the ship. Based on Butler's account, the rough location of *Warwick* in the king's anchorage in Castle Harbour has always been known. In 1620, three guns and some barrels of beer were salvaged from the shipwreck, followed by the recovery of five more guns in 1621, all of which were put to good use

in the newly constructed South Hampton Fort. Since the guns had been securely lashed to the decks in preparation for the approaching hurricane and could not be freed until the rope had rotted, not all the armament was salvaged (Hallett 2007:120–128).

In 1967, *Warwick* was again located by Teddy Tucker, a local Bermudian salvor, and Mendel L. Peterson of the National Museum of History and Technology at the Smithsonian Institution. Using a magnetometer, they detected a conglomeration of iron off of Frick's Point. After 13 days of probing with an airlift, Tucker and Peterson discovered a ballast pile and pieces of decaying wood, as well as wooden barrels and boxes. In 1979, Tucker, in association with the Philadelphia Maritime Museum, returned to the site and excavated roughly half of the wreck in a project that lasted 25 days. They measured and sketched a section of the shipwreck and raised numerous artifacts. These artifacts can now be viewed at the Bermuda Underwater Exploration Institute (BUEI) and at the Bermuda Maritime Museum (BMM). The collection includes three guns, several cannonballs, expanding bar shot and musket shot, casks of meal, smoking pipes, several types of English ceramics, and numerous elements of ship's rigging. According to the reports and sketches, the surviving hull remains of *Warwick* constituted almost the entire starboard side of the vessel. While the keel was missing, the extant portion of the hull extended from just below the turn of the bilge to an upper deck. It was estimated that *Warwick* was a 300-ton ship with a length on deck of 100 to 110 ft. Significant features included the sheer massiveness of *Warwick's* construction, as well as a cannonball found embedded in the hull, which was covered with a lead patch and packed with what appeared to be turtle oil and lime (Tracey and Tucker 1979).

### New Archaeological Investigations of *Warwick*

Between 21 and 27 July 2008, the Institute of Nautical Archaeology (INA) and the Center for Marine Archaeology and Conservation

(CMAC), in collaboration with the Bermuda Maritime Museum, conducted a reconnaissance survey of the galleon *Warwick*. Thanks to the assistance of the BMM, the survey was conducted from a privately owned and operated catamaran, generously provided by James Davidson, who volunteered to work with the team throughout the project. The staff included Piotr Bojakowski and Katie Custer, project archaeologists and primary investigators; Sara Hoskins, visiting archaeologist; James Davidson, boat captain and diver; Elena Strong, BMM curator; and Robert Steinhoff, BMM trustee.

*Warwick* is located in a shallow protected cove called Waller's Bay, on the southern edge of Castle Harbour. As shown in Figure 1, the shores of Waller's Bay consist of weathered limestone cliffs that extend 30 to 40 yds. out into the bay forming shallow reefs. Beyond the 40 yd. mark, these limestone reefs abruptly drop from a depth of about 5 ft. to the sandy and silty floor of the bay. The wreck rests directly under a rocky ledge that separates the reefs from the sandy bottom of Castle Harbour, about 40 yds. from the shore on a gently sloping bottom 15 to 25 ft. below the surface. With the exception of some isolated brain coral, the area seems to be largely uninhabited by most of the Bermuda's marine fauna and flora, reducing the potential degradation of marine wildlife by the excavation.



**FIG 1**  
View of the *Warwick* wreck site in Waller's Bay. Photograph by Katie Custer and Piotr Bojakowski, 2009.

Compared to the typical diving conditions in Bermuda, the visibility at the site is relatively poor and ranges between 1 and 10 ft. due to the fine silt that covers the bottom of Castle Harbour, a remnant of a land reclamation project undertaken for the airport built during World War II. Although poor visibility and a thick layer of silt might be a nuisance at times, these same conditions have helped to preserve the exposed timbers. The uppermost layer of sediment consists of very fine yellowish silt of varied thickness, below which lies a highly compact gray clay-like layer. By sealing the timbers, this grayish layer seems to be responsible for the excellent preservation of *Warwick's* hull timbers.

Using archival documents, photographs, and original sketches of the site, the team located *Warwick* and uncovered a small stern section of the hull to evaluate the extent of preservation and to explore the potential for future excavations. The team created a high-resolution photomosaic and detailed archaeological drawings of the uncovered portions of the hull in order to produce a scientific record of the work. Additionally, to determine the extent of the site without an invasive removal of the overburden, the vicinity of the exposed timbers was explored using sub-bottom probing, two types of handheld metal detectors, and a side-scan sonar. Upon completion of the survey, the exposed portion of the site was reburied.

### Survey of *Warwick's* Hull

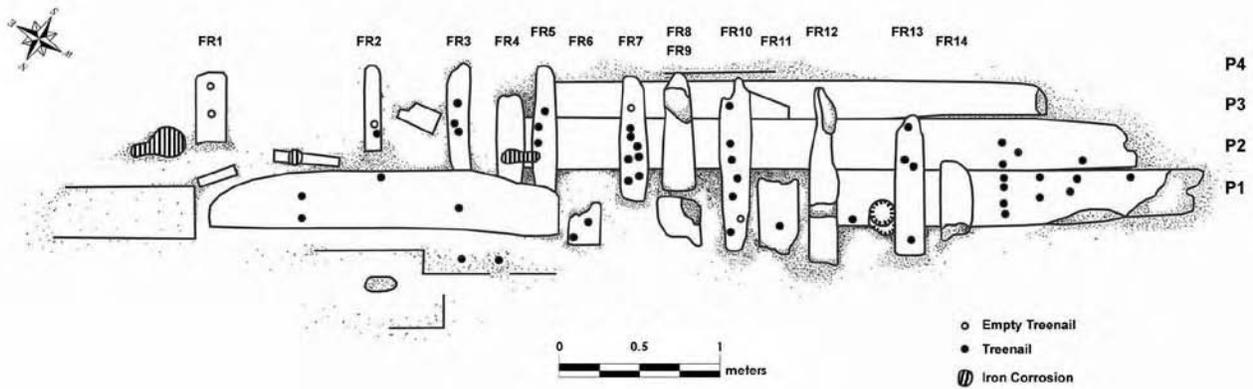
During the initial dive along the bottom of the rocky ledge, a large ballast pile was easily discerned. Upon closer examination, it was

found that the pile consisted of large, irregularly shaped pieces of gray slate, broken and intact red bricks, and some small fragments of timber. In close proximity to the ballast pile, several iron bolts and some other pieces of timber were located.

Directly west of the ballast pile, between two large metal bolts that protruded from the bottom sediment, the partially buried starboard stern section of *Warwick* was found. With the consent of Philippe Rouja, the Bermudian government representative with authority over the wreck, this small portion of the wreck was uncovered and investigated. The section constituted a 2 m by 6 m rectangle representing an upper stern portion of the starboard hull. Soon, the previously mentioned metal bolts were revealed to be fasteners for the remnants of two lodging knees that originally supported a deck. This interpretation was reinforced with the discovery of a robust shelf clamp, significantly thicker and wider than the ceiling planks, right below the knees.

The exposed section of the hull comprised at least 13 frame timbers, four of which were most likely the second or third futtocks and the remaining nine appeared to be top timbers. The longitudinal structure included one or possibly two ceiling planks; a shelf clamp; and three outer hull planks. A photomosaic and site plan of the uncovered portion is shown in Figures 2 and 3. On average, the frames measured 15 cm sided by 15 cm molded and 6 to 108 cm in uncovered length. The spacing between adjacent frames was between 6 and 88 cm. The shelf clamp measured 30 to 34 cm

in width and 210 cm in uncovered length. Finally, the outer planks, one of which exhibited a nicely preserved diagonal scarf (Fig. 4), measured about 23 cm in width, 5 to 6 cm in thickness, and between 50 and 300 cm in uncovered length. It is noteworthy that although the frames showed overlapping between various futtocks and top timbers, the arrangement was rather loose and the timbers did not appear to be fastened to each other. All the frames were fastened directly to the outer planks by treenails and, with the exception of the iron bolts associated with the lodging knees, no metal fasteners were present in the exposed hull section. Although *Warwick* sank only 10 years after the wrecking of *Sea Venture*, these preliminary observations reveal significantly less structural resemblance between the two than was originally expected. What is even more intriguing is the fact that *Warwick* appears to be an older ship and its construction features seem to be more antiquated than that of *Sea Venture*. According to Jonathan Adams (2003:123), the overall massiveness of *Warwick's* structure and its unique arrangement of alternating thick ceiling planks and even thicker stringers give the impression that the ship shares more structural commonalities with *Mary Rose*, which was lost in 1545. At present, the provisional research done during the 2008 field season does not permit any conclusive answers; nonetheless, the hypothesis that the *Warwick* structure predates that of *Sea Venture* is highly plausible.



### The Future of *Warwick*

The island of Bermuda is an ideal location to study shipwrecks: the shallow reef system extending far into the ocean and its unique geographical position has created a virtual graveyard of wrecks. Almost without exception, Bermuda shipwrecks represent every period of European seafaring from the 16<sup>th</sup> century to present. *Warwick*, located in less than 30 ft. of water, is an exceptional site not only to train university students, but also local sport divers and Bermudians with an interest in their maritime heritage.

The 2008 survey demonstrated a strong scientific rationale to properly excavate and study *Warwick*. The possibility that this ship was built in the late 16<sup>th</sup> century will provide us with the first insight into the actual

construction of English galleons in comparison to the contemporary treatises on ship construction. Additionally, the excavation and analysis of *Warwick* (1619) in the context of *Sea Venture* (1609) will enable us to study the construction of English galleons from the keel to the upperworks while at the same time seeing the progression of this shipbuilding tradition from the late 16<sup>th</sup> to the early 17<sup>th</sup> centuries. What is even more significant is the fact that the structure of this galleon might provide comparative data not only for the famous Tudor warship *Mary Rose* (1545), but also for the Swedish royal galleon *Vasa* (1628). *Warwick* and *Sea Venture* provide the closest comparative material to *Vasa* and as such they are of considerable interest to international scholars.

**FIG 2** above top  
Photomosaic of  
uncovered portion of  
*Warwick*. Photomosaic  
by Katie Custer and Piotr Bojakowski, 2009

**FIG 3**  
Site plan of the  
uncovered portion of  
*Warwick*. Rendering by  
Katie Custer and Piotr Boja-  
kowski, 2009

## Acknowledgments

The authors would like to express their sincere gratitude for the support the project received from the Institute of Nautical Archaeology and Donny Hamilton, and for the generous donations of time and resources by the staff and directors of the Bermuda Maritime Museum. We would like to thank INA Archaeological Committee members Donny Hamilton, Edward Harris, James Delgado, and Kevin Crisman for their unyielding support. We also would like to thank project advisors Fred Hocker and Jonathan Adams for combining their dreams with ours as we begin the excavation of a fantastic shipwreck.

## References

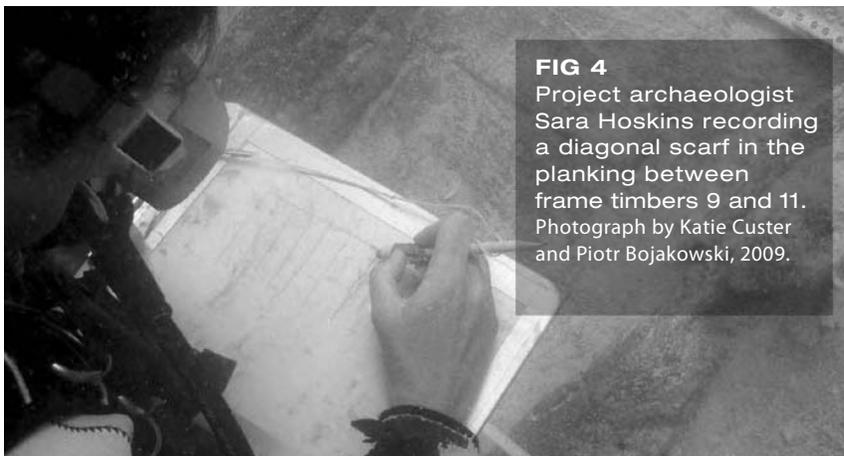
Ferguson, Leland (1992). *Uncommon Ground: An Archaeology of Early African America 1650–1800*.

Smithsonian Institution Press, Washington, DC.

Adams, Jonathan (2003). *Ships Innovation & Change: Aspects of carvel shipbuilding in northern Europe 1450–1850*. Stockholm, Studies in Archaeology 24. Stockholm Marine Archaeology Reports 3, Stockholm.

Hallett, C. F. E. Hollis, Editor (2007). *Butler's History of the Bermudas: A contemporary account of Bermuda's earliest government*. Bermuda Maritime Press, Bermuda.

Tracey and Tucker (1979). *The Warwick*. Unpublished Report for the Bermuda Maritime Museum, Bermuda.



**FIG 4**  
Project archaeologist Sara Hoskins recording a diagonal scarf in the planking between frame timbers 9 and 11. Photograph by Katie Custer and Piotr Bojakowski, 2009.

Piotr Bojakowski and Katie Custer  
Texas A&M University/INA

## Western Ledge Reef Wreck

– 2008 Season Report

During June and July, 2008 the authors reviewed the archival data, copied the artifact records, and analyzed the hull timbers of the late 16<sup>th</sup>-century Iberian-Atlantic Western Ledge Reef Wreck in Bermuda. The project was carried out thanks to generous support received from the INA, as well as an assistance of Dr. James Delgado, Dr. Kevin Crisman, and Dr. Donny Hamilton. It should be emphasized here that prior to the fieldwork, the authors also met with Dr. Fred Hocker who not only provided detailed information related to the early excavations of the site, but also offered his support and expertise in interpretation of the hull structure. As for the research objectives set for the 2008 field season, these were fully accomplished and the data secured for final dissemination in the form of Piotr Bojakowski's dissertation. The project was a great success, potentially shedding light on important nuances of the 16<sup>th</sup> and 17<sup>th</sup> centuries Caribbean wrecks within the Iberian-Atlantic shipbuilding tradition.

### Summary of the 2008 Season

To facilitate the fieldwork, the project was divided into two phases: (a) phase one, which consisted of archival research at the Bermuda Maritime Museum (BMM) library and archives; and (b) phase two, which focused on analysis of preserved hull timbers stored in outdoor tanks on the museum ground.

(a) During the archival portion of the project, the team reviewed the data and scanned the photographs related to the final, 1991 season, of excavations under ECU/BMM team. It was during that season the hull remains were disassembled, raised from the bottom, and transported to the museum; hence the data constituted an important link between the original shipwreck, as an intact structure found on the seabed, and the timbers currently stored at the BMM. This data ranged from sketches

and renderings of the timbers *in situ*, to photographs and an amateur film, to detailed description of the work that was carried out on the site based on John Broadwater's field journal. This also included an informative description of the methodology used for the timber recording, which will provide a great aid in interpretation of the original 1:1 drawings.

Another aspect of the archival portion of the project included reviewing, scanning, and photographing the Western Ledge Reef Wreck's artifacts and rigging elements. During this process, the team went through all of the artifacts in the BMM collection, which mostly consisted of wood and metal pieces and some limited ceramic shards. Special emphasis was placed on a collection of diagnostic artifacts that might facilitate reliable reconstruction of the ship's structure and rigging. In addition, the team obtained photographs of the objects from the private collection of Brian Malpas and Donald Canton, original discoverers of the site. These artifacts were raised from the Western Ledge Reef Wreck soon after the original discovery and have never been used for any interpretative purposes.

To supplement the archival research, Piotr Bojakowski was granted permission to review and use for his dissertation, a portion of relevant documents obtained by the BMM from the *Archivo General de Indias* (AGI), Seville. As Dr. Harris, executive director of the BMM indicated, in 1987 the museum acquired a collation of registers and letters focusing on Spanish influence on the Island of Bermuda covering a period from 1508 to about 1614. Although the importance of Bermuda for Spanish authorities during that time was rather limited and references to the island scarce; this collection contains numerous navigational instructions, official orders, indications of colonization, as well as letters concerning the fleets, ships, crews, and cargos that disappeared near the island. As such, these materials provide not only an excellent geopolitical background for the period, but also a direct link between Bermuda and the Iberian shipwrecks.

(b) During the second phase of the project the team moved the operation to the BMM Corange Conservation Laboratory (CCL) and began inspecting and analyzing the Western Ledge Reef Wreck hull timbers. Unfortunately, the assessment of the storage tanks revealed that the water level in one of the three tanks was let to drop again (similar to the situation that was noted last season). Exposure to the atmosphere and extensive desiccation of the outer surfaces of the stored timbers, including three sections of the keel and the master couple, produced irreversible deterioration. At this stage, it is safe to say that these timbers have little to no interpretive value.

Since all other storage tanks were found in good condition, the team meticulously studied the keelson, garboards and outer planning, preserved frames and futtocks, and elements of a distinctively Iberian stern assembly. Since both port and starboard garboards and outer planning were originally drawn as 1:5 scale inboard views on one sheet of mylar, one of the most important tasks involved making a set of new drawings in 1:1 scale showing both views and profiles. The ability to combine the original drawings and direct observations of the timbers themselves allowed answering numerous questions and verifying or disproving some previous formed hypotheses. It also allowed us to verify and measure numerous features, predominantly wood and metal fastenings, which were not

recorded before. As such, this portion of the project constituted a crucial element of the timber evaluation for an accurate ship reconstruction.

Finally, thanks to assistance of Robert Steinhoff, one of the BMM trustees, and Phillip Rouja, a Conservator of Wrecks on the side of Bermuda government, we revisited the site of the Western Ledge Reef Wreck. For the first time since the end of the excavations in 1991, the site was inspected by a team of archaeologists. Over the course of two days, we made about four dives surveying the site and surrounding reefs. One of the most significant features that indicated the original location of the wreck was an elongated ballast pile removed from the site and now marking the perimeter.

This visit tremendously helped the authors to understand not only the nature of the site itself, but also the geography of Bermuda's western reefs, specifically the Chub Heads area. The extensive maze of shallow reefs cut by narrow channels, channels that may or may not be navigable depending on tides and currents, make these reefs extremely dangerous even today. In the past, however, any approach to Bermuda from the western direction would inevitably end up in a disaster. Although known for centuries among Spanish pilots, these reefs were oftentimes impossible to avoid due to currents, strong Atlantic pressure systems, and sudden storms. For vessels powered only by sails, some areas of the Bermuda's western reefs are literally inescapable traps and the location of the wreckage perfectly illustrates that.

## The Future of the Project

At this stage, the fieldwork part of this project is complete and all the data related to the Western Ledge Reef Wreck is secured. The next step involves the analyses and interpretation of the collected data, a process that will integrate research and writing of Piotr Bojakowski's dissertation. After successfully passing doctorate preliminary examinations planned for the Spring 2009 semester, Bojakowski will begin a full-time writing routine. Optimistically, the manuscript will be finished in the later part of the 2010 and defended in early 2011. During that time, the author plans to engage in general dissemination of the data in the form of journal and popular articles, and conference presentations. So far, this project was showcased at the Association of Preservation Technology (APT) international conference in October, 2008 in Montréal, Canada, in a presentation entitled: "Conservation Aspects of the 16<sup>th</sup>-century Western Ledge Reef Wreck." Additionally, Bojakowski and Custer's article on the Western Ledge Reef Wreck was selected and approved for the next issue of MARITimes BMM journal.



**Ben Ford**  
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## Lake Ontario Maritime Cultural Landscape Project

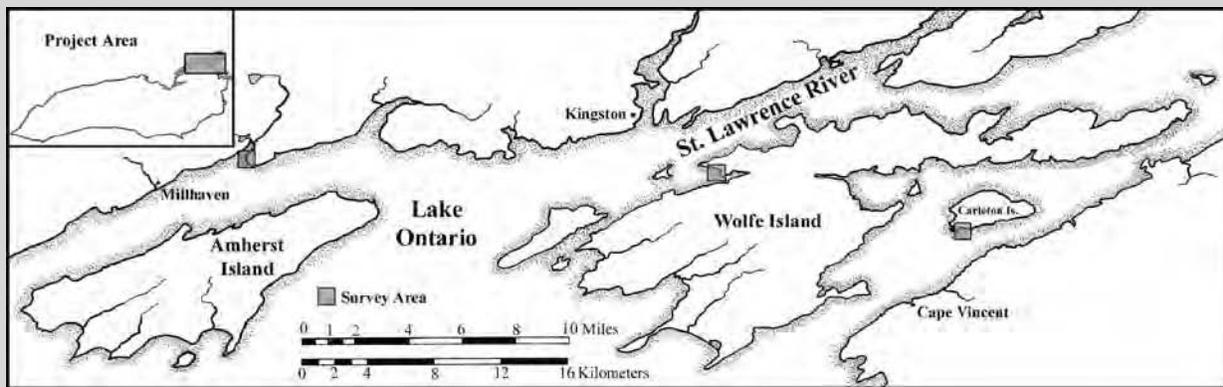
The 2008 Lake Ontario Maritime Cultural Landscape Project examined three one-kilometer-square survey blocks along the New York and Ontario shoreline (Fig. 1) using multiple survey methods including marine remote sensing, terrestrial pedestrian survey, and informant interviews. This year's survey areas consisted of Carleton Island's southern shore, including South Bay; Barretts Bay on Wolfe Island, including the northern terminus of the Wolfe Island Canal; and Parrotts Bay. The survey was completed with the help of seven volunteers, including past and current graduate students from Texas A&M University, Southampton University, and Flinders University. Each survey block was divided into a terrestrial component that was subjected to a pedestrian survey and a submerged component that was investigated with a side-scan sonar and magnetometer. Unfortunately, due to equipment failure, the magnetometer was not available for half of the Carleton Island survey and all of the Wolfe Island survey. In an attempt to partially ameliorate this loss of data, the shore of Wolfe Island was additionally surveyed via kayak and all of Carleton Island's South Bay was surveyed by archaeological divers. Divers also conducted transect surveys in water too shallow for the remote sensing equipment and inspected remote sensing targets. Additional sites were identified through informant interviews. An attempt was made to speak with every property owner within each survey block, as well as local archaeologists and historians, both professional and avocational.

The survey resulted in the identification of 13 historic and pre-Contact sites and several isolated finds. One of the two pre-Contact sites contained a diagnostic projectile point dated to the Late Archaic (4500 to 3000 years ago). Both pre-Contact sites appeared to be small camp sites. The historic period sites consisted of both habitation and commercial sites, including two farmsteads, a lime kiln, an early 19<sup>th</sup>-century artifact scatter, four turn of the century docks, and a ferry landing. Additionally, the survey identified and recorded the hull of a late 19<sup>th</sup>-century coal barge (Fig. 2). Based on

informant interviews, the vessel burned and sank during the 1920s but a search of local newspapers has yet to produce further information. This wreck is interesting in that it is representative of the decline of Lake Ontario commerce and the end of wooden shipbuilding on the Great Lakes. When the barge sank in the 1920s it was not removed despite blocking one of the island's coal docks. The use for the dock was declining and the profit to be made from it was not balanced by the cost of removing the vessel. While the ship was not abandoned, much of its situation marks the loss of a vessel that was no longer viable, carrying a cargo of declining value, to a port of limited importance. Additionally, the ship does not appear to be a purpose-built barge, but a cut-down schooner. The shape of the hull and the presence of a large timber in the location where a centerboard trunk would be expected on a sailing vessel all argue for a reused schooner. This ship, like many others in the early

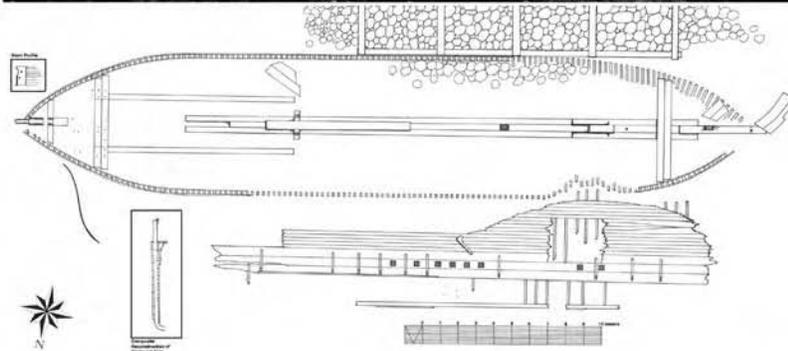
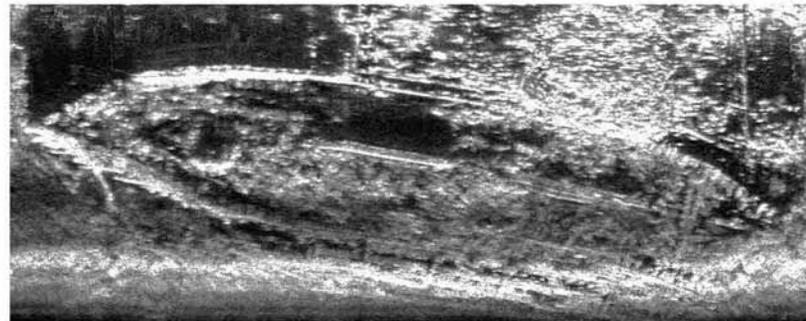
20<sup>th</sup> century, was cut down and transformed from an independent sailing vessel to a barge to be towed behind a steamer. Both the dock and the ship were simply left behind by changes in technology and transportation. This landscape is likely repeated in several locations throughout the Great Lakes and is indicative of transitions to the modern era but is an under-studied aspect of the Great Lakes maritime culture.

The 2008 season also offered



**FIG 1** above  
Survey areas, 2008.

**FIG 2** right  
Keyes Wreck, Wolfe  
Island, Ontario.



the opportunity to explore magnetic anomalies identified during the 2007 season. These anomalies spanned several survey transects in an area near Sackets Harbor (Storrs Harbor) where a War of 1812 gunboat wreck is indicated on an 1829 chart. The wreck occurred when one of the 15, 75-foot gunboats (built during the final naval construction push of 1815) that was moored at Storrs Harbor broke free in a storm and became lodged on a sandbar. No surface evidence of the wreck was visible due to the large sandbar formed by the intersection of Muskellunge Creek and the Black River. In order to further investigate the site, a total of 279 probes were sunk to approximately five feet below the sediment. Most of the targets were ‘negative’, meaning the probe was pushed into the sediment without encountering an obstruction. Some of the probe locations were ‘positive’ where the probe hit a definite obstruction. There was also the third category of ‘possible.’ Possible targets were those where the probe could be forced down, but only with great difficulty. These locations may have been simply dense patches of sand or they may have been very soft wood. The preliminary results of this exercise are included here as figure 3. The results of the probe survey will require further analysis, taking into account the depth of each obstruction; however, the grouping of positive and possible probes in the lower center of the figure is promising. This area includes both a north-south and east-west alignment that measure approximately 75 feet in length. These hits may be the gunboat, but they may also be a collection of tree trunks or particularly hard

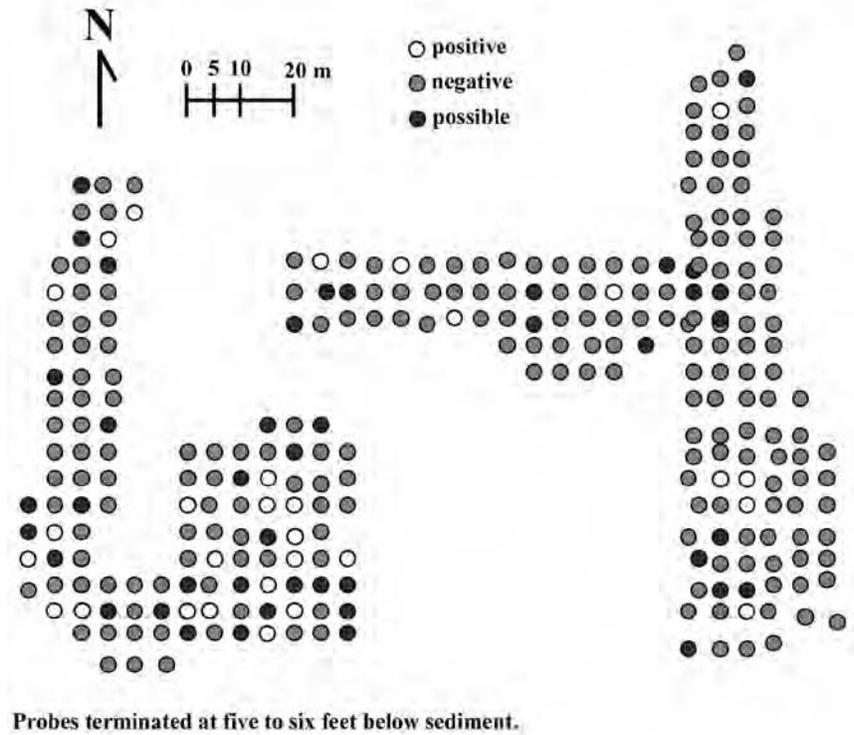
sand. The only ways to follow up on this location are to partially excavate the area or conduct a close-interval sub-bottom profiler survey of the area. This may be a worthwhile undertaking as very little is known about the American Lake Ontario gunboats and the wreck may contain data relevant to the U.S. Navy’s transition from craft production to more formalized techniques.

The survey also touched on the previously discovered *Haldimand*, a circa 1765 British 16-gun, snow, sunk in the North Bay of Carleton Island, and a Revolutionary War era dock adjacent to the wreck. Both the wreck and the dock are associated with Fort Haldimand and Carleton Island’s role as the British naval station on Lake Ontario. The station included a shipyard and served as the supplies redistribution point for the Great Lakes during the American Revolution. Coincidentally, the survey crew became embroiled in a dispute between the individual who owns North Bay (including the bottom lands) and treasure hunters who were removing materials from the bay. The confrontation came to a head when the treasure hunters claimed to have located a cannon and offered to exchange its location for permission to remain in the bay. Ultimately, the treasure hunters left the area with a minimum of artifacts. Due to the threat of continued pillaging and the close proximity of *Haldimand*, the dock, Fort Haldimand, and the British naval shipyard all at the head of Carleton Island, this area has good potential for a focused maritime landscape study. This study will combine an analysis of *Haldimand* combined with additional survey work on and around the island to explore the shipyard and an area referred to historically as Merchant Cove.

The 2008 season was the last year of fieldwork for this phase of the Lake Ontario Cultural Landscape Project. A total of 27 sites were identified during the two seasons of fieldwork, as well as many isolated finds, that represent dispersed but important activities along the lake shore. Additionally, a plethora of primary and secondary historical data and informant interviews were collected. These data elucidated several broad patterns in Lake Ontario archaeology, including the historic permeability of the international boundary, differences between how Native Americans and European Americans perceived danger on the lake, the importance to lake culture of ice roads and other features of limited archaeological visibility, how change through time was perceived by lake residents, and how the transition from ships to cars has changed the perception of the lake shore.

In a nutshell, several sites pointed towards the easy movement of people and materials across the international border, both legally and illegally, throughout the 19<sup>th</sup> century. During the first half of the century, this ease of communication appears to have caused some Lake Ontario residents to identify more strongly with their international neighbors than their more distant countrymen on the East Coast. These connections began to erode during the mid-19<sup>th</sup> century as locomotives and telegraph lines pulled Lake Ontario into the eastern heartlands and have continued into the modern era with the realignment of shore transportation along shore roads rather than coastal sailing routes. Shore roads are interrupted by the waterways and associated border crossings that separate the two nations, making distinctions more clear. These roads help to

**FIG 3**  
Results of probe  
survey, Storrs Harbor,  
New York.



connect communities along the shore but weaken the bonds with communities across the water. Historic ice roads, conversely, helped to connect communities around and across the lake margin. These seasonal transportation networks linked otherwise isolated towns during the winter months and had a profound effect on how people viewed distance, time, and their community. Like much of culture, however, these roads are almost invisible archaeologically and are a strong argument for the importance of historic research and informant interviews to bolster archaeological investigations.

Drawing heavily on the historic and ethnographic accounts, it became clear that Native Americans and European Americans both saw danger in the Great Lakes, but positioned that danger in different contexts. Western Europeans tended to see the lake as benign except for when it was affected by an outside force such as a storm, while Iroquoians and other Late Woodland Period (circa AD 600 to 1500) Native Americans associated the lake itself with malignant forces. I argue that these different views are associated with the historical development of the two cultures and the weakness of their types of water transportation; essentially the capabilities and routes of canoes versus those of sailing vessels.

Finally, the survey crew was constantly reminded that one of the defining features of life along the shore is that the lake is constantly in flux: the water rises and falls, specific resources are available at certain times, transportation options open and close, etc. Other, more drastic, changes have taken place during the past; including a 60 meter (197 ft.) rise in the lake level during the Middle Archaic Period (7500 to 4500 years ago) and the introduction of the telegraph and locomotive to the lake at the same time that steamboats and urban industrial centers were flourishing

during the 1840s. These changes are clearly written on the landscape and evident to archaeologists, but the 1840s were not apparently perceived as a watershed decade by the people who lived at that time. Rather it was seen as one increment in the progressive growth and stabilization of the region. This example was an important lesson for the archaeologists, reminding us that it is the perceptions of the people in the culture that drive their decisions and ultimately influence cultural change. Our outside perspective is useful for identifying broad trends but for understanding culture we need to understand the perceptions of past peoples too.

Additional information regarding the 2008 season is available through a web journal hosted by the Museum of Underwater Archaeology ([www.uri.edu/mua/](http://www.uri.edu/mua/)).



left to right

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## Finds from INA Surveys off the Turkish Coast

Two Archaic Shipwrecks at Kekova Adası  
and Kepçe Burnu

### Summary

In 1983, the Institute of Nautical Archaeology discovered an early Archaic shipwreck at Kekova Adası, near Uçağız in the Antalya region of Turkey (Fig. 1), during its annual survey of the Turkish coast (Frey 1984, 4; Yıldız 1984, 23). Revisited by subsequent INA survey teams in 1996 (Pulak 1997, 313–4) and 2004 (Hentschel 2004, 12–13), the Kekova Adası wreck lies at a depth of 8–25 m not far off the island. Ceramic material visible on the seabed, along with diagnostic samples raised on survey and currently housed in the Bodrum Museum of Underwater Archaeology, speak for a cargo contained primarily in basket-handle jars from the Cypro-Levantine coast, along with a number of southeast Aegean and Corinthian amphoras. A second, more scattered Archaic wreck of Cypro-Levantine basket-handle amphoras at Kepçe Burnu, along the north of the Gulf of Gökova in the Muğla region, was discovered by INA's 1973 and 1980 surveys (Bass 1974, 335; Rosloff 1981, 279). The two sites represent the only probable 7<sup>th</sup>-century BC wrecks currently known from Turkish waters. Teams from the Institute of Marine Science and Technology at Dokuz Eylül University (2006, 2007) and Brock University, in collaboration with INA (2008), conducted visual reassessments of the two wrecks in order to determine their current condition and potential for future study. The information presented here is based primarily on photographs and notes from these earlier INA surveys (1973, 1980, 1983, 1996, and 2004) at the two sites, along with more recent restudy of diagnostic artifacts raised at the time and now in museum storage in Bodrum.

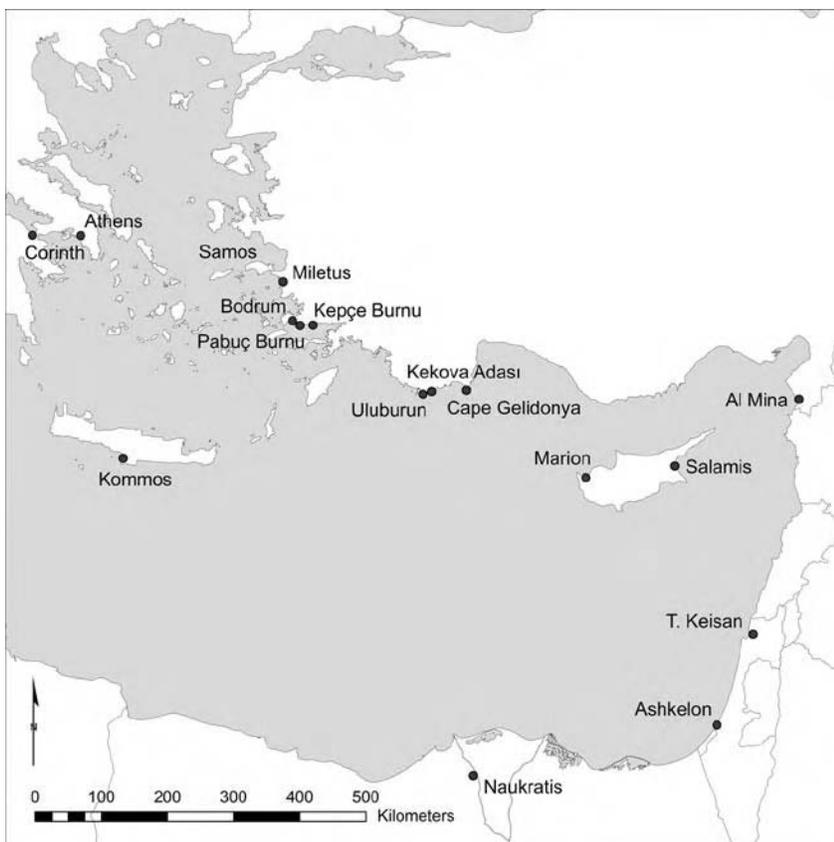
## The Site at Kekova Adası

Running northeast to southwest, Kekova Adası (Kekova Island) is located south of the modern towns of Üçağız ('three mouths', or ancient Teimiussa) and Kaleköy (named for the castle on its acropolis, or ancient Simena). Most of the visible ruins at sites in the area have been dated to the Hellenistic and Roman periods, including Aperlai, situated in an inlet just 5 km to the west (Hohlfelder and Vann 2007). Despite the later date of such architectural remains, the shelter provided by numerous anchorages inside the Kekova Roads and along this region of Lycia would have drawn coasting sailors certainly from the Bronze Age, as attested by the nearby shipwrecks at Uluburun and Cape Gelidonya (see Fig. 1). Indeed, the Lycian coast marks a critical passage for sailors making their way from Cyprus and the southern Anatolian coast toward ports in Aegean Asia Minor, the Ionian islands, and the cities of the Greek mainland. Descriptions of Homer and Herodotus support early occupation in the region, including during the Archaic period when a merchant vessel came to rest inside the straits, not far off Kekova Adası. Here, a shallow reef presents a prominent maritime hazard that would have threatened ancient mariners attempting to make landfall or simply seeking temporary shelter from storms and high seas.

Reports and photographs from the 1983, 1996, and 2004 surveys reveal a wreck marked by the broken and scattered remains of a ceramic cargo containing a mix of several Aegean and Cypro-Levantine amphora types: basket-handle jars from the coastal region of Cyprus or the Levant, south-east Aegean amphoras likely from Miletus or other nearby cities, and containers from Corinth (Fig. 2).

**FIG 1** below left  
Map depicting the locations of Kekova Adası and Kepçe Burnu.

**FIG 2** below right  
General view of the ceramics scattered on the seabed.  
Photograph by H. Özdaş, 2007.



*Basket-handle amphoras.* Perhaps as many as 90 Cypro-Levantine basket-handle amphoras comprise the largest visible component of the Kekova shipwreck assemblage, and probably represent the major cargo (Fig. 3). Named for the handles that rise above the rim to facilitate transport, these wide, biconical jars were produced in the eastern Mediterranean, probably first on Cyprus, where the earliest recorded examples appear by the latter 8<sup>th</sup> century in Tomb 79 in the necropolis of Salamis (Karageorghis 1973-1974, 115). Over the course of the 7<sup>th</sup> century, the type is known from the eastern Mediterranean littoral, including Cyprus and the Levant. Distribution beyond this edge of the Mediterranean, though, is minimal, especially for the early Archaic period, when the only assemblage that can be dated with any certainty to the 7<sup>th</sup> century is from Archaic “Building Q” at Kommos on Crete (Johnston 1993, 370).

While no intact basket-handle amphoras have yet been noted on the wreck, diagnostic fragments in the Bodrum Museum that include rims, bases, and handles allow for an overall impression and certain specifics of form and manufacture. The Kekova examples show the wide biconical body indicative of a generally early date—in the 7<sup>th</sup> century—with the closest parallels being Salamis Tomb 79 and T. Keisan. Just what agricultural product the jars carried remains unclear, but epigraphic evidence from the early Archaic period suggests their role in the transport of olive oil (Puech 1980, 301-303; Masson 1967, 132-133).

*Milesian(?) amphoras.* In far fewer numbers, but probably the second most common amphora at Kekova Adası, are the fragments from a type that resembles 7<sup>th</sup>-century examples from Miletus or perhaps other nearby Ionian centers (Fig. 4, also see Pulak 1997, 313-4, 320 fig. 8). Local finds from contexts datable to the middle of the 7<sup>th</sup> century at Miletus provide parallels for the rims, necks, and toes (Naso 2005, 79, cat. 4-6). By the mid-6<sup>th</sup> century, jars from Miletus and Samos see widespread circulation in the eastern and western Mediterranean, with finds in Etruria, South Italy, and Sicily, Athens, Abdera, Rhodes, Chios, Cyprus, Syria, Israel, and Egypt (Cook and Dupont 1998, 165; 174). In the west, the Giglio wreck, dated to approximately 600 BC (Bound 1991, 24), carried Samian amphoras alongside Corinthian aryballois, which Shipley (1987, 61) suggests may have contained perfumed oil from Samos. In general, the Milesian jars and their Samian counterparts have been associated with the transport of olive oil, but other agricultural goods including wine are plausible (Shipley 1987, 45, 61; Naso 2005, 78). Gras’ (2000, 155) suggestion of perfumed olive oil would fit well with the wreck’s association primarily with other oil-producing regions.

*Corinthian amphoras.* A few fragments of Corinthian Type A amphoras were raised during the 1983 and 1996 surveys to Kekova Adası (Fig. 5, also see Pulak 1997, 313-4, 320 fig. 8). Although the type appears least frequently in survey records, these fragments are perhaps most useful in establishing a date for the wreck. The earliest examples of the type, dated to the later 8<sup>th</sup> and early 7<sup>th</sup> century, are found at coastal sites in the western Mediterranean, where they were occasionally reused for infant burials, and are contextually associated with Protocorinthian fine wares (Berlingò 1995). Perhaps the closest parallels to amphoras found on the Kekova Adası wreck come from well-stratified deposits from the third quarter of the

**FIGS 3-5** opposite  
top to bottom

Basket-handle  
amphora fragments  
from Kekova Adası  
(raised in 1983),  
currently stored in the  
Bodrum Museum.

Top and base of  
Milesian(?) amphoras  
raised during the 1983  
and 1996 surveys at  
Kekova Adası,  
currently stored in the  
Bodrum Museum.

Top of a Corinthian  
amphora raised during  
the 1996 survey at  
Kekova Adası,  
currently stored  
in the Bodrum  
Museum.



7<sup>th</sup> century at Corinth itself (Amyx and Lawrence 1975, 157–8), as well as mid-century sites and tombs in Sicily, central and south Italy. Scattered underwater finds of Type A amphoras in the western Mediterranean have also been noted by Koehler (1978, 231). Based on fabric similarities with contemporary oil lamps and jugs, Koehler suggests that the Type A amphoras transported olive oil, as has been speculated for the basket-handle and Milesian(?) amphoras. The two Corinthian tops raised during the INA surveys exhibit certain differences in both form and fabric that may indicate the involvement of multiple producers.

*Other finds.* In addition to the amphoras, several examples of coarse ware ceramics have been noted. Near the center of the site, large fragments of two heavy rimmed shallow bowls, or mortaria, were observed along with many broken basket-handle amphoras (Fig. 6). Evidence from late Iron Age sites along the Syro-Palestinian coast, Cyprus, Rhodes, and Egypt—where mortaria are found alongside transport amphoras—as well as the 6<sup>th</sup>-century BC shipwreck at Pabuç Burnu, Turkey, suggests that such shallow bowls may have been used in the preparation of food for consumption or sale, or, alternatively, for the commercial measurement of dry goods (Greene et al. 2008, 705). Additional material on the wreck includes a fragmentary roof tile (raised in 1996) and what may be a (cooking?) pot. Mixed among the ceramic remains, ballast stones consisting of round riverine rock were found throughout the site (Hentschel 2004, 12). Both the ballast stones and the ceramic remains are heavily coated with marine concretion, bonding the artifacts to each other and the surrounding reef. Although this concretion obscures visibility, concentrations of artifacts appear to extend beneath the items on the surface, and it seems likely that smaller finds may have trickled down through crevices in the reef. Additionally, the flat sandy area that lies at the base of the reef around 21 meters deep may conceal other material, including surviving hull.

### Kepçe Burnu

Also contributing to the study of Archaic trade relations between Cyprus and the Ionian coast is a wreck of basket-handle amphoras at Kepçe Burnu discovered by INA surveys in 1973 and 1980 (Bass 1974, 335; Rosloff 1981, 279; Cowin 1986, 24–25, 49–51). Conveniently located about half the distance between Gökova and Gümüşlük, the harbor of Çökertme provides a safe evening's anchorage for sailors making their way along the Carian coast (see Fig. 1). Ceramic finds in the vicinity of the harbor suggest that the region held appeal to ancient sailors too, while a low headland just outside the bay—known locally as Kepçe Burnu, or 'Ladle Point' for its rounded, spoon-like shape—represents an ancient and modern navigational hazard (Fig 7). The shallows around the point have claimed at least two wrecks; the 1973 and 1980 INA surveys record a second assemblage of Hellenistic Knidian and Rhodian amphoras (Rosloff 1981, 279–280; Cowin 1986, 52–54). Diagnostic fragments of basket-handle amphoras raised during these investigations reveal regional, typological and probably chronological similarities to the Cypro-Levantine jars from Kekova Adası (Fig. 8; see also Cowin 1986, pl.1). In 2008, a team from Brock University visited the site to observe the remains of this large

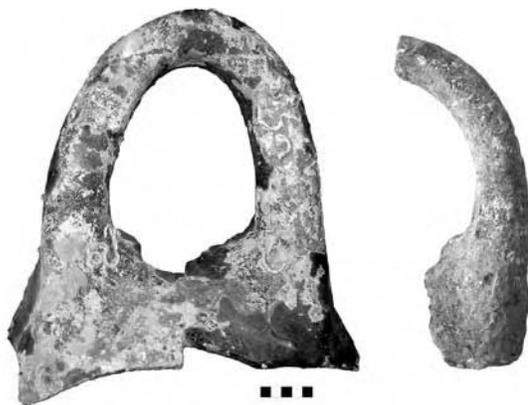


**FIG 6**  
Two fragmentary mortaria lie among the remains of basket-handle amphoras at Kekova Adasi. Photograph by S. Matthews, 2004.

**FIG 7** right  
View of Kepçe Burnu, or “Ladle Point”, taken from the northeast.



**FIG 8** below  
Basket-handle amphora fragments from Kepçe Burnu (raised in 1980), currently stored in the Bodrum Museum.



shallow scatter, its heavily broken material extending into and often obscured by *Poseidonias* grass.

While the scattered and broken condition of the site makes conclusions far more difficult to draw at Kepçe Burnu, the wreck adds another dimension to the picture of Archaic interaction between the Cypro-Levantine region and the Ionian coast. At both Kepçe Burnu and Kekova Adası, the basket-handle amphoras suggest olive oil—destined for consumption or manufacturing—as the driving force behind the exchange. The Milesian(?)—style amphoras seen on the wreck at Kekova Adası, along with the location of the Kepçe Burnu wreck, may suggest a developing (or developed) partnership in the transport of olive oil between the Cypro-Levantine coast and the cities of the southeast Aegean.

### Preliminary Conclusions and Future Research

The unique material assemblages at Kekova Adası and Kepçe Burnu could yield significant new insight into the structure of early Archaic production, distribution, and exchange systems during the age of Greek colonization and state formation. Of particular interest for future study is the development of mechanisms designed to facilitate trade in the largely protomonetary economy of the 7<sup>th</sup> century. Before the widespread use of coinage in the Greek world, ceramic amphoras—the medium of exchange visible on shipwrecks—might mimic the function of early money—that is, approximately standard in size, shape, visual appearance, and linear or metric dimensions, as guaranteed by the issuing city—and provide a window

into the problematic mechanics of this early economy (Greene et al. 2008, 703–7). Through future exploration of the sites, artifact analysis, and the investigation of additional Archaic wrecks along the Aegean and Mediterranean coasts of Turkey, we hope to ask a series of interlaced questions about (1) the exchange of bulk agricultural material in ceramic storage containers; (2) the location, scale, and standardization of early amphora production; and (3) how the material record of seaborne trade correlates to the picture obtained from the literary record.

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### Works Cited

- Amyx, D. A. and P. Lawrence (1975). *Corinth*, Vol. 7.2. *Archaic Corinthian Pottery and the Anaploga Well*. Princeton.
- Bass, G. F. (1974). "Turkey, Survey for Shipwrecks, 1973." *IJNA* 3:2, 335–338.
- Berlingò, I. (1995). "Importazione Corinzie nella Siritide." In *Corinto e l'occidente: Atti del trentaquattresimo convegno di studi sulla Magna Grecia*, 417–430. Taranto.
- Bound, M. (1991). *The Giglio Wreck: a Wreck of the Archaic Period (c. 600 BC) off the Tuscan Island of Giglio*. Enalìa Supplement 1. Athens.

- Cook, R. M. and P. Dupont. (1998). *East Greek Pottery*. London.
- Cowin, Margaret M. (1986). *Artifacts Recovered off the Southwestern Turkish Coast by Institute of Nautical Archaeology Shipwreck Surveys in 1973 and 1980*. M.A. thesis, Texas A&M University.
- Frey, D. A. (1984). "Turkish Coastal Survey." *INA Quarterly* 11: 4.
- Gras, M. (2000). "Commercio e scambi tra Oriente e Occidente." In *Magna Grecia e Oriente mediterraneo prima dell'età ellenistica: Atti del 39 Convegno di Studi sulla Magna Grecia: Taranto 1-5 Ottobre 1999*, 125–64. Taranto.
- Greene, E. S., M. L. Lawall and M. E. Polzer (2008). "Inconspicuous Consumption: the Sixth-Century BCE. Shipwreck at Pabuç Burnu, Turkey." *AJA* 112, 685–711.
- Hentschel, F. (2004). "The 2004 Ancient Shipwreck Survey in Turkey." *INA Quarterly* 31:4, 10–13.
- Hohlfelder, R. L. and R. L. Vann. (2007). "Cabotage at Aperlae in Ancient Lycia." *IJNA* 29, 126–135.
- Johnston, A. (1993). "Pottery from Archaic Building Q at Kommos." *Hesperia* 62:3, 339–382.
- Karageorghis, V. (1973-1974). *Excavations in the Necropolis of Salamis*, Vol. 3. Nicosia.
- Koehler, C. (1978). "Evidence around the Mediterranean for Corinthian Export of Wine and Oil." In *Beneath the Waters of Time. Proceedings of the Ninth Conference on Underwater Archaeology*, edited by J. B. Arnold III, 231–239. Austin.
- Masson, O. (1967). "Les inscriptions syllabiques." In *Excavations in the Necropolis of Salamis*, Vol. 1, by V. Karageorghis, 132–142. Nicosia.
- Naso, A. (2005). "Funde aus Milet. XIX Anfore commerciali arcaiche a Mileto: rapporto preliminare." *AA* 2005:2, 73–84.
- Puech, É. (1980). "Inscriptions, incisions et poids." In *Tell Keisan (1971-1976): une cite phénicienne en Galilée*, edited by J. Briand and J. B. Humbert, 301–310. Fribourg.
- Pulak, C. (1997). "1996 Sualtı Araştırması." *Araştırması Sonuçları Toplantısı* 15, 307–322.
- Rosloff, J. P. (1981). "INA's 1980 Turkish Underwater Survey." *International Journal of Nautical Archaeology* 10:4, 277–286.
- Shiple, G. (1987). "A History of Samos: 800–188 BC." Oxford.
- Yıldız, Y. (1984). "1983 Sualtı Batık Gemi Araştırması." *Araştırma Sonuçları Toplantısı* 2, 21–29.



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# The Nautical Archaeology of Puerto Rico

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## Introduction

Puerto Rico played a key role in the five centuries of history of the New World. Its waters harbor the remains of thousands of years of human occupation and a submerged cultural heritage that spans five centuries of European and American maritime history.

The importance of this immense repository of knowledge is obvious, from the scientific viewpoint, but also from the environmental one, since the cultural heritage is an integral part of a country's environment.

In June 2007 we met with a number of Puerto Rican officials to introduce the Centre for Maritime Archaeology and Conservation and Texas A&M University's Nautical Archaeology Program, and to present our interest in the study of the country's maritime history, with a special focus on its shipwrecks. We met with officials from the State Historic Preservation Office, the Council of Underwater Archaeology (Instituto de Cultura), and the Direccion de Recursos Naturales e Ambientales.

We combined to start a three-phase project. In 2008 we planned to start the first phase, consisting of a diagnostic of the submerged cultural heritage situation in Puerto Rico. The main objectives of this phase were to evaluate the number, chronologic span and condition of the known shipwreck sites, and document the destructions of treasure hunters and looters, in order to allow the second phase to start in 2009.

The second phase will consist of a number of prognostics pertaining to the situation of particular areas or shipwreck sites in order to classify them in terms of their stability and threatens, in relation to their rarity and archaeological relevance.

In 2010, we are planning to take action in terms of starting a small conservation laboratory in Puerto Rico, perhaps in cooperation with the Council of Council of Underwater Archaeology.

**Field Season Duration**

The Centre for Maritime Archaeology and Conservation, the Institute of Nautical Archaeology, and the Instituto de Investigaciones Costaneras, conducted a joint field season in 2008, from July 1 to July 21.

**Team**

The team was composed of Filipe Castro, archaeologist, PI, Richard Fontánez, archaeologist and MD, co-PI, Gustavo García, archaeologist, co-PI, Raymond Tubby, archaeologist, Wayne Lusardi, archaeologist, and Freddy Martinez Gonzalez, skipper.

**Area**

The area of study in the 2008 field season was situated between the points with coordinates N 18° 27' 20.88", W 065° 54' 26.69" and N 18° 28' 27.35", W 066° 07' 26.43", spanning the coasts of the municipios of Loíza, Carolina, and San Juan.



**FIG 1** above top  
Area of intervention of the 2008 field season. Photograph from Google Earth.

**FIG 2** above  
West areas surveyed in the 2008 field season. Photograph from Google Earth.

## Methodology

As stated in our January 2008 proposal, our objective is to promote the study of Puerto Rico's seafaring history through the investigation of its submerged cultural heritage. This objective entails five basic tasks:

1. A systematic survey the archipelago's coast to assess the geomorphology and archaeological potential;
2. An inventory of the archipelago's submerged cultural heritage and assessment of each site's importance, formation, state of preservation, and potential threats;
3. Inspection, documentation and characterization of all relevant sites;
4. Excavation of a selected number of sites with potential to substantially increase our knowledge of the archipelago's seafaring history;
5. Research, compilation, and organization of the archipelago's maritime history with special emphasis on the historical records of shipwrecks in its waters;
6. The creation of a research center and maritime museum, in partnership with the government.

The area selected in this first season was a natural expansion

of the research started by Richard Fontánez in 2006, on the coastal area situated between Boca de Cangrejos and Punta Isla Verde.

The means utilized in the surveys of areas selected within the study area were remote sensing (with magnetometer and side scan sonar) and visual inspection (through diving and tow boarding).

Fieldwork proceeded uninterrupted throughout the weeks, between 06:00 and 16:00 hours, after which the team cleaned and maintained the equipments and performed the daily bureaucratic tasks, except in the days 3, 7, and 9 of July, when the weather did not allow any diving or remote sensing activities.

## Results

In the course of the field season, 20 previously known sites were located and 19 inspected, a new site was located (Isla Verde 3), and about 80 sites with potential interest were identified through conversations and interviews with local divers and informants.

The most relevant sites surveyed in 2008 were:

### Punta Vacia Talega

001—*Punta Vacia Talega*, c. 1650? The Punta Talega site is located off Punta Vacia Talega. The area surveyed measures approximately 400 meters long and 400 meters wide. It covers the purported position of a wood stock anchor and cannon recovered by a local fisherman several years ago. The site was said to lie just off the reef at the eastern end of Punta Vacia Talega. The goals of the survey were to search for other possibly associated cultural material or shipwreck debris. Survey tracklines were informally laid, running both north/south and east/west to

cover the entire area under investigation. The area close to the islet was surveyed but no evidence of a shipwreck was located. Three targets were identified but proved to be limestone outcrops. Another informant later told us that the site is located at a depth of around 30 m (100 ft).

### Isla Verde

Consisting of a wide bay divided longitudinally by a coral reef that runs parallel to the coast, the Isla Verde Bay has a fairly flat rocky bottom with thin sand pockets on the outside of the reef, and a predominantly sandy bottom on the area inside the reef.

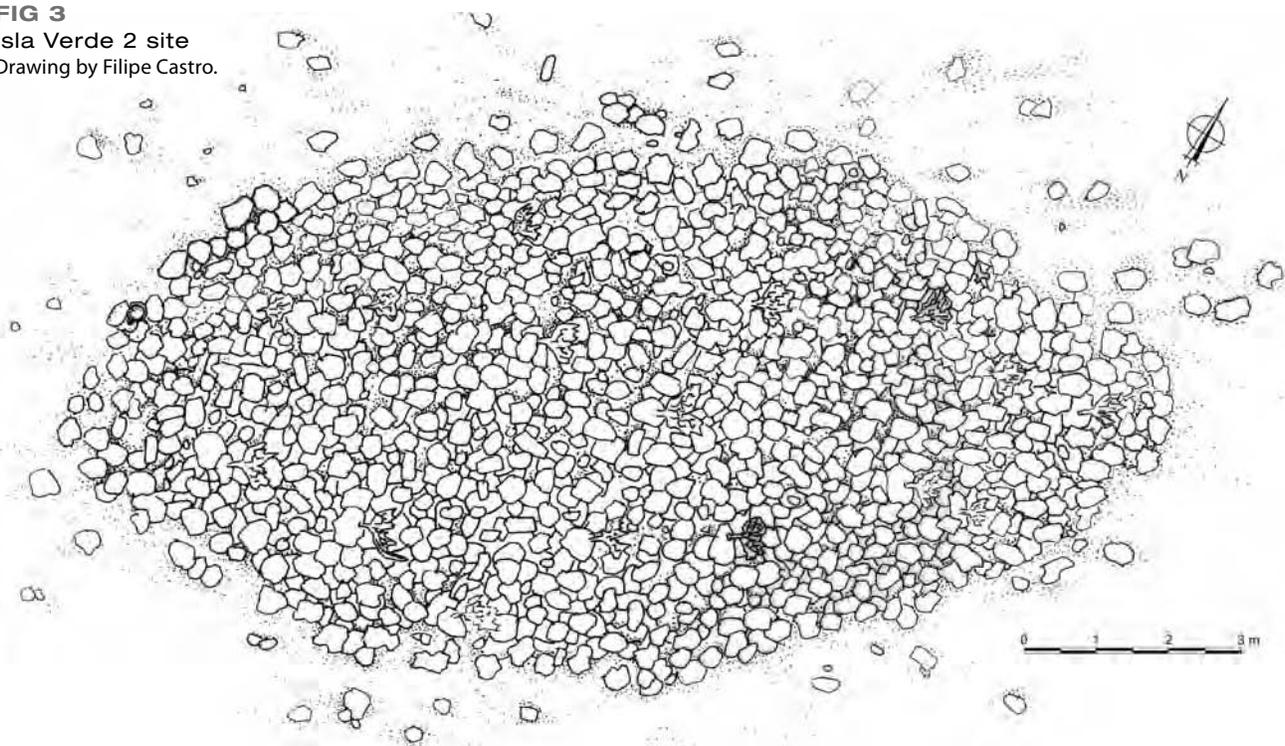
Richard Fontánez has surveyed part of the bay, inspecting the 1898 site of *Consquistador*, and discovering the previously unknown Isla Verde 2 site, as well as a Pre-Colombian site that is out of the scope of this project, although only for the time being.

In this 2008 campaign Wayne Lusardi found a 19<sup>th</sup>-century anchor while tow boarding in parallel lines to the beach.

002—*Isla Verde 1—Conquistador*, 1898 This is a late 19<sup>th</sup>-century steamer previously studied by Richard Fontánez. It was badly broken after salvage operations that recovered some of its bronze parts. The site strands across a large area and is mixed in certain areas with materials from the Isla Verde 2 shipwreck site.

There is a plan to record the entire site under the direction of Richard Fontánez. A large number of rims and shards from large jars—which seem to come in two different sizes—can be seen on the shipwreck and between this shipwreck and the nearby Isla Verde 2. One of these rims—of the

**FIG 3**  
Isla Verde 2 site  
Drawing by Filipe Castro.



smallest size –has been raised by Richard Fontánez in 2006 and a drawing has been made. An extensive area, over and around this site, was examined through tow boarding which resulted in the identification of the site Isla Verde 3 (see below).

003–*Isla Verde 2*, c. 1800

This site consists of a ballast pile with ceramics that have not yet been identified nor dated (Fig. 3). The ballast pile measures approximately 15.5 x 8.5 m. There were no other diagnostic remains on the site, such as anchors, cannons, or artifacts. The ceramics that occur, embedded in the ballast pile, are spread over a large area, extending all the way to the reef, at a very shallow depth, about 200 m away from the ballast pile. The larger stoneware pots—which do not appear embedded in the ballast pile—are also spread over a large area, the best preserved appearing under the remains of the steamer *Conquistador*.

Although very unlikely, at this stage we cannot exclude the possibility that the larger stoneware pots were part of the *Conquistador* cargo.

004–*Isla Verde 3*, c. 1900?

An admiralty anchor similar to the one found in Isla de Cabras 3, isolated, with no apparent shipwreck site associated.

### North Coast from Isla Verde to the Bay of San Juan and Isla de Cabras

The coastal area between Isla Verde and San Juan was partially surveyed in 2008. Focus was placed on the areas where fishermen claim to have seen artifacts and shipwreck remains.

The remote sensing areas previously established were subdivided and in certain cases newly created in order to isolate groups of material

culture which have potentially different origins.

005–*San Geronimo*, 18<sup>th</sup> century  
San Geronimo site is located at the eastern end of Isla San Juan, approximately 250 meters north east of Fort San Geronimo. Tradition claims that General Abercrombie lost one ship in this area in 1797. More recently, in the 1980s, a diver reportedly raised an iron gun from within the area and noted a second one nearby at a shallower depth (Fig. 4).

There is no mention of a shipwreck in any of the accounts of Abercrombie’s failed attempt to conquer Puerto Rico.

Informant Mr. Agustin Otero showed us the second gun, still in situ, and Gustavo Garcia found a third gun nearby on our first dive. Mr. Agustin Otero told us later that there are another two iron guns nearby, on top of a rock, concreted together.

The survey area measures approximately 1,000 meters long and 600 meters wide and includes both inshore and offshore sections of coastal reef. The survey area was established to encompass the location of the two cannons mentioned by Mr. Otero as situated inshore of the reef. The goals of the survey were to determine whether the cannons were associated with an unknown wreck site and if additional cultural material lies offshore of the reef complex. To ensure sufficient data would be available to locate any potentially significant targets in the area survey tracklines were established on a 23-meter lane spacing and laid in an east-west direction.

The bottom is rocky with shallow sand pockets, and the sea has a fairly high energy in the area almost all year round. The depth, between 3 and 6 m

(10 and 18 ft.), makes it unlikely that these guns are connected with the main portion of the shipwreck, assuming that there is one. Due to its shallow nature, this shipwreck was certainly salvaged and all the local fishermen seem to know about it.

During a subsequent dive Wayne Lusardi spotted what seems to be a copper pot buried in the sand and heavily decayed.

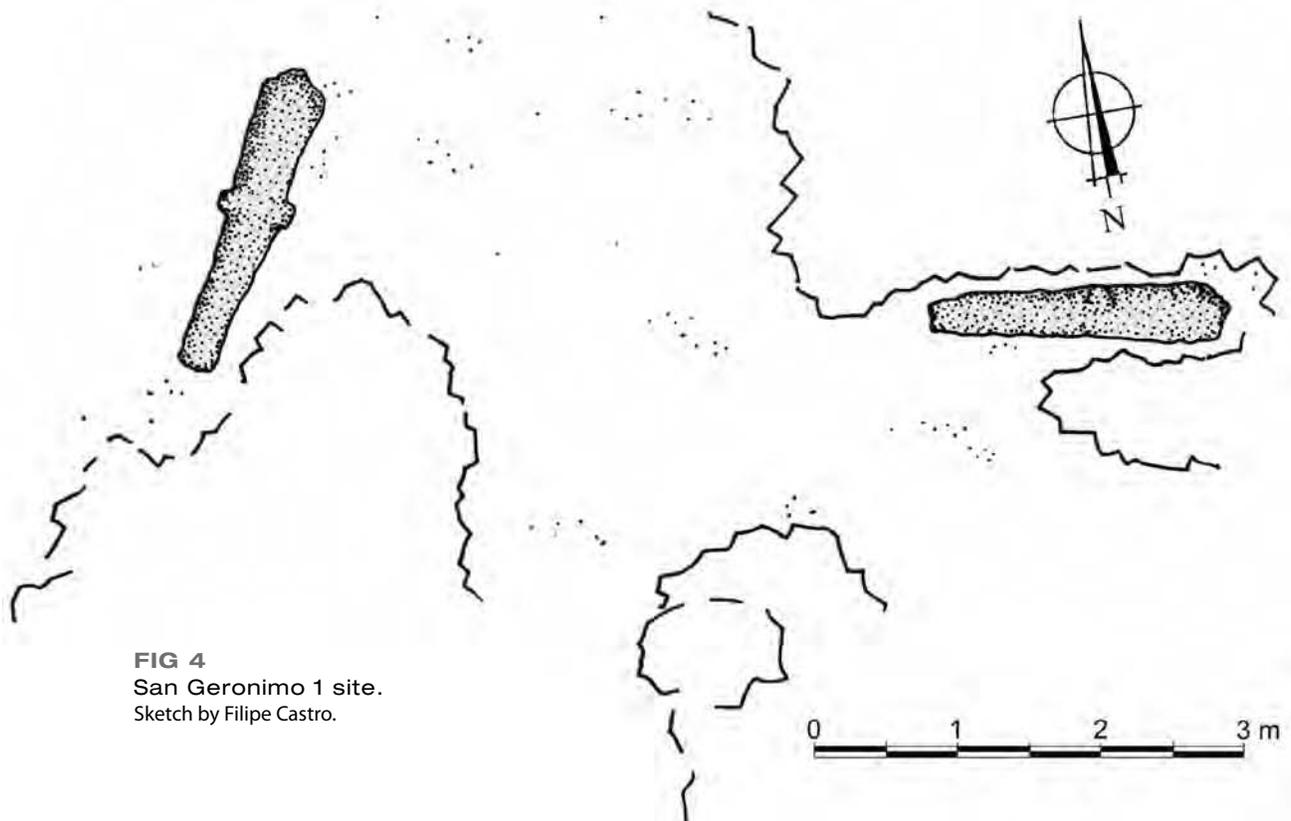
It is likely that, as it happened with so many places, the surroundings of El Morro were regularly surveyed for artifacts, mostly after the development of scuba diving.

The site was surveyed with magnetometer, side scan sonar and visual inspection, both with tow boarding and diving. A total of 13 magnetic targets were located and are described in the comprehensive report.

006—*San Juan 1* (Tinajas site), c. 1750

*San Juan 1* site is located adjacent to the shoreline of Isla San Juan on the western side of El Morro. The survey area measures approximately 300 meters long and 60 meters wide. The area was established to explore a known scatter of cultural material consisting principally of olive jar fragments. The goals of the survey were to determine whether the ceramic fragments were associated with an unknown wreck site. To ensure sufficient data would be available to locate any potentially significant targets in the area, survey tracklines were established on a 15-meter lane spacing and laid to follow the shoreline.

Upon visual inspection, this site was found to consist of a scatter of ballast stones and red clay shards mainly consisting of olive jar rims spread over an area with



**FIG 4**  
San Geronimo 1 site.  
Sketch by Filipe Castro.

iron concretions attached to the rocks.

The area surrounding the ballast pile is littered with olive jar shards and iron concretions, which accumulate in the rock crevices. There are large pockets of sediment that may contain artifacts and perhaps hull remains. We have raised one olive jar rim to make a drawing and placed it back on the site. It appears to be a typical Middle Style rim, dating from somewhere between 1580 to 1800. One charred timber was found in one of the crevices. A sample was taken for carbon dating and yielded a date (for 2 sigma) Cal AD 1440–1640, compatible with the rim style.

007—*Isla de Cabras 1*, not yet dated  
Situating near the main San Juan channel, between the forts of El Morro and Isla de Cabras, the remote sensing area designated 008/009 was subdivided into Isla de Cabras sites 1 and 2.

Site 1 was recorded (and salvaged) by Mr. Miguel Pagan, and later destroyed by dredging works.

The entire area 008/009 extends in a roughly north-south direction beginning half way between buoys R2 and R4 and ending to just south of buoy R6, and measures approximately 600 meters long and 200 meters wide.

It was surveyed with remote sensing equipment and visually inspected. The main goals of the survey were to determine whether sections of the wrecks still survived: the site salvaged by Mr. Pagan and designated Isla de Cabras 1, and the sites of the remains of two 19<sup>th</sup>-century iron hulls—*Cristobal Colon* and *Manuela*—destroyed and removed by the U.S. Army Corps of Engineers in 2000. To ensure sufficient data would be

available to locate any potentially significant targets in the area, survey tracklines were established on a 15-meter lane spacing and laid to follow the buoy line along the west side of the channel.

Richard Fontáñez had surveyed this site in the 1990s. We surveyed the edge of the channel with side scan sonar and could not find any trace of this vessel. It was probably destroyed by dredging works. A number of dives were performed on the area and we were unable to locate the remains of the Isla de Cabras 1 site.

008—*Isla de Cabras 2*  
(*Manuela* and *Cristobal Colon*), 1898  
Near the channel, between the forts of El Morro and Isla de Cabras, the remains of two metal hulls from the Spanish American War (*Manuela* and *Cristobal Colon*), which were classified as modern and destroyed during dredging works. Their remains were later found to have archaeological importance and partially salvaged, recorded, and barged to a site near the *Antonio Lopez* shipwreck site.

We surveyed with side scan sonar over the edge of the channel and found several portions of *Manuela* broken and scattered along the edge of the channel. In fact, seven acoustic anomalies were identified in the Isla de Cabras 2 survey area, of which six may indeed be sections of iron hull from the Spanish-American War vessels *Cristobal Colon* and *Manuela*.

009—*Isla de Cabras 3*, c. 1850  
A sand channel next to Isla de Cabras, around 10 meters deep, where a number of important artifacts have been retrieved in the past. The channel lies almost perpendicular to the San Juan channel. The sea breaks before and

after the channel but normally not over the area.

Fishermen obviously fish in the area because the bottom is littered with tires (placed as habitats for lobsters) and beer bottles.

There is an anchor with an iron stock (admiralty) on the site, perhaps dating to the early 19<sup>th</sup> century. Wayne Lusardi found a doll head in porcelain and a glass (or crystal) bottle stop, perhaps dating to the mid-19<sup>th</sup> century. Richard Fontáñez found a small portion of a copper bolt around 2.5 cm in diameter.

010—*Isla de Cabras 4*, early 17<sup>th</sup> C  
Nearby an old anchor was raised around 20 years ago, together with five iron guns and a bronze cannon, dated to 1602, that is now in the University of Puerto Rico. The anchor is also in San Juan (at the time it was purchased it was said to come from Mona Island), presumably in a bad state of preservation. According to Mr. Agustin Otero the site was littered with clay jars that were slowly looted and raised by fishermen since the mid-1960s. A few ballast stones were observed scattered within the area during the 2008 investigation.

011—*Isla de Cabras 5 and 6*, 1982  
The remains of a barge and a tow boat allegedly lost in this area in the 1980s cover the entire area with debris.

012—*Isla de Cabras 7*, 1598?  
Near the small fortress close to Isla de Cabras, probably where Drake lost around 400 men, the possible remains of a small boat with a grapnel anchor seen by Richard Fontáñez and Jerome Hall about a decade ago.

013—*Isla de Cabras 8*, not yet dated  
The Isla de Cabras 8 site is located in the coastal waters near the mouth of San Juan Bay off the northern end of Isla de Cabras. The survey area measures approximately 1,000 meters long and 200 meters wide. The area covers the purported position of two small cannons recovered by Mr. Agustin Otero, a local fisherman, some years ago. We surveyed the area with side-scan sonar and found the bottom to be sandy and fairly flat. No remains of an historic shipwreck were found. Later on, Mr. Otero told us that this site consisted of a scatter of debris, and that as far as he knew there was no ballast mound. He confirmed, however, that the two small bronze (signal) guns, around 70 cm in length, were found there, among scattered pot shards and ballast stones.

Four acoustic anomalies were identified in Isla de Cabras 8 survey area and are described in the comprehensive report. Three of the sonar contacts (IC-S1, IC-S3, and IC-S4) appear to be isolated limestone/reef outcrops and have been classified as low priority for shipwreck and/or other submerged cultural resources. The remaining anomaly (IC-S2) consists of two linear objects less than 1.5 m long. The targets may represent cannons, pipe or other modern debris. As the anomaly could represent either a historic resource or modern debris it has been classified as moderate priority for shipwreck and/or other submerged cultural resources. The bottom surface in the survey area is characterized as a mostly featureless sandy bottom. Time constraints and weather conditions prevented diver investigation of IC-S2.

014—*Isla de Cabras 9*, c. 1900?  
A site located outside the bay, near the entering channel, about 25 feet deep. It is a metal hull, probably dated to the late 19<sup>th</sup> century. We believe this to be the one marked on the San Juan Bay chart.

015—*San Juan 2*—Governor's Palace, not yet dated  
A site inside the San Juan Bay where Mr. Agustin Otero found two jars many years ago. The site borders with the channel, which has been dredged many times since the late 19<sup>th</sup> century. There were a few red bricks, some pot shards with red paste and Wayne Lusardi saw a fluke of a concreted anchor on the edge of the platform, where the dredging works stopped.

### Cerro Gordo

Cerro Gordo is a small bay (Fig. 4) with a small coral reef in the center, and another larger, at the entrance. In spite these shoals, the bay was used as a shipyard, perhaps intermittently, from the 17<sup>th</sup> to the mid-19<sup>th</sup> century.

The bay was surveyed and inspected by Richard Fontáñez in the mid-1990s, and four sites of interest were inspected. In 2008 we dived twice in the bay, mainly to assess the condition of these sites.

016—*Cerro Gordo 1*, not dated  
A number of small ballast piles to the east of the bay, probably not from a shipwreck. In the 2008 season we did not dive on this area.

017—*Cerro Gordo 2*, c. 1850  
A number of timbers with carpenter's marks that were left buried when an existing shipyard was closed in the late 19<sup>th</sup> century.

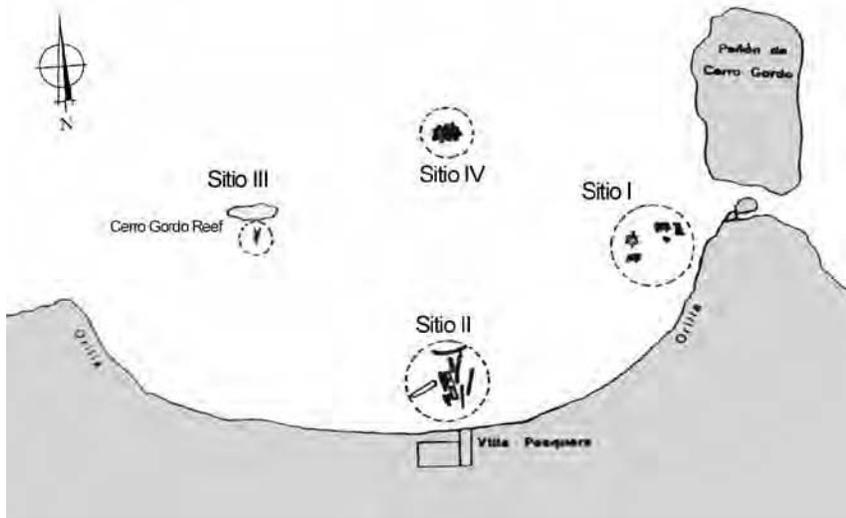
018—*Cerro Gordo 3*, not yet dated  
Timbers situated next to a reef in the center of the bay. In the 2008 season we only briefly passed over this area and observed the existence of timbers and other material culture.

019—*Cerro Gordo 4*, 1621? (Fig. 5)  
The remains of a shipwreck of unknown date, with timber under the ballast. This site was surveyed by Richard Fontáñez in the 1990s and the timbers partially recorded. There is a historical account of a nao being lost here in 1621, upon its launching. According to the historical account a company of soldiers was sent to the site to salvage as much as they could from the stranded ship.

In the 1970s a treasure hunter is said to have turned each and every ballast stone and raised all the artifacts he could find, which were sold and have since disappeared. Along with these artifacts were early style olive jars.

Given the nature of the salvage works, however, it is impossible to assert whether these jars were in association with the shipwreck site, as was allegedly claimed by the treasure hunter.

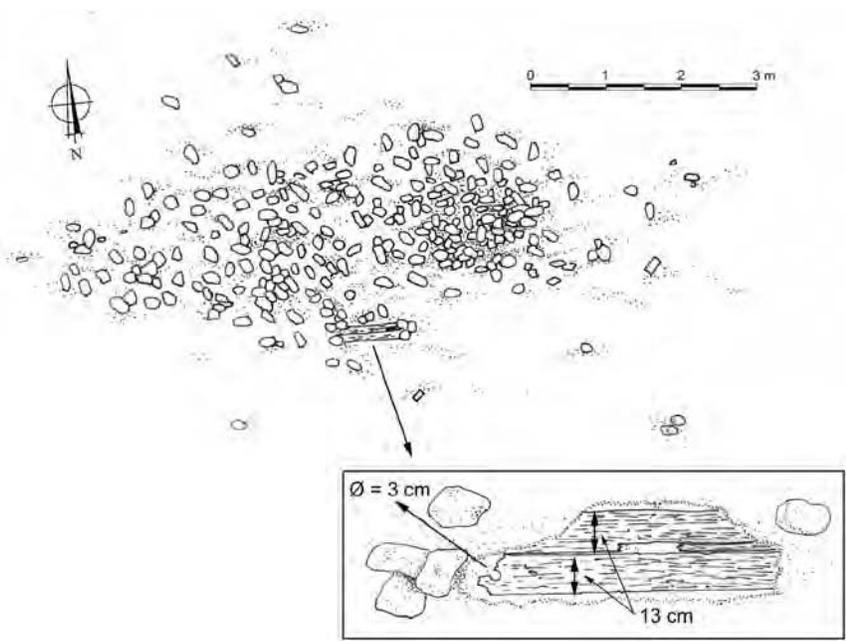
In our second dive we focused our attention on this shipwreck site, in order to assess the condition of the shipwreck remains. The timbers that Richard Fontáñez saw in the 1990s appear to be there, in a good state of preservation. We opened a small trench, about 5 cm deep, and took a 5 x 3 x 1 cm sample of the timber for carbon dating. The date obtained by radiocarbon intercepted the calibration curve in three places, yielding a range of possible dates situated between 1650 and 1950.



## Conclusions

As in many other places around the world, the last four decades were very destructive for Puerto Rico's cultural heritage. Almost all the sites considered (19 out of 20) had been dredged, salvaged, or looted. This fact illustrates the destruction of the world's cultural heritage by looters and treasure-hunters—the distinction made here being that treasure-hunters work legally—during the second half of the 20<sup>th</sup> century, and argues for urgent government action to protect whatever remains.

A GIS map of all the sites surveyed and those whose locations were indicated to us is being developed, having after the first season around 100 targets. We hope that the 2008 field season is the first of a long series of archaeological interventions aiming at a full inventory of the island's submerged cultural resources and a comprehensive study of the country's maritime history. We believe that even if many of the sites surveyed have been heavily destroyed, a careful assessment of each one will help us find patterns and trends, and further a better understanding of New World maritime history.



**FIG 5 top**  
Sketch of the bay. Richard Fontanez, 1995.

**FIG 6**  
Sketch of Cerro Gordo 4 site. Filipe Castro.



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## The Frigate *Ertuğrul*

The 2008 Underwater Excavation Season

### Background

In 1889, Sultan Abdulhamid II dispatched the Imperial frigate *Ertuğrul* to Japan under his admiral Osman Pasha. The voyage was a goodwill mission signaling growing friendship between the Ottoman Empire and the new rising power of the East, but it ended in tragedy. *Ertuğrul* sank in a typhoon before leaving Japan in September 1890, and all but 69 of her 609 crew and their commander were lost. To this day the disaster holds an important place in both Japanese and Turkish history, and the shipwreck itself is recognized as a founding monument of the friendship between the two nations.

In 2004, Tufan Turanlı visited Kushimoto to investigate the possibility of excavating and recovering the remains of *Ertuğrul*, which sank near the lighthouse of Oshima Island in southeast Japan. The result was the “*Ertuğrul* Project,” a collaboration between the Institute of Nautical Archaeology and Yapi Kredi Emeklilik. Other Turkish and international companies also participated as complementary sponsors providing transportation (Turkish Airlines), sonar survey (TOYO) and magnetometer survey (OYO).

In January 2007, a team from Turkey under the direction of Tufan Turanlı and Cemal Pulak conducted an underwater survey of the *Ertuğrul* wreck location. Various teams worked simultaneously to ascertain the site area and locate the remains of the ship and her cargo using sonar, magnetometer and visual survey. Several of the objects raised during this time were brought to INA’s lab in Bodrum for conservation before being returned to the Turkish Museum on Oshima Island, Japan. (see 2007 archaeological report and *The INA Annual 2007*).

A year later, Tufan Turanlı and his team returned for the first season of underwater excavation of *Ertuğrul*.



**FIG 1 top**  
Akagi, Enomoto, Nakamura, Turanlı in the dive boat.

**FIG 2 middle**  
Lledó, Nakamura, Enomoto and Turanlı planning a dive.

**FIG 3 bottom**  
Dive boat approaching the wreck site.

## The First Excavation Season: Jan–Feb 2008

The experience of the 2007 survey helped us plan and prepare for the logistics of a more ambitious project in 2008—and as always, the work began many months before the field season.

Based on the 2007 survey, we determined that the main concentration of artifacts of this very disturbed site had collected in an underwater valley. This feature is a narrow gorge about 55 meters in length with a width varying from 2 to 4 meters. At the end of this gorge, the channel makes a 90 degree turn to an area where a large rock has fallen, creating a pseudo cave. For the 2008 season we decided to concentrate our excavation efforts in two areas: the north end of the submerged valley in an area of approximately 8 by 4 meters, and in the cave, an area of about 3 by 3 meters.

The 2008 field season occupied 40 days but due to unfavorable weather the dives were limited to 20 days. During the non-diving days we were able to work in the lab keeping records up to date. The diving team consisted of Turanlı, Subay, Lledó, Nakamura, Enomoto, Shimano and Akagi (Figs. 1 and 2). Dives were conducted twice a day, and lasted approximately one hour each, which resulted in a total of 153 hours of bottom time for the season. Twice during the campaign the underwater site was opened to journalists and press representatives.

The site is surrounded by high rocks that in some cases reach the surface: these are the treacherous rocks that *Ertuğrul* hit before sinking (Fig. 3). This rugged landscape together with the shallow depth of the site (averaging



**FIG 4 left**  
Turanlı and Lledó  
examining a wood  
fragment raised by  
Enomoto.

**FIG 5 right**  
Aerial view of the  
excavation area.

13 meters) and the currents channeled through the underwater gorge, made the underwater work quite demanding. We often had to hold on to the rocks to be able to work. The remains of *Ertuğrul* have been subject to the battering of this dynamic ocean environment for the last 118 years, and our expectations of finding anything substantial from the ship and cargo were not high when we started the excavation.

The first dive went into the water on January 15. Our first task was to get a safe anchorage for our dive boat, a 4-ton fishing boat from the local harbor of Kashino. Once the vessel was secure, a dredge system was set up. Two high pressure Honda water pumps sat on the fishing boat deck. The water hoses were left on our permanent anchoring buoy, ready to be attached to the pumps at the start of each day's work.

During the first few dives the dredges were used to clean the target areas of gravel and shells while large stones were carried out by means of baskets and balloons. Some large stones were also removed. At this point one of our divers, Feyyaz Subay from INA-Turkey, got ill with a serious case of influenza, which required a trip to hospital and unfortunately ruled out further diving. Feyyaz returned to Turkey a few days later.

At the start of the 2008 excavation, the wreck site was covered with 118 years of accumulated broken shells and pebbles, mixed with many fragments from *Ertuğrul's* hull and cargo. These small items included porcelain, glass, and especially copper alloy objects such as nails and screws. The location of such debris, like the gravel it was mixed in with, bore little relation to the point of its original deposition. This heavily disturbed archaeological level extended down almost 0.5 meters in some areas. We reached a layer of compacted sand only in the last few days of the 2008 field season. The artifacts found at this level proved to be in much better condition, and some may even occupy their original resting places.

For example, we uncovered some broken porcelain pieces with all the fragments in place, or showing old fractures; some objects here were concreted to surrounding metal or wood pieces (Fig. 4). Although the nature of the wreck and the condition of the terrain make us doubt we will ever find purely undisturbed layers, we now have great hopes in the 2009 excavation season (Fig. 5).

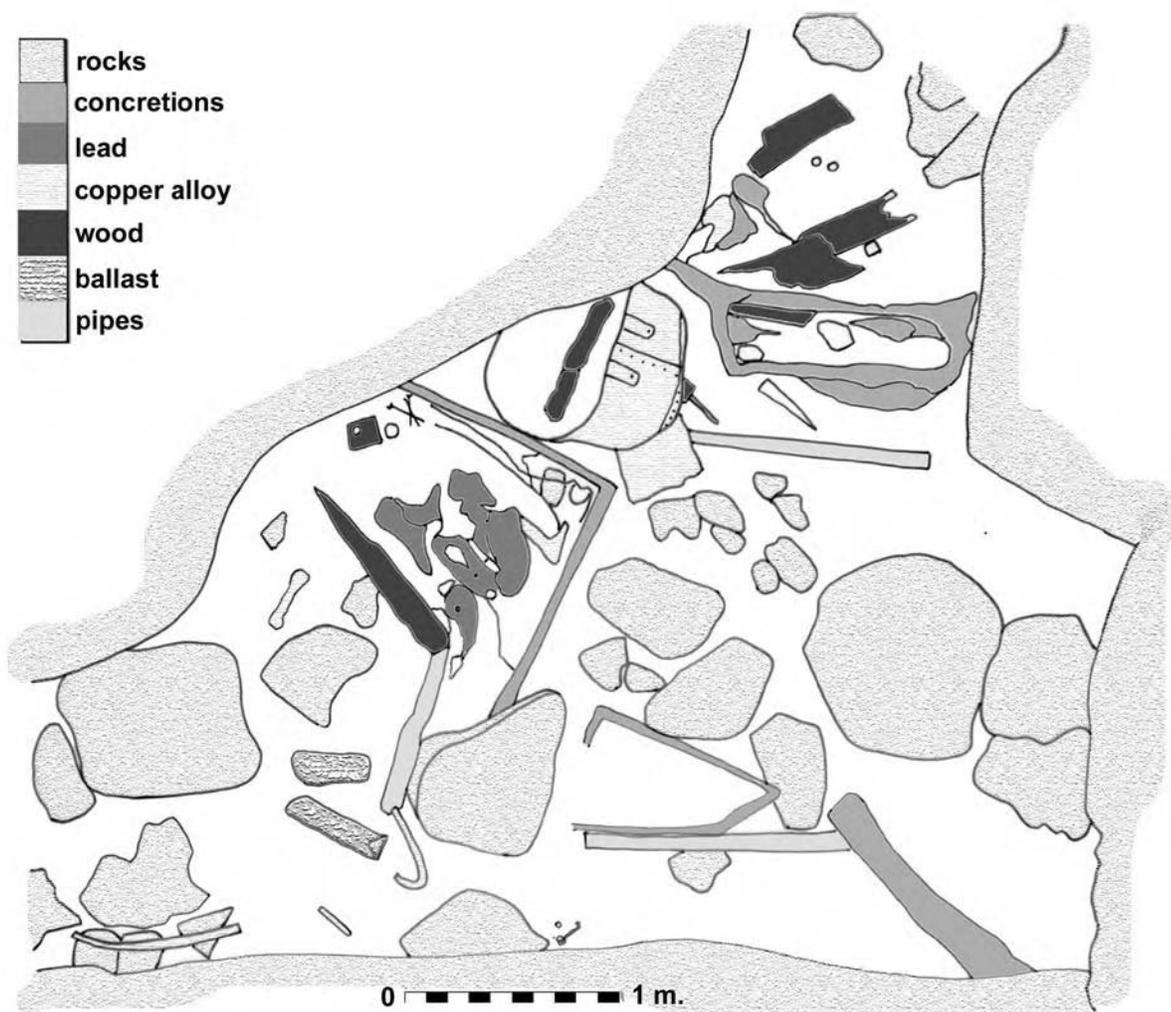
In the center of the excavation area there is a large cooking pot (Fig. 6), surrounded by at least three iron objects that appear to be large containers. The iron has disappeared by now but the sea has created a concretion layer around it, showing exactly the dimensions and shape. Unfortunately this concretion is now fragile and part of the sea floor and it will not be possible to raise it or even cast it underwater. Detailed records and photographs must suffice. A few large pipes of more than 1 meter length are also on the sea bed along with extensive areas of what appears to be lead sheeting, possibly sheathing, and some large pieces of wood, most likely part of the ship's timbers or planking (Fig. 7).

By the end of the 6 week season, 144 individual dives—153 hours of bottom time, more than 1000 artifacts were raised, registered and catalogued and we were able to put together a detailed map of the excavation area (Fig. 8).



**FIG 6** above right  
Nakamura excavating around the cooking pot.

**FIG 7** above  
Wood remains of *Ertuğrul* being cleaned by Nakamura using a dredge while NHK television films the work.



**FIG 8**  
Preliminary work-  
ing site plan of  
the main area.  
The cave is not  
included here.

## Mapping

As described earlier, 2008 focused on two limited excavation areas within an underwater gorge. The nature of the rocky terrain and the limited working space made impossible to use traditional excavation squares, and so we opted for using natural features to delineate our working areas. Rock formations and larger features of the wreck—such as large concreted pipes and iron structures—became the boundaries of our irregular “squares.” We assigned numbers to these areas in order to reference the artifacts found within, which were always photographed, assigned to lots, and immediately registered accordingly to their designated origin.

Specially-planned photography runs were made at intervals in order to reconstruct the site in a 3D plan, using the now well-established site mapping system of photomodeler.

One of the main goals of the excavation in 2008 and future campaigns is to continue to create a detailed map of the site and of excavation areas as they evolve.

**FIG 9** right top  
Turanlı poses in front  
of the *Ertuğrul* Research  
Center.



**FIG 10** right bottom  
Berta Lledó and Ada  
Turanlı work in the lab  
sorting and registering  
artifacts.



### Laboratory work

We established our conservation lab and offices in an old school building on Oshima Island. The facilities were named “The *Ertuğrul* Research Center”. In 2009 the plan is to use this building not only as a working space but also for living, thereby lowering operating costs and increasing efficiency.

In the *Ertuğrul* Research Center (Fig. 9) we had an archaeological laboratory to register, catalog and photograph the finds and start the conservation process when necessary. After every set of dives, new artifacts were brought to the lab and immediately registered, and all the related information about the lot number was recorded by the archaeologist or the conservator. Some more significant artifacts were selected for individual cataloging, while others were merely recorded and described in the registry (Fig. 10). All the lot numbers were separated according to material, then labeled and photographed. Every catalogued piece was also photographed individually.

**FIG 11** top to bottom Akagi, Lledó, Atac and Senol working in the *Ertuğrul* Research Center.

In the lab, materials were kept in plastic vats with a mixture of sea and tap water, and rain water was also collected when possible and used as distilled water to treat some of the artifacts.

### Collection of data

As is now common on INA projects, we used a database system custom designed to hold all the information related to the project (journal, diving logs, registry, catalog, conservation data and other general information). At the moment, research is continuing on a number of pieces in the lab in Bodrum and more pieces are being catalogued and photographed after conservation has been completed (Fig. 11). Therefore, the database is still being updated.

### Conservation

During the 6 weeks we were at Kushimoto some of the artifacts from 2007 that were already desalinated, cleaned and dry, were deposited in the Turkish museum of Kashino. While the artifacts recovered during the 2008 season were recorded, photographed and labeled, they were kept wet at all times, and in some cases the process of desalination was started at our lab.

At the end of the 2008 season we decided to bring some of the artifacts to Bodrum, Turkey, and continue the conservation work in

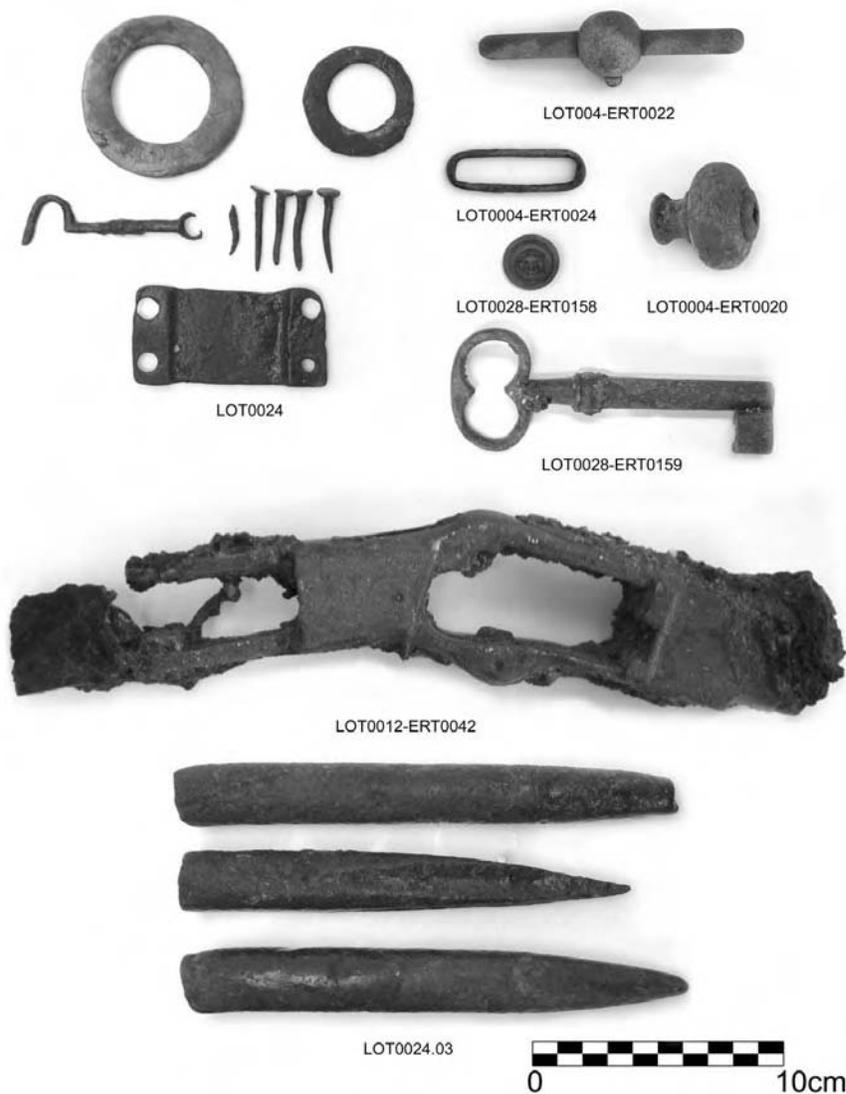


INA Turkey's Bodrum laboratory. For that reason we continued to pay for the services of the conservator, Fatma Senol, who stayed from February to May and successfully completed the processing of about 60% of the artifacts, including all the porcelains, glass and about half of all the copper alloy objects. This work with the *Ertuğrul* objects has also become the subject of her Master's thesis for Istanbul University.

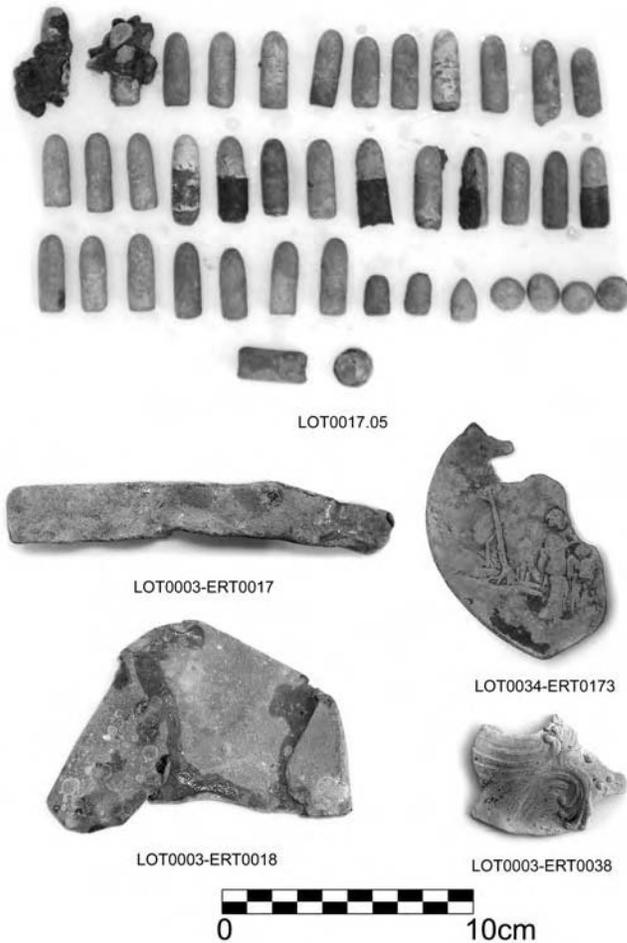
The remaining 40% of the artifacts are now still in the desalination process, including some organic pieces such as three leather shoe heels, a wooden mallet, a few ironwood sheaves, and several plank or timber fragments. As soon as the desalination is finished, conservation treatment will start.

Seven of the wood artifacts that are scheduled to start treatment in the end of the year were sampled to be analyzed by Dr. Nili Liphshitz, from the Institute of Archaeology–The Botanical Laboratories, Tel Aviv University, with the following results:

“Cross and longitudinal, tangential as well as radial sections were made with a sharp razor blade for each sample. The identification of the wood up to the species level, based on the three dimensional structure of the wood, was made microscopically from these sections. Comparison was made with reference sections prepared from systematically identified, recent trees and shrubs and with anatomical atlases. One wood beam and a piece of wood were made of *Quercus cerris* (Turkish oak). Another wood beam was made of *Cupressus sempervirens* (Cypress). Two samples from a mallet were of *Buxus*



**FIG 12**  
Copper alloy objects



**FIG 13**  
Lead Objects

sempervirens (Common boxwood) and three sheaves were made of *Guaiacum officinale* (Lignum Vitae).”

Some of the artifacts which have finished their conservation process will be returned to the Turkish museum in Kashino at the end of 2008 and the rest will remain in the Bodrum laboratories until the conservation treatment and archaeological research is finished.

### Finds

Among the artifacts registered during our first excavation season there were many interesting and surprising finds.

The bulk of the artifacts are made of copper alloy (Fig. 12), mainly nails in every size, from 0.02 to 0.07 meters long and some of them as large as 0.03 meters in diameter. Many of our finds could be identified as structural elements of the ship or its essential equipment, such as tackles, washers, screws, bolts, pipes, rods, valves, and even furniture parts such as hinges and knobs. *Ertuğrul* was also carrying considerable armament, of which we recovered the remains of two rifles. Other interesting finds included a large key, a uniform button, and two unidentified coins.

Another element making up a substantial part of the assemblage of artifacts recovered this season was lead (Fig. 13), mainly bullets –some of them only the lead tips, some still with their brass shells. Some distorted lead pieces are most likely fragments of the ship’s lead sheathing, a lot of which remains on the sea bed. Other lead fragments and artifacts recovered were more refined and could have been among the presents the Japanese Emperor was sending to



LOT0018-ERT 0092



**FIG 14**  
Different views of a complete porcelain plate. Ink drawing by Berta Lledó.

**FIG 15 below**  
Porcelains.



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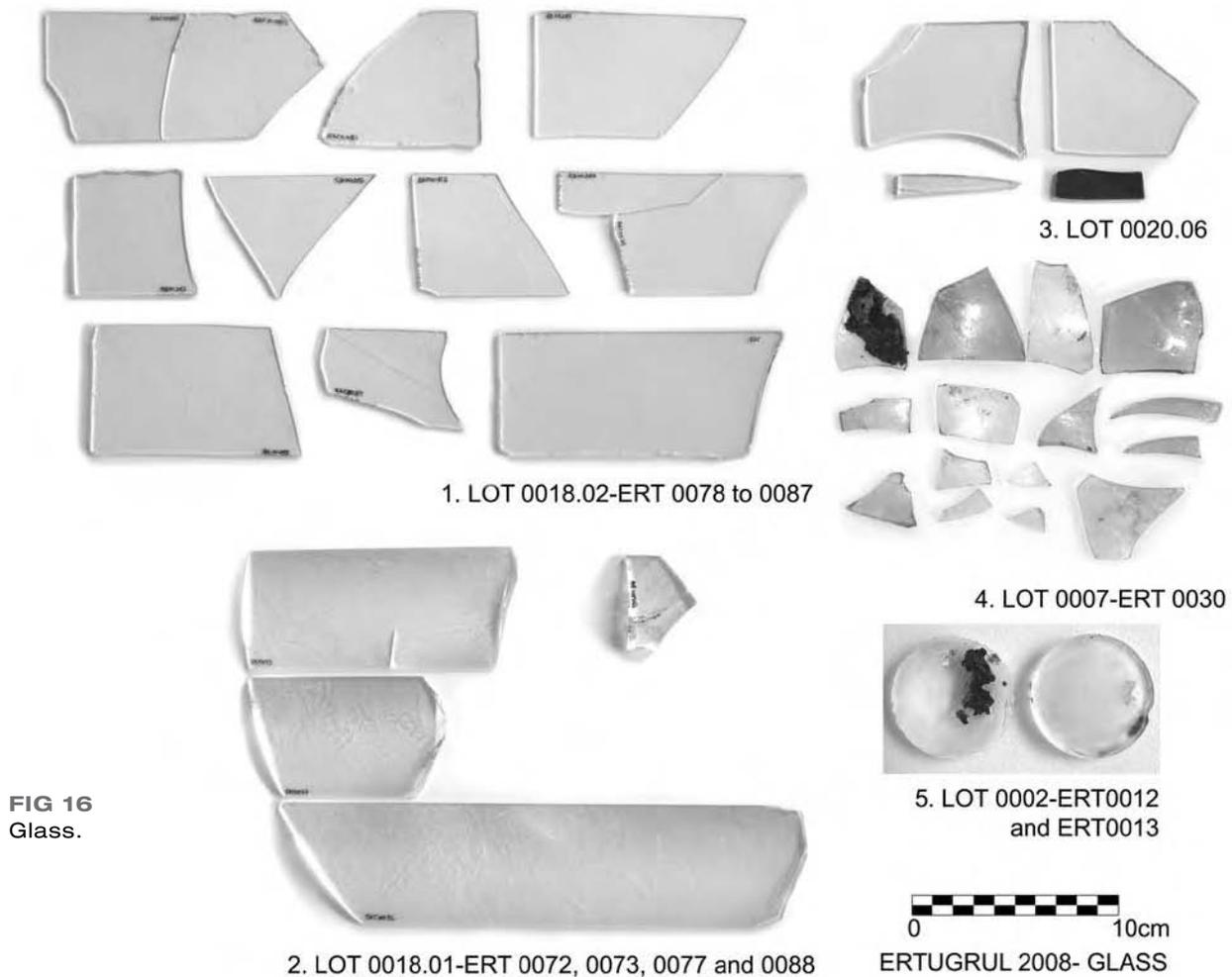


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the Ottoman Sultan. These include a few fragments of decorated thin lead or pewter plates depicting human images on a mountainous landscape. An almost complete shellshaped decorated lead plate was recovered from the site in the 1970's, and is now on exhibit in the Turkish Museum of Oshima.

A number of the porcelains recovered were also interesting and surprising. What to the naked eye appears to be plain white porcelain fragments were actually highly decorated pieces. Unfortunately they have lost their surface pigments, and only the edged imprint of the design remains. Experimenting with various light sources and with the help of a computer we managed to draw some of these complicated and



**FIG 16**  
Glass.

beautiful decorations, which seem to be repeated in different pieces, although never identically (Fig. 14). Among them we have part of what seems to be a tea set: tea cups and plates and dessert plates, unfortunately nothing intact (Fig. 15). Many of these pieces have preserved the artist's seal on the base.

Glass is abundant at the wreck site, and mostly related to ship instruments. A number of the glass fragments recovered seem to form a collection consisting of rectangular flat pieces. These are mainly of clear glass but also in green and red (Fig. 16).

One set of these rectangular pieces has a convex side, and the

surviving original edges indicate that they belonged to a round object. A set of two optical lenses of a spy glass were found lying together on the cave area. Only a few pieces of the glass we recovered seem to have belonged to common commodities such as bottles. We found only two glass rims, probably belonging to bowls.

Organic materials were also common. Three leather shoe soles with copper nails are now in Bodrum receiving conservation treatment along with several ironwood sheaves, some of them with copper centers, and some timber fragments. But the most interesting wooden artifact appeared close to the end of the excavation: a wooden mallet, almost completely intact (Fig. 17).

The most compelling discovery of the season was a poignant reminder of the human tragedy all these everyday objects represent. This was a fragment of a human skull and a phalanx. These finds were not treated as archaeological objects, and it was decided by the project director in consultation with Turkish and Japanese authorities to bury the remains with the rest of *Ertuğrul's* dead (Fig. 18 & 19). The fragments were buried with the rest of the Turkish sailors that rest in peace in the Turkish monument on Oshima Island.

The event was accompanied by an Islamic burial ceremony held on



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LOT0052-ERT0195



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**FIG 17**  
Organics.



**FIG 18 & 19**

Religious ceremony held at the Turkish Monument to the *Ertuğrul* Sailors in Oshima Island, Japan, to bury the human remains found during the excavation.

location by the Turkish Imam from Tokyo. The Turkish Military attaché in Japan, Japanese dignitaries and the project participants attended the ceremony.

The artifacts recovered during 2008 form a varied and impressive collection, despite the fragmentary nature of most of the material in the surface layers of this very disturbed site. We did observe that personal effects were becoming more common towards the end of the excavation season as we reached deeper levels, and more complete pieces were found. We believe that next year will yield even more objects of interest, including items that illustrate the lives of the victims as well serving as reminders of their untimely deaths.

## Public Relations and Publicity

As it is part of the agreement with our sponsor, and also in the best interests of our project, we have to dedicate some effort to publicity and dealing with the media. It is quite time-consuming but always worthwhile. Several press conferences were held in 2008 to introduce the project and to inform the media of progress. The press conferences were organized by the Kushimoto Municipality and had wide attendance, resulting in more than 50 articles in local and national newspapers, including a front page article with a color picture in the newspaper with the largest circulation in the world, the *Asahi Shimbun* (26<sup>th</sup> of January 2008).

One significant contribution to the project's popularity was the daily column *Turanlı* wrote in the same newspaper, which consisted of a short article about the project with a color picture. These articles, which also talked in general about underwater archaeology and INA, were printed daily in *Asahi Shimbun* newspaper for the duration of the 2008 field season.

Besides newspaper journalists, television crews also came to the site and produced several news programs for NHK, Tokyo and local television channels. Reports about the project were broadcasted daily in Turkey on the evening news of Turkish national television.

Shortly after our return to Bodrum, *Turanlı* was invited to Ankara to give a presentation about the project to the Turkish President, His Excellency Abdullah Gul, who apparently had been following the project on the news and our website.

## Acknowledgements

In 2008 the project's major sponsor was Yapi Kredi Emeklilik. We also received a generous contribution from Mr. David Koch. The generosity of these sponsors made the project possible in every sense. We are pleased to acknowledge Turkish Airlines for contributing all transportation expenses and INA for contributing Tufan Turanlı's time for the project and providing some equipment. Thanks to Donny Hamilton and Asaf Oron and Bodrum's INA personnel for helping and advising on the artifact conservation process whenever it was needed. Several meetings were held with Japanese Government officials and delegations from Yokohama, Osaka and other government offices came to visit the work and contributed personal donations to the project. Thank you.

Special thanks goes to Kushimoto Municipality. Without their overall support, our work could not have been possible. We extend our gratitude to to all participants in the project and offer special thanks to Ada and Bora Turanlı for helping in the lab as well as our many visitors who were often put to work. (Figs. 20–23).



**FIGs 20–23** top to bottom

Ada and Bora Turanlı in the lab.

Turkish Military Attaché in Japan, Capt. Murat Saka visiting the lab.

Mr. Hamaguchi from the Kushimoto Municipality labeling bags in the lab.

Joanne Thirst also helped in the lab during her visits.



James P. Delgado  
Institute of Nautical  
Archaeology

## *Sub Marine Explorer*

### A Civil War-Era Submersible in Panamá

In 2001, a visit to Panamá's Archipiélago de las Perlas (the Pearl Islands), which lie off the Pacific coast of the isthmus, resulted in the chance rediscovery of a forgotten submarine that lies in the intertidal zone of Isla San Telmo, the farthest west and most remote of the islands (Fig. 1). After two years of research, the likely identification of the craft as *Sub Marine Explorer*, a 12 meter long, 3 meter broad riveted and cast iron vessel built in Brooklyn, New York in 1865–1866 was advanced as a working hypothesis.

Three seasons of field work in Panamá (2004, 2006 and 2008) demonstrated that the craft at Isla San Telmo is *Sub Marine Explorer*. Designed by German-American engineer Julius H. Kroehl (1820–1867), and built at the Brooklyn shipyard of Ariel Patterson, *Sub Marine Explorer* was financed by a group of businessmen who incorporated the Pacific Pearl Company of New York to capitalize the craft's construction and operation (Silka 2008). While one aspect of the Company's business plan was an intended sale of the craft's design to the United States Navy, the principal focus of the Pacific Pearl Company was the recovery of pearls and oyster shells from the Pacific pearl beds of Panamá and Mexico's Baja California peninsula (Pacific Pearl Company 1866).

*Sub Marine Explorer* employed an ingenious system of pressurized air and salt water ballast tanks that allowed the craft to submerge, navigated by a hand-cranked propeller, and hover over the sea bed. The pressurized air was then employed to equalize the interior of the submarine to the ambient pressure of the surrounding water. When the sub's working chamber equalized, hatches on the bottom of the craft were opened and allowed workers to harvest shells and pearls, or conduct other work as needed (Pacific Pearl Company 1866).

Following successful trials of the submarine off New York in 1866, Kroehl partially disassembled it, shipped it to Panamá, and then reassembled *Sub Marine Explorer* on the Pacific shores of the Bay of Panamá. After initial trials in Panamá, Kroehl died of fever, and the





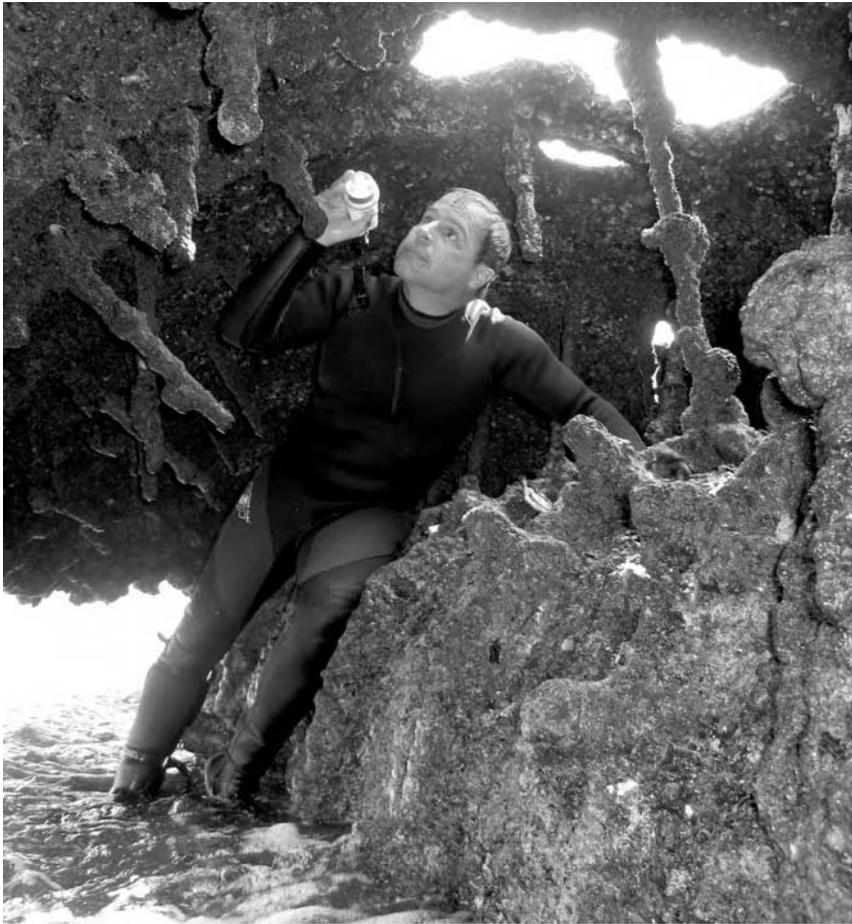
**FIG 2**  
*Sub Marine Explorer* at  
low tide. Photograph by  
James Delgado.

**FIG 3** *inset*  
Aerial view of the  
cove and *Sub Marine  
Explorer* at low tide.  
Photograph by Lance Mil-  
brand.

who worked with Dr. Horgan (Fig. 4) and archaeologist Fritz Hanselmann. Milbrand and Hanselmann worked with me as principal investigator and McKay to complete documentation of every exposed aspect of *Sub Marine Explorer* (Fig. 5). A very significant aspect of the 2008 field season was the survey of the surrounding seabed—the submerged maritime cultural landscape in which *Explorer* worked—by a REMUS autonomous underwater vehicle (AUV).

That survey, conducted by Woods Hole Oceanographic Institute’s Mike Purcell and Greg Packard, found that the waters immediately in front of the cove where *Explorer* lies were shallow and most likely were not where the submarine had operated, despite the proximity to the cove, because none of the depths were close to those recorded in the contemporary news accounts of *Sub Marine Explorer*’s dives. The waters to the west, however, were deeper, and it appears that dive operations would have taken *Sub Marine Explorer* offshore. Dives on the pearl beds in the area found very few oysters in depths greater than 24 meters, suggesting that *Explorer*’s technological benefit took it into waters with less than optimal conditions for the oysters and pearls it sought. In doing so, the dives also exposed *Explorer*’s crew to decompression sickness. This was a breakthrough observation, and a critical aspect in assessing *Explorer*’s failure in a larger context.

After three field seasons and seven years of research and analysis, it is clear that *Sub Marine Explorer* is an evolutionary “branch” in the family tree of submarine development. *Sub Marine Explorer* is, as a Civil War



**FIG 4 top**  
Erich Horgan assessing biological organisms in the compressed air chamber. Photograph by Lance Milbrand.

**FIG 5**  
Delgado, Hanselmann and McKay documenting *Sub Marine Explorer*’s damage. Photograph by Lance Milbrand.

veteran submarine engineer noted, a link between the diving bell and the submarine, borrowing her basic systems configuration for pressurization from an earlier bell, Van Buren Ryerson's *Explorer* of 1858, but with fundamentally different aspects that make it a true submarine, and particularly a submarine with a lock-out diver chamber (Baird 1903:852).

Different in design and form from the Confederate submarine *H.L. Hunley*, *Explorer* is most closely linked to *Intelligent Whale*, another New York-built submarine of the period. Historical accounts and "conventional wisdom" of the 19<sup>th</sup> century placed *Intelligent Whale* in the category of a "failure," even a deadly one, but as early as 1900, submarine developer and engineer John P. Holland had dismissed those allegations and perceptively commented that *Intelligent Whale* had not been competently handled (Holland 1900:902). The archaeological, architectural and historical assessment of *Intelligent Whale*, completed by Peter W. Hitchcock in 2002, confirms the accuracy of Holland's assertions (Hitchcock 2002). The same is true of *Sub Marine Explorer*. Technologically ingenious, the craft was only dangerous if not properly handled. The fatal flaw for both craft was the fact that technology outstripped human ability to understand and cope with the consequences of employing it, as will be seen later in this article.

Similar to *Intelligent Whale*, *Explorer* like it, is not representative of the principal thrust in submarine development, which is better seen in other American-built craft like *H.L. Hunley*, and Holland's own craft, *Fenian Ram* of 1881, and his subsequent "Holland" class boats, the submarines ultimately incorporated

into the U.S., British and other navies in the early 20<sup>th</sup> century. The same holds true with foreign-built submarines such as de Villeroi's *Alligator*, Peral's *Peral*, or Reverend Garrett's *Resurgam*. These one-atmosphere, sealed craft (*Alligator* had a separate lock-out chamber), led directly to the modern submarine (Compton-Hall 1999:81–106).

*Sub Marine Explorer* and *Intelligent Whale* represent an alternate line of evolution, in which the diving bell became a submarine, only to die out, and the basic principle devolved back to the sophisticated diving bells of today. *Explorer* was also incredibly sophisticated. One of the key observations of the ongoing excavation and analysis of *H.L. Hunley* is the discovery of key features of modern submarines that surprised the pundits. Flush-riveted construction, pumped ballast tanks, sublimation of form to submerged operation characterizes *Hunley*, and they characterize *Sub Marine Explorer*. Modern submariners have commented on *Sub Marine Explorer*'s turtleback form, one reminiscent of modern nuclear submarine hulls, and the use of compressed air tanks to "blow ballast" and surface.

Some shipwrecks are artifacts that relate to an associated maritime landscape of where the land meets the sea (Westerdahl 1991:5). *Sub Marine Explorer*, wrecked in close context to the site of its final operations, is such a resource. Isla San Telmo, as the 2008 AUV survey showed (Fig. 6), rests at the edge of a formerly rich series of pearl oyster beds that were known to the pre-European contact inhabitants of the islands, and after their demise, the beds were successively depleted by heavy "fishing" in the early

Spanish colonial period and again in the 18<sup>th</sup> and early 19<sup>th</sup> centuries. The "Pearl Islands" were a seemingly ideal locale to operate the submarine and utilize its technological advantage for greater profit than the earlier, breath-holding divers. Such would not be the case, however. Human activities take place in both physical space and time. In the case of *Sub Marine Explorer*, it was a technology that was in the wrong place because it was there at the wrong time. By the time *Sub Marine Explorer* arrived, the pearl beds had effectively been fished out; pushing the submarine into increasingly deeper, more dangerous waters that ironically were less favorable habitat for the oysters.

Assessing the landscape also shows that the placement of the wreck is therefore not an accident, even if it eventually drifted or was pulled ashore. An aerial perspective of the submarine shows that it lies in the cove, hemmed by submerged rocks and reefs that make its drifting into the cove highly improbable. More than likely, the craft lies in close proximity to the site where it was laid up and ultimately abandoned. *Sub Marine Explorer* is part of the landscape encompassed by the cove, the inshore area, site of the secondary activities associated with the oyster harvesting, and in a broader context the island of San Telmo and its surrounding waters, whose submerged oyster beds were the site of *Sub Marine Explorer*'s dives and hence the source of the pearls and shells collected by its crew. The only known contemporary account of the submersible's operations places it at Isla San Telmo in late 1869, and at the conclusion of its last known dives, "it was decided, the experiment having proved a complete success,

to lay the machine up in an adjacent cove” (New York Times, August 19, 1869).

The cove was the probable base of operations for the submarine, as it lies in the lee of the island and away from the open ocean, and as such would have housed a temporary camp for the pearling operation. While the most recent charts of San Telmo date to the mid-20<sup>th</sup> century and were insufficient to determine whether the immediate offshore area was of sufficient depth to be the site of *Explorer's* 1869 dives, which reportedly reached a depth of 30 m (100 ft), the sonar survey of the waters surrounding Isla San Telmo in 2008 determined that the area offshore and to the west were shallower, although some areas had depths approaching 24 meters. Assessment of the area, which included dives with local pearl divers from the neighboring village of La Esmerelda, as well as biological assessment dives by scuba conducted by Dr. Horgan, revealed rock-based clusters populated by larger numbers of immature (smaller) oysters, in the shallows along the western (windward) side of San Telmo.

The channel between San Telmo and neighboring Isla del Rey, while possessing an ideal habitat for oysters (a channel lined with rocks), also revealed oysters that are more immature, clustered in waters that do not exceed 10 meters in depth at high tide. While based at Isla San Telmo, and in the once-rich pearling waters of the archipelago, *Explorer* was not in an ideal location. The depths it is reported to have worked required a tow of the submarine away from the island, into open ocean waters on the windward side, where its dives were at depths beyond the ideal range for the oysters it sought.



**FIG 6**  
Preparing the REMUS AUV for survey operations.  
Photograph by James Delgado.

The pearl oyster, *Pinctada mazatlanica*, thrives on hard rocky bottoms in shallow depths up to 21 meters, but does not live in water exceeding 33 meters in depth (Galtsoff 1950:14 and Mackenzie 1999:58).

*Sub Marine Explorer* arrived too late, and its technological advantage of a large craft capable of sustained operations at depth was for naught as it was forced to look for oysters in deeper waters that had not been fished

out. Operating at depth for several hours, *Sub Marine Explorer* surfaced, quickly equalized to surface pressure, and its crew then opened the hatches. Under these circumstances, as we reconstructed the dive profiles, safe diving limits were exceeded, exposing the crew to decompression sickness (the bends). This explained references to illness among the crew in 1869. Combined with a less than optimal return on pearls and the illness of the crew, as well as a likely

failure to continue to raise funds for the Pacific Pearl Company after three years of no returns for investors, the probable reasons for the abandonment of the submarine on an isolated Pacific island are now much clearer.

The final results of the various field seasons have been provided to the Panamanian government along with a series of recommendations for the ongoing preservation of the submarine. The rate of corrosion is such that recovery and conservation of the craft may be prohibitively expensive and possibly not successful in the long term. Other options have been suggested, and even if no further work is undertaken, the technology and characteristics of a rare, surviving example of Civil War-era nautical technology have been preserved through the detailed plans prepared as part of this project.

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### Sources Cited

- Baird, G. W. "1902 Submarine Torpedo Boats." *Journal of the American Society of Naval Engineers* 14:2, 845–855.
- Compton-Hall, Richard (1999). *The Submarine Pioneers*. Sutton Publishing Ltd., Phoenix Mill.
- Delgado, James P. (2006). "Archaeological Reconnaissance of the 1865 American-Built *Submarine Explorer* at Isla San Telmo, Archipelago de las Perlas, Panamá." *International Journal of Nautical Archaeology* Vol. XXXV:2, 230–252.
- Galtsoff, Paul (1950). *The Pearl-Oyster Resources of Panamá*. U.S. Fish and Wildlife Service, Washington, DC.
- Hitchcock, Peter W. (2002). *Intelligent Whale: A Historical and Archaeological Analysis of an American Civil War Submersible*. Thesis presented to the Office of Graduate Studies of Texas A&M University.
- Holland, John P. (1900). "The Submarine Boat and Its Future." *The North American Review* 171:DXXIX, 894–903.

Mackenzie, Clyde L., Jr. (1999). "A History of the Pearl Oyster Fishery in the Archipelago de las Perlas, Panamá." *Marine Fisheries Review* LI:2, 58–65.

Pacific Pearl Company (1866). *The Pacific Pearl Company: Incorporated Under the Laws of the State of New York*. John B. Lyon, New York.

Silka, Henry (2008). "Williamsburg, Brooklyn: The Home of the First Successful Commercial Submarine." *Long Island Historical Journal* XX:1–2, 71–82.

Westerdahl, Christer (1991). "The Maritime Cultural Landscape." *International Journal of Nautical Archaeology* XXI:1, 5–14.

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