

# THE INA QUARTERLY

BRINGING HISTORY TO LIGHT THROUGH THE SCIENCE OF SHIPWRECKS

**INA**  
**CHALLENGE**  
DETAILS ON  
BACK COVER

## ROMAN-ERA LACED BOATS IN CROATIA

**YUKON RIVER  
STEAMBOATS**  
THE HULL OF THE  
SS KLONDIKE

AN INTERVIEW WITH  
ARCHAEOLOGIST  
AND ILLUSTRATOR  
**SUSAN KATZEV**



SPRING/SUMMER 2017  
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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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## AN INA CHALLENGE

INA members and regular readers of the *INA Quarterly* already know that less than one year ago INA finished construction of *Virazon II* – a brand new, custom-built, state-of-the-art, 75-foot-long steel ship, the first ever to be classed in Turkey as an Archaeological Research Vessel.

The construction of *Virazon II* was made possible through the stunning generosity of a single individual. Now a second individual has made another bold show of support for INA by launching a \$1 million Challenge Grant to fund an endowment that will ensure the use and maintenance of *Virazon II*.

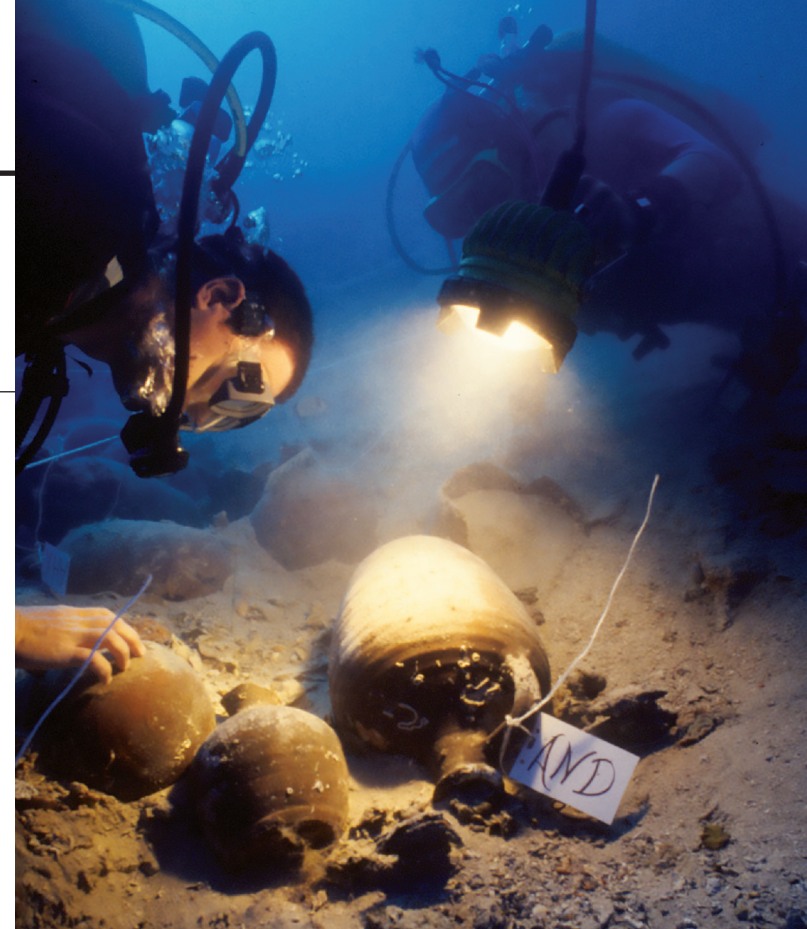
How does it work? Every dollar donated toward the *Virazon II* Challenge Grant between now and June 1, 2018 will be matched by the donor, up to one million dollars. That means we have a precious opportunity to double a \$1 million gift and generate \$2 million of impact. A \$2 million endowment invested at a 5% rate of return would provide \$100,000 per year. \$100,000 per year will ensure that *Virazon II* is always in

project-ready condition, whether it be for shipwreck surveys or archaeological excavations in the Mediterranean, the Red Sea, the Black Sea, or even the Indian Ocean. The *Virazon II* endowment will also provide funding for project expenses such as transportation, fuel, food, etc., which in the past have been raised largely by the lead archaeologist.

INA now has a first-class research vessel and with your help INA archaeologists and research associates will be able to make maximum use of it. I am urging every INA member and every reader of the *INA Quarterly* to help us reach our \$1 million goal by contributing to the *Virazon II* Challenge Grant, thereby guaranteeing future INA surveys and excavations. With every donation, no matter how small, you will help INA bring history to light through the recovery of our shared maritime past!

With thanks for being part of INA!

George F. Bass  
INA Founder



INSTITUTE OF  
**NAUTICAL**  
ARCHAEOLOGY



## JOIN US AND SUPPORT INA TODAY!

### Bringing History to Light through the Science of Shipwrecks

The Institute of Nautical Archaeology (INA) is a non-profit international research organization committed to locating, excavating, recording, preserving, and publishing shipwrecks and other archaeological sites of maritime significance. INA was founded over 40 years ago by Dr. George Bass, who in the 1960s pioneered the science of archaeological excavation under water. Today there is greater need than ever before to support the work done by INA; dredging and commercial fishing have severely damaged or completely erased sites around the world. INA members are institutions, professionals, enthusiasts, and students united in their passion for discovering the untold stories that lie hidden beneath the sea. Join INA today and become a patron of discovery!

### BENEFITS OF INA MEMBERSHIP

- > **Four print or digital issues of the *INA Quarterly***, now in its fifth decade
- > **Monthly e-news via the *INA Insider***, featuring behind-the-scenes field reports and announcements about upcoming lectures, publications, and book signings
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- > **20% discount** on membership in the Nautical Archaeology Society (NAS) which includes two issues of the *International Journal of Nautical Archaeology* (IJNA)
- > **10% discount** on merchandise available through INA's online store

Visit us at [www.nauticalarch.org](http://www.nauticalarch.org) to become a member or call (979) 845-6694



# NEWS & EVENTS

INA Project Updates, Turkey Shipwreck Survey, NAP Alumni News

## COUNTING CALORIES AND MICROBES

**Grace Tsai**, a Ph.D. student in the Nautical Archaeology Program and current INA Archivist, made headlines recently with her INA-funded project *Ship Biscuit and Salted Beef—A Study of Sailor Diets in the 17th Century*. Tsai's project, which is aimed at determining the true nutritional value of common shipboard foodstuffs through the preparation of authentic recipes and storage in historically accurate wooden barrels, was featured in *Texas A&M Today* and the TAMU Foundation's *Spirit Magazine*. In addition to securing a partnership with the **Karbach Brewing Co.**, which is assisting with the production of historically accurate beer, this summer Tsai moved barrels of salted beef, pork, cod, ship biscuit, peas, and oatmeal

onto *Elissa*, a restored 19th-century sailing ship moored in Galveston, TX. After two months, samples of the food will be analyzed for nutritional content and microbes.

## NEW LIGHT ON VERY OLD INGOTS

The Late Bronze Age **Cape Gelidonya** shipwreck, which is so important as the site where George Bass established underwater archaeology as a scientific discipline in 1960, continues to yield fresh information under the lens of new methods of analysis. With support from the Brennan Foundation and the Council for Overseas Research Centers (CAORC), INA Affiliated Scholar **Nicolle Hirschfeld**, together with archaeometallurgists **Emre Kuruçayırılı** and **Seppi Lehner** are

examining the physical and elemental characteristics of the copper ingot assemblage, now amounting to more than 1200 fragments and weighing over one metric ton. A scanner on loan from the University of Central Florida and graduate students from the same institution produced 3D scans of many ingots for remote study and forging new paths of research in microtextural analysis, 3D printing, and join-finding. These renewed attentions promise new insights into this unique cargo.

## VIRAZON II GETS TO WORK

INA staff and the crew of *Virazon II*, INA's new archaeological research vessel, worked with archaeologists from the **Bodrum Museum of Underwater Archaeology** this summer to survey for



Cemal Pulak



Matthew Harpster



Staci Willis



Michael Jones

shipwrecks along the Bodrum peninsula. This project provided an excellent opportunity to exercise the research and survey capabilities of *Virazon II* by assessing known sites and locating previously unknown wrecks. Work began just days after a 6.3-magnitude earthquake hit Bodrum and the Greek island of Kos, and continued through late September.

## NAUTICAL ARCHAEOLOGY PROGRAM (NAP) NEWS

We are pleased to announce that **Cemal Pulak**, INA Vice President and NAP faculty member, was recently promoted to the rank of Professor at Texas A&M University. Cemal holds the Frederick R. Mayer Fellowship in Nautical Archaeol-

ogy and has many interests and areas of specialization but is most recognized for his excavation and ongoing analysis of the Late Bronze Age shipwreck at Uluburun, Turkey. Our congratulations to Cemal for this tremendous academic achievement.

INA Research Associates and NAP alumni **Matthew Harpster** (Ph.D. 2005) and **Michael Jones** (Ph.D. 2013) have recently accepted faculty positions in maritime archaeology within the Department of Archaeology and History

of Art at the prestigious Koç University in Istanbul, Turkey. NAP alumna **Staci Willis** (Ph.D. 2016) recently accepted an anthropology teaching position at Houston Community College.

Among the 2017 NAP graduates are **Christopher Dostal** (Ph.D.) who wrote his dissertation on the recording of timbers from the World Trade Center ship, and M.S. recipients **Chelsea Cohen**, **Raphael França**, **Miguel Gutierrez**, **Kelsey Rooney**, and **Phil Watson**. Our congratulations to all graduates!



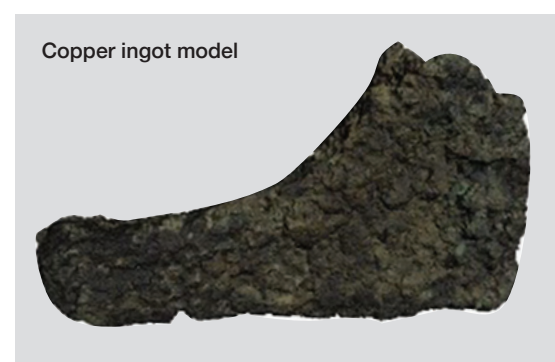
**FOR MORE INFORMATION** check out news and events updates on the INA website at [www.nauticalarch.org/news-events](http://www.nauticalarch.org/news-events)



Grace Tsai



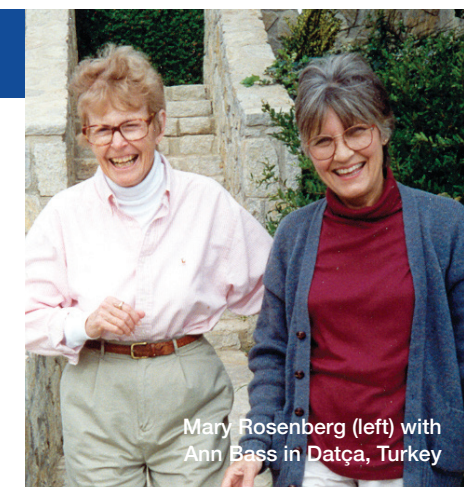
Creating 3D scans of Cape Gelidonya ingots



Copper ingot model

## IN MEMORIAM | Mary Rosenberg (1926-2017)

The INA family is deeply saddened to report the passing of **Mary Rosenberg** (1926-2017) who, with her husband Dick (1926-2013), supported INA for nearly 40 years. The Rosenbergs fell in love with Turkey and established a farm south of Bodrum at Datça which employed over 100 local Turks pressing olive oil from their centuries-old trees. At home in Portland, Oregon, the Rosenbergs formed the Northwest Friends of INA, helping to raise \$250,000 in direct support for INA's Bodrum Research Center (BRC), and fund the purchase of the 4,000-volume Homer Thompson Library for the BRC's research collection. Mary once emphasized her own love of the ocean as being a pivotal element in her family's decision to join the INA family; she will be sorely missed.



Mary Rosenberg (left) with Ann Bass in Datça, Turkey



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PROFILE:

## SUSAN WOMER KATZEV

Meet a pioneer in the discipline of nautical archaeology

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*Susan Womer was born in Alton, Illinois and grew up playing along the banks of the Missouri River in Florissant, Missouri. After high school she spent a year at the Boston Museum School of Art before entering Swarthmore College, where she earned a degree in Art History. During her sophomore year in 1960, word got round that George Bass was looking for mechanics, architects, and artists to staff his new excavation of a Byzantine ship wrecked at Yassiada, Turkey. For her job interview, George took a Greek pot from the back shelves of the University of Pennsylvania Museum and asked Susan to start drawing; hours later she was offered the position of staff artist. Susan spent four seasons as staff artist and excavator at Yassiada, followed by a graduate year at Temple University's Tyler School of Art. During the fourth season at Yassiada in 1964, Susan met her future husband Michael Katzev (1939-2001); they married in 1966. Just one year later, the Katzevs were shown a small mound of amphoras off the coast of Kyrenia, Cyprus which proved to be one of the best preserved and most illuminating ancient Greek shipwrecks ever excavated (1968-69). Michael and Susan delivered so many public lectures about their excavation, study, and replication of the Kyrenia ship that the names Kyrenia and Katzev have become almost synonymous. Today, Susan Womer Katzev spends much of her time coordinating an international team of scholars and scientists working to complete the final publication of the Kyrenia ship; in her free time she indulges her lifelong passion for art by visiting museum exhibits and art galleries with friends from all over the world.*

**Describe what it was like for women in the early days of nautical archaeology. Was sexism as pervasive as some people suggest? Were there advantages to being a woman in a field characterized by machismo?**

I never felt a single instance of being looked down upon. As long as you could do a man's work on the diving front all was equal. And, being the only single girl on a desert island with about 18 eligible bachelors was kinda fun!

**Tell *INA Quarterly* readers something they don't know about Michael Katzev and the kind of person he was.**

Something readers might not know is

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**This page:** Susan carries a cast anchor replica along the harbor's edge in Bodrum, Turkey. **Opposite page:** Inking illustrations of the amphoras from the Yassiada shipwreck.

how much he cared for our team members. There was no hierarchy on the excavation. We were all in it together, and I believe that is why our Kyrenia "family" has kept in touch and thinks back on the dig with only fond memories.

**You excavated, conserved, and researched one of the most important archaeological sites in the world. Tell us about the process of publishing a site of such historical importance.**

I find it rigorous, picky work, demanding great patience and high standards. There are over 50 specialists and scientists contributing to our four-volume report: two discuss what was found within the ship and two present the ship itself, a complex piece of architecture, whose joinery by thousands of mortises and tenons demanded high skills.







**My greatest joy is discovering something I've never seen before. I want to leave myself open to falling in love with - or being hit between the eyes by - some unexpected work of art that grabs my gut, my eyes, my heart.**

**Tell us your favorite memory or story from the Kyrenia shipwreck excavation.**

Favorite memories abound from our 1968 and 69 excavation days in Kyrenia

**This page:** Members of the original Kyrenia Ship research team (clockwise from top left): Dick Steffy, Netia Piercy, Robin Piercy, Frances Talbot Vassiliades, Susan Katzev, Michael Katzev. **Opposite page, from top:** Susan in the field, Susan and Michael, Susan at work ca. 1963

— joining our castle custodian in spirited dancing, the kindness of the townspeople. But perhaps the most generous gesture of all came when we were in the second summer of excavation and it became clear that we could uncover and raise the hull before autumn storms set in. Leaving the wood on the bottom would expose it to destructive currents. We had to raise it. Our first thought was to lift the ship intact by building a cradle under

it and helicoptering it into the central courtyard of Kyrenia Castle. Soon it was clear that no military or civilian helicopter in the region was capable of such a lift. Still thinking to raise the hull as a whole, Michael mentioned our dilemma to then Director of Antiquities, Vassos Karageorghis. Out of the blue, he offered to dismantle a section of the Castle wall for us to drive the ship inside! Have you seen the thickness of those stone walls?

Well, this became the plan..... until we came to realize that for ease of handling and preserving the wood, it would be best to take the ship apart and raise it piece by piece. This we eventually did, but I shall never forget the daring of Dr. Karageorghis' kind offer.

**You and Michael co-designed the “underwater telephone booth” which has become a mainstay of INA excavations. What do you think the next major innovation in underwater archaeology will be?**

Back in 1967, George was preparing to begin a Late Roman shipwreck at Yassada and had been wondering if we could find a way for divers to communicate with the surface in mid-dive.

Michael and I went out to dinner that night to our favorite restaurant in Philadelphia, “The Three Threes.” We each drank three dry martinis and in that joyful state designed “the telephone booth.”

What might be a next big innovation in underwater work? Now that ROVs can excavate and record at nearly any depth, I would suggest talking with as many local fishermen as fast as we can and let raki and ouzo replace the martinis.

**If you could tell the world one thing about nautical archaeology in general and/or INA, what would it be?**

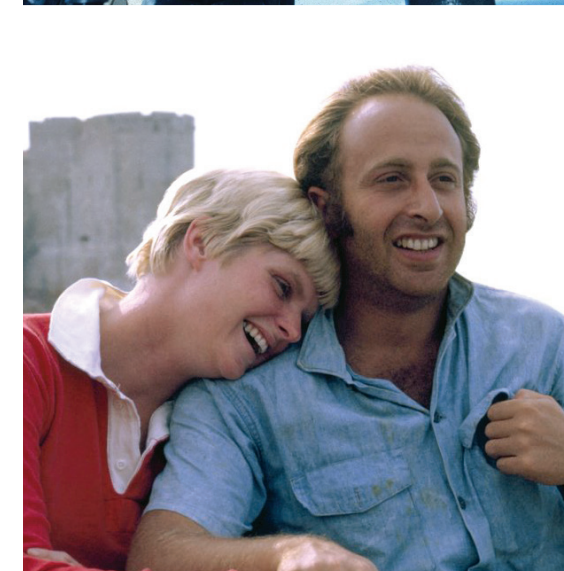
Be prepared for it to take over your life, and do it through INA. The seas have been preserving every millennium of history just for you.

**If you could find and excavate any type of shipwreck in the world, what would it be and why?**

If you've been lucky enough to see the traveling exhibition “The Power and the Pathos,” you know how engaging, how full of motion and emotion Hellenistic sculpture was — especially the bronzes. I would want to fulfill Michael's dream and release from its watery nap a new collection of Hellenistic bronze statues.

**What are your personal interests?**

Collecting art, and also folk art that makes me laugh. People who visit my home in Maine are warned that it is eclectic. But to a person, they always leave saying, “I have no idea what I just saw here.” It is surely not an encyclopedic or scholarly collection. My greatest joy is discovering something I've never seen before. I want to leave myself open to falling in love with - or being hit between the eyes by - some unexpected work of art that grabs my gut, my eyes, my heart. It can be any period of human communication. I look forward to catching sight of some work for the first time and spurting out, “Wow!”





# SS KLONDIKE

## YUKON RIVER'S LARGEST STERN-WHEEL STEAMBOAT

Examining an evolving hull design

JOHN POLLACK AND ROBYN WOODWARD



PHOTOS, FROM LEFT: J. POLLACK 2016; YUKON ARCHIVES

John Pollack and Robyn Woodward In the spring of 2016 we talked with Kate Alexander, Parks Canada site manager for *SS Klondike 2*, a stern-wheel steamboat of the 1930s. Kate was shaken by a recent arson attempt on the vessel - a National Historic Site and a leading tourist attraction in Whitehorse, Canada. The fire had been set at the stern of the vessel and entered the oil-soaked hull below the engines. Only luck, quick thinking by staff, and a fast response from the fire department saved the vessel from serious damage.

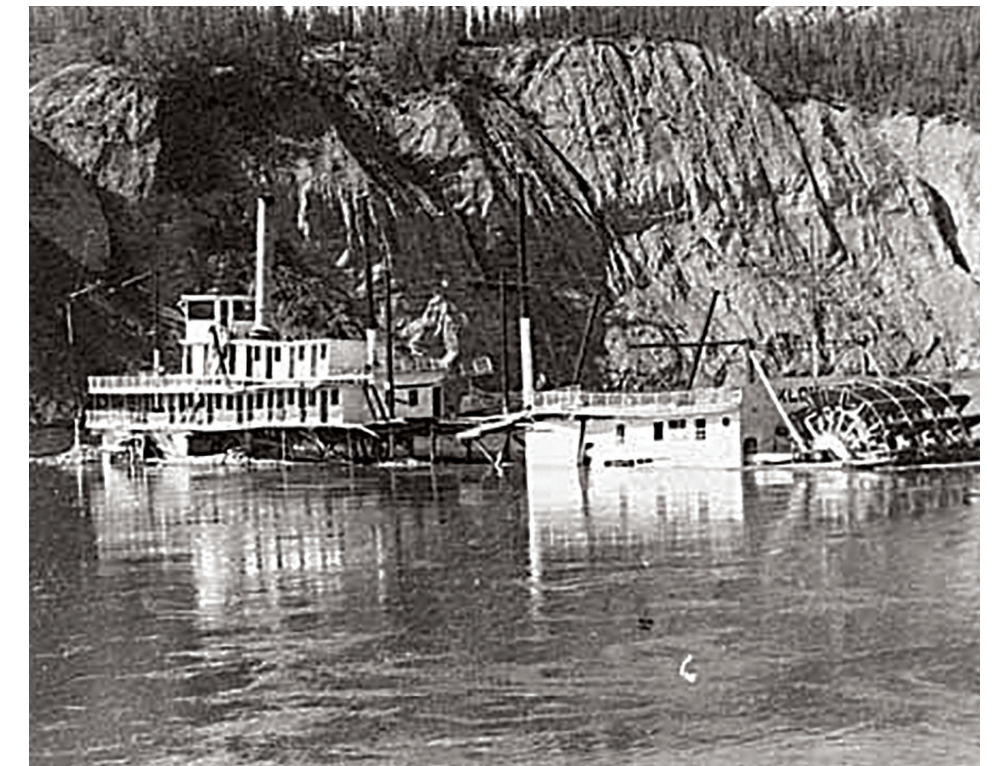
Arson has been the suspected cause of fires that destroyed a number of other steamboats and hulks in the Yukon Territory. On June 20, 1974 two large laid-up stern-wheel steamboats burned in Whitehorse. "Hundreds of people stood on the banks of the Yukon River yesterday morning and cried as the riverboats *Casca*

and *Whitehorse* were engulfed in flames" reported the *Whitehorse Star*. And on July 25, 1990 the *Tutshi*, another great heritage vessel laid up at Carcross, was completely destroyed. Similar risks exist at the unprotected West Dawson shipyard; these risks were partially the catalyst for this INA project, which has documented seven stern-wheel steamboats at this site over the past decade.

Given the arsonist was still at large, we realized hull evaluation was an immediate priority. This ship is the last Yukon River stern-wheel steamboat constructed and its design should reflect four decades of local ship-building expertise. Parks Canada offered to expedite the complicated Federal permitting process, and we slated the work for May 2016.

The original *SS Klondike* (*Klondike 1*) was designed by White Pass and Yukon Route (WP&YR) president Herbert Wheeler and shipyard foreman, Bert Fowler, and was launched at Whitehorse in 1929. This large steamboat was used by the British Yukon Navigation Company

From left: Bow of *SS Klondike (2)* at Whitehorse, with R. Woodward for scale; Photograph of the wreck of *Klondike 1* in June 1936.







(BYNC) - a subsidiary of the WP&YR - to move silver-lead concentrate upriver the Mayo Mine to Whitehorse. From there the concentrate was shipped by rail to Skagway Alaska, and then moved south by freighter to smelters in the Pacific Northwest.

*Klondike 1* was the largest (by gross ton displacement) stern-wheel steamboat to operate on the Yukon River. It was designed to carry all its cargo aboard, and eliminate the slower, fuel-consuming practice of pushing a heavily laden barge in front of the steamship. When travelling upstream to Whitehorse, *Klondike 1* could carry 300-350 tons of concentrate stacked in 125 lb. bags on the main deck. On the return trip downriver to Stewart Landing or Dawson, the ship carried a lighter load (250-270 tons) of general freight and a few passengers.

The ship was swift, burned less wood per hour than comparable large vessels, and ferried cargo both ways. However, there were substantial risks to running such a large ship through the treacherous Thirty Mile section of the Yukon River immediately north of Lake Laberge. This section of the river had already claimed approximately 30 stern-wheel steamboats since the 1890s and required "backing," that is running the paddlewheel in reverse, to slow a vessel headed downstream in a swift current, while negotiating the tight bends of the river.

*Klondike 1* seldom ran aground due to the expertise of the captain and pilots, who typically loaded the ship to be bow heavy so as to prevent damage to the sensitive paddlewheel and rudders. However on June 12, 1936 *Klondike 1* sank five miles north of Hootalinqua while en route to Dawson fully laden with cargo. The ship was steaming downstream in a 6.5-knot current when the new pilot did not enter a bend correctly, and the ship drifted sideways into a bluff. The chine was torn out along one side of the vessel, the rudders were disabled, and the ship flooded rapidly. As *Klondike 1* drifted downstream in the fast water, the crew chopped down

jammed stateroom doors to free trapped passengers, and then abandoned ship in the lifeboats. The wreck flooded up to the salon deck, and was grounded on a sandbar 3.6 miles downstream of the first impact. Remarkably there were no fatalities.

*Klondike 1* was a major link in the WP&YR transportation system, and the loss had to be replaced immediately. An eight-man shipbuilding team from Vancouver led by Syd Smith arrived in Whitehorse July 4, 1936 - 23 days after the accident - to begin work on a new hull, while salvage efforts succeeded in recovering machinery and superstructure from the shattered vessel.

The new *SS Klondike (Klondike 2)* was virtually identical in size and appearance to *Klondike 1*. The salvaged tandem, compound, horizontal engines and single locomotive boiler were reused, and much of *Klondike 1*'s superstructure and kingposts were reinstalled in the new hull. *Klondike 2* was launched in 1937 and worked on the river until it was laid up in 1955. The ship became a National Historic Site under the management of Parks Canada in 1967. The hull was stabilized and extensively rebuilt in two stages between 1974-1979 and again between 2000-2004.

As the last of the Yukon stern-wheel steamboats to be constructed by a major shipping company, it was our belief that *Klondike 2* represented the pinnacle of Canadian riverboat hull architecture. In order to determine this we had to compare this latest hull to *Klondike 1*, which is still semi-submerged in the river 96 km (60 miles) from the road.

Robyn Woodward and John Pollack had mapped the wreck of *Klondike 1* in 2010, and arrived in 2016 on *Klondike 2* just before the start of the tourist season. We obtained scantling measurements, conducted a simple baseline-and-offset survey of the hull, measuring from original timbers whenever possible, and described the hogging and rudder-and-tiller systems. It is a strong and meticulously built vessel with large scantlings of consis-



**On June 12, 1936 Klondike 1 sank five miles north of Hootalinqua while en route to Dawson fully laden with cargo... the new pilot did not enter a bend correctly, and the ship drifted sideways into a bluff.**

tent dimension. The portions of the hull reconstructed by Parks Canada are extensive, including much of the bow, the stern and major sections of the chines. Some minor hull components were missing. The restoration had removed oakum between the strakes and blocking between the frames in an effort to promote ventilation, but it was still possible to deduce original block positions and construction because of water staining and nailing patterns.

The six transverse and three solid longitudinal bulkheads divide the hull into 21 distinct compartments of which the majority are accessed via small hatches and ladders. To our surprise, an estimated 17 of these compartments had been watertight. The large number of watertight compartments on *Klondike 2* is a

**Opposite page, from top: Two hatches with a watertight bulkhead below, running from port to starboard; John Pollack runs the total station on *Klondike 1* during a period of low water. This page: Photograph of *Klondike 1* underway in 1935.**

noteworthy evolution in Yukon River stern-wheel steamboats. Many of the vessels built at the start of the Klondike Gold Rush in 1898 had only one transverse bulkhead just aft of the bow capstan. They were completely open below decks and vulnerable to catastrophic flooding. *Klondike 2*'s belt of water-tight compartments along the port and starboard sides of the vessel would have prevented the vessel from flooding completely if the hull had ever been perforated.

The hogging system is extensive and the most intricate seen to date. It consists of three lines of hog posts: a central line positioned directly above the centerline keelson, and two lines positioned along the outboard edges of the longitudinal bulkheads. The two centerline king posts are supported within the hull with transverse carriers whereas the remaining hog posts and braces are supported on footlings - large longitudinal timbers resting on the hull bottom and spanning 5-6 floor timbers, larger than those on any of

the Yukon vessels assessed to date.

*Klondike 2*'s hull form is less barge-like than earlier paddlewheelers. The forward portion of the hull displays a round chine with curved side frames that run aft from the bow for roughly 1/3 of the vessel's overall length. At this point the chine becomes angular through the utilization of tapering side frames joined to floor timbers by a triangular futtock or "cocked hat". The entire assembly was reinforced with a bilge keelson. Cocked hat bilges or "hard chines" are common on fast-water river boats. Toward the stern the chine becomes progressively rounded, and the cocked hats transition back to curved side frames. A plain stern rake or apron begins 13 frames forward of the transom, to provide protection for the four rudders.

Overall *Klondike 2* contains many of the common architectural elements seen in earlier stern-wheel steamboats. The consistency and strength of construction are noteworthy - the vessel does not exhibit the piece-meal approach seen on

PHOTOS: THIS PAGE, FROM TOP: R. WOODWARD; D. REID; OPPOSITE PAGE: YUKON ARCHIVES



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LEGEND

Hull Planking

Watertight Canvas and T&G Transverse Bulkhead

Longitudinal Timber and Iron Tie Rod Truss

Watertight Solid Timber Longitudinal Bulkhead

Solid Timber Longitudinal Bulkhead

Cylinder Timber and Iron Tie Rod Truss

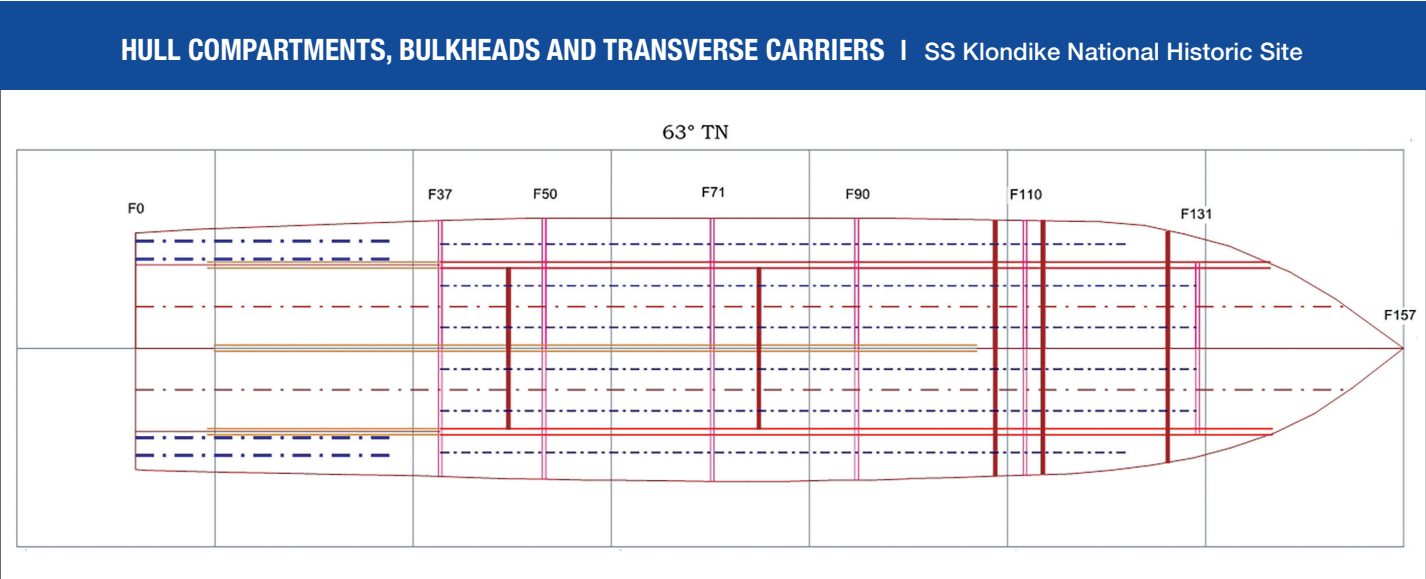
Low Timber Keelson with Hold Stanchions

Stringer with Hold Stanchions

Transverse Carrier

F110

Parks Canada Frame Numbering



some early vessels such as the inconsistently framed *Schwatka* (*INA Quarterly* 42.1: 12-17), or the inadequate hogging systems used in *Julia B* and *Mary F Graff*. Examples of mature design in *Klondike 2* include a) large footlings supporting the hog posts and braces, b) large single floor timbers spanning the entire width of the vessel from port to starboard, c) the extensive use of curved side frames at the bow and stern, and d) an intricate hogging system. Finally, the design allowed for a reduction of hull draft/weight due to the use of composite carriers, a broad model bow, variable hog chain diameters, and minimized timber dimensions in certain hull structures.

*Klondike 1* and *2* display two unique features. The first involves four balanced rudders that are slaved with connecting rods, to an innermost, "master" tiller. The long, steel arm of the master tiller is supported by a wooden arc known as a sweep or cradle. Sweeps are seen in *SS Moyie*, *Seattle No. 3*, and *Schwatka*, but only *Klondike 1* and *2* have a single master tiller and corresponding rudder-stock lacking a rudder. The second unique feature is the squat "in-hull" hog chains and the forward transverse carrier used to support the bow. This structure is completely hidden

below the main freight deck. Only one other example of "in-hull" hog chains has been seen in *SS Moyie* at *Kaslo*.

**CONCLUSION**

In 1926, Wheeler and Fowler constructed *Klondike 1* as a large, sophisticated steamboat destined for some of the most dangerous waters on the Yukon River. They opted for continuous floors, multiple but light keelsons and longitudinal bulkhead assemblies combined with an extensive hogging system. Chines were rounded at the bow and stern but transitioned to cocked hats and tapering side frames amidships, to create a hard chine, which would resist sideways drift when negotiating the bends and strong currents of the Thirty Mile.

While *Klondike 1* survived only 8 seasons, it was a fast and profitable freighter - so successful it was replaced with an almost identical vessel the year after its loss. However, the sinking prompted some structurally small, but functionally major, alterations that tripled the number of watertight compartments in *Klondike 2*. There is no documentation on this subject, but the evidence of the ships themselves - suggests that in 1936, the master shipwright sought to reduce



[*Klondike 1* was] a large, sophisticated steamboat destined for some of the most dangerous waters on the Yukon River... the sinking prompted some structurally small, but functionally major alterations.

the risk of catastrophic flooding that doomed *Klondike 1* by replacing truss-built longitudinal bulkheads with solid, watertight bulkheads, enhanced with blocking beneath to prevent cross-flooding. These minor modifications increased the number of watertight compartments from an estimated 6-7 in *Klondike 1* to 17 in *Klondike 2* - the largest number known on any steamship in the Yukon.

A final, unexpected discovery was made after historian Robert Turner joined us. During the *Tyrrell* and *Moyie* study, we found compelling evidence that Western Canadian riverboats were built using half-hull models well into the 1920s. If any stern-wheel steamboats had been blueprinted as a first step, *Klondike 1* and *Klondike 2* were good candidates given the size and professionalism of the WP&YR

and the BYNC. Interviews with shipyard workers in 1981 suggested a builder's half-hull model was used for *Klondike 1* from which measurements were taken with calipers, and then scaled up for construction. General blueprints were submitted to the Federal Board of Steamship Inspection in 1928 when the ship was registered, but any half-hull model would predate the blueprints and the surviving shipyard workers did not recall using blueprints in the yard.

Our last day was spent with Turner in the basement of the MacBride Museum, where staffer Mackenzie Downing produced an assemblage of rare stern-wheel steamboat half-hull models. There - to our delight - was the original builder's half-hull model of *Klondike 1*, complete with layout marks inked onto the hull.

**ACKNOWLEDGEMENTS**

The 2016 project was possible due to the cooperation of Parks Canada, the Government of Yukon, the MacBride Museum of Yukon History and the Carcross/Tagish First Nation. We also thank the 2010 Klondike 1 field team and INA's Archaeological Committee for their steadfast support.

AUTHORS

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This page: Paddlewheel of *Klondike 2* with two monkey rudder assemblies. Opposite page: General hull plan of *Klondike 2*, SS *Klondike* National Historic Site Whitehorse, Yukon, Parks Canada Permit SSKL-2016-21056.



FOR MORE INFORMATION check out the Yukon River Steamboat Survey page on the INA website at [www.nauticalarch.org/projects/yukon-river-steamboat-survey](http://www.nauticalarch.org/projects/yukon-river-steamboat-survey)



# AN ANCIENT LACED BOAT IN THE SHADOW OF A SENATORIAL ESTATE

2017 excavation of a Roman-era vessel in Croatia

BY DAVID RUFF

PHOTO: L. ROUX (CC/JAMU-CNRS)

Professional and recreational historians of ancient Rome are familiar with the Calpurnius Piso family, a name documented from the 3rd century B.C.E. and frequently reflected in consulships as well as eponymous legislation. During the transition from Republic to Empire, the Calpurnii Pisones became the second-most important family after the imperial family, with several members serving as consuls during the reign of Augustus (31 B.C.E.-C.E. 14). However, the family became infamous in the first quarter of the 1st century C.E. after a series of conflicts between Gnaeus Calpurnius Piso, the governor of the province of Syria, and Germanicus, the adopted son of the emperor Tiberius (C.E. 14-37). The death of Germanicus in Antioch in October 19 C.E. led to suspicion of poison, and the prosecution of Gnaeus for murder. Although his guilt was never proved, his aggression against Germanicus was not to be forgiven, and Gnaeus committed suicide on 8 December 20 C.E. Two days later a decree of the Roman Senate, describing the facts of the case, was inscribed on bronze plates in public places to reinforce the consequences of *maiestas* or high treason.

The Senatorial decree specifically mentions Gnaeus Calpurnius Piso's property in Illyricum (modern Croatia), which was awarded to him by the emperor Augustus, and confiscated by Tiberius. Gnaeus' son Gnaeus changed his name to Lucius in order to erase the memory of his father, and became consul in 27 C.E., and later proconsul of Africa and prefect of the city of Rome. Another member of the Calpurnius Piso family was actively involved in the politics of Illyricum from 43 to 46 C.E. Yet another family member was consul in 175 C.E., demonstrating the political survival of the Pisones for

over 400 years.

The private property belonging to the Pisones in Illyricum has been tentatively identified in the protected bay of Caska on the island of Pag, Croatia, and archaeological research over the last 15 years has begun to illuminate this large senatorial provincial estate. Pag is an elongated island, extending in a NW – SE orientation along the Adriatic coast. It is separated from the mainland by the relatively narrow (3-4 km) and long (120 km) Velebit Channel, notorious for its strong northeastern wind known as the *bura*. Pag is situated in the inner row of the Eastern Adriatic islands, and with its surface area of over 280 km<sup>2</sup> it is the fifth largest of over 1200 Adriatic islands, islets and reefs off of the Croatian mainland, exceeded in size only by the islands of Cres, Krk, Brač and Hvar.

Archaeological interest in the bay of Caska at the northern end of the island began to grow in 2003; land finds in the area suggested that the Roman presence in Caska dates back to the 1st century B.C.E. Local support from the Municipality of Novalja as well as support from the Ministry of Culture of the Republic of Croatia allowed underwater survey and test trenching to begin in 2005. Four years later these efforts evolved into an in-

View of site setup from the tunera after one week of excavation activities; note the multiple sandbags placed on the planking for protection, and the large pile of removed rocks.





tense, international, and interdisciplinary coastal archaeological research project, the CissAntiqua Project, aimed at better understanding the cultural landscape of Caska in Roman times.

In the muddy bottom of the bay were preserved a wooden anchor and the remains of two seagoing vessels from the Early Roman Imperial Period, constructed with completely different techniques. The ship Caska 1, located in 2007 and excavated from 2009-2010, was assembled with the old Liburnian laced technique that survived into Roman times, and was probably about 8-9 m long. The ship Caska 2, located in 2013 and excavated from 2014-2016, was more than 15 m long, and was assembled by the standard Roman mortise-and-tenon shipbuilding technique. Both ships were purposefully sunk to reinforce wooden

Camille Jullian (Aix-Marseille University, CNRS, Ministry of Culture and Communication), France, both INA Affiliated Scholars. This work was also part of the Archaeology of Adriatic Shipbuilding and Seafaring (AdriaS) Project, a four year multi-disciplinary effort to interpret the technological development of shipbuilding and seafaring in the Eastern Adriatic, sponsored by the Croatian Science Foundation and directed by Dr. Radić-Rossi. It is also part of the Centre Camille Jullian's Adriboats project, a study of shipbuilding in the Eastern Adriatic in Antiquity supported by the French Ministry of Foreign Affairs since 2010. INA Research Associate Dave Ruff also participated and INA was pleased to support the 2017 excavation.

Caska is a challenging archaeological site, hiding precious evidence in the tidal

tion in some fashion.

The team was housed in a residence approximately 200 m from the dive site. The dive entry point was adjacent to a stone *tunera*, or tuna watching tower, built in 1888, and the only such tower made of stone in Croatia. The site of Caska 4 is only 20 m from land, in 2-3 m of water.

The focus of the first week of the excavation was to remove the large stones used to scuttle Caska 4, define the outline of the ship's remains, and slowly begin the process of removing silt from the ship's hull. This turned out to be an extremely delicate process, because of the very poor condition of the ship's hull. As the planking of the ship began to emerge, it became clear that neither the bow nor the stern had survived, most likely due to the fact that the extremities of

**The focus of the first week of the excavation was to remove the large stones used to scuttle Caska 4, define the outline of the ship's remains, and slowly begin the process of removing silt from the ship's hull.**

coastal structures of the ancient port. The hold of Caska 2 contained pieces recycled from another laced ship, named Caska 3, which was disassembled and loaded into Caska 2 before it was scuttled, probably to support the rocks already loaded into Caska 2. The remains of Caska 3 were removed from Caska 2 and studied in 2015. During the 2016 excavation season, after completing the excavation of Caska 2, a survey was made of rectangular caissons composed of logs and filled with stones, which probably served as the basis of a pier or a breakwater. During that survey, another ship built with the ancient Liburnian laced tradition, designated Caska 4, also filled with stones, was found alongside a caisson. The excavation of Caska 4 was conducted in May 2017, co-directed by Dr. Irena Radić-Rossi of the University of Zadar, Croatia, and Dr. Giulia Boetto of Centre

zone, where it is not possible to conduct either a typical land or underwater excavation, and where natural forces can quickly reverse all the results of archaeological effort. The near-shore excavation of Caska 4 was carried out exactly on schedule in an intense three-week excavation. One of the strengths of the CissAntiqua project is its emphasis on student involvement and volunteer engagement, while drawing on the expertise of team members. The 2017 excavation of Caska 4 had an outstanding international team, including local experts from the University of Zadar as well as international archaeologists from Centre Camille Jullian. Student participants in the excavation included a broad spectrum from Croatia, France, Slovenia, Spain, Italy, Romania, and the United States, as well as volunteers from Croatia and Germany. A total of 30 people participated in the excavation.

the ship had been scuttled directly onto bedrock. The center was better preserved because the planks had been compacted into sand by the rocks used to scuttle the ship; however, the planking was very soft and flexible, thus easily damaged by rock removal or aggressive hull cleaning.

During week two of the excavation work shifted from rock removal and heavy dredge work to fine cleaning of the ship with flexible tubing, and a focus on better defining the edges of the wreck via dredging. Because the ship had been intentionally scuttled, relatively few finds were made; however, some pottery sherds and pieces of roof tiles were retrieved. Additionally, the work of labeling the

**Opposite page, clockwise from top: The tunera from the excavation headquarters; Irena Radić-Rossi prepares to dive; Pierre Poveda (left) with Giulia Boetto studying Caska 4 wood samples.**

PHOTOS: L. ROUX (CC/JAMU-CNRS)





components of the entire ship began, including the keel, the ship's planking, and the surviving frames. Also labeled were the numerous wooden poles found in the vicinity of the wreck. To provide better contrast for photogrammetry, pins with white heads were used to highlight the vast quantity of pegs holding the lacing in place, and pins with yellow heads were used to mark the location of some treenails used to connect floor timbers to futtocks. Unfortunately, the external lashing used to connect the frame to

the planking was not preserved. Labeling of ship components, verification that all remaining parts of the ship's hull had been found, and fine cleaning of all surfaces of the wreck were performed in tandem. When all tasks were complete, the grid was removed, and the excavation photographer performed full site photogrammetry. With photogrammetry complete, the final three days of excavation could be devoted to taking measurements (to back up and enhance the photogrammetry),

sampling designated pieces of wood, and properly covering the site in accordance with UNESCO recommendations for *in situ* preservation. Before taking any samples, measurements of all wooden components were recorded, including the distances between stitches, peg diameters, plank lengths, and other dimensions of interest. Then, numerous samples were collected, both for species identification, and to support research dedicated to dendrochronological studies of the Adriatic region. Finally, when all available

archaeological data had been recorded, all of the markings (label tags, pins, etc.) were removed from the wreck. The site was then covered with fine silt, and sealed with geotextile material to reestablish a barrier between the wood and oxygenated water. Rocks were then stacked on top of the site, and all materials removed from the site that were not needed for further laboratory testing were returned and sealed with silt to preserve them for future study.

This excavation was an outstanding success, and a validation of the methods developed over several years of excavating in the bay of Caska. The ship was excavated quickly and efficiently, on schedule and within budget. Preliminary analysis of the laced pattern of Caska 4 compared to

Caska 1 shows a similar lacing style, with a simple stitching strengthened by round pegs. However, Caska 4 differs from Caska 1 in that the batten material and textile used on Caska 4 along the plank edges for waterproofing at some points extended between the seams of the planking, while on Caska 1 the material was strictly over the top of the plank seams. The stitching pattern on both ships held the material in place, while also connecting adjacent planks. On Caska 4, some of the batten material appeared to be almost a cloth-like fiber. Samples of the plant materials were collected, and further conclusions are expected after analysis is complete.

The preliminary analysis of the scuttled ship designated Caska 4 suggests that it was a locally made, locally operated ship, built in the traditional Liburnian laced technique, and tentatively dated to the 1st century C.E. Approximately 7 x 3 m of the hull survived. The ship was intentionally scuttled by filling it with stones and sinking it to strengthen a wooden port facility. No obvious repairs to the surviving portion of the ship were noted; however, it may be assumed that the ship was at the end of its useful life when it was scuttled. The construction technique is similar, but not identical to Caska 1, which was also intentionally scuttled less than 100 m away. Extensive samples and detailed photogrammetric analysis will add new information to our understanding of this ship.

The excavation and study of Caska 4, performed under the auspices of the international CissAntiqua Project, the Croatian Science Foundation AdriaS project, and the French Adriboats project

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On Calpurnii Pisones: Tacitus (*Annals* III, 7-18) Suetonius (*Caesar*, 21)

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confirmed the methodology for excavating and recording a Liburnian laced boat, realized the projects' goals of training students and engaging volunteers, and has enhanced our understanding of maritime activity in the bay of Caska during the early Roman Empire. The importance of this area continues to grow, and ongoing research shows that the inhabitants of this provincial, senatorial property were operating and repurposing ships built in different seafaring traditions at the very time of Rome's transition from Republic to Empire.

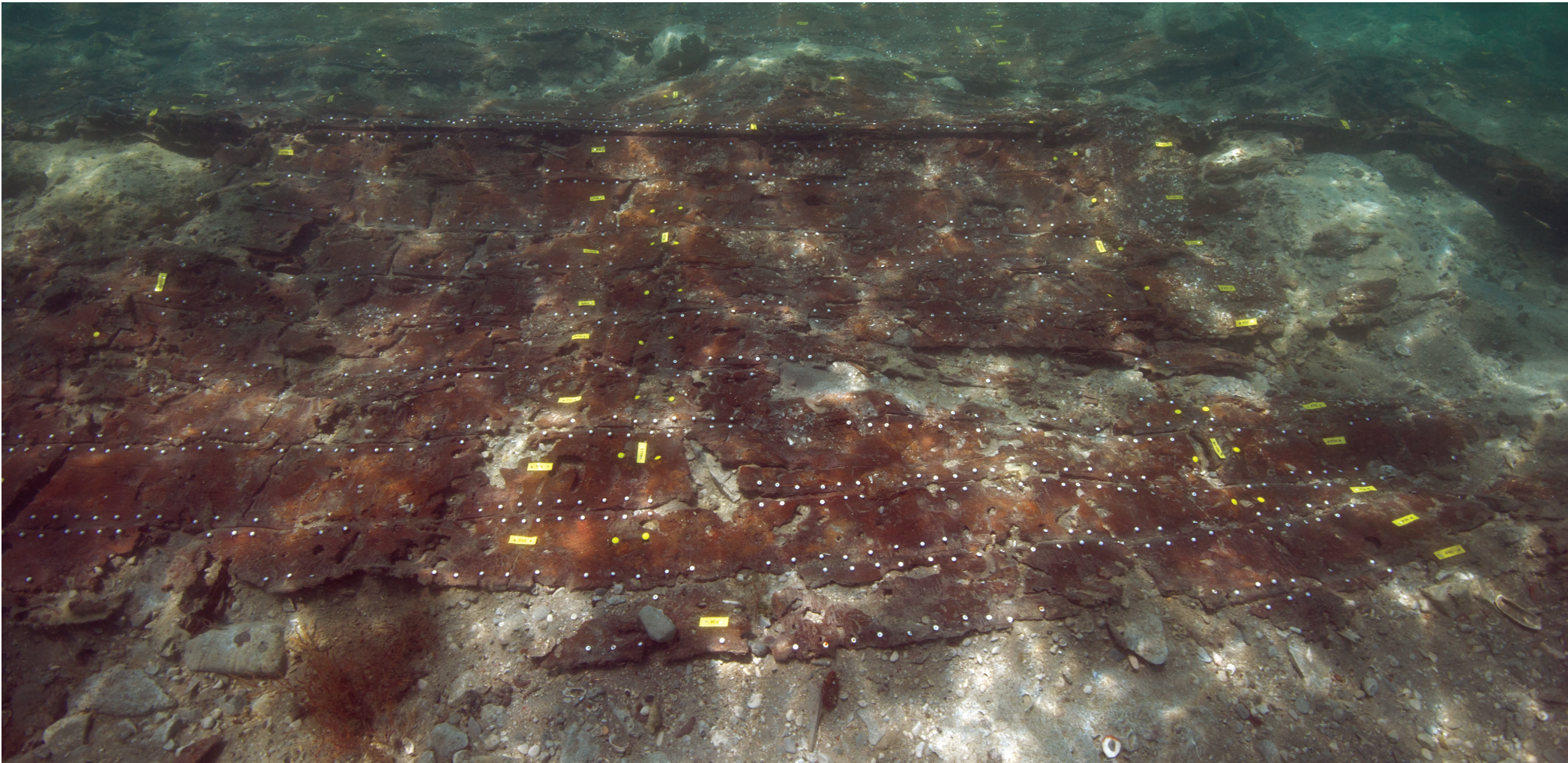


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**FOR MORE INFORMATION** about archaeology in the Adriatic, see [www.adrias.org](http://www.adrias.org); about the Croatia Ministry of Culture, see [www.min-kulture.hr](http://www.min-kulture.hr); or about the Centre Camille Jullian, see [www.ccj.cnrs.fr](http://www.ccj.cnrs.fr).



Labeled hull remains ready for photogrammetry, photo by L. Roux (CCJ/AMU-CNRS).

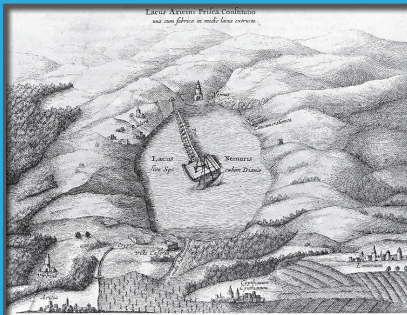


# REVIEW

## CALIGULA'S BARGES AND THE RENAISSANCE ORIGINS OF NAUTICAL ARCHAEOLOGY UNDER WATER

John M. McManamon, S.J.

CALIGULA'S BARGES  
AND THE RENAISSANCE ORIGINS  
OF NAUTICAL ARCHAEOLOGY  
UNDER WATER  
JOHN MCMANAMON, S.J.



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In the field of scholarship there is often a significant lag between the initial concept and its successful completion. Great ideas take time to reach fruition, sometimes even centuries. Nautical archaeology is a case in point. In 1960 Institute of Nautical Archaeology founder Dr. George F. Bass and his colleague Peter Throckmorton planned and executed the first scientific underwater excavation of a shipwreck. Their study of a Bronze Age vessel sunk off the coast of Cape Gelidonya, Turkey, established and popularized a field of archaeological research that has, over the past 57 years, dramatically

expanded our knowledge of ships and seafaring in the history of the human species. Where might we find the earliest model for this great achievement? In *Caligula's Barges and the Renaissance Origins of Nautical Archaeology Under Water*, historian and archaeologist Dr. John McManamon, S.J., identifies a convincing starting point one half-millennium ago on a small lake in central Italy.

*Caligula's Barges* is an engrossing tale of two early forays into the field of shipwreck archaeology. It is a story of collaborations by Renaissance-era humanist scholars, engineers, and philanthropists to locate, recover, and study the submerged remains of two enormous wooden vessels built by the Roman emperor Gaius Caligula on tiny Lake Nemi southeast of Rome. Abandoned and sunk shortly after the assassination of Caligula in 41 C.E., the wrecks were for centuries known only to the fishermen on Lake Nemi who regularly fouled their nets on the timbers and occasionally recovered Classical-era relics.

Scholarly interest in the Lake Nemi wrecks was kindled in the 1440s when the owner of the lake -- Cardinal Prospero Colonna -- recognized their potential to answer questions about Roman ship design and building practices and was inspired to find out more about them. At the suggestion of his colleague Flavio Biondo, Colonna hired the polymath humanist and engineer Leon Battista Alberti to salvage one of the hulls. Alberti's efforts came to naught (his Genoese breath-holding divers and winch-equipped raft recovered only a handful of waterlogged timbers), but McManamon

sees in this project a hint of the elements of a basic archaeological investigation: surveying, excavation and mapping, recovery of materials, and interpretation and publication.

McManamon considers the work of the next Renaissance-era scholar to investigate the wrecks, Francesco De Marchi, even more of a prototype for future nautical archaeology projects. When De Marchi carried out his investigations beneath the lake in 1535 he relied on a recently-developed undersea technology that greatly extended the time that divers could spend on the bottom: a functional, crystal-port-fitted diving bell. He and his colleagues made repeated dives under the lake, mapped and measured the outlines of the two wrecks, and recovered hull timbers and fasteners which De Marchi brought back to his laboratory in Rome. He studied these finds, wrote descriptions of them, and provided a basic analysis of the construction features. De Marchi noted the existence of mortise-and-tenon fastening in the planks, the significance of which would only be fully realized in the second half of the 20th century when other wrecks of the ancient Mediterranean were found and studied.

If *Caligula's Barges* simply described the early fieldwork on the Nemi wrecks it would be an impressive piece of scholarship, but this topic is just the starting point for McManamon's wide-ranging examination of 15th- and 16th-century Renaissance Italy. The book immerses us deeply in the intellectual, social, technological, and maritime world of Colonna, Alberti, De Marchi, and their contemporaries. McManamon follows both the

research and inventive efforts of humanist scholars, engineers, wealthy patrons, church officials, and a host of others who, over the course of two centuries, repeatedly attempted to reclaim these relics of the Classical world which remained tantalizingly beyond their reach beneath the murky waters of Lake Nemi. In telling this story McManamon undoubtedly makes a strong case that the efforts of these Renaissance savants laid the groundwork for modern-day underwater exploration and for archaeological studies of ancient seafaring.

It must be emphasized that McManamon's book focuses on the Nemi wrecks in the Renaissance era, on the research

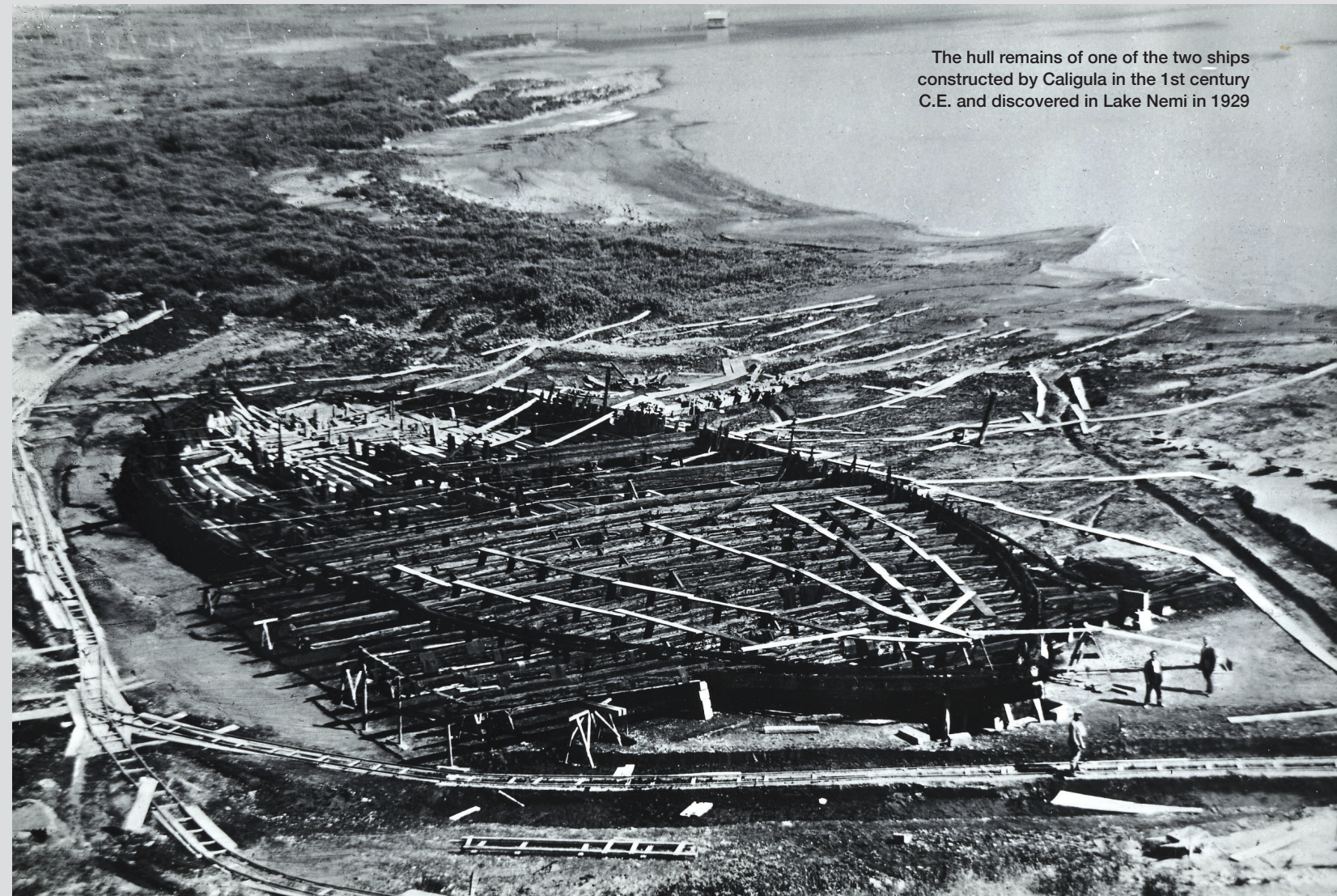
on them at that time, and on the early development of archaeological methodologies and maritime technologies for underwater work. Despite the title, *Caligula's Barges* is not, strictly speaking, a detailed archaeological study of the wrecks themselves.

As for the Nemi Barges, they met a sad fate. Protected by their immersion for nearly 1900 years, they were ultimately salvaged by Mussolini's fascist government in the late 1920s and early 1930s by the expedient of partially draining Lake Nemi. The hulls were shifted from the lake bed onto the shore, then housed and exhibited in an impressive museum, only to be burned to ashes during the

German Army's retreat from the area during World War II.

Dr. John McManamon, S.J. and Texas A&M University Press are to be congratulated on this fine book, published in association with the Institute of Nautical Archaeology as part of the press's Ed Rachal Foundation Nautical Archaeology Series.

*Kevin Crisman is a Professor in the Nautical Archaeology Program at Texas A&M University and INA's Vice President specializing in New World seafaring. Dr. Crisman additionally serves as the Director of the Center for Maritime Archaeology and Conservation.*



The hull remains of one of the two ships constructed by Caligula in the 1st century C.E. and discovered in Lake Nemi in 1929



RETROSPECTIVE:  
**PORT ROYAL EXCAVATION, 1981**

Travel back to the excavation of Port Royal, Jamaica, the pirate town known as the "Wickedest City on Earth." Port Royal was a leading commercial center among the English colonies when it was destroyed by a massive earthquake on June 7, 1692. How many faces can you identify?



**STANDING (REAR)**

(LEFT TO RIGHT)  
Bruce Thompson  
Lisa Shuey Richardson  
Jim Duff  
Roger Smith  
Guy Harvey

**STANDING (MIDDLE)**

(LEFT TO RIGHT)  
Cemal Pulak  
Tom Oertling  
Denise Lakey  
Jody Simmons  
Steve Hoyt  
Donny Hamilton  
Robyn Woodward  
Coast Guard Officer

**STANDING (FRONT)**

(LEFT TO RIGHT)  
Douglas Ball  
John Salisbury  
Tony Aarons  
Minister Ridsen,  
Head of Mining



# WILL YOU ACCEPT THE CHALLENGE?

Less than one year ago INA constructed *Virazon II* – a custom-built, state-of-the-art archaeological research vessel. Now INA is pleased to announce the launch of a \$1 million matching challenge grant sponsored by a single INA donor. The grant will ensure that *Virazon II* is always project-ready and equip project directors with additional funds to make the cost of conducting surveys and excavations aboard *Virazon II* as affordable as possible.



## HOW CAN YOU HELP?

**Every dollar donated toward the *Virazon II* Challenge Grant between now and June 1, 2018 will be matched, up to one million dollars.** With every donation, no matter how small, you will help INA archaeologists bring history to light through the recovery of our shared maritime past!

**Your tax-deductible contribution can be made payable to:**

**The INA Foundation  
PO Box 2310 College Station, TX 77841-2310**



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