



FRED & BJ VAN DOORNINCK BYZANTINE SHIPWRECK ENDOWMENT

The Institute of Nautical Archaeology (INA) has a long history of excavating and researching shipwrecks from the Byzantine era (AD 330-1453). The excavation by INA of important shipwrecks at Yassiada, Bozburun, Serçe Limanı, and Yenikapı, Turkey has contributed to a growing realization that Byzantium had a much greater maritime, economic and technological impact on our modern world than was earlier imagined.

To ensure INA's continued, long-lasting impact on this undervalued era of ancient history, the INA Foundation is seeking contributions to support the newly-established **Fred and BJ van Doorninck Byzantine Shipwreck Endowment**.

The van Doornincks first became involved with nautical archaeology in the 1960s at the excavation of the Yassiada Byzantine shipwreck. Fred and his late wife BJ worked tirelessly on Yassiada material, with BJ illustrating hundreds of graffiti on the transport amphoras that continue to occupy Fred today.

Funds awards from the **Fred and BJ van Doorninck Byzantine Shipwreck Endowment** will be decided by the INA Archaeological Committee, with preference given to projects contributing to the final publication of shipwrecks already excavated, shipwrecks located in Turkey or in Turkish waters, and artifact conservation during and after excavation.

For more information about making a tax-deductible gift to support this endowment, go to www.nauticalarch.org/vandoorninck
With your financial support, awards may be allocated as early as 2016

THE INA QUARTERLY

A PUBLICATION OF THE INSTITUTE OF NAUTICAL ARCHAEOLOGY

THE NAVIO OF PEDRO DÍAZ CARLOS

SEARCHING FOR THE 1608
CONTRABAND SMUGGLER



AMPHORAS MADE
FOR WAR?
BYZANTINE AMPHORAS
OF THE 7TH CENTURY

THIS YEAR'S
PROJECTS
CHECK OUT WHAT'S
NEW FOR INA IN 2014

SPRING 2014
VOLUME 41, NO.1

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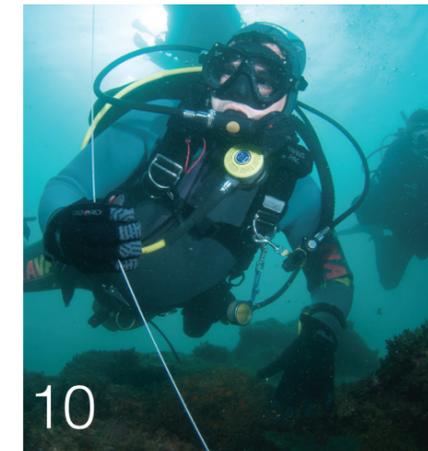
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ON THE COVER: Documentation of an encrusted iron anchor excavated during the Navio of Pedro Díaz project in southern Portugal. Photo: VRfotografía

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

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If you are interested in submitting an article for publication please contact the Editor at inaq@nauticalarch.org

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LETTER FROM A VICE PRESIDENT

Greetings, friends and colleagues. 2014 is promising to be a banner year for INA research in the Americas. Long-standing major studies are wrapping up, ongoing endeavors keep achieving significant milestones, and many new and exciting field, lab, and publication projects are in the hopper.

2014 is the bicentennial of the War of 1812's final year, and also marks the completion of a related project begun in 1981 when INA affiliated scholar Arthur Cohn and I located four warship hulls at the southern end of Lake Champlain. Since then those four, and twelve others dating to the same conflict, have since been studied by Texas A&M students and by professional colleagues in the U.S. and Canada. Who knew such a short war could leave behind so many wrecks? The results of three decades of archaeological research are now summarized in *Coffins of the Brave: Lake Shipwrecks of the War of 1812*, released by Texas A&M University Press in February. Much of the work featured in the book was directly sponsored by INA.



Kevin Crisman has been Vice President of INA's New World research since 2008.

Ongoing New World projects have been generating new discoveries in the field, as well as publications and exhibits. INA affiliated scholar Dr. Kroum Batchvarov of the University of Connecticut stopped by INA headquarters in March to share photos and results from his just-completed magnetometer survey of Rockley Bay in Tobago. The first recipient of INA's Claude Duthuit Archaeology Grant, Kroum is returning to the site this summer to carry out further examination of the wreck and two other promising targets. Meanwhile, the early 17th-century English galleon *Warwick*, excavated off Bermuda by INA research associates Drs. Katie Custer and Piotr Bojakowski, is yielding two soon-to-be completed M.A. theses.

2014 is also promising to be the year of steamboat archaeology for INA. Four articles were recently published on INA's excavation of the Mississippi River steamboat *Heroine*; two M.A. theses on artifacts are nearing completion, and a major exhibit on the wreck opened at the Oklahoma History Center in February. In June, a field school jointly sponsored by INA, Texas A&M's Center for Maritime Archaeology and Conservation, and the Lake Champlain Maritime Museum will examine a veritable graveyard of early steamboats in Vermont.

These are just a few of the archaeological projects INA is supporting in the Americas. Stay tuned to the *INA Quarterly* to learn more about them. And thanks for your support of this research!

Kevin Crisman
Vice President, INA



FIRST ANNUAL CLAUDE DUTHUIT GRANT AWARDED

INA recently announced the establishment of the **Claude Duthuit Archaeology Grant**, a \$25,000 award made annually to the underwater archaeological project that best captures the spirit of Claude Duthuit.

Dr. Kroum Batchvarov, an INA Affiliated Scholar and Assistant Professor at the University of Connecticut in Avery Point, is the first recipient of this prestigious award.

Kroum has worked around the world researching ships and shipwrecks of the 17th century. The Claude Duthuit Archaeology Grant will support his work at Scarborough Harbor on the Caribbean Island of Tobago where Kroum is searching for remnants of 17th-century naval battles between the Dutch and the French.

The Rockley Bay Research Project is extremely proud to have been awarded the inaugural Claude Duthuit Archaeology Grant, which makes it possible to accomplish our scientific goals for the 2014 season. I would like to acknowledge the generosity of Mrs. Duthuit for establishing the grant and thank the members of the INA Archaeological Committee for placing their trust in us.

-KROUM BATCHVAROV



www.nauticalarch.org/duthuit

NEWS & EVENTS

New directors, new partnerships, new projects, and new opportunities

NEW INA DIRECTORS AND SCHOLARS

INA is delighted to welcome several new additions to the Board of Directors: Grace Darden, granddaughter of Frank and Lucy Darden, joins INA as an Associate Director, creating a three-generation legacy of leadership for the Darden family. Dana Mc Ginnis, who has been an Associate Director of INA since 1998, is advancing to full Director. Dana earned a degree in Art and Archaeology from Princeton University and is CEO of Mission Advisors in San Antonio, Texas, where he lives with his wife Myriam. Finally, Sheila Matthews, who has been a vital part of every INA archaeological project in Turkey for the last four de-

acades, retired recently and relocated to Merida, Mexico but will continue her involvement in INA as a full Director. We appreciate so much your collective commitment to INA and we are proud to have you as part of the family!

We are also pleased to welcome new INA research associates Dr. Massimo Capulli and Mr. Miguel San Claudio. Capulli, who is adjunct professor of methodology of archaeological research at the University of Udine (Italy), has been working with Staci Willis, Ph.D. candidate in the Nautical Archaeology Program (NAP) researching the laced boats of the Adriatic. San Claudio has been collaborating with NAP faculty member Filipe Castro and NAP Ph.D. student

José Casabán, on the Finisterre Survey Project in Galicia, Spain.

UNDERWATER INTERVENTION 2014

Underwater Intervention, a conference and exhibition operated jointly by the Association of Diving Contractors International and the Marine Technology Society, took place in New Orleans February 11-13, 2014. The first Underwater Intervention was held in San Diego, California in 1993; 20 years later, the event has grown to include manned submersibles, instruments and sensors, sonar and acoustics, ocean engineering, and underwater vehicle technology. INA Associate Director Terry Ray and Dave



Massimo Capulli



Miguel San Claudio



Dana McGinnis



Sheila Matthews



Ruff, a Ph.D. student in the Nautical Archaeology Program, attended the conference as INA's representatives. While there the pair met Allan Palmer, Vice President of Cal Dive International, which recently donated to INA a high-pressure Bauer air compressor. INA thanks Cal Dive Chairman Quinn Hebert and Allan Palmer for their generosity in making this important piece of diving equipment available to INA researchers!

SHIPWRECK WEEKEND 2014

Shipwreck Weekend is an annual spring-time open house showcasing the fieldwork and research conducted under the auspices of INA, the Nautical Archaeology Program (NAP), and the Center for Maritime Archaeology and Conservation (CMAC). This year's event took place on April 12, on the campus of Texas A&M University, and featured presentations by NAP graduate students Nick Budsberg, Chris Dostal, Carolyn Kennedy, and Rachel Matheny. INA Vice President and NAP faculty member Dr. Kevin Crisman introduced his latest book, *Coffins of the Brave*, a comprehensive collection of chapters dedicated to War of 1812 shipwrecks on the Great Lakes. The keynote speaker for this year's event was Dr. Rebecca Ingram, a recent Ph.D. graduate of NAP, who spoke about her participation in the recent excavation and recording of numerous Byzantine-era shipwrecks at Yenikapı, Turkey.

INA IN THE INDIAN OCEAN

In February, a team of INA staff and NAP graduate students returned to the Indian Ocean to work with archaeologists from Sri Lanka's Department of Archaeology on the ancient shipwreck at Godavaya. The three month-long campaign to excavate what is presently the oldest shipwreck in the Indian Ocean (dating from the first century B.C. or A.D.) marks INA's second consecutive season on the site, which is characterized by poor visibility and dangerously strong currents. To outfit the team with the necessary safety equipment, a shipping container filled with a recompression chamber, diving equipment, inflatable boats, and other project supplies left Houston in early January and arrived in Colombo one month later. Archaeological dives began in March and yielded a number of interesting artifacts including glass ingots, grinding stones, and what appears to be a bronze spearhead. The presence of weapons on shipwrecks implies that the cargo was sufficiently valuable (or the passengers sufficiently important, or both) to warrant the presence of armed personnel. This important collaborative project is being funded by a grant from the National Endowment for the Humanities.

SOCIETY FOR UNDERWATER TECHNOLOGY (SUT)

Texas A&M University's Student Chapter of the Society for Underwater Technology (SUT-TAMU) is the first official student chapter to be affiliated with its parent organization, the Society for Underwater Technology (SUT). Founded in 1966, SUT brings together individuals with common interests in underwater technology. SUT-TAMU was founded in 2013 to promote student networking opportunities with industry professionals. Nautical Archaeology Program (NAP) graduate students Mara Deckinga, Stephanie Koenig, and Patricia Schwindinger serve on the SUT-TAMU executive board, which is working to highlight burgeoning opportunities for nautical archaeologists in the gas and oil industry. SUT-TAMU held its first-ever One-Day SUT Subsea Awareness Course in March 2014. What is normally a five-day course taught by industry professionals introducing the latest underwater technology was offered as an intensive one-day seminar free of charge to TAMU students. Those interested in viewing the presentations should visit the SUT-TAMU website (<http://sut.tamu.edu>).



FOLLOW INA ONLINE: Find the latest news, excavation blogs, photos and more at www.nauticalarch.org. Like our Facebook page, too!

EXPLORE THE INA ARCHIVES

Chronicling the history of nautical archaeology and INA

The Archives of the Institute of Nautical Archaeology (INA) house the tangible history of the birth and growth of a discipline. Photographs, film reels, original journals and letters all chronicle the development of underwater archaeology. The Archives are home to the documents and objects that reflect this journey, and provide glimpses into the lives of INA researchers and their contributions to the field.

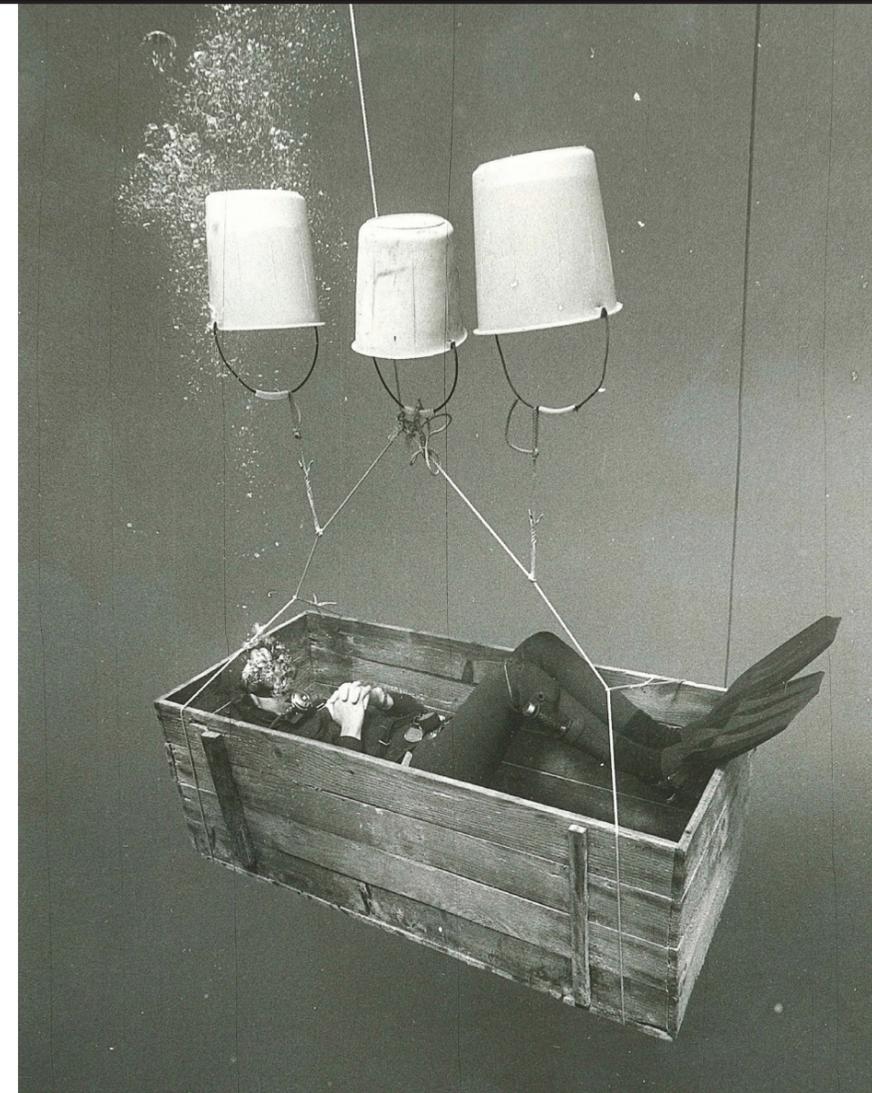
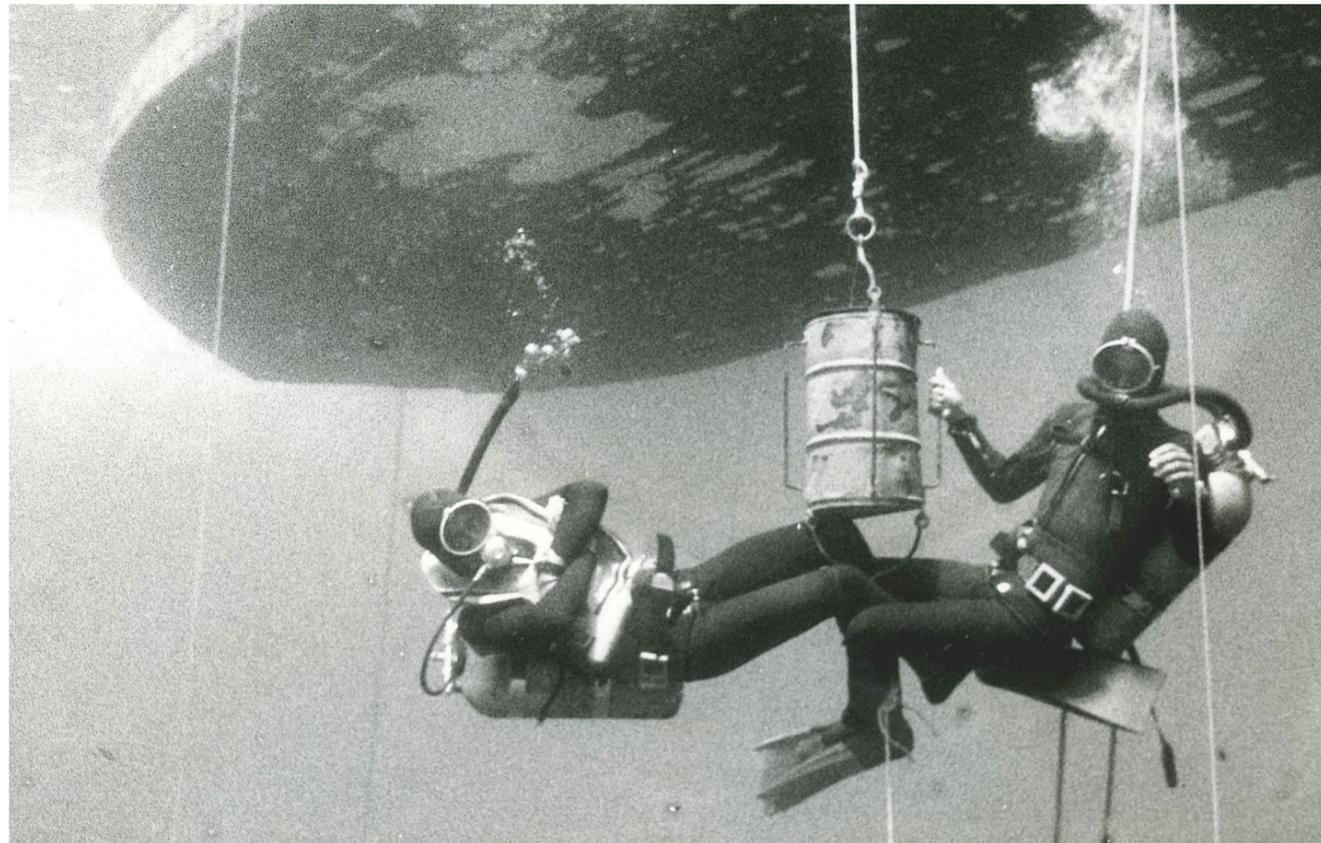
According to the most recent inventory, the Archives has a slide collection that exceeds 40,000 images. The collection includes original photographs from more than two dozen excavations, enhanced by

bequests from journalist Peter Throckmorton and ship reconstruction expert Dick Steffy. INA has also been among the forerunners of underwater cinematography, and has a collection of 479 film reels which include footage from the earliest excavations. The reels, along with original slides, drawings, also site plans and notes are kept in a fireproof room to protect these highly flammable materials. The Archives are also home to some interesting and unusual artifacts including Peter Throckmorton's wooden diving goggles and Dick Steffy's modeling tools.

The role of the archivist is not only to organize all of this material, but also to

facilitate public access to it. Many of our objects, such as the Egyptian ship model and artifact replicas, are displayed in vitrines located at the INA headquarters in College Station, Texas. Similar exhibits exist at INA's representative office in Turkey, the Bodrum Research Center. However, the general public is most familiar with INA's photographic collec-

This Page: Ayhan Sicimoğlu (left) and Tufan Turanlı (right) rest at the decompression stop after diving on the shipwreck at Şeytan Deresi, Turkey in 1975. **Opposite Page:** Robin Piercy relaxes in a tray designed to carry timbers of the Serçe Limanı ship safely to shore.



tions. Every year hundreds of requests are received and processed by the INA Archivist. Certain images are featured on the INA website, but the collections are vast and mostly unknown to the general public.

In recent years INA has begun to digitize its image collection in an effort to make the holdings readily available to the public. Thus far we have succeeded in digitizing more than 15,000 slides

and prints, and that number continues to grow. We have also expanded our digitizing efforts to include high-resolution searchable PDF files of older *INA Quarterly* issues, which are gradually being made available on the INA website. Directors of new and ongoing projects often generate their own project blog, which allows interested visitors to see and experience various fieldwork as it happens around the globe.



FOLLOW INA ONLINE: Photo gallery: visit www.nauticalarch.org/photos_and_videos/; *INA Quarterly*: www.nauticalarch.org/ina_quarterly/archived_issues/

MEET INA ARCHIVIST MEGAN ANDERSON

MEGAN ANDERSON is pursuing an M.A. in the Nautical Archaeology Program at Texas A&M University. She graduated with a B.A. in Archaeology from the University of Evansville in 2012. Megan's graduate research focuses on the logistics of maritime transportation of animals in the Eastern Mediterranean. As INA Archivist, she is responsible for maintaining, organizing, and curating archival materials covering the entirety of INA's history and representing all INA-affiliated surveys and excavations. Megan is in the midst of building a keyword component for the database that will help future archivists find materials more easily. She has spent several weekends this past year with INA Founder George Bass helping to identify thousands of slides from the Peter Throckmorton collection.





ARCHAEOLOGICAL
SEARCH FOR THE
**NAVIO OF PEDRO
DÍAZ CARLOS**

How the discovery of a 17th-century contraband
smuggler will advance knowledge of Iberian seafaring

BY GEORGE SCHWARZ

In March of 1608, Captain Pedro Díaz Carlos of Huelva, Spain, and crew were en route to his home port after completing a round trip voyage from South America. His small, ocean-going vessel was loaded with 30 crates of sugar in addition to other trade items collected in Río de la Plata and Rio de Janeiro. Upon rounding the southernmost tip of Portugal, Carlos and his crew diverted to the Cove of Baleeira, known for its good anchorage amidst the rocky coastline of this region. The small ship entered the cove but was never to depart. Archival documents from Spain's Archivo General de Indias (AGI) reveal that Carlos likely entered Baleeira intending to unload contraband acquired in the New World, but was shipwrecked due to adverse weather conditions in the cove.

There are thus far only a handful of known archival documents related to Carlos's wrecked vessel. A recently discovered letter from the governor of Sagres (municipality near the Cove of Baleeira) to the King of Spain describes a suspected plot by the governor of nearby Lagos to seize the contraband for himself with the assistance of brigands, and kill the governor of Sagres if necessary. The governor explains that some of the cargo was salvaged from the wreck a few nights after the sinking, suggesting that it was accessible and in shallow water. While the rest of the story has yet to be unveiled, 17th-century documents indicate that not all of the contraband and other materials were fully recovered, and some were still washing up on the beaches of Baleeira ten and even fifteen years after the wreck. Carlos's complete story is as yet unknown, but he was summoned before Spanish court in 1611 to answer for actions related to illicit trade, and he appears again in AGI court records in 1622 for similar accusations.

Carlos's ship belonged to a class of light vessels used for a range of operations during the European Age of Expansion.

Believed to be either a *patacho* or small *caravela*, based on brief descriptions found in the surviving documents, Carlos's vessel represents one of the ship types used for both trans-Atlantic voyaging and coastal work in both the New and Old Worlds for which we have scant archaeological evidence. In addition to ship-related details, the study of Carlos and his exploits can also reveal information about the illicit trade network that existed in the early-17th century between the Iberian Peninsula and the New World.

The archaeological search in southern Portugal for the light, trans-Atlantic *navio* (Spanish for ship) belonging to Pedro Díaz Carlos will enter its third year in 2014. While the specific goal of the current project is to locate and study Carlos's ship, the broader agenda is to document all submerged cultural remains in the survey area in an effort to draw public and scholarly attention to the region's underwater archaeological resources. Known to ancient mariners as *O Fim do Mundo* (End of the World), this part of the Algarve has a long and eventful maritime history and is replete with archaeological material. To date, material culture dating from the 3rd century B.C. to the 20th century A.D. and including at least three shipwrecks has been located during surveys in the Cove of Baleeira.



Opposite page: Recording machinery discovered at wreck site EBT1.



cies and businesses with a strong interest in preserving their collective underwater cultural heritage. At that time, Tiago Miguel Fraga, a graduate of the Nautical Archaeology Program at TAMU, joined the project as co-principal investigator representing CHAM.

The 2012 survey focused on a small section of the planned survey area and involved the use of a gradiometer to locate the buried remains of the wrecked *navio*. A team of archaeologists from TAMU and CHAM investigated promising targets in order to determine if they might represent a 17th-century wreck. Due to the continued support of Martinhal Beach Resort and Hotel, fieldwork headquarters were located on the beach of Martinhal, which overlooks the cove and provides ready access to the survey area. Magnetic anomalies gathered from the remote-sens-

ing survey conducted by project partner Subnauta in early October 2012 revealed more than three dozen possible man-made anomalies, all of which were prioritized for investigation by divers. As there existed some evidence of submerged concreted cannon (possibly 4-5 pounders) in the bay, our objective was to create a map of magnetic anomalies in the survey area and assess them visually with teams of divers.

The first anomaly investigated in 2012 turned out to be the scattered remains of a wrecked vessel that included concreted pieces of machinery and rigging elements partially buried and intact on the sea floor. Although unconfirmed, this is possibly the wreck of a late 19th-century wooden vessel fitted with iron knees, one of which was discovered on the sea floor. While this was not the wreck our team was searching for, its presence confirmed that the environ-

PHOTO TOP LEFT: VRFOTOGRAFIA; BOTTOM: AUGUSTO SALGADO

ment in the bay is conducive to shipwreck preservation despite its shallow depth and high wave-energy.

With a prioritized list of the remaining anomalies, the team entered the cove to investigate each target. We opened a trench across one of the anomalies in search of buried ferrous material that had been detected by the gradiometer. Although buried material was discovered and examined by the team, no evidence of the wrecked *navio* was encountered during the 2012 investigation.

When we resumed our survey efforts in 2013 we brought a multibeam echosounder and gradiometer. The 2013 gradiometer survey in the Cove of Baleeira encompassed an area of 0.17 km² or 43.7 acres. A multibeam echosounder survey was undertaken in the bay, covering approximately 1/3 of the total survey area and

providing some overlap with the gradiometer survey. From these data sets, a total of 71 new targets (40 magnetic anomalies and 31 multibeam features) were identified during the very short two week-long field project in November 2013.

Two dive teams consisting of four divers each were assigned to investigate these anomalies through visual assessment, document finds with sketches and underwater video, and mark targets of archaeological interest with a hand-held GPS. Divers descended via a mooring line over the magnetic anomaly, conducting an expanding radial search using visual survey methods as well as a metal detector, and marking potential objects of interest with a buoy, the position of which was recorded with a hand-held GPS unit on the surface. Another team conducted more in-depth investigations of each target by means of

seafloor dredging and excavation, archaeological photography and videography, and more precise documentation of material culture.

DISCOVERIES AND PRELIMINARY ASSESSMENTS

A wide range of man-made objects were encountered during the 2013 field season, including pipeline debris, telegraph cable, a modern fiberglass hull and engine, and Roman pottery which presumably drifted into the survey zone from ancient kilns located on the cliffs adjacent to the beach of Martinhal. All sites of importance were documented and reported to the local government for management purposes. Only the most significant nautical finds, however, are described below.

The team discovered additional artifacts associated with the late 19th-century wreck identified in 2012, including rigging elements buried under approximately 30 cm of sand as well as two probable pieces of iron masts and yards. The wreck, designated EBT1, was scattered in a northeasterly direction toward the beach. Further mapping and investigation of this site is planned for 2014.

Approximately 100 m south of this wreck, a 2.5m-long encrusted iron anchor was found 70 cm beneath the seafloor within the cove. This is a particularly

Magnetic anomalies gathered from the remote-sensing survey conducted by project partner Subnauta in early October 2012 revealed over three dozen possible man-made anomalies.

FIELDWORK 2012-2013

This INA project began in 2007 when a preliminary investigation was conducted in the Cove of Baleeira to locate cannon allegedly associated with Carlos' vessel. In that same year I visited the Archivo General de Indias (AGI) in Seville, Spain, in an attempt to locate more information on the suspected wreck site of the 17th-century vessel. Following the completion of my Ph.D. degree at Texas A&M University (TAMU), the investigation was re-launched in 2012 as a joint project with Universidade Nova de Lisboa's Centro de História de Além Mar (CHAM) and with the assistance of sponsors and partners including local government agen-

Top left: Excavating a trench across site EBT3e. Bottom Right: Recording iron rigging components at wreck site EBT1.



AUTHOR



GEORGE SCHWARZ
Marine Archaeologist,
Naval History & Heritage
Command



Two heavily-concreted iron cannon, possibly dating to the 17th or 18th century, were located less than 100m from [the] Martinhal beach.

interesting find, inasmuch as the anchor may date to the 17th or 18th century, but further research is required for verification. No other associated objects were discovered nearby, suggesting that the anchor may have been abandoned. Two additional isolated iron anchors of unknown date, smaller than the above-mentioned anchor, were found among the rocky outcrops within the bay. While the date and origin of these finds are currently unknown, these smaller anchors appear to represent modern types and are not likely associated with the *navio*.

A second wreck which likely dates to the early 19th century was investigated briefly and recorded. It includes exposed wooden hull remains and two encrusted 19th-century artillery pieces which may represent carronades. Further investigation of this site is also planned for 2014.

Toward the end of the 2013 fieldwork season came the most significant find of the season. Two heavily-concreted iron

cannon, likely dating to the 17th or 18th century, were located less than 100 m from Martinhal beach. A metal detector survey revealed no fewer than 20 buried metallic objects within an 8-m radius of the cannon. A 4 m x 4 m rope grid was erected around the cannon site, designated EBT6. After initial *in situ* documentation, three 1 m x 1 m test trenches were opened around the cannon to determine if buried cultural remains existed in the vicinity, or if we were dealing with jettisoned ordnance. Upon excavating the sandy bottom, several iron concretions with fasteners embedded in them were discovered, as well as a knee-shaped object with an iron fastener protruding from one face. Because time was short, we collected measurements, made sketches, and took photographs before reburial of the site for future investigation. This is a high-priority target for 2014, because it may represent the remains of an early 17th-century vessel which could be the *navio* of Pedro Díaz Carlos.

PRELIMINARY RESULTS AND FUTURE RESEARCH PLANS

The preliminary results of this survey

confirm that a range of material culture relating to the Algarve's nautical history exists in the Cove of Baleeira. The 19th-century ship and machinery remains discovered in 2012 make clear that some wrecks have survived relatively close to the modern beach of Martinhal, despite the high-energy conditions of the inner portions of the bay.

In addition to the fieldwork, additional archival research conducted in 2013 is expected to augment our knowledge of the wreck of Carlos's vessel. One relevant document now being transcribed was brought to our attention by project partner Centro de Investigação Naval (CINAV) and is located in the naval museum in Simancas, Spain. It is a letter from a local official dated a few days after the sinking of Carlos' vessel. The author describes the shallow nature of the wreck site and various attempts to salvage some of the cargo before being forced back by adverse sea conditions. Further archival research in Simancas, Huelva, and Lisbon is planned for 2014 in order to gather more information on the vessel's specifications, planned route, mission, and loss.

The objectives of the upcoming 2014 fieldwork season are to conduct extensive excavations around the EBT6 cannon site, and to examine additional remote-sensing targets not investigated in 2013 due to time constraints. If the evidence we have at hand, which includes anchors and cannon, is suggestive of 17th-century shipwreck remains, then a full-fledged excavation will be planned and this nascent research project will take on a very exciting and long-term scope.

The continuation of this project is expected to shed light on the nautical patrimony of this important region, which is rich in the history of European discoveries. To support this effort, the Council of Vila do Bispo in the Algarve has pledged considerable funding to support the investigation, recovery, and conservation of archaeological materials in the area.

Long-term curation and museum exhibits are planned for enriching our collective maritime heritage and for disseminating this information to the public in the widest way possible.

ACKNOWLEDGMENTS

In addition to the generosity of volunteers and graduate student researchers, this project was made possible through a number of supporting agencies including INA, CHAM, Martinhal Beach Resort and Hotel, VR Fotografia, Dinamika, Water World Lagos, Subnauta, Algarve Archaeological Society, CINAV, Direção-Geral do Património Cultural, Mar Ilimitado, Geoscience Earth & Marine Services, and Honda Marine. Additional project funding came in the form of a National Geographic Society/Waïtt Grant and the project was featured in a recent issue of National Geographic Portugal.



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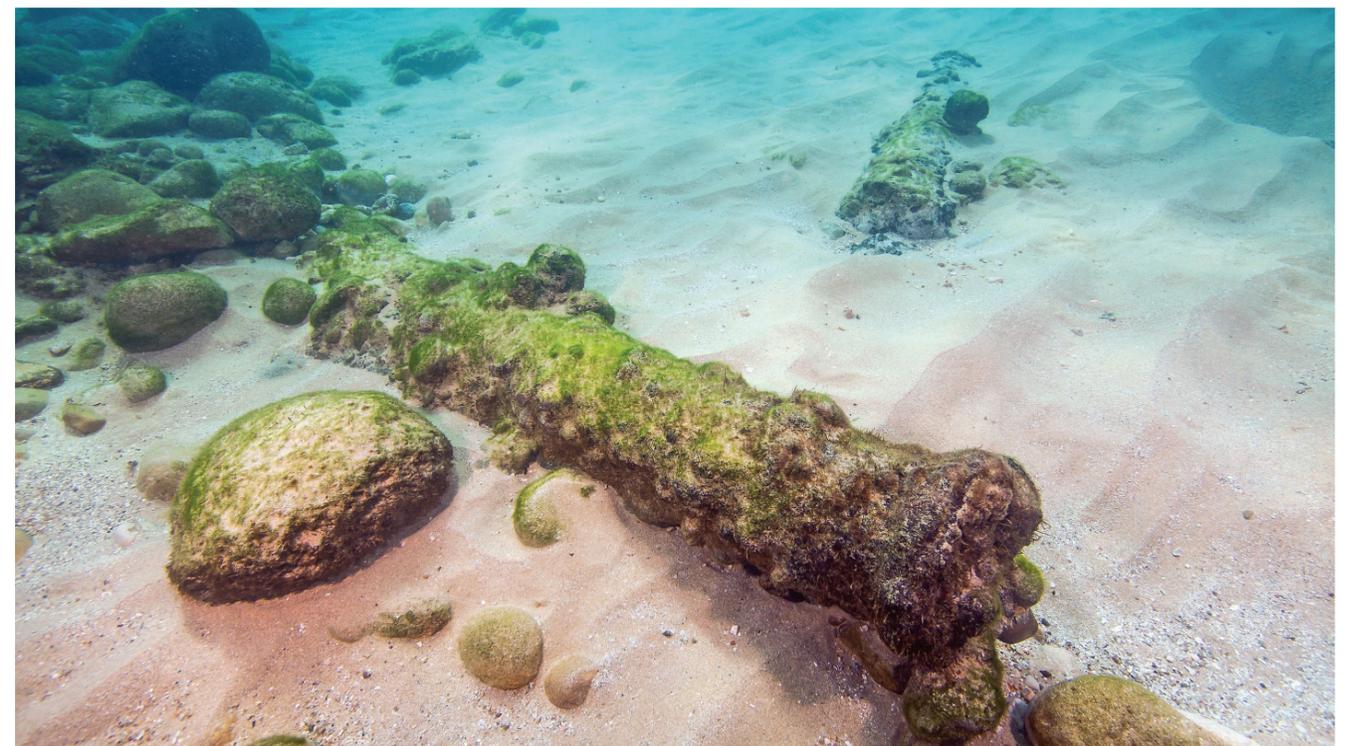


PHOTO TOP LEFT: LOLITA PETRICONI; BOTTOM: VRFOTOGRAFIA



210' stern-wheel steamboat Klondike remains in the Yukon River

25 INA PROJECTS FOR 2014

The INA Archaeology Committee awarded \$60,000 in project support for 2014. Learn more about the surveys, excavations and research that will take place around the world under the INA flag.

NORTH AMERICA

1 Shelburne Shipyard Steamboat Field School

Location: USA
Kevin Crisman (INA/TAMU)
In collaboration with the Lake Champlain Maritime Museum (LCMM), this 2014 field school will provide underwater archaeological survey experience to nautical archaeologists through the documentation of 19th-century steamboat remains in a shallow, protected harbor. In addition to hands-on underwater training, the course will include a classroom component, where students will receive training in GIS and analyze the results of the survey work. Participants will learn the necessary professional techniques for surveying and documenting shipwreck remains, as well as CRM practices and artifact conservation through LCMM's Conservation Laboratory. Lake Champlain is the site of nearly 300 well-preserved shipwrecks dating to the French and Indian War, Revolutionary War, and the War of 1812; consequently it provides a fantastic setting to learn more about Early American seafaring.

2 Yukon River Steamboat Survey

Location: Canada
John Pollack (INA) & Robyn Woodward (INA)
Since 2005, the goal of this INA project has been to pinpoint and document the dozens of wrecks that mark the river and lake routes once used by gold-seeking "stampedeers" during the last great gold rush at the end of the 19th and the beginning of the 20th century. The 2014 field campaign will involve two separate phases. First, we will conduct a detailed hull assessment of *Schwatka*, a large 1898 stern-wheel steamboat lying on land at the West Dawson Shipyard. Second, we will attempt to explore two excellent sonar targets that were located in 2013 in Steamboat Slough. These may be the remains of the 1898 stern-wheel steamboats *Mona* and *Glenora*, which burned in 1902 while in winter quarters. If confirmed, site inventory reports for both vessels will be prepared and added to the national archaeological inventory.

3 Warwick Project

Location: Bermuda
Katie Custer-Bojakowski (INA)
The excavation of the 17th-century English galleon *Warwick* is complete and the

post-excavation study began in 2013. The next stage of our research will involve reconstruction of the *Warwick's* hull and the analysis of hydrostatics and stability using Rhinoceros® 3-D modeling software and Orca3D® plug-in for naval architecture. These data will be prepared for an interim report to be submitted to the *International Journal of Nautical Archaeology*.

4 Denbigh Phase IV, Archival Research, Analysis, and Write-up

Location: USA
J. Barto Arnold (INA)
The *Denbigh* was a Civil War blockade-runner lost at Galveston, Texas in 1865. Following five summers of fieldwork, in 2014 we proceed with ongoing archival research on blockade-runners, our ship in particular, and with the preparation of publications.

THE CARIBBEAN

5 Rockley Bay Research Project

Location: Tobago
Kroum Batchvarov (INA)
Since 2012, INA and the University of Connecticut have been working to locate the wrecks from a 1677 battle between a French squadron and the Dutch West Indies Company in Scarborough Harbour, Tobago. The 2014 goals of this project are to identify, map and record the remains of the 17th-century Dutch warships, determine their construction characteristics and obtain more information about life aboard a West Indies Company frigate. Based on these data, we will establish the dependability of historical sources on late 17th-century ship construction and generate comparanda for the interpretation of *Vasa*, the Swedish 17th-century warship built by Dutch shipwrights. We also hope to be able to investigate and interpret the tactical aspects of this important naval battle.

6 Nevis Shipwrecks

Location: Nevis
Chris Cartellone (INA/TAMU)
This project is a continuation of a multi-year initiative to locate and document shipwrecks off the coast of Nevis. The island's tiny size and modern reputation as a quiet tourist destination contrast sharply with its history as the birthplace of Alexander Hamilton, an entrepôt for the slave trade in the Lesser Antilles, and site of the U.S. Navy's first battle. The 2014 season will capitalize on a growing network of private

and governmental support generated by the Project Solebay research initiative.

EUROPE

7 Molecular and Pollen Analysis of Shipbuilding Materials

Location: United Kingdom
Laura White (INA/TAMU)
The aim of this project is to use robust methods of chemical and biological analysis to characterize organic materials used in the banding and preservation of ancient Mediterranean wooden ships. This sort of analysis has far-reaching implications that can inform archaeologists about the identity of shipbuilding materials, the location and environment in which a ship was constructed, the choices made by shipbuilders, and the processes of ship maintenance.

8 Patacho of Pedro Diaz Carlos

Location: Portugal
George Schwarz (INA)
In 1608, Pedro Diaz Carlos was en route to Spain after completing a round trip voyage from South America to smuggle contraband from the New World. The objective of this project is to advance our knowledge of Iberian seafaring during the Age of Expansion by locating and subsequently investigating off the coast of Portugal a patacho that might be Carlos' sunken smuggler. Archival research combined with remote sensing surveys and site investigations suggest the presence of a 17th-century shipwreck in the Cove of Baleeira, where the patacho is known from historical records to have been wrecked. Read more about this project in this issue.



Artifact concretion from the Ertugrul Project

PHOTO: YUKON RIVER BY JOHN POLLACK; ERTUGRUL BY BERTA LLEDO

9 **Projecto Carta Arqueológica Subaquática da Baía de Lagos**

Location: Portugal

Tiago Miguel Fraga (Centro de História de Além Mar / CHAM)

This systematic survey of the Bay of Lagos will be conducted in order to locate and record underwater cultural heritage that provides evidence of maritime activity. In 2014 we will examine various clusters of artifacts already identified, review proposed anchorages and fishing areas and continue mapping two newly identified shipwrecks, Lagos B and Lagos F.

10 **Finisterre Project**

Location: Spain

José L. Casabán (INA/TAMU), Filipe Castro (TAMU) & Miguel San Claudio (INA)

Finisterre is a small village in northwestern Spain where a large number of shipwrecks, spanning many centuries of history, lie untouched. One of the most important clusters of wrecks dates from 1596, when a Spanish fleet of 80 large ships under the command of Martin de Padilla was caught in a storm and 25 ships sank. The objective of the Finisterre Project is to study the shipwrecks in this area to gain a better understanding of 16th-century shipbuilding.

11 **The Twelve Apostles: Late 16th-Century Spanish Galleons**

Location: Spain

José L. Casabán (INA/TAMU)

Between 1589 and 1591, twelve galleons were built and launched in the shipyards of northern Spain. These vessels were known as the Twelve Apostles and were constructed for the coastal defense of Spain and to escort the fleets making the run to the Indies. Their design was the result of one century of technological innovation in shipbuilding. The main objective of this project is to determine the original design, appearance, and outfitting of the Twelve Apostles using shipbuilding contracts, inventories, official reports, and personal letters located in the Spanish General Archive of Simancas (Valladolid), the Naval Museum (Madrid), and the General Archive of Indies (Seville).

12 **A Submerged WWII Aircraft Survey**

Location: Croatia

Megan Lickliter-Mundon (TAMU)

During WWII there was a small airfield for allied aircraft on the island of Vis in Croatia. In December 1944 a US B-24 Liberator was trying to reach the landing strip before

being attacked by German aircraft when it lost power and crashed into the sea close to the island. The aircraft, known as Tulsa-american, is notable because it is the last B-24 produced by the Douglas factory in Tulsa, Oklahoma. This project is a viability survey of that aircraft for inclusion in a field school that will focus on the documentation and possible partial recovery of sections of the wreck. Although ancient and historic metal conservation techniques have been studied fairly intensively, modern metal conservation techniques, namely those for aluminum alloy and composite aircraft originating from underwater sites, are not well-developed. Additional research includes a study of the crossover between modern museum aircraft conservation and two known aluminum conservation methods for submerged archaeological material.

13 **The Life, Works, and Ships of the Venetian Humanist Vettor Fausto (1490-1546)**

Location: Italy

Lilia Campana (TAMU)

The ongoing assessment and study of rare Venetian manuscripts dating from 1500 to 1620 continues to add to our knowledge of Renaissance shipbuilding in this center of Mediterranean trade and culture. The 2014 season of this multi-year research project will include a full transcription of all documents concerning Vettor Fausto and an Auto-CAD reconstruction of his vessels as recorded in the *Misure di vascelli*.

14 **Excavation of a Laced Vessel at Altino**

Location: Italy

Staci Willis (TAMU) & Massimo Capulli (INA)

In collaboration with the Department of History and Preservation of Cultural Heritage at the University of Udine and the Superintendency for the Archaeological Heritage of Veneto, we will conduct a thorough examination of the hull remains of a laced boat uncovered in 1999 during a land improvement project in the territory surrounding Quarto d'Altino in northeastern Italy (ancient Altinum). This boat is part of a broader tradition of laced construction which occurred in northeastern Italy from about the 2nd century B.C. to the 6th-7th centuries A.D. Only two complete hulls

using this construction method have been thoroughly examined. Thus the Altino boat may provide key insights into this local tradition of boatbuilding.

15 **Venice Lido Laced Timbers**

Location: Italy

Staci Willis (TAMU) & Massimo Capulli (INA)

This project is part of an ongoing effort to record laced boat timbers found washed ashore in Venice Lido in November 2012. Currently, the excavated remains of laced boats represent mostly riverine and some coastal watercraft. At least two of the timbers from Venice Lido have planking thicknesses that are greater than the Commachio wreck, the largest of these vessels yet found. The size and location of these timbers suggest that they may be from a sea-going vessel, which would be unique for this construction tradition.

TURKEY

16 **Burgaz Harbors Project**

Location: Turkey

Elizabeth S. Greene (INA), Justin Leidwanger (INA) & Numan Tuna (Middle East Technical University)

This collaborative initiative explores the four harbors associated with the Archaic through the late antique maritime site of Burgaz on the Datça Peninsula, Turkey. Begun in 2011, this project comprises comprehensive survey and excavation in the site's four harbors and within associated onshore port facilities. By combining excavation with surface survey and geophysical prospection both on land and under water, we are seeking answers about the long-term development of the ancient town, its military and commercial ports, and its integration within a broader maritime cultural and economic landscape.

17 **Maritime Landscape Survey of Rough Cilicia**

Location: Turkey

Matthew Harpster (INA)

Begun in 2013, the 18km-long Maritime Landscape Survey of Rough Cilicia between modern Boğsak and ancient Aphrodisias is a five-year program prompted by shifting cultural resource needs and new academic perspectives on the inhabitation and construction of maritime space.



Surface survey at the Burgaz Harbors Project

In collaboration with the terrestrial surveys directed by Gunder Varinlioğlu in the same region, we employ coastal underwater surveys, and GIS spatial analysis, in an effort to model how this landscape may have been fashioned and used over past millennia. Preliminary results from our first season include the documentation of a set of four slipways at Boğsak Limanı, the investigation of a second set on Dana Adası, and the preliminary recording of an assemblage of pan and ridge tiles, alongside Late Roman Keay 25 amphorae, at the northeastern end of Boğsak Adası.

18 **Post-excavation Research on Merchant Vessels from Yenikapı, Istanbul**

Location: Turkey

Rebecca Ingram (INA) & Michael Jones (INA)

Since 2005, 37 Byzantine shipwrecks have been discovered at Yenikapı in Istanbul, Turkey, during construction related to the Marmaray Project, a major expansion of the city's transport infrastructure. An INA team under Cemal Pulak and working in cooperation with the Istanbul Archaeological Museums recovered eight of the ships between 2005 and 2008; in 2013, Ingram and Jones completed dissertation-related research on two of the ships, YK 11 and YK 14. During 2014, the collection of data from the Yenikapı shipwreck materials housed at INA's Bodrum Research Center will continue in preparation for publication. The goals of the project are to collect fur-

ther information on the ships' hull timbers in order to proceed with hull reconstructions, accurately date the vessels using C-14 analysis of sampled hull timbers, and analyze materials used in the construction and maintenance of the vessels.

19 **Analysis and Conservation of Artifacts from the Kızılburun Late Hellenistic Shipwreck**

Location: Turkey

Deborah Carlson (INA/TAMU)

Post-excavation research, conservation, mending, and analysis of the artifacts from a five-season excavation that concluded in 2011 continues at INA's Bodrum Research Center in Turkey with the assistance of INA staff and graduate students from the Nautical Archaeology Program at Texas A&M University. In 2014 these efforts will be directed toward cleaning the eight marble column drums, with input from conservators and geologists from Istanbul University, as well as toward ongoing assessment of the ship's Hellenistic finewares to include researchers from the University of Lyon in France.

20 **Analysis and Conservation of Artifacts from the Uluburun Bronze Age Shipwreck**

Location: Turkey

Cemal Pulak (INA/TAMU)

Post-excavation research, conservation, mending, and analysis of the artifacts continue at INA's Bodrum Research Center in Turkey with the assistance of INA staff and graduate students from the Nautical



The Spanish General Archive of Simancas from the Twelve Apostles Project

PHOTO: 12 APOSTLES BY JOSÉ CASABÁN; BURGAZ BY ELIZABETH S. GREENE

Archaeology Program at Texas A&M University. In 2014 scholars turn their attention toward analysis of the ballast stones, the ship's wooden hull remains, and ongoing volumetric analysis of the Canaanite amphoras from the ship's cargo.

21 Restudy of 7th-Century Yassiada Amphoras

Location: Turkey

Frederick Van Doorninck (INA), Peter van Alfen (INA) & Justin Leidwanger (INA)

During the summers of 1961-64, an expedition of the University Museum of the University of Pennsylvania under the direction of INA founder, George F. Bass excavated the wreck of a 7th-century Byzantine ship that had struck a reef just off the small coastal island of Yassiada and the Greek island of Kos. This project has entered its final pre-publication phase in which descriptions, comparisons, fabric analysis and volumetric studies of the many types, subtypes and variants of the cylindrical and globular transport amphoras involved are being prepared for publication. Read more about this ongoing research in this issue.

ISRAEL

22 Ioppa Maritima

Location: Israel

Shelley Wachsmann (INA/TAMU)

In antiquity, Yaffo, located inside modern

Tel Aviv, Israel, was one of the most important ports along Israel's long, shallow, straight, and mainly harborless Mediterranean coast. The Jaffa Cultural Heritage Project (JCHP) carries out ongoing excavations of the ancient tel, or mound. The 2014 INA/JCHP Ioppa Maritima Project is a collaborative effort intended to add nautical or maritime dimensions to this existing terrestrial project. It consists of two independent foci: A) a remote-operated vehicle (ROV) survey, and B) a geoarchaeological/ground penetrating radar (GPR) survey of a geological depression, known locally as 'the Bassa' to determine whether it served as an inland estuary harbor in antiquity as has been suggested repeatedly in the past.

ASIA

23 Godavaya Ancient Shipwreck Excavation

Location: Sri Lanka

Deborah Carlson (INA/TAMU), Osmund Boparachchi (CNRS-Paris), Senarath Dissanayake (Department of Archaeology), & Sanjyot Mehendale (University of California at Berkeley)

The Godavaya shipwreck was discovered by local fishermen in 2003 who brought it to the attention of officials from the Department of Archaeology (DOA). Since then various exploratory campaigns

have been undertaken at the site, which included INA's first six-week field season in 2013. In 2014 a joint INA-DOA team will carry out an extended and intensive 12-week excavation of what is likely the oldest known shipwreck in the Indian Ocean. Thus far it is clear that the ship was transporting a cargo of raw materials, including what appear to be ingots of iron and others of colored glass, as well as finished stone querns and ceramic bowls, when it sank in the first century B.C. or first century A.D. This important project is funded by a grant from the National Endowment for the Humanities.

24 Ertuğrul: An Ottoman Shipwreck

Location: Japan

Tufan Turanlı (INA) & Berta Lledó (INA)

In 2007 the team performed a detailed and exhaustive survey to determine the extension of the Ertuğrul wreck area. For six weeks each year between 2008 and 2010, underwater archaeological excavations took place in the area of highest concentration of ship remains raising approximately 7500 artifacts. In 2014 we plan to work on the conservation of the artifacts still in wet storage in Kushimoto town and in Bodrum, as well as continue the archival research on the vessel and its sinking.

25 Naval Battlefield Archaeology in Vietnam

Location: Vietnam

Randall Sasaki (INA) & Jun Kimura (INA)

In October-November 2013 an international team conducted fieldwork at naval battlefield sites relating to the 13th-century invasion of Vietnam by Kublai Khan. The expedition was a joint project with the Asia Research Centre at Murdoch University (Australia), Monash University (Australia) and the Institute of Archaeology in Hanoi. The team investigated sites associated with two highly significant naval battles when Kublai Khan's invasion fleet was defeated by Kai Viet (Dynasties of Vietnam) at Van Don and the Bach Dang River in 1288 A.D. Efforts continue to encourage further work and preservation of the historical remains in inland waters and seas.



PHOTO: AIRPLANE WRECK BY DANIEL FRKA

BYZANTINE AMPHORAS MADE FOR WAR?

The remarkable design and detailed fabrication of transport amphoras from the Yassiada shipwreck

BY FRED VAN DOORNINCK

Some 80% of the 630 cataloged globular cargo amphoras from the seventh-century shipwreck excavated at Yassiada, Turkey in the early 1960s have a number of design and fabrication characteristics that would have made them particularly useful as military transport jars. Evidence of reuse and stan-

dardization indicate they may have been made to serve one of the most brilliant and prolonged campaigns in Byzantine military history.

The most immediate way that these jars stand out from the other globular cargo jars is that their necks and handles are markedly less massive. This dimen-

sional reduction increased the amphoras' efficiency as transport jars, their weight when empty being only 20% of their weight when full.

One of the jars' unusual fabrication features is the neck, which was made separately before being joined to the body, presumably in order to achieve

The author at work in a cistern of the English Tower within the Crusader castle that is the Museum of Underwater Archaeology in Bodrum, Turkey.



B-24 Submerged WWII Aircraft Survey



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greater uniformity in size and shape. The bottom of the neck ended in a sharp, wedge-shaped edge, while the opening at the top of the body ended in a short, vertical sleeve. Dimensions were so precise that when the neck's bottom edge became tightly wedged within the sleeve, it was usually flush with the bottom of the sleeve.

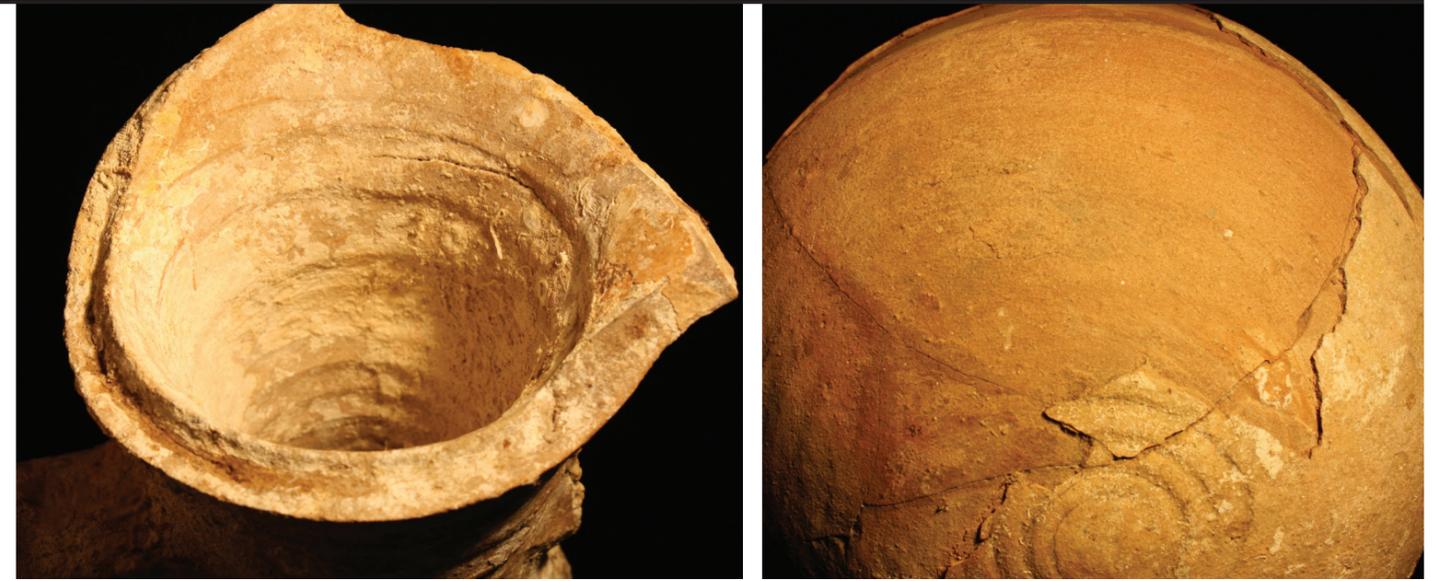
A major effort was made to increase the resistance of bodies and necks to breakage by adding an unusually thick layer of slip that often increased wall thickness by 50 to 100 percent. Sometimes the initial surfaces were left very uneven and covered with coarse grit, presumably

in an attempt to ensure better bonding. Different workshops enjoyed varying degrees of success in achieving good bonding and greater jar durability. We have to date found no other examples from the ancient Mediterranean world of this fabrication technique.

Before the addition of slip and handles, all of the jars looked the same, but by the end of the fabrication process, the jars from any particular workshop had been given an appearance that made it easy to distinguish them from jars made in other places. Upper bodies were decorated with one of several different patterns of combing, by spiral grooving, or occasion-

ally were left plain. Necks had broad or narrow ribbing, or were made smooth, and there was sometimes a collar on the neck just below the lip, made by adding a thin layer of slip or merely indicated by a thin groove. Most jars have bow-shaped handles, but we find several different handle configurations on jars with a broad band of combing on the lower shoulder and upper body, sometimes two different handle shapes occurring on the same jar.

Slip was added to the initial lip to form a new, more prominent lip. Jars from any particular workshop had their own distinctive form of lip that is a variation of one of



We have to date found no other examples from the ancient Mediterranean world of this fabrication technique.



three basic sectional shapes: rounded, flat, and slightly rounded and sloping.

The jars belong to at least six major types, with up to several subtypes. The task of organizing the jars into a coherent typological catalog, often quite bewildering, will soon end. The companion task of determining through fabric analysis where each group of jars was made can then begin in earnest.

The jars show signs of being used multiple times as transport jars and were designed to be recycled. Some jars have evidence of pry damage to their lip or mouth interior, and several have damaged lips that were subsequently carved down to reduce chances of further damage. To reduce the incidence of pry damage, stoppers were seated so that their outer face was flush with the lip. In this way, a pry tool could be held almost horizontally and thus exert minimal outward pressure against the lip.

Seating stoppers flush to the lip had

Opposite page: Two jars having the same capacity but a weight difference of almost 40 percent. **This page, from left:** Wedge-shaped neck bottom showing neck was made separately and joined to body; Exfoliation of thick slip reveals a surface beneath that is rough and gritty for better bonding.

PHOTOS BY ESRA ALTINANIT

already been a practice prior to the appearance of our new type of globular amphora, but in this new type, we find a subtle but significant design change in the stopper seat that further decreased chances of pry damage and therefore prolonged their life. Whereas stopper seats had tended to be in close contact with the tapered stopper sides throughout, only the upper part of the stopper sides was in contact with the seat in the new jar type. This was due to a finger groove just below the lip on the mouth interior that reduced the height of the seat to only 5 mm. This reduced contact of stoppers with the mouth interior made it even easier to dislodge them.

The mouths were designed to be sealed by tapered bark stoppers that were mass produced in standard sizes whose outer face diameter was 6, 7, or 8 *lepta*, the *lepton* being a 1/32 of a foot. In workshops where the Byzantine foot (31.23 cm) was used, the *lepton* was equal to 0.975 cm; where the Ionic foot (29.6 cm) was used, 0.925 cm. In most cases, stoppers had an outer face diameter of 7 Byzantine *lepta* (6.825 cm), an indication of increased centralized control.

Both the stopper and the seat for the stopper had to be of precise dimensions for the system of standardized stoppers

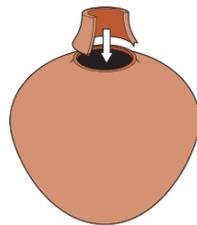
to work. The seat, located along the exposed inner side of the original lip, was attended to after the lip had been given its final form but before the handles were attached. One supposes that some kind of disc-shaped gauge was used in making any dimensional adjustment required so that the seat had the proper dimensions after firing. If the opening were too narrow, the surface of the seat was abraded; if too wide, a layer of slip was added. Were the seat opening after firing too narrow, the stopper it was designed for would have stood several millimeters above the lip, whereas were

AUTHOR

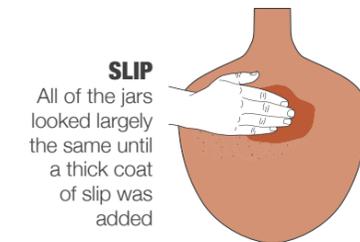


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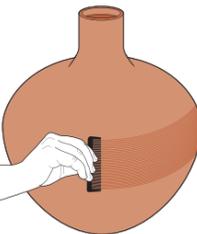
THE MAKING OF A BYZANTINE AMPHORA



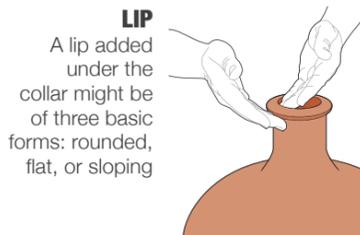
ASSEMBLY
After creating the body, the potter attached the neck, which was made separately



SLIP
All of the jars looked largely the same until a thick coat of slip was added



COMBING
The shoulder and body were often decorated with combing or grooves incised into the slip



LIP
A lip added under the collar might be of three basic forms: rounded, flat, or sloping



HANDLES
The final step before firing was the attachment of the handles, which sometimes gave the neck an oval shape



the seat opening even 1 mm too wide, the stopper might even fall into the body of the jar, due to the seat's extremely narrow height. How remarkable it is that in over three-quarters of the jars, the outer face of a stopper comes within .5 mm of being flush with the lip.

When handles were attached, the pushing of their upper ends against the neck sometimes imparted to the mouth an oval shape. In most instances, this resulted in only a slight gap between the stopper and the mouth on one side between the handles that made it even easier to pry out the stopper.

Let us now turn to the metrology of our jars. Both large and small sizes are involved, but here we will confine our attention to the large amphoras.

The jars belonged to a weight capacity system expressed in Byzantine pounds of

This page: This combination of angular and non-angular handle sometimes occurs on only one type of jar. **Opposite page, from left:** This neck ends in a plain, vertical, convex lip made broader by a thick layer of slip forming an exterior collar; A rounded lip form.

wine with a density equivalent to that of water. In order to determine the weight capacity of a jar, you measure its volume capacity in liters and then divide by the number of grams in the Byzantine pound at the time and place of the jar's making.

Measuring the volume capacities of globular cargo amphoras that are sufficiently intact has consumed more time and effort than any other aspect of this project. The volume capacity of perhaps 150 globular jars can be measured, but of these only 60 are complete and sound enough to permit measurement by water. The capacity of the other jars has been measured with Styrofoam beads, but the results have often proven to be quite unreliable. The problem with Styrofoam beads is that they easily become charged with static electricity which causes them to occupy a greater volume; conversely, they can be compacted into a smaller volume with any increase in overlying weight or perhaps atmospheric pressure. Under unchanging conditions, results can be consistently the same, but results can be alarmingly disparate when the vessels involved are of a relatively large

size. For example, there are several instances where bead measurements yielded capacities for a jar whose approximate capacity was somewhere between 36 and 38 liters. For this reason, we publish only water-measured capacities, citing in the case of bead-measured jars what we conclude was their most likely intended weight capacity size.

So far, we have managed to make reliable capacity measurements with water of 31 of the full-sized globular jars. These results, when plotted on a linear graph, fall into surprisingly tight clusters. In 2006, we made a linear graph with the capacities of 41 jars, 14 measured with water and the rest with beads; in this case the capacities fall into less clearly defined clusters. The earlier graph led me to conclude that the jars have weight capacities in multiples of 5 Byzantine pounds; with a weight value of 315 grams/pound, these capacities range from

105 to 125 pounds. The new graph raises another possibility: that the capacity sizes are multiples of 6 pounds and that the weight value of the pound was about 318.5 grams. The higher weight value for the pound would be considered somewhat more likely for the early seventh century.

We see plotted on our graph the volume of 105, 110, 115, 120, 125 and 130 Byzantine pounds of wine with a 315 g weight value and 102, 108, 114, 120, 126 and 132 Byzantine pounds of wine with a 318.5 g weight value; the mid-points between the latter volumes are also indicated. Let us suppose that potters were able to make jars of the latter weight capacities within $\pm 2.2\%$ of the desired capacity. The jars produced would have had actual capacities ranging from approximately 2.5 pounds below to 2.5 pounds above the desired capacity size, and we see this cluster pattern

of volume capacities occurring at the 108 and 114 weight-size locations on the graph). A fuller cluster pattern may emerge at the 120 weight-size location when our capacity measurements are completed.

A 6-pound interval system would have worked well for jars that were made to transport both wine (specific gravity 1.0) and oil (specific gravity 0.9). Jars with capacities of 120-122.5, 114-116.5, and 108-110.5 pounds of wine could have efficiently carried 110, 105 and 100 pounds of oil, since jars could be filled up to the stopper rather than to the bottom of the neck, as was the case with wine. We presently know that oil was being transported on the ship in globular jars of at least two oil sizes: 110 and 100 pounds.

We have just begun to weigh complete and thoroughly cleaned jars that are first oven dried to ensure consistent results.

How remarkable it is that in over three-quarters of the jars, the outer face of a stopper comes within .5 mm of being flush with the lip.



Of the 17 full-sized jars that have been weighed, 16 form 4 clusters that center on 26, 27, 28, and 29 pounds when the pound is assigned a value of 318.5 g.

A tight control of jar weight would have been quite remarkable in view of the complexity of the fabrication process. The weight of the clay and slip used in each jar would have had to have been carefully controlled. The necks were

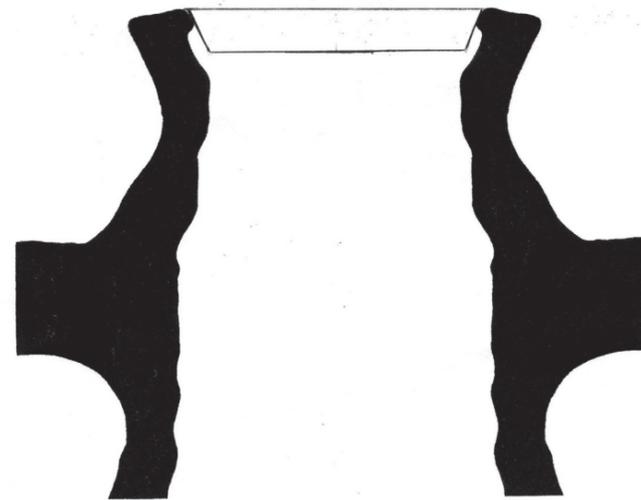
made separately but were of a standard size and weight. Handle weight was also carefully controlled. It would appear that in a majority of cases the 2 handles of a jar had a combined length of 1 Byzantine or 1 Ionic foot.

It seems clear that the jars of new design had been made under the direction of some central authority and for some special purpose. Their reduced weight,

enhanced durability and recyclability, and precise capacities and weights made the amphoras particularly useful as military transport jars. This conclusion is further supported when one considers they came into being as a part of preparations for Heraclius' brilliant expeditionary counteroffensive against Persia that began in 624 and ended with the disintegration of the Persian state in 628. Heraclius planned to take a force estimated at 20,000 men on a prolonged campaign, well aware that so large an army could not survive without receiving substantial supplements from the homeland. These supplies had to be efficiently and dependably transported by ship, wagon and pack animal.

It is my conclusion that the seventh-century Yassiada ship probably sank during the summer of 626 while transporting wine, olive oil, and liturgical oil to the Cilician coast. These supplies

This page: A pry-damaged lip subsequently carved down. **Opposite page, from left:** A stopper seat having minimal direct contact with a seated stopper; Pry marks optimally located on a slightly oval mouth. **Below:** Graph relating specific amphorae to their weight class in Byzantine pounds based on their capacity in liters.



Their reduced weight, enhanced durability and recyclability, and precise capacities and weights made the amphoras particularly useful as military transport jars.

would have been transported overland to the Byzantine army in northeast Anatolia when Persian forces had withdrawn to attend the Avar siege of Constantinople. The more we learn about the transport jars on the ship, the stronger the case for this scenario has become. We hope to

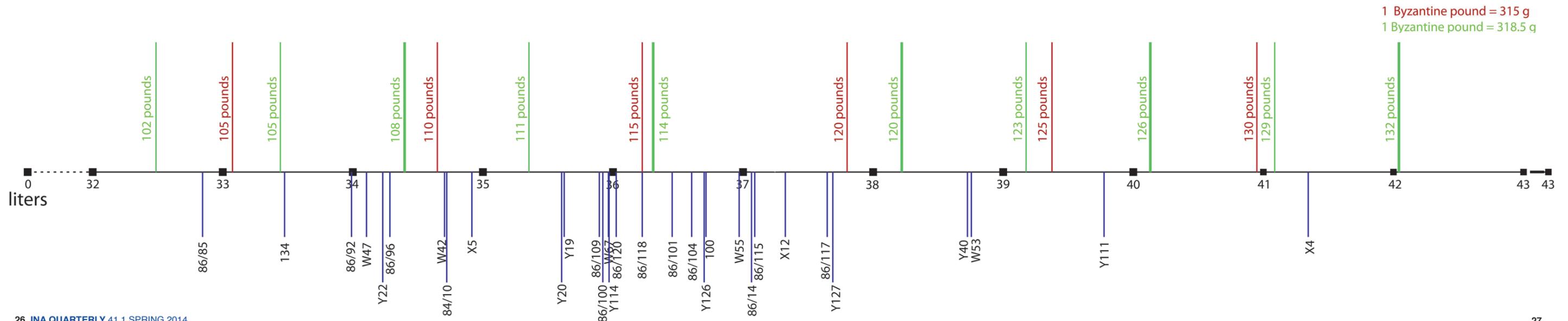
complete the restudy of the jars by the end of this decade, knowing now that the

results will be of enormous archaeological and historical importance.



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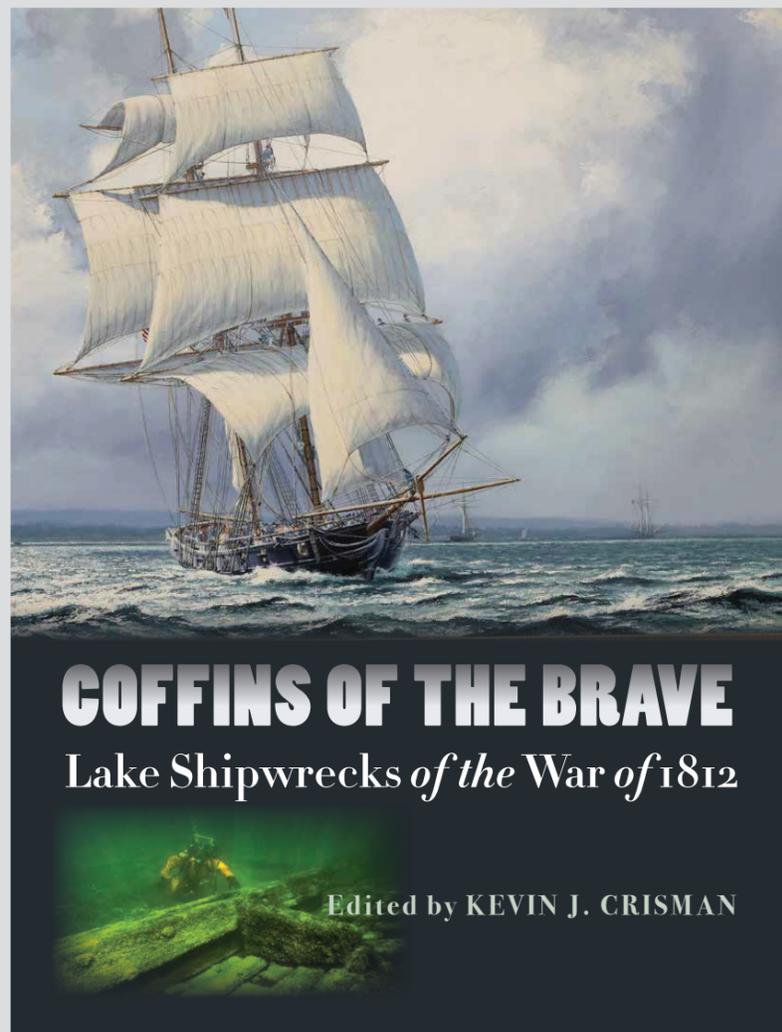
RELATING WEIGHT AND CAPACITY



REVIEW

COFFINS OF THE BRAVE: LAKE SHIPWRECKS OF THE WAR OF 1812

Edited by Kevin J. Crisman



TEXAS A&M UNIVERSITY PRESS

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REVIEWED BY ROBERT S NEYLAND

My first and last impression of the book is a beautifully illustrated and well crafted collection of chapters written by twelve

authors but well blended by the editor, Dr. Kevin Crisman. *Coffins of the Brave* comprises over three decades of historical and archaeological research on the War of 1812 shipwrecks of the Great Lakes. The authors discuss in detail sixteen different shipwrecks and the artifacts recovered from an underwater battlefield at Plattsburgh Bay. The quantity and variety of archaeological examples of vessels and diverse types considered here is remarkable and provides scholars an opportunity to compare and contrast ship construction within the historical context of this war.

The book is organized into three parts (Upper Lakes, Lake Ontario, and Lake Champlain) on the basis of the geography and progress of the war on the Great Lakes. Crisman provides the historical and archaeological context at the beginning of each part. This organization provides a historical context for understanding the progression of the war for the Lakes, for comparing the shipbuilding initiatives, and the vessels built or adapted to naval purpose.

The evidence for the War of 1812 ships of the Upper Lakes are considered in four chapters by authors Rybka, Cassovoy, Sabick, and a co-authored chapter by Gordon, Hoskins, and Heinold. Rybka provides a thought provoking account of how victory was forgotten and then commemorated a century after with the raising and refitting of USS *Niagara*. However, the inclusion of experience gained from *Niagara* afloat gives the reader a clearer understanding of the demands on a crew sailing a naval brig during the war of 1812. The chapter brings home the fact that war was not just documents and artifacts but real people, American, Brit-

ish, and Canadian who lived, worked, and died on these ships. Cassovoy introduces us to the archaeology as he steps onto the beach to view the remains of the Canadian-built *General Hunter* protruding out of the sand. He provides us with an archaeological site plan and ample details on the ship's construction and artifacts and raises the readers' awareness that wreck identification is not accomplished in weeks but takes years of continued analysis and archival research. Sabick relates the story of another Canadian built vessel, the schooner *Nancy* that was pressed into British service. Recovered in the 1920s it is now a museum exhibit as the physical remains of one of the early lake merchant vessels that underwent conversion by the Royal Navy. Gordon, Hoskins, and Heinold document the brief history of two British schooners hurriedly assembled after the end of the war to serve dual purposes as military transports and fast sailing, armed naval schooners. The authors analyze those hull remains salvaged and left to rot, such as *Tecumseth*, and those of in situ *Newwash*, gleaming many details of hull construction and the work of shipwright Robert Moore.

In Part II, Crisman and authors Moore and Amer consider seven of the surviving vessels built during the race for naval superiority on Lake Ontario, which Crisman defines as the "epicenter of the War of 1812," although it was a war fought in the shipyard rather than on the battlefield.

Hamilton and *Scourge* are two of the most remarkably preserved wrecks to be found anywhere in the world. Capsized in a sudden Lake Ontario squall and righting as they sank to a depth of 300 feet, they remain where they came to rest relatively intact. Plans for their recovery never came to fruition, perhaps luckily, although invasive mussel species might eventually take a toll. Moore's chapter brings forth refreshingly new and in-depth information regarding the condition and site formation of the wrecks recovered through remote sensing with sonar and remotely

operated vehicles (ROVs). The loss of these two ships emphasizes the danger of sailing on the lakes with shallow draft ships, weighted with cannon and a large spread of sail.

Crisman discusses the brig *Jefferson*, which might have capsized as well if not for the quick actions of the officers and crew who threw the cannon overboard. *Jefferson* is important as the only surviving example of Henry Eckford's adaptation of the US Navy's brig design to the sailing requirements of the lakes and Crisman relates how even a much abused wreck can yield a wealth of information. Moore's chapter relates the difficulty of building ships under the frontier conditions of limited manpower and materials, as well as conducting transatlantic communications with the Admiralty. He compares British with American shipbuilding, showing that while the Royal Navy took many wartime shortcuts, the American builders were ultimately faster. Amer concludes Part II describing the lone example of a Royal Navy gunboat. This is a unique vessel, being clinker built and, after the war, converted to a local trader by overlaying the difficult-to-repair lapstrake with an outer layer of planking and adding a centerboard to counter the lateral drift of the gunboat's shallow draft.

Part III consists of six chapters discussing the Lake Champlain campaign, four shipwrecks and an underwater battlefield in Plattsburgh Bay, as well as concluding the book. Crisman again provides the context for this campaign and the remarkable story of an early steamboat converted into a sailing warship, the US Schooner *Ticonderoga*. Crisman completes the story of the shipwrecks of Lake Champlain with his study of Adam Brown's 19-day construction of *Eagle*, which spared the salvage that impacted other lake shipwrecks, evidences the simplicity and robustness of Brown's construction. Near *Eagle* lies the wreck of the *Linnet*, which Washburn interprets in and the wreck of the galley *Allen*, which is the focus of Emery's chapter.

Battlefield archaeology is frequently done on terrestrial sites, but rarely accomplished in underwater archaeology. Cohn and Crisman describe the artifacts deposited on the lake bottom during the battle of Plattsburgh Bay. A map showing the location of these recovered artifacts would have shown great potential for interpreting the battle, but presumably artifacts recovered without archaeological methodology lack provenience. One artifact stands out, a Royal Navy anchor lost during the battle and recovered in 1998 with the word "Quebec" in white paint on the fluke. In the concluding chapter, Crisman emphasizes the significance of the war for the lakes in creating the final lasting peace between Britain and the United States and helping to solidify both American and Canadian national identities. In comparing and contrasting opposing shipbuilding efforts, it is readily apparent that both the American and Royal Navies altered their established shipbuilding methods in desperately trying to outbuild each other. Both sides confronted unusual challenges in organizing shipyards on the frontier with shortages in naval materials, a skilled workforce, and difficulties in communication.

Coffins of the Brave is a masterful work weaving naval history with underwater archaeology to illustrate the mutual relevance of both for interpreting the past. This volume will further our knowledge and understanding of the War of 1812 on the Great Lakes and undoubtedly will become a classic for future underwater archaeologists. The book is skillfully edited and superbly illustrated. My congratulations to the editor and authors for creating a book that will be of lasting value to archaeologists, historians, and other nautical researchers!

Dr. Robert Neyland is an expert in underwater archaeology, the US Navy, and founding Head of the Underwater Archaeology Branch, Naval History and Heritage Command within the Department of the Navy.

TRIBUTE:
BILL CHARLTON (1941-2014)

Friends of INA reflect on his legacy of dive safety

William H. Charlton, Jr., known as Bill to friends and colleagues, recently lost a valiant eight year-long fight against cancer. Bill served his country in the Marine Corps for 29 years, completing a combat tour in Vietnam. He retired a Mustang Officer and entered the Nautical Archaeology Program (NAP) at Texas A&M University (TAMU), where he wrote an M.A. thesis on rope and knot-tying in the ancient Mediterranean. In the 1990s Bill served as Dive Safety Officer for the Institute of Nautical Archaeology (INA), and supervised dive safety at INA's excavation of a Byzantine shipwreck at Bozburun, Turkey, which was the first INA project to utilize oxygen-enriched air on a large scale (INAQ 25.4). His 1:10 scale model of the ancient boat recovered from the Sea of Galilee was featured on an Israeli postage stamp (INAQ 26.3). Bill was responsible for making the Scientific Diving course at TAMU-Galveston available to NAP graduate students in College Station (INAQ 29.2), and served as TAMU's Dive Safety Officer until his death at the age of 73.

I am the director of recreational SCUBA for the Texas A&M College Station campus. Years ago Bill came to me for suggestions regarding finding time and access to confined water so he could lead a scientific diver section of the Galveston course on the College Station campus. It was at this initial meeting that I saw Bill's gentle and professional way and his ability to make it easy for me to help him to achieve his goal. There could not have been a better representative for the Scientific Diver

course at A&M College Station than Bill Charlton. I considered him a friend from that first day and every day since. I will miss Bill Charlton.

-JIM WOOSLEY

In the eight years I have known Bill, I only got to dive with him once, on the day that I met him. I was nineteen, a sophomore at Texas A&M Galveston completing a field practical for a Scientific Diving class. I don't remember much about that dive,

but I do remember that Bill was larger than life, and I remember his stories. As a young student who dreamed of becoming a nautical archaeologist, I hung on the tales of his adventures at Uluburun, Bozburun, and more. Many years later when I came to Texas A&M, Bill and I turned our casual acquaintance into a true friendship, and for the past four years we have worked together. More than anyone else I know, Bill loved diving and he loved archaeology. But even more than that, he loved



students, and he loved that place where the three came together. To him, I think these were the places where *stories* were born.

-LAURA WHITE

On the Bozburun Byzantine Shipwreck excavation, Friday evening was the day off. Bill and I, along with whomever else wanted to come, would pile into Robin Piercy's old Land Rover (the one with the bullet and shrapnel holes) and drive over the mountain to Bozburun town in the late afternoon. Our first stop was Bayram the barber, where we would get a shave and maybe a haircut (Marine-style high-and-tight was a foolproof excavation hairstyle). There was only the one chair, and so while we waited, a boy would come along with little glasses of scalding hot tea, which we drank while sitting in the street on rickety wooden chairs. From the barber, we would

This page: Bill with his 1:10 scale model of the ancient boat recovered from the Sea of Galilee. **Opposite page, from left:** Bill alongside the recompression chamber at the Bozburun shipwreck excavation in 1997; Bill suited up to dive from *Virazon* with Claude Duthuit and George Bass in 1992.

head over to the Bozburun restaurant, the only decent eatery in town, for one beer and a quiet dinner. We would finish up at Sami's carpet shop, lounging on the camel bags, telling stories and drinking lemonade until it was dark and time to go home. As we came back over the mountain, with Selimiye Bay laid out before us in the moonlight, we rarely said a word. It gave me a great sense of comfort to watch the road unroll in the company of someone who was happy to share the burden of running the excavation and could be trusted to do his job and more without any fuss. This ritual was the caesura that separated the weeks, both marking the passage of the season and making it timeless.

-FRED HOCKER

Bill worked diligently to keep the scientific diving safety program afloat at Texas A&M. He had a passion for supporting academics and research involving diving and he particularly had empathy for the graduate students pursuing their degrees while "living on rice and beans." We dearly enjoyed the many chances we had over the years to visit with Bill on a variety of

topics including his diving experiences, his love of nautical archaeology, his pride in his military service, his love and devotion to each member of his family and even his endless pursuit of "holistic" and "alternative" medicine remedies.

-CHRIS MEYER AND DEBBIE ADKINS

I never get in the water without thinking about Bill. I was a SCUBA diver before I met him, but became a much smarter, safer, more efficient diver as a result of my time with Bill. Some small part of Bill is in everything I try to pass on to students about doing science under water. Bill was a student's best friend – he always took the time to answer questions and provide advice. In my case he went one step further. He loaned me his trailer to take gear to Lake Ontario. He freely handed over the trailer, knowing full well that a group of graduate students were taking it most of a continent away for several weeks of field work. I couldn't have done the project without him and we couldn't have done it well without his training. I miss just knowing that Bill is out there.

-BEN FORD

