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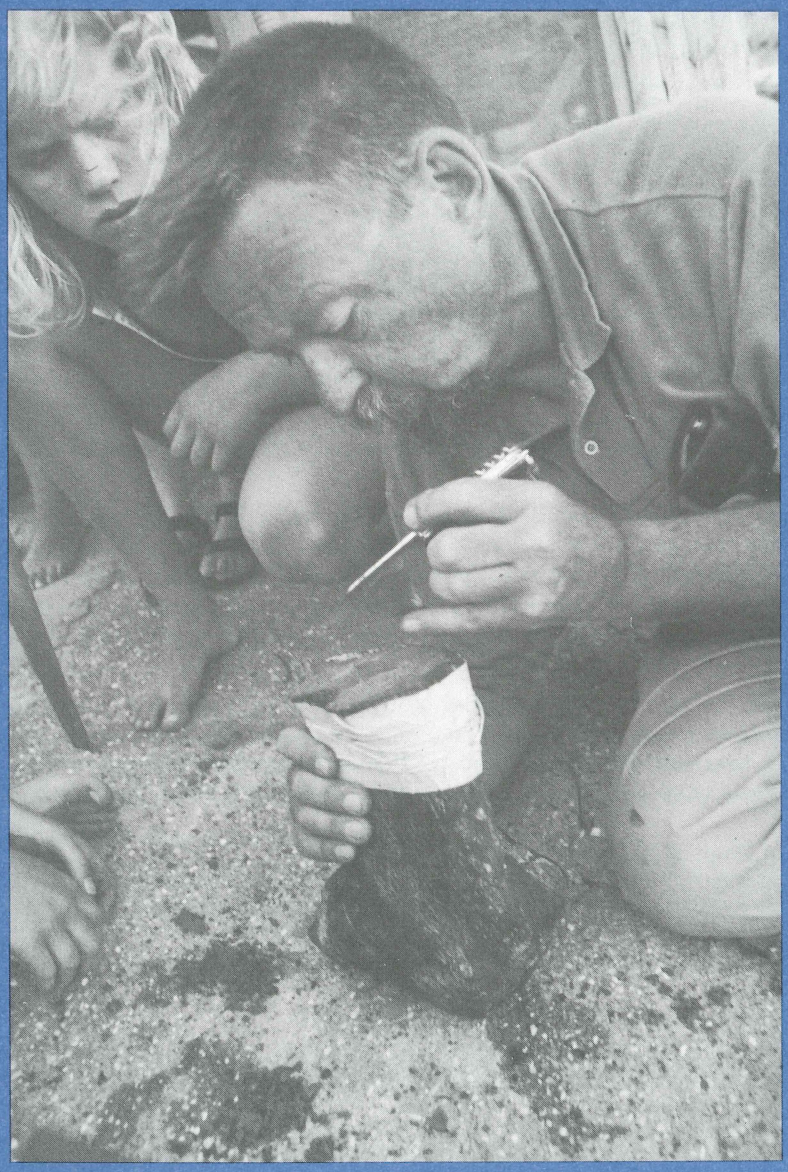

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On the cover: Peter Kuniholm, from the Malcolm and Carolyn Wiener Laboratory for Aegean and Near Eastern Dendrochronology at Cornell University, collects samples of Uluburun wood for use in dating the ship. Photo by Cemal Pulak.

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President's Letter

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Continuing Study of the Uluburun Shipwreck Artifacts

Excavation of the 14th-century B.C. Late Bronze Age Uluburun Shipwreck was completed in September 1994. Since then, all efforts have been concentrated on full-time conservation, study, and sampling for analysis in the conservation laboratory in the Bodrum Museum of Underwater Archaeology in Turkey. The following accounts describe the work undertaken in 1995.

Conservation

by

Claire Peachey

More than 18,000 complete and fragmentary artifacts were raised during INA's excavation of the Uluburun shipwreck between 1984 and 1994. Although conservation by INA staff and volunteers at the Bodrum Castle laboratory has proceeded year-round since the first season of excavation, the large number of artifacts and the long treatment times required mean that work will continue for several years after the final artifact was raised from the seabed. It is INA's experience that every three-month season of excavation requires two years of conservation and study, so we could be here until the year 2007!

Over the past year or so, conservation efforts have been increased so that study and publication can proceed in a timely manner. With the help of funds from the National Geographic Society and the Institute for Aegean Prehistory, several conservation students and professionals were invited to Bodrum to help with the enormous task. Over the course of the year, a total of 15 interns from many different laboratories and institutions worked in the lab for two to four months each: Paula Artal-Isbrand, Ayşe Atauz, Tania Collas, Serpil Çubukçu, Diane Fullick, Leylâ Goldstein, Mona Korolnik, Lori McCoy, Mohamed Moselhy, Axel Nielsen, Ticca Ogilvie, Meghan Thumm, Aylin Tuncer, Barbara van Meir, and Howard Wellman. Paula and Mohamed were returning to the laboratory after having participated in INA's National Endowment for the Humanities-funded course in marine conservation conducted in Bodrum in the summer of 1994 (another two from that course, Asaf Oron and Noreen Carrol, worked on INA field projects). In addition, Birgül Akbulut and Sevil Gökmen began working in the laboratory on a long-term basis, joining eight-year INA veteran Güneş Özbay. The contributions of each of these people is gratefully acknowledged.

Inviting conservation trainees and professionals to participate in the Uluburun conservation project allows far more artifacts to receive treatment than would otherwise be possible. An equally valuable benefit of the system is that many people can receive training and hands-on experience with the special problems of marine conservation, which they cannot easily receive elsewhere. The Uluburun shipwreck yielded a remarkable variety of materials in different states of preservation, allowing conservators to observe and treat a wide range of problems. In addition, this group of conservation interns, along with archaeology students and professionals working in the laboratory and living together in the INA headquarters complex, made for a lively community and a continuous exchange of ideas. INA considers this to be an important aspect of its presence in Bodrum.

Starting in late December 1994, the Bodrum laboratory was reorganized to accommodate several additional conservators and archaeologists. One intern has begun to design a computerized database system to ease management of the large number of Uluburun artifacts. All artifacts awaiting treatment in wet storage were inspected in

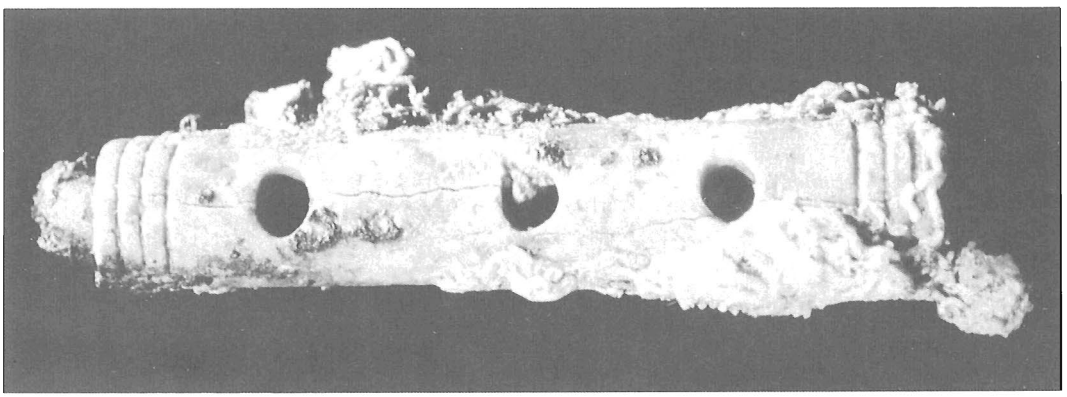

Photo: INA

Fig. 1. *Carved ivory hinge, probably belonging to a wooden diptych, before cleaning and conservation.*

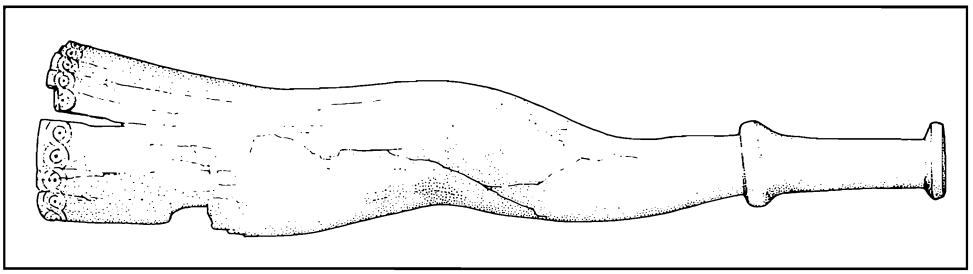

Fig. 2. *A hippopotomus incisor carved into a ram's horn-shaped trumpet. Scale 1:2. Drawing by Sema Pulak.*

order to prioritize treatment and revise the long-term conservation schedule. New equipment included a binocular microscope to bring the laboratory's total to four, and a few books to augment our small but growing library.

A significant amount of time and space in the laboratory is devoted to collection and production of pure water, maintenance of the equipment and storage tanks, and the regular monitoring of salinity and changing of water in artifact containers. Purified water-producing machines (a still and a reverse-osmosis "watermaker") were repaired or improved, and a rainwater collection system was implemented so that large volumes of rainwater can be stored and fed into the laboratory as necessary. Large numbers of ceramic sherds, glass ingots, copper ingots, ballast stones, tin fragments, and other artifacts were desalinated in bulk after this water supply was secured.

Uluburun shipwreck artifacts treated this year include copper and tin ingots; tin vessel fragments; whole ceramic Canaanite jars, lamps, bowls, pilgrim flasks, and juglets; coarseware and fineware ceramic sherds; worked and unworked bone, shell, ostrich eggshell fragments, tortoise carapace, and ivory, the last including both hippopotamus and elephant tusks, as well as many delicately carved objects; bronzes such as bowls and bowl fragments, tools, balance pans, cauldron handles, pins, and blades; whole and fragmentary glass ingots; zoomorphic and geometric pan-balance weights of stone, lead, and bronze; molded faience vessel sherds; wood fragments; lead and tin-alloy jewelry; amber and stone beads; and stone tools.

Treatment usually involves removal of calcareous marine encrustations, identification and removal of corrosion products to reveal original surfaces, desalination to prevent corrosion or physical damage by salt crystallization, and slow drying. Many materials also require appropriate strengthening with polymers, corrosion inhibitors, or protective coatings.

Ivory and Bone Artifacts

One of the priorities this year was the conservation of ivory and bone artifacts. A new treatment with a water-based consolidant was tested in an attempt to reduce the physical and chemical stresses to the objects, but it was found that the "tried and true" organic solvent-based method was more consistently successful. Several unworked hippopotamus and elephant tusks are in the final stages of treatment, and several carved ivory and bone objects are either completed or nearly completed. Objects include a flat disk, hinges (fig. 1, probably belonging to a wooden diptych), inlay strips with fastening pegs still preserved, and a long, cylindrical rod, all of which are decorated with incised circles, false spirals, and other geometric designs; several partially worked or scrap pieces; unidentified button-like objects; pomegranate-shaped finials; and perhaps two of the most unusual ivory objects on the shipwreck, an acrobat carved in the round, and a trumpet in the shape of a ram's horn carved from a hippopotamus incisor (fig. 2). This latter object and a few of the other ivories, including two duck-shaped cosmetics containers conserved in previous years, still require time-consuming reconstruction of their many fragments.

Ceramics

The laboratory also focused on the treatment of ceramics this year, for two specific research purposes (fig. 3). The first was to identify and quantify the utilitarian coarseware vessels carried on the Uluburun ship, as a possible clue to the identity of the ship's crew. The second was to quantify and sample the Cypriot White Slip II bowls for neutron activation analysis, which may identify clay sources. One conservation intern, Lori McCoy, of the Art Conservation Program at the University of Delaware, is performing accelerated aging tests on an adhesive formulation being used on ceramics in the Bodrum laboratory for the first time this year. Thousands of sherds were excavated from the shipwreck and will require years to reconstruct into vessels once they are cleaned, desalinated, dried, and sorted.

Metal Ingots and Artifacts

Another 42 of the 354 copper oxhide-shaped ingots (oblong with four, or occasionally two, protrusions like handles from the long sides) were treated this year, as were a total of 20 copper bun, copper oval, copper quarter-oxhide, and tin quarter-oxhide ingots. A large outdoor storage tank was filled with rainwater and devoted to bulk desalination of cleaned copper oxhide ingots, as an improvement upon desalination in individual basins.

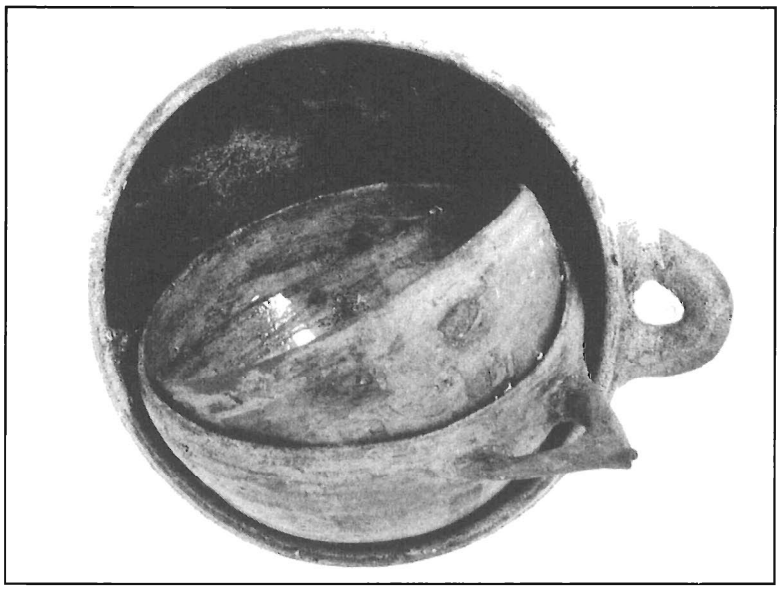

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Fig. 3 (above). *Two White Slip II bowls of Cypriot origin and one carinated bowl, stacked in a way similar to that in which they were excavated from the inside of a pithos.*

Fig. 4 (below). *A leaf of a wooden diptych still showing the incised crisscrossed pattern that once helped wax adhere to the tablet.*

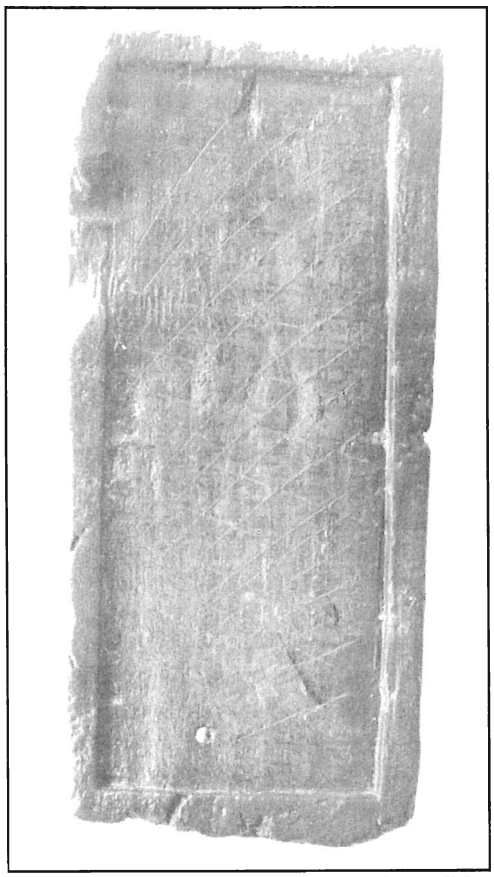


Photo: INA

Several small bronze artifacts were also treated, but only a fraction of the hundreds that remain: fish hooks, spearheads, arrowheads, pins, blades, bowl and cauldron fragments, three daggers, a saw, a sword, and more. Most of the bronzes are heavily concreted and retain little metallic strength, so are painstakingly slow to treat.

Wood Remains

It was planned that treatment of the wood remains from the Uluburun shipwreck could begin this year. However, repair and re-installation of steel tanks for polyethylene glycol treatment await construction of the building that will house the tanks. The remains include logs of ebony and cedar, a leaf of a folded wooden writing tablet, the lid and base of two small containers, the "keel" and planks of the ship's hull, the branches of what may have been a woven bulwark, branches and twigs of dunnage, and many miscellaneous fragments. All Uluburun wood that was in plain water was put into a fungicidal solution of boric acid and borax.

It is hoped that the laboratory will soon be able to acquire a freeze-dryer so that the wood can be stabilized with a polyethylene glycol pretreatment followed by freeze-drying, a method that has been highly successful with waterlogged wood from other sites around the world. Meanwhile, several fragments of wood raised from the early third-century B. C. Kurtoğlu Burnu site during an INA coastal survey in 1985 were treated with the acetone-rosin method to determine this method's suitability for some of the smaller fragments of Uluburun wood.

Glass

Samples of glass beads were provided to Catherine Magee, a conservation intern at the Smithsonian Institution, and to Diane Fullick at the Art Conservation Program of the University of Delaware, to experiment with a new consolidant and to investigate deterioration features of the beads. These two former INA interns are helping to develop a treatment for the hundreds of glass and faience beads from the shipwreck, as is INA staff member Wayne Smith in College Station. His experimental silicon bulking techniques have yielded outstanding results.

Cataloging and Study

Alongside and sometimes inseparable from the conservation work performed this year, many archaeology students and professionals from the Uluburun excavation team continued to catalog, study, and draw several categories of artifacts in preparation for publication. Specific conservation work associated with these activities included revealing or clarifying decorative or technological features, restoring broken fragments, identifying materials and corrosion products, and taking samples.

Also, as in past years, several visiting scholars of Late Bronze Age archaeology visited the Bodrum conservation laboratory. Various experts came to examine or study Aegean coarse-ware stirrup jars (Dr. Hal Haskell,

Southwestern University, Georgetown, Texas), incised marks on Mycenaean and Canaanite ceramic vessels (Nicolle Hirschfeld, University of Texas at Austin), glass and faience materials (Valerie Matöian, French School of Archaeology, Damascus), cylinder seals (Dr. Dominique Collon, British Museum), glass beads and ingots (Torben Sode, Royal Collection, Copenhagen), and copper and tin objects (Drs. Noel Gale and Sophie Stos-Gale, Oxford University). Others came simply to see the assemblage from the Uluburun shipwreck and discuss its implications for the history of the Late Bronze Age. In addition to these specialists, dozens of other interested visitors were given tours of the laboratory.

It is estimated that conservation of all the Uluburun shipwreck artifacts will require a minimum of five more years, provided the work can proceed as it did in 1995. Several conservation students have applied to come to the laboratory to provide their invaluable help in 1996 and 1997. The Turkish Ministry of Culture and the Director of the Bodrum Museum plan to open the display of the Uluburun finds to the public in the year 2000, in a specially designed building currently under construction. In addition, INA and the Ministry of Culture are planning a traveling exhibit in the U.S. of many of the Uluburun finds, to begin in 1998.

Laboratory Research and Analysis

by

Michael Fitzgerald

The Uluburun shipwreck materials received a great deal of individual study during 1995. The following is a report on a selection of this ongoing research.

The Uluburun and Cape Gelidonya Pan-Balance Weights

Final drawings of the 151 domed, sphendonoid, discoid, and zoomorphic Uluburun weights were completed in the fall of 1995, while cataloging for final publication began during the summer. Weights from the 13th century B.C. Cape Gelidonya wreck (excavated by Dr. George F. Bass in the 1960s and reexamined by INA in 1987–89) are also being examined for comparison purposes. Excavation data for the weights from both sites were compiled, and then each weight was measured twice (to 1/100 of a millimeter) and weighed three to five times (to 1/100 of a gram). All data were entered into computer files and are being analyzed by statistical programs designed to ascertain the units common to the mass standards that were in use during the Bronze Age. For this analysis, only weights preserving their originally intended masses are being considered. Preliminary descriptions of the Uluburun weights were recorded and then supplemented by detailed examination under the microscope. The weights are now being examined a second time, again under the microscope, as the initial descriptions are edited and loaded into computer files. The 65 weights from the Cape Gelidonya wreck are also being examined in this way. This will constitute a comparative data base that will permit a more comprehensive evaluation of the pan-balance weights from both Bronze Age shipwrecks, indeed of all known pan-balance weights from the period.

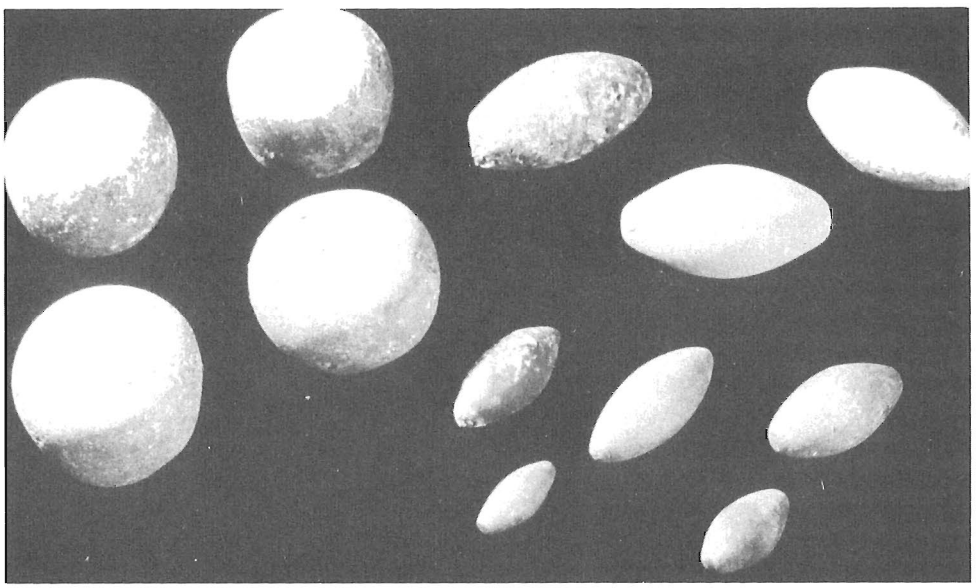


Fig. 1. *Stone pan-balance weights.*

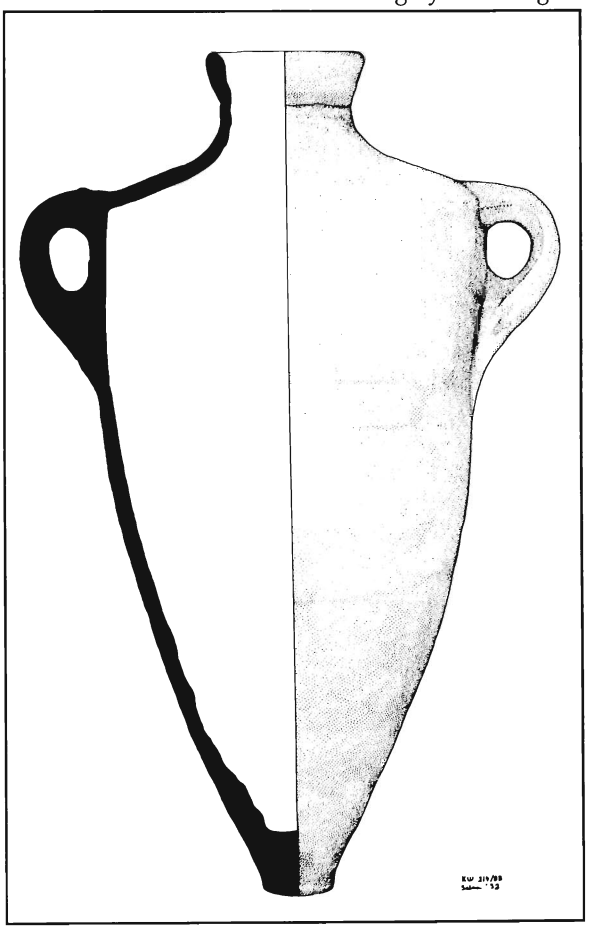
Photo: INA

Photo: INA

Fig. 2 (left). *Cedar plank with mortise and tenon joint. A section of an oak tenon is visible at the bottom (indicated by the finger) and a wooden peg can be seen in the center of the photograph.*

Fig. 3 (below). *Canaanite jar. Scale 1:5.*

Drawing by Selma Oğuz



The Uluburun Hull Wood

Beginning in mid-June of 1995, we reorganized the Uluburun hull remains, inventoried and mapped them, and then began cleaning, recording, and drawing the wood at full scale (fig. 2). Because this is the only appreciable quantity of wood from a Bronze Age seagoing hull raised from the seabed, the work was conducted with extreme care. Consequently, it took from mid-June to early September to meticulously draw and record 15% of the remains.

Since the first hull remains were exposed in the summer of 1984, we had known that the ship's planking was assembled with mortise-and-tenon joinery like that found on Greek and Roman ships of more than a millennium later. That meant that the use of this construction technique in the Uluburun hull is the earliest known occurrence in the history of seagoing ship construction. Thus, we had been afforded the unprecedented opportunity to compare details of this shipbuilding method with those evident in Greek and Roman ships of similar size, i.e. some 15–18 meters in length.

The work in 1995 revealed several unexpected explanations for what we had previously observed. It had been clear from the beginning that the Uluburun ship's joinery was more robust and more widely spaced than that found in similar Greek and Roman hulls, which seemed consistent with our knowledge of mortise-and-tenon shipbuilding concepts. Unlike most Graeco-Roman mortise-and-tenon joints, those in the Uluburun hull remains were found to be extraordinarily deep, extending from one plank edge to within 1.5 or 2 centimeters of the opposite plank edge. Secondly, each joint cut from one plank edge is positioned

immediately next to the nearest joint cut from the opposite edge, so mortises often intrude on one another. Occasionally, the edge surface of a tenon nearest the adjacent mortise displays chisel marks made when the mortise from the opposite plank edge was cut. This practice, which required removal of a volume of wood some 13–15 centimeters long and 1.5–2 centimeters thick over nearly the entire width of the plank, would seem to have compromised severely the structural integrity of the planks and thus the hull. Yet it was observed so consistently that pairs of internal "frames" of tenons extended up the sides of the hull planking every 24–26 centimeters, center to center. We do not yet know if this was simply a convenient way of maintaining consistent joint spacing, or if it represents a specific, conscientiously executed structural practice.

Several other construction features underscored the importance of understanding these issues fully. During the summer of 1995, we received the results of new wood species analyses. They revealed that the hull was built of cedar (*Cedrus* sp.), instead of fir (*Abies* sp.) as previously identified and published. This new identification is not at all surprising when we consider that Bronze Age references often mention cedar as the timber most preferred for building ships. Cedar is a shipbuilding material far different from fir in its mechanical and physical characteristics, including suitability to extended submersion in saltwater. The summer's work did not yield evidence for the employment of either frames or metal fastenings in the Uluburun hull. Work will resume in the spring of 1996.

The Uluburun Canaanite Jars (fig. 3)

Final drawings of 39 of the 95 intact or reconstructible jars recovered from the site are now complete, 30 having been finished in 1995. Cataloging for final publication will commence in spring 1996.

Capacity studies of the jars continued on a limited scale. When several jars were ready to exit desalination together during the summer, we developed a means of measuring with precise repeatability (within less than plus or minus 0.06%) the wet volume capacities of the jars, corroborated by net water weight. Two to four separate measurements of a jar's volume were taken at each of several capacity levels (lip or brim, interior and/or exterior neck features that could be associated with stopper location or fill level, and the neck/shoulder junction). All jars presently in water will be measured in this way before drying and dry volumes will continue to be taken after drying, with the hope of deriving correlations between wet and dry volumes. In this way we may be able to apply a correction factor to dry volumes obtained in previous years and to those yet to be taken of jars already cleaned, conserved, and in storage.

The Copper Oxhide and Bun Ingots

by
Patricia Sibella

Of the 354 complete copper oxhide ingots and 121 bun ingots found on the Uluburun wreck, 81 were cleaned, drawn, recorded, and examined between June and November of 1995, bringing the total that have been studied to date to 180. Particular attention was devoted to the modification of the oxhide ingot typology first established by H. G. Buchholz, and later modified by G.F. Bass in his study of the 34 examples from the Cape Gelidonya shipwreck. There

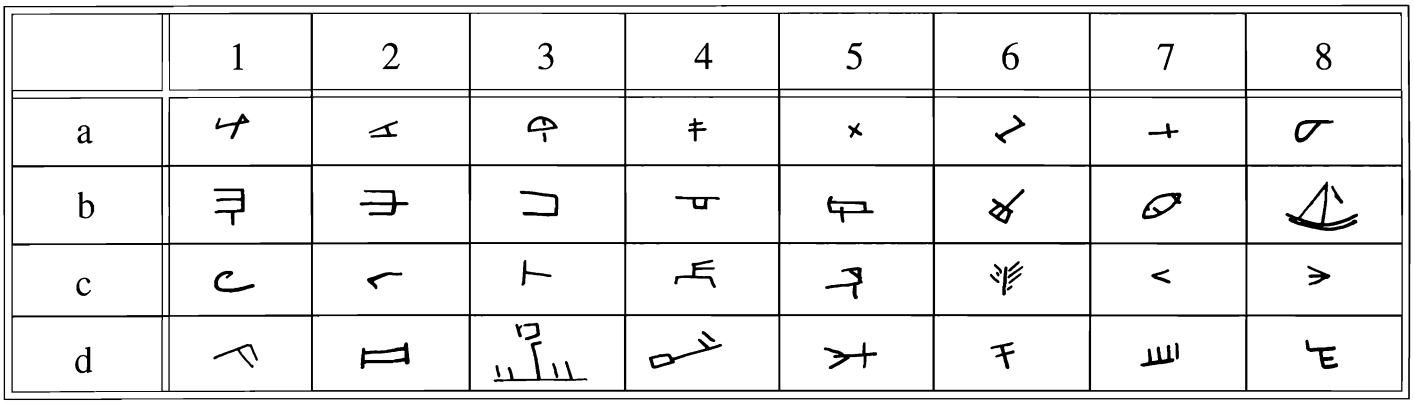


Fig. 1. *Examples of incised marks found in the surfaces of the Uluburun oxhide and bun ingots. The orientations of the marks are in the direction of the ingots as found on the sea bed. The left side of the table corresponds to the upslope ends of the ingots. Drawing not to scale. Drawing: P. Sibella.*

are 31 ingots of a type unique to Uluburun, provided with only two handle-like protrusions, one on each corner of one of the ingot's long sides. We have designated these as type 4. For the purpose of our research, the traditional type 3, as well as type 4, have each been divided into 4 subtypes. These subdivisions are primarily based on the ratios of the ingots' dimensions and on the shape of the handle-like protrusions.

In addition to the morphological features of these ingots, we have documented and studied the marks chiseled into their surfaces (fig. 1). Although most of the ingots still need to be cleaned of surface encrustation, preliminary examination has revealed that at least half of the oxhide ingots, or about 160 examples, are incised with at least one, and possibly as many as three, marks on their upper or rougher surfaces opposite their mold sides. In addition, six oxhide ingots bear linear incisions along their shorter edges, but only three of these six examples are also associated with marks on the upper surface. In contrast, only 28 out of the 121 bun ingots appear to be marked. This is still a high percentage, considering that (so far as we know) no marked bun ingots have been found in any other land or underwater site. On the Uluburun bun ingots, these marks are always single marks on their lower, or smoother mold sides. An exception is KW 1088, which shows an incised mark on its rough surface (fig. 2).

In some cases, the incisions are preserved sufficiently to document the individual chisel strokes in the mark, thereby allowing us to determine not only the sequence in which the strokes were made, but also the shape and size of the chisel used and the angle at which it was struck (fig. 3). Close attention should be given here to the traces of wear discernible on the chisels found on board the ship to determine if some of these tools may have been used to mark the ingots. If so, this discovery may provide some information about when these marks were made.

The 64 marks thus far examined on the surfaces of oxhide and bun ingots comprise only 32 different shapes (fig. 1). Of these marks, 13 appear more than once (fig. 1: 1b, 1d, 2c–d, 3b, 4b–d, 5a, 6c–d, 7c–d) and one is repeated at least six times (fig. 1: 4d). Some marks are common to both the oxhide and bun ingots, but there are fewer types of markings on the latter variety of ingot. Of the six types of marks observed on the bun ingots, five are also found on the oxhide shape (fig. 1: 2d, 3b, 4b, 4d, 6d). The sixth mark, however, is found only on the oval bun ingots and appears on all six of them. The precise location of the marks on the surfaces of the oxhide ingots, and the diverse mark combinations, do not appear to follow any specific pattern. The specific marks cannot be associated with certain ingot subtypes. The marks vary in complexity from a simple cross (fig. 1: 5a) or a fishhook (fig, 1: 1c) to a complicated trident (fig. 1: 2b), a fish-like shape (fig. 1: 7b) or a sailing boat (fig. 1: 8b). At least 5 of them could be associated with Cypro-Minoan writing (fig. 1: 2c, 3c, 6a, 7a, 7c). One of the Uluburun marks (fig. 1: 3a), also seen on a copper oxhide ingot from Ayia Triada in Crete, seems to find its parallel in the later 11th-century B.C. northwestern Semitic syllabary. In only one instance does a perfectly identical mark, almost certainly made by the same hand (i.e. same orientation of stroke, depth of incision, size of tool, etc.) appear on two separate oxhide ingots (fig. 1: 2c). Each of the two ingots thus marked also has a second V-shaped mark chiseled along one of its shorter edges. These two ingots do not belong to the same ingot subtype, but future studies may reveal identically-marked examples on the same subtype. Any markings of this nature may have profound implications for our understanding of ancient metallurgical practices and the mechanisms by which these ingots were distributed.

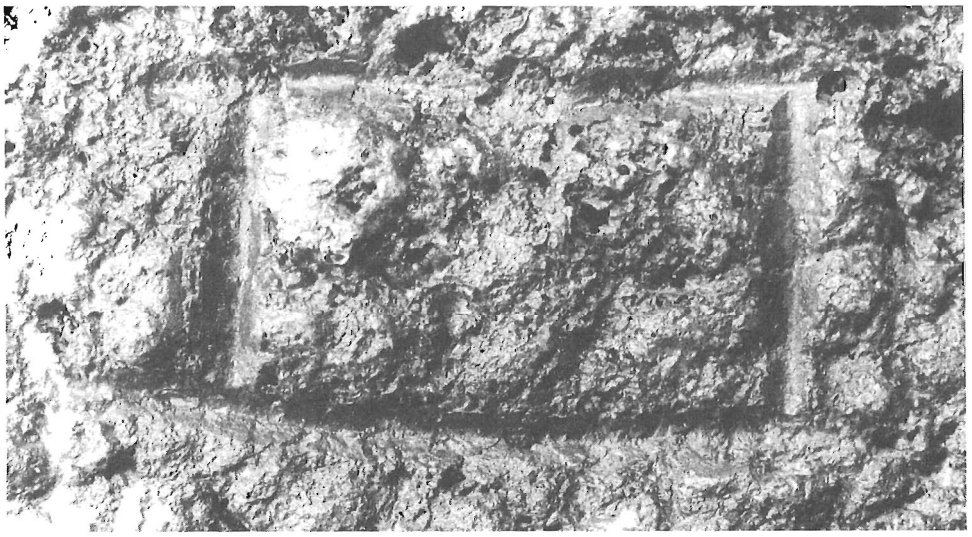


Photo: M. Fitzgerald

Fig. 2. *Incised rectangular-shaped mark on the rough surface of a bun ingot (KW 1088).*

Although similar marks are also observed on oxhide ingots from Ayia Triada in Crete (fig. 1: 3a, 6a), San d'Antioco di Bisarcio in Sardinia (fig. 1: 6d), and Enkomi in Cyprus (fig. 1: 6d, 3c), their meaning and purpose still elude us. That the Uluburun marks were incised and not stamped (as were the many examples from Cape Gelidonya) leads us to believe that these marks probably were made at some point of receipt or export

rather than at primary production centers. This supposition seems to find further confirmation in a similar mark that appears on a tin ingot (fig. 1: 7a). As tin and copper are mined in different geographical regions, it is highly unlikely that the same mark was placed on ingots of dissimilar metals and of diverse origins, unless they were incised at a center that initially received both metals before they were shipped.

Concerted efforts have also been dedicated to the identification of mold siblings, ingots cast in the same mold. This is an acknowledged but poorly attested phenomenon in the archaeological record that could help us better understand Bronze Age casting techniques. The mold impressions of at least five ovoid bun ingots, bearing identical incised marks (fig. 1: 7d), demonstrate that they indeed are mold siblings, as are two pairs of small type 1b oxhide ingots studied and presented earlier. It seems likely, therefore, that these ingots were cast in reusable stone or clay molds, rather than in perishable sand molds. We have yet to discover siblings of full-sized oxhide ingots. There are indications that these ingots may have been cast in multiple pourings of molten metal into the mold. An indication of this practice may be observed on the edges of oxhide ingots that frequently display what we have provisionally termed as a "casting groove." Presumably, this groove results from the lower half of the ingot being poured first and contracting slightly upon cooling before the second pour was made. This groove, on the other hand, usually does not appear along the perimeter of bun ingots, which suggests that they were cast in single pourings.

Until the remaining Uluburun ingots are cleaned, our comprehension of these marks will remain inconclusive. Of interest in this connection is our continuing study of the distribution of the incised marks and their association with ingot types and subtypes. We are also searching for possible patterns in the ingots' stacking within the ship's hold. Such ingot clusterings, if they occur, may provide clues about whether the copper ingots were stacked in specific batches that have common origins, ownership, and quality of metal.

Lead-isotope analyses are being conducted by Noel Gale and Sophie Stos-Gale of Oxford University Isotrace Laboratory on 80 copper ingots recovered from the Uluburun shipwreck, and 45 ingots from the Cape Gelidonya shipwreck. The pending results of these analyses may help us to answer some of the foregoing questions. Lead-isotope analysis is also imperative for determining the source(s) of copper from which the ingots were most likely cast, and establishing possible correlations between copper source, ingot types, and incised marks. Samples for lead-isotope studies were also taken from 71 other bronze and copper objects from Cape Gelidonya, and 14 tin ingots from Uluburun. This may enable further correlations between the sources of the ingots and the sources of the metal in the artifacts.

Fig. 3. *Incised mark from the rough surface of an oxhide ingot showing the various strokes constituting the mark, as well as the sequence of the chisel used (KW 4374).*

Photo: M. Fitzgerald

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Dendrochronological Dating of the Uluburun Ship

by Cemal Pulak

A key question for the proper interpretation of the Uluburun Shipwreck is obviously the date of the ship. The artifacts studied until now yielded only a *relative* date within the Late Bronze Age, specifically Late Helladic IIIA:2. However, recent developments toward refining the Mediterranean master tree-ring sequence allow determining an *absolute* date for some Uluburun finds with considerable certainty. This, in turn, has enormous implications for Eastern Mediterranean chronology.

Ceramic sequences in the Mediterranean have been established with some precision. The Bronze Age has been divided into Early, Middle, and Late. Late Bronze Age corresponds to the Mycenaean era on the Greek mainland, known as Late Helladic (LH), and the Late Minoan (LM) on Crete. The final phase, LH III, is subdivided into A, B, and C. These sequences allow determining the relative date of an archaeological locus on the basis of the pottery type(s) found there. They also give a general indication of absolute date. LH IIIA (including both IIIA:1 and IIIA:2) roughly corresponds to the 14th century B.C., IIIB to the 13th, and IIIC to the 12th and part of the 11th century.

The sequence of events in Egypt is well known because scribes kept detailed lists of the regnal years of their kings. At the end of the 18th Dynasty, the long reign of Amenhotep III was followed by the 16-year rule of Amenhotep IV (who changed his name to Akhenaten and moved the capital from Thebes to Amarna). Akhenaten was briefly succeeded by Tutankhamun (who transferred the capital to Memphis in his third regnal year), after possibly others, before his family died out. The general Horemheb (who demolished Amarna) reigned for about 28 years before Ramses I founded the 19th Dynasty. This established framework allows the estimation of absolute dates throughout the era if just one fixed date can be determined. However, there has been considerable scholarly disagreement concerning chronology.

There are several competing systems for dating events in the second millennium. These differ both in the way they synchronize events in Egyptian history with periods in the pottery sequence, and in the absolute dates they assign to these events. A synchronism between Akhenaten, the 18th Dynasty rulers who succeeded him, and the LH IIIA:2 to IIIB:1 period is suggested by the quantities of LH IIIA:2, and to a lesser extent of the newer style IIIB:1, pottery found at Amarna. The "high" chronologies would date Akhenaten's death as early as 1360 B.C., "middle" chronologies around 1347, the most common "low" chronologies around 1336, and "ultra-low" chronologies as late as 1324. Until now, there has been no published evidence for dating any of the LH IIIB:1 pottery at Amarna more precisely than to the period from Akhenaten to Horemheb, inclusive.

What, if anything, does the Uluburun material tell us about Eastern Mediterranean relative and absolute chronologies? The ceramics, jewelry, and wood provide invaluable evidence. J. Rutter, who is studying the Mycenaean pottery from Uluburun for publication, notes the chronological homogeneity of the assemblage and dates it to the LH IIIA:2 period. Although Rutter has yet to personally examine the pottery, some of which is still in need of cleaning, he further notes that none of the Uluburun vessels appears to have any morphological or decorative features that require a LH IIIB:1 dating. Since the pottery on the shipwreck shows the developed characteristics of LH IIIA:2, but not of LH IIIB:1, it must predate the transition between the two styles that occured toward the end of the brief occupation of Amarna (assuming that the Mycenaean pottery from the wreck is representative of its time and was not a collection consisting exclusively of heirlooms).

The unique gold scarab of Egypt's Queen Nefertiti, Akhenaten's beloved wife, appears to be fairly worn from use, which suggests that it had been around for some time before it was taken on board the ship. Furthermore, it may have been part of a jeweler's hoard, as it was discovered in the midst of complete, cut, and folded jewelry pieces and other bits of scrap precious metals. If the scarab was a part of the scrap hoard, which is debatable, it almost certainly arrived on the ship after Nefertiti's time, when her scarab would have been worthless except for its gold value. Before the death of Akhenaten (or at latest the removal of the capital to Memphis), a scarab of the Queen would have been a venerated object unlikely to be discarded. On the other hand, it is difficult to imagine that the scarab would have long survived the eradication of all references to Akhenaten's family under Horemheb without being melted down.

In the hope of obtaining an absolute date for the ship, seven wood samples taken from the keel-plank, planking, and cedar logs were submitted to Peter Kuniholm of Cornell University for dendrochronological dating. While some samples did not have a sufficient number of tree rings to match the established master sequence, others with more rings appeared not to match at all. A large log-like piece of undetermined purpose, but with its outer layers trimmed, yielded a date of 1441 B.C. ±37 years, the uncertainty factor arising from the carbon dating of samples constituting the floating master conifer-ring sequence. A small log or branch, presumably fresh-cut firewood, however, yielded a date of 1356 B.C. ±37 years, with an additional unmeasurable ring on the exterior. Kuniholm further reports that recent calibration curves, along with several other factors, allow for the modification of these dates by shifting the entire floating sequence to the extreme recent end of the ±37 years. This would then date

the most recent sample on the wreck to 1319 ±2 B.C. or 1318 ±2 B.C., after taking into account the unmeasurable ring. It would appear, therefore, that the ship sank sometime after that date, but probably not much later.

If the scarab, the collection of Mycenaean pottery from the wreck, and the absolute sinking date are addressed in concert, they bear important implications for Aegean chronology. The evidence indicates a *relative* date for the sinking of the Uluburun ship very near the end of LH IIIA:2 and within a few years, or at most decades, after the death of Akhenaten. The shipwreck thus provides a very valuable synchronism between the pottery sequence and the kings list. The evidence supports moving the date of the LH IIIB:1 pottery at Amarna forward from Akhenaten's time to nearer the end of the 18th Dynasty.

Of equal importance is that dendrochronology gives an *absolute* date for the synchronization point in 1318 B.C. ±2, or shortly after, which narrows to approximately 1320–1295 B.C. the possible range of dates for the LH IIIA to IIIB transition, and rules out the "high" chronologies and favors the lower chronologies for Egyptian history. Thus, INA's Uluburun excavation will provide crucial assistance in dating events in New Kingdom Egypt and throughout the wide distribution range of Mycenaean ceramics.

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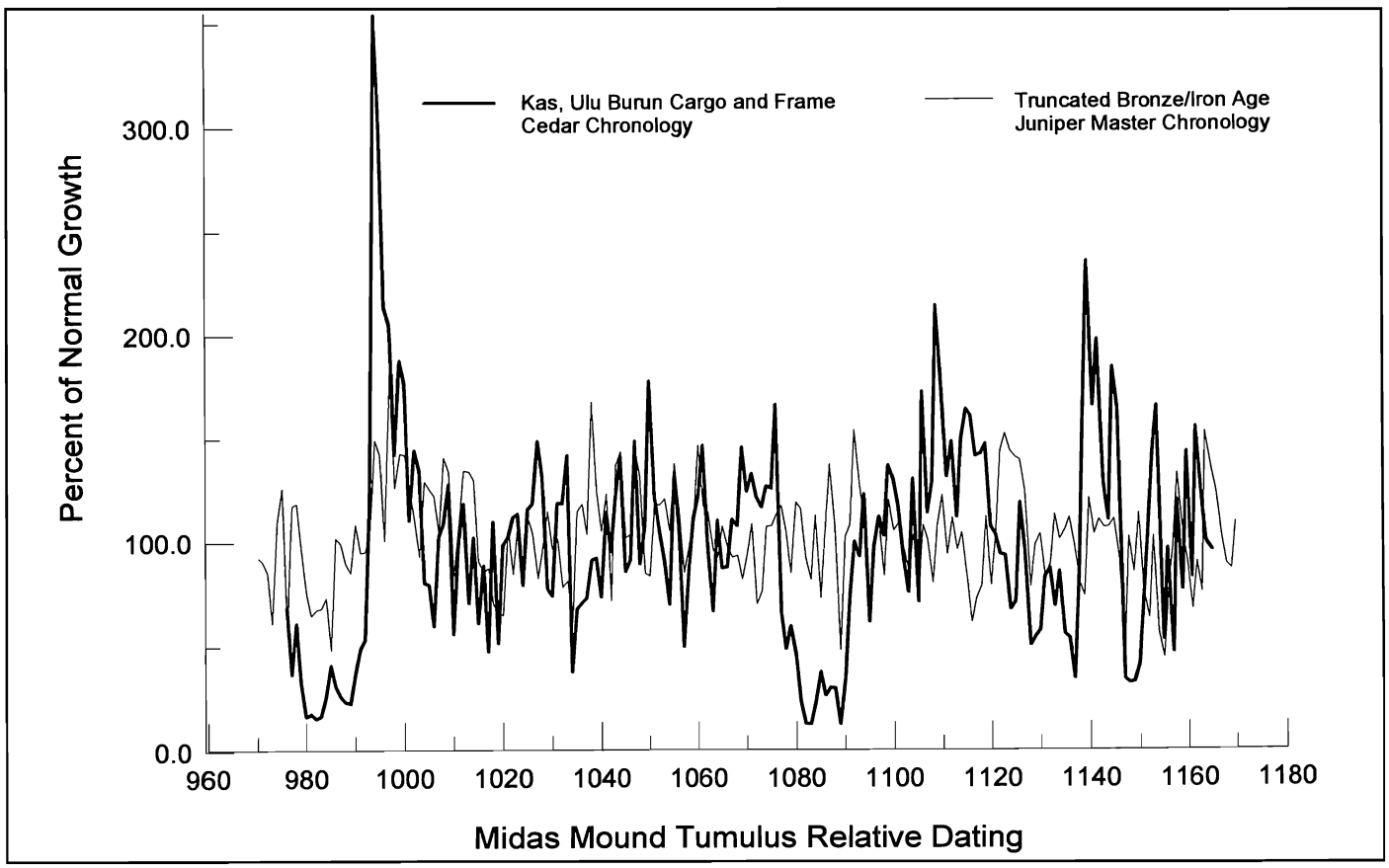


Fig. 1. *A comparison of the master tree-ring sequence and the timber from Uluburun shows that both high-growth and low-growth seasons match over a period of approximately 190 years. The last ring occurs in year 1165 of the floating sequence. The author believes this translates to an absolute cutting date of 1318 B.C. ±2. Chart courtesy Prof. P. I. Kuniholm, Cornell University.*

Linnet:

A Brig from the War of 1812

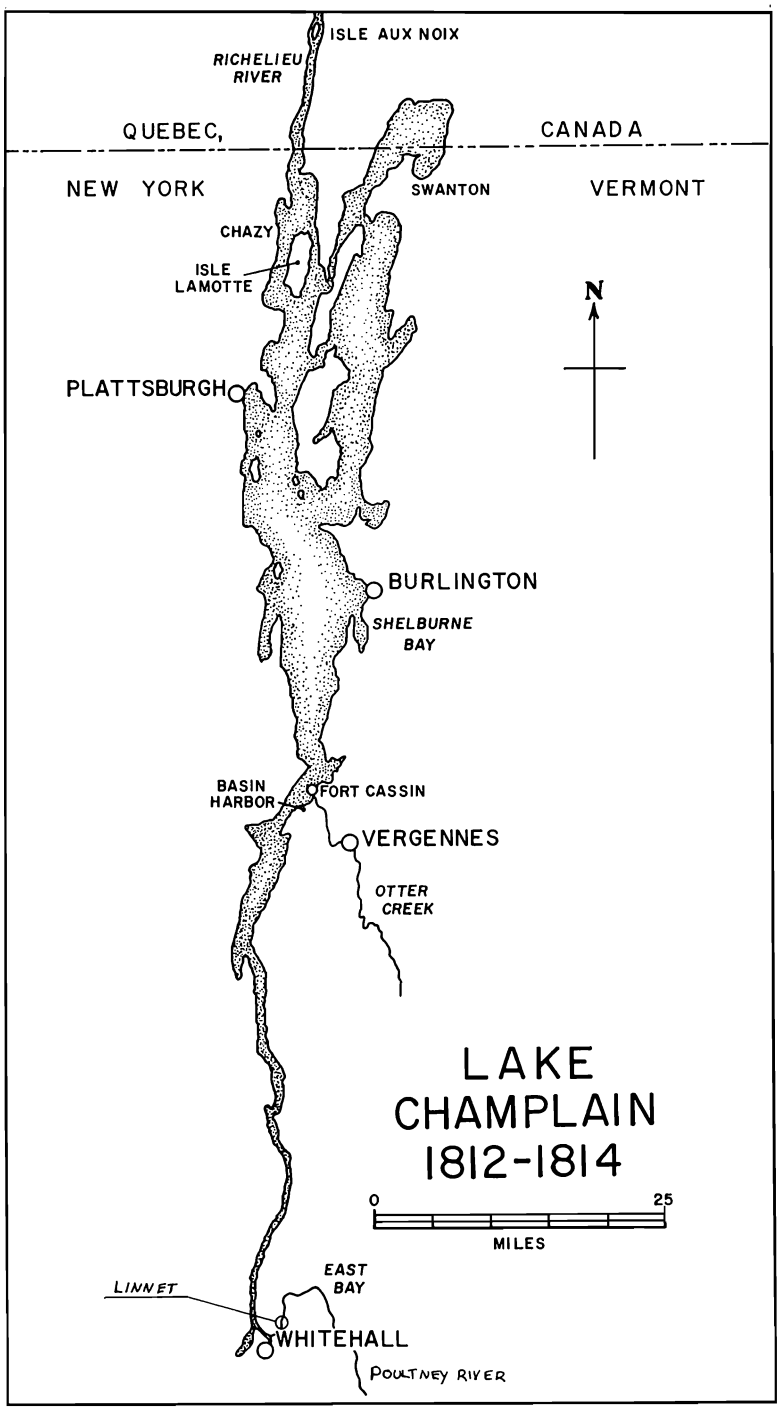
by
Erika Washburn

In the summer of 1981, Art Cohn (founder of the Lake Champlain Maritime Museum) and Dr. Kevin Crisman (of the Institute of Nautical Archaeology at Texas A&M University) conducted a survey of the Poultney River estuary, at the southern end of Lake Champlain between New York and Vermont (fig. 1). On July 23, they discovered the remaining hull of the War of 1812 brig H.M.S. *Linnet*. Preliminary measurements were taken in 1981 and 1982. It was possible to confirm the identification of the British brig by using a process of elimination based on reported hull dimensions. *Linnet* was the first large warship built on Lake Champlain during the War of 1812 and is, to date, the only known existing Royal Navy hull from the British squadron on the lake. She had an interesting, albeit short, career during the war as the last great British warship to surrender on Lake Champlain. During the summer of 1995, I was part of an archaeological team that returned to study *Linnet*.

H.M.S. Linnet in the War of 1812

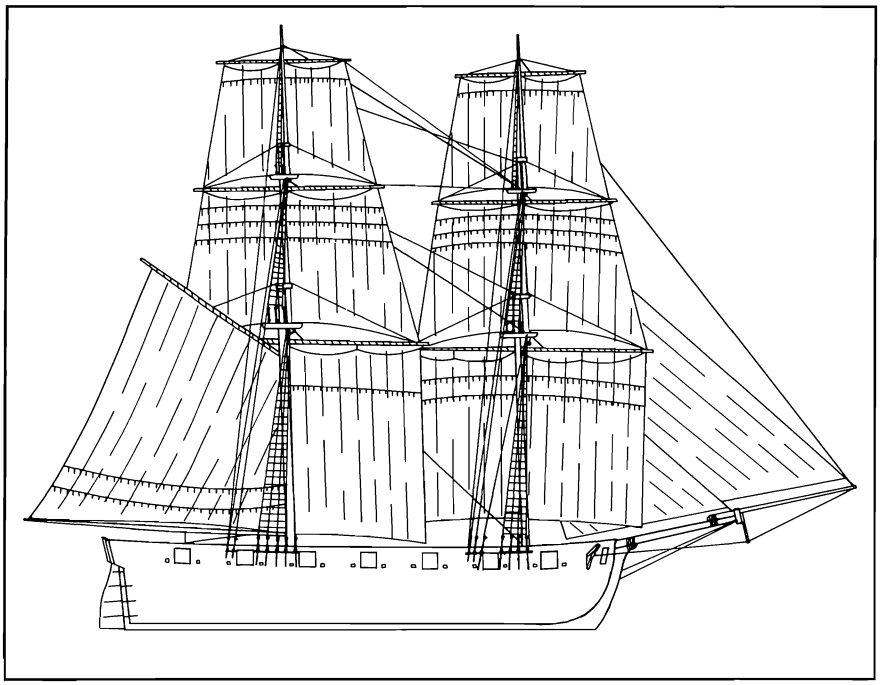
In the fall of 1813, word of American shipbuilding activity on Lake Champlain reached Ile-aux-Noix, Québec, the British base of operations for the lake. Captain Daniel Pring, head of the growing naval establishment, began to request new vessels and sailors to man them. The war was then eighteen months old and had been primarily fought in the western theater—the Great Lake region. On November 7, 1813, after much bartering between Pring and Canadian Governor General Prevost, William Simons, a shipwright from Kingston, Ontario, was awarded the contract to build one brig, to be launched and completed by May 1 (fig. 2). The price of the contract: 6 pounds Halifax currency per ton. This brig, *Linnet*, would become the first large warship built on Lake Champlain during the War of 1812. The British government agreed to supply the spikes, bolts, iron work, lodging, and rations for Simons' crew. The start of construction signalled the beginning of a shipbuilding race between the United States and Great Britain.

During the winter of 1813–14, a dockyard was built at Ile-aux-Noix, allowing Simons to construct the brig. Everything from manpower to sup-



Map: K. Crisman

Fig. 1. *Map of the Poultney River (East Bay of Lake Champlain), showing the location of the British brig* Linnet.



Drawing: E. Washburn

Fig. 2. *Schematic rigging plan of* Linnet.

plies had to be shipped to the island, and was in short supply. Very slowly, reinforcements arrived from the Navy and Pring's fleet was augmented. Rumors of American shipbuilding activity at Vergennes caused the British to hurry the building of *Linnet* (initially named *Niagara*). She was finally launched in April, 1814 and made ready for battle in May. Most sources indicate she carried 16 long twelve-pounders and would have been approximately 350 tons burthen with a complement of around 120 men. *Linnet* was 85 feet (25.9 m) in length overall (82 feet 6 inches [25.14 m] on deck), with a beam of 27 feet (8.2 m) and a depth of hold of 6 feet 8 inches (2.03 m). The brig probably resembled the vessel depicted in fig. 3.

In early action as Pring's flagship, *Linnet* harassed local residents on the New York and Vermont shores of the lake. In May of 1814, *Linnet* accompanied a small flotilla for an unsuccessful attack on Fort Cassin, an American post on Otter Creek. In mid-June, the American fleet reappeared on the lake. The British moved back into the waters of the Richelieu River, to remain in Canada for the rest of the summer. The last time *Linnet* sailed up the lake was on September 11, 1814, in the company of the Royal frigate and new flagship, *Confiance*, the sloops *Chub*, *Finch*, and *Icicle*, and 13 gunboats. All were bound for Plattsburgh Bay to attack the American naval squadron waiting there. The ensuing British defeat was an important turning point in the war and helped finalize the peace treaty in Ghent later that year.

At the British court martial held to investigate the defeat, several factors surfaced that revealed the British military's ill state of preparedness in the Lake Champlain theater. Pring openly accused Prevost of failing to uphold his part of the plan, which was to attack the American fortifications in Plattsburgh at the same time as the naval attack. The

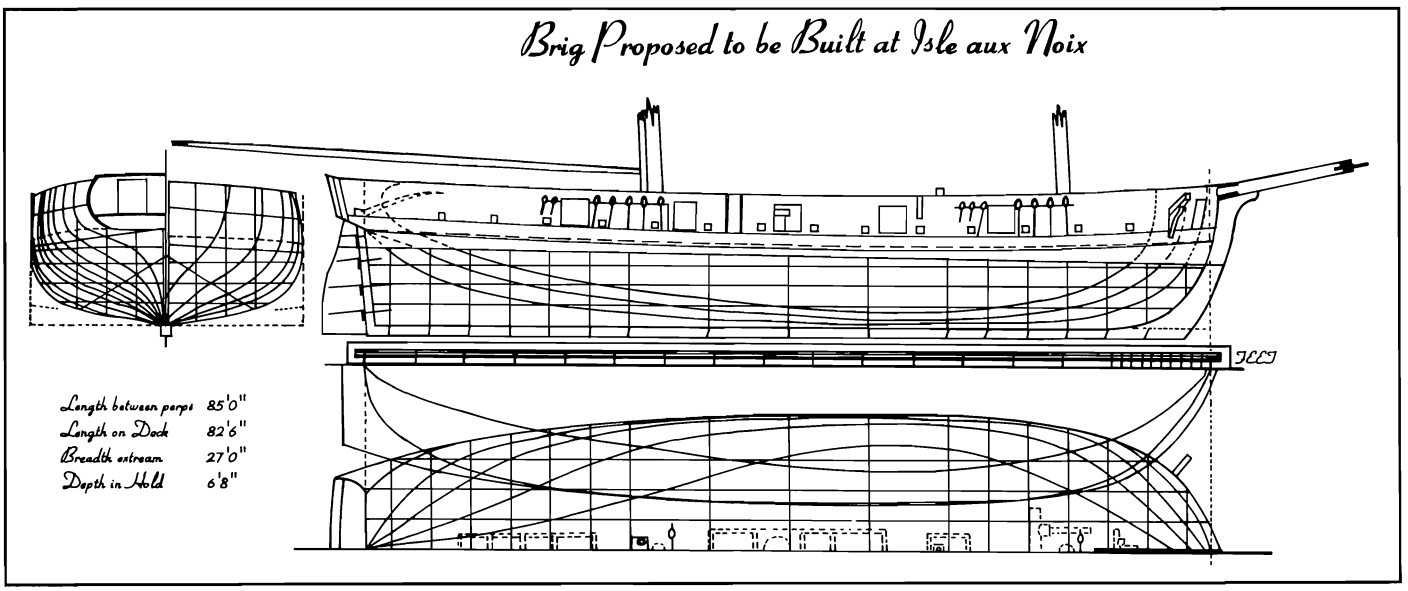


Fig. 3. *Lines drawing of an early 19th-century vessel similar in dimensions to* Linnet *(Chapelle, 1949:272).*

British had always lacked manpower and the Americans had, according to Pring, prime seamen, some of whom (he said he was sorry to observe) were natives of Great Britain. The British squadron fought under poor circumstances. Their vessels had difficulty sailing around Cumberland Head and into Plattsburgh Bay due to a strong headwind. The court martial blamed the lack of army support for the loss and managed to exonerate nearly all the naval officers.

Pring's actions aboard *Linnet* were not among the factors that contributed to the British loss of the Battle of Plattsburgh Bay. *Linnet*'s assignment was to take position at the northernmost end of the line of battle and, together with *Chub*, to fire upon the American brig *Eagle*. This *Linnet* did for over two hours. As a matter of fact, she was the only ship to hold her position as ordered. *Linnet* did her job so well that Robert Henley of the *Eagle* described her fire as "raking and most destructive." Henley eventually cut the *Eagle*'s bower anchor and, giving up his position, sailed past the American flagship, *Saratoga*, to a new position out of reach of *Linnet's* guns. The ill-prepared *Confiance* bore the brunt of American fire, and her commanding officer was killed within the first 30 minutes of battle. After *Confiance* surrendered, Pring kept up the fight for an additional 15 minutes before succumbing to the guns of the American flagship *Saratoga*. *Linnet* was the last British warship to surrender that day—or ever—on Lake Champlain. The two hour and twenty minute battle had ensured American dominance.

After the battle, *Linnet* became the property of the U.S. Navy and was in desperate need of repair. She was riddled with 30 to 50 shot holes, most of which probably came from the guns of the *Saratoga* in the last 15 minutes of battle. Twenty men were killed and 30 wounded during the engagement. In early October, *Linnet* was moved south to Whitehall to be put in ordinary (noncommissioned storage) with the rest of the squadron. There she remained.

Fig. 4. *View of* Linnet's *stern after 1949 raising (New York State Archives, 1949).*

In a relatively short time, the naval presence on the lake dissipated. Equipment and vessels were either placed in storage or auctioned off to help pay the war debt. By 1820, shipping activity had increased in Whitehall and the ragtag fleet was blocking passage of commercial vessels. They were moved to an area known locally as East Bay, actually the mouth of the Poultney River. *Linnet* sank at anchor along the New York bank of the river around 1825 and remained there for 124 years, attacked only by rot, ice, and seekers of firewood.

The First Discovery, October, 1949

The October 20, 1949, edition of the *Whitehall Times* reported an exciting event in local history: the hull of a "colonial" warship had been raised from East Bay. Knowledge of the Poultney River wrecks was nothing new for Whitehall residents. It was locally believed that the vessels were from the Revolutionary War. Many had known about them or even played on them as children. In 1949, a small group of farmers hooked two steel cables around the timbers of an unidentified hull and, with horses and three tractors, dragged her from the New York to the Vermont side of East Bay (fig. 4). Over 300 people stopped by the Galick family farm to look over the many relics on display there after their discovery in the wreck. Among the visitors were representatives from Fort Ticonderoga, New York, and a furniture dealer from Rutland, Ver-

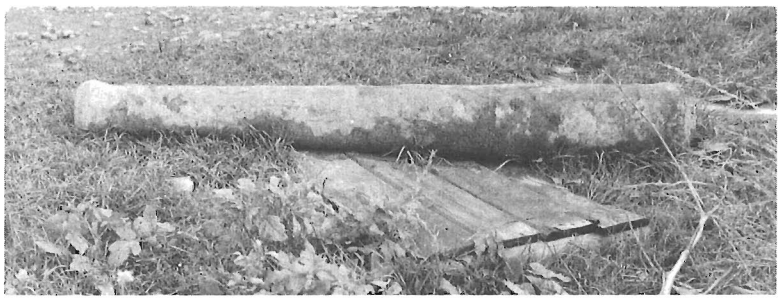


Fig. 5. *A nine-pounder cannon, probably ballast, recovered from* Linnet *(New York State Archives, 1949).*

mont, who intended to carve the timbers into special furniture.

Recovered from the wreck were two nine-pounder cannon and over 350 cannon balls which reportedly were filled with gunpowder (fig. 5). One of the nine-pounder cannon and a split mortar were sold by three local families to Fort Ticonderoga, the paper reported. Another cannon, weighing 1200 pounds (545 kg) and 6.5 feet (1.98 m) long, was acquired by Fort Mount Hope, which later became the property of Fort Ticonderoga. Both cannon and mortar were unserviceable and used as ballast in 1814. Mount Hope also acquired many of the ship's timbers which were put on display as remnants from a "colonial gunboat." In addition to the cannon balls, the *Whitehall Times* reports that 38 bar shot and 6 "exploding bombs" were found within the hull. According to the Galicks, the area between the ribs was filled with cannon balls. Shot was sold by one local farmer for "two dollars a pop."

Photo: P. Larocque

Fig. 6. *K. Crisman, R. Wilczynski, and E. Heinold measuring* Linnet's *frames during the 1995 field season.*

According to the *Whitehall Times*, the ship was identified as from the Revolutionary War and, oddly enough, of French construction. This "colonial warship" was nothing of the sort. She was, in fact, *Linnet*, although her identity would remain a mystery for an additional 32 years. There was one important fact that the paper had not recorded: what happened to the hull when the farmers pulled it from one bank to the other. In the process of raising the ship, the bow broke off and the remaining hull spun around. The forward end now faced down the Poultney River, unlike the other wrecks from the former U.S. Naval fleet on the opposite side.

The 1995 Archaeological Field Season in Whitehall, New York

In contrast to the 1949 events, *Linnet* was scientifically excavated during the 1995 Lake Champlain Nautical Archaeology Field School from July 11 through July 31. The season's work concentrated on the hulls of *Linnet* and the U.S. gunboat *Allen* (*INA Quarterly* 22.4). The main objective in the *Linnet* excavation was to record timber measurements so an accurate reconstruction of the vessel could be made through lines drawings and construction plans.

Approximately 160 hours of dive time were spent recording features of the hull during the three week period, with a team of four divers excavating about 65% of the remains. The team focused on the keel/keelson arrangement, the frames, and mast step. They also searched for the bow and stern sections. The highly disturbed nature of the site prompted the use of the frames as an internal reference system rather than setting up a grid over the site. Few artifacts were expected, due to the thorough scouring in 1949. Indeed, few were found, apart from iron spikes, iron or copper nails, 3 lead musket balls, 2 iron grapeshot, bird shot, canister shot, 2 copper alloy buttons, drift bolts, staples and metal fragments. The canister and one grapeshot were donated by the Galick family of Whitehall, New York.

During the first week, modern litter was cleared from the wreck and an appropriate work area was created by cutting back the riverside shrubbery. The site was examined and divers began dredging to clean up what was then called simply the "Vermont side" of *Linnet* (this was later determined to be the starboard side). A third of the floor timbers on this side of the hull were in such shallow water that their tops extended above the surface of the river adjacent to the shore (fig. 6). Overburden became deeper nearer to the bow of *Linnet* and was generally sterile except for a few inches above the timbers. A combination of tree limbs, decaying plant matter, fishing line and hooks, broken beer bottles, cans, and other garbage was common and evenly distributed over the entire length of the hull. Visibility averaged 10 cm, although on "good" days divers could see up to about 36 cm.

Fig. 7. *The mast step as it appeared in the* Whitehall Times *in October 1949 (Whitehall Public Library).*

The hull was generally not in a very good state of preservation but it was evidently well-built. The wood samples analyzed by Dr. Roy Whitmore, Professor Emeritus, University of Vermont, indicated that all the principal timbers were of white and red oak. The total length of the existing hull is approximately 58 feet (14.7 m). Although an extensive river bank and bottom search was carried out, the bow and stern sections were not located. As previously noted, the bow appears to have been lost downriver in 1949. Most of the missing 25 feet (7.62 m) and other detached hull timbers, however, ended up at Mount Hope. These were examined after the conclusion of the field season. During the course of the excavation, cable used in the 1949 raising was found on shore, as were several loose timbers.

The keelson averaged 6 to 8 inches (15–20 cm) sided and 11.25 to 12.5 inches (29–32 cm) molded. We determined that the keel had broken off in the forward section of the hull, splintering the garboard strake. The overburden was so deep here, and the bank erosion rate so high, that a cofferdam was constructed around the last few frames to keep the sediment from settling over the excavated timbers. At the forward end of the hull, the water depth was approximately 2.75 m. The last few forward feet of the keelson consisted of a three-foot-long (0.91 m) flat scarf. This was the only scarf located in the keelson, which also has slightly unusual construction, first noticed in 1982. It is cut out along the bottom to fit over the frame sections for every frame except those immediately surrounding the mast step (fig. 7). About a third of the hull's length forward of the stern of the ship, this step was probably intended for the mainmast. It measures approximately 3 feet long by 1 foot wide (0.91 by 0.3 m) and is an oak block with a rectangular hole in the center for the mast, laterally supported by iron bars on each side. The step is connected to the keelson by six 7/8-inch (2.22 cm) diameter iron drift bolts.

The frames on the starboard side were completely uncovered and excavated between every other frame. No ceiling planking was located intact on this side. Each frame section was measured. A total of 23 floor timbers were discovered, with futtocks (side frames) for the three at the forwardmost end of the hull. On average, the frames were sided 7 to 9 inches (18–23 cm) and molded 9 to 10 inches (23–25.5 cm). A midship frame was not identified during the excavation; there was no noticeable difference in measurements between any of the frame sections. About 14 feet (4.26 m) of the keel, with stern deadwood, was discovered 2.44 meters upriver from the main part of the hull. All the frames from this area are missing, and are probably some of those on display at Mount Hope. Furthermore, no evidence of lateral fastenings was located in the floor sections or in the excavated futtocks.

By the end of week two, we realized that the initial goal of excavating the port side could not be fulfilled. The overburden there was even deeper than on the starboard side and consisted of fine, thick clay which made dredging a difficult and lengthy process. With each of the four

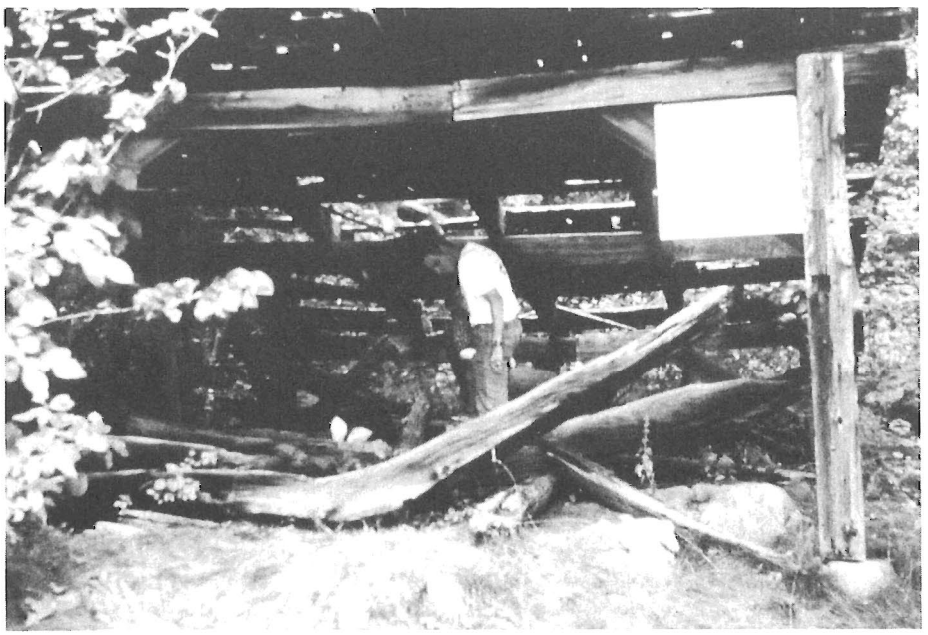


Fig. 8. *Timbers displayed at Mount Hope, New York, 1995.* Photo: E. Washburn

team members diving twice daily for nearly two hours at a time, we estimated an additional three weeks in order to mirror the full excavation on the port side. Consequently, only one section of the port side was excavated. The remainder of our time was spent carefully analyzing specific construction details.

After the official three-week field season was over, remaining team members went to Mount Hope and surveyed the timbers on display there (fig. 8). These were in very poor condition, having been subjected to the extremes of New England seasons for 46 years under a mere scrapwood shelter. Most timbers had the consistency of a wet sponge and literally fell apart in our hands. In three days, we recorded a total of 3 floors, fragments of approximately 8 futtocks, and 14 miscellaneous timbers and planks. All these were measured and photographed. They were safely stored away from the elements in a replica blockhouse on Mount Hope property. After the lines are drawn and a preliminary construction for *Linnet* is suggested, some of these timbers may fit into the brig's construction, making her less of a jigsaw puzzle.

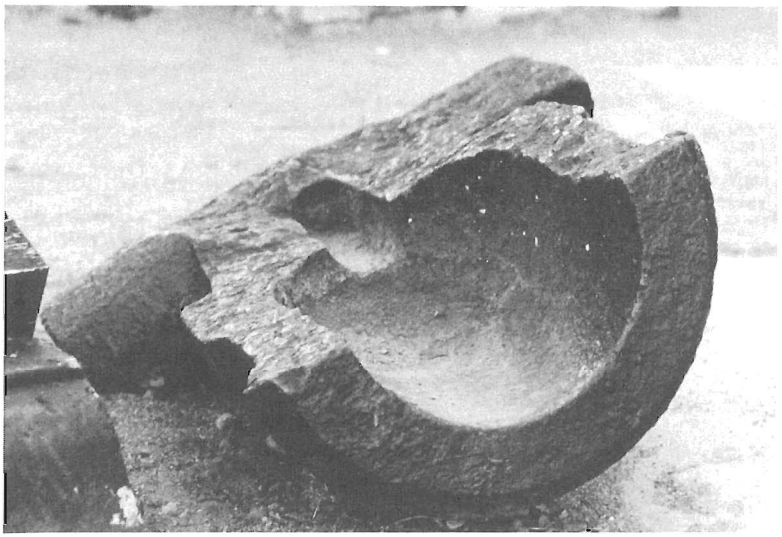


Photo: E. Washburn

Fig. 9. *Split mortar removed from* Linnet *on display at Fort Ticonderoga, New York, 1995.*

Team members also visited Fort Ticonderoga to identify and record two trunnion-less cannon and a split mortar. These were removed from *Linnet* and sold to the Fort in 1949. The mortar was found within the fort and the cannon were located in a line of other cannon outside the main entrance (fig. 9). The mortar's bore measures 13 inches (38.2 cm) and the construction is of cast iron—not bronze, as some Whitehall residents had suggested. Both cannon are over 6 feet long and fired nine-pounder shot.

Conclusion and Future Study Goals

The current picture of *Linnet* is still a complicated puzzle with pieces scattered over two states and three different locations. Future research goals include reconstructing the ship based on the archaeological data from the 1995 field season and comparing this with information from the British Public Records Office and National Maritime Museum, as well as from the National Archives of Canada. I also plan to follow up the 1995 season with a more thorough investigation targeting residents of Whitehall and vicinity who have knowledge pertaining to the 1949 raising. The final goal is to use this information to reconstruct the complete story of *Linnet*, including her design and building details.

Acknowledgments. Linnet was excavated during the 1995 Lake Champlain Nautical Archaeology Field School with support from a Navy Legacy grant, the Naval Historical Center, the Vermont Division for Historic Preservation, the University of Vermont, Texas A&M University, the Institute of Nautical Archaeology, and the Lake Champlain Maritime Museum. I would like to acknowledge Dr. Kevin Crisman and Mr. Arthur Cohn for their guidance and assistance, the Lake Champlain Maritime Museum, Mr. Harlan Crow for donating the hookah units, Dr. Robert Neyland at the Naval Historical Center, and Craig Williams at the New York State Archives. Thanks go to members of the 1995 Lake Champlain Nautical Archaeology Field School: Steve Bilicki, Steven Butler, Eric Emery, Erich Heinold, Pierre LaRocque, Scott McLaughlin, Scott Padeni, Cheryl Quinn, and Robert Wilczynski.. I would also like to acknowledge the staff of these institutions who made research simpler and more enjoyable: the Whitehall Public Library, Canadian National Archives and Public Library, State University of New York Plattsburgh Special Collections, Fort Ticonderoga, and Parks Canada of Fort Lennox.

Suggested Reading

Crisman, K.J.
1987. *The* Eagle*: An American Brig on Lake Champlain During the War of 1812*. Shelburne, VT and Annapolis, MD.

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1981. *The War of 1812 in the Champlain Valley*. Syracuse, NY.

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Sailing into Adventure

The 1995 Cutty Sark Tall Ships Races

by
Gregory D. Cook

July 1994: St. Ann's Bay, Jamaica. My muscles screamed as I dumped the last bucket of ballast stone into the excavation trench. I paused for a moment to allow my breathing to slow down as I surveyed the excavation site running along the bottom of the bay. Slowly I rose to the surface, then signalled the boat tender to turn off the dredge depositing backfill over the site. My friend Dorrick Gray, a Jamaican archaeologist, ascended to the surface with a quizzical look on his face. "That should do it," I replied wearily to his unasked question. Buried under a blanket of sediment and ballast stone, we had once again put the Reader's Point sloop to rest.

Despite our aching backs we were quite proud of our accomplishment. With the assistance of the Institute of Nautical Archaeology and the Jamaican National Heritage Trust, we had excavated and recorded a 20 meter long sloop dating to the late eighteenth century. The excavation had involved a crew of fifteen friends and colleagues who had spent four months and hundreds of hours underwater working on the site. Although the ship remains were to stay behind, we collected volumes of data, bags of samples, thousands of measurements, scantlings, photographs, and slides. Nearly 700 artifacts from the site were recorded *in situ*, conserved in our field laboratory, and given to the Trust.

Later that evening we celebrated the end of an exhausting yet exhilarating project. Over toasts of dark Jamaican rum, we wondered what it might have been like to sail the Caribbean more than 200 years ago. My childhood in Indiana was spent surrounded by fields of soybean and corn rather than the deep blue waves of the sea. Still, my fascination with sailing ships and history had led me to pursue a career in nautical archaeology. I regretted my lack of first-hand sailing experience. My feet had trodden the decks of numerous vessels lying on the bottom of rivers, lakes and seas, but I yearned to sail living ships like those I had explored underwater. I reached my bed early that night, a victim of exhaustion as well as the potent Jamaican rum. Visions of sails, water, and graceful ships filled my mind before succumbing to sleep.

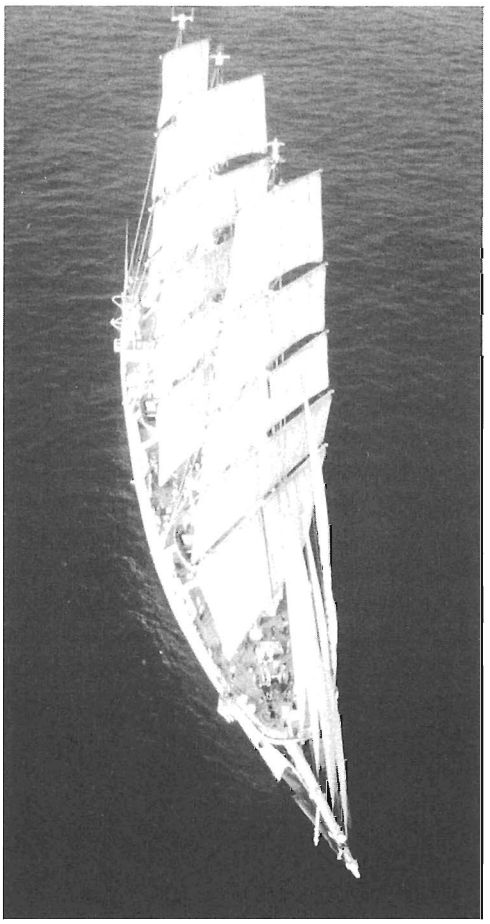


Fig. 1. Dar Mlodziezy *under sail. Photograph courtesy of Cutty Sark Scots Whisky.*

July 1995: Somewhere on the North Sea, on board the Polish sail training ship *Dar Mlodziezy*. My arms felt as if they would separate from my shoulders. The callouses on my hands had turned into blisters. Groans of my shipmates nearly drowned out the barrage of Polish curses coming from officers on either side of us. A line of twenty-five drenched, shivering Polish merchant cadets (and a few equally cold Americans) attempted to turn the main yard on the foremast by heaving together on the starboard brace. Although we had been pulling on lines for twenty minutes, it seemed like hours, perhaps because it was three in the morning and the fourth time that night we had been called to task by the deck officers. The frigid North Sea drizzle that made it difficult to get any rest on the cold, hard deck now made it impossible to gain any footing. By bracing our feet against those of our mates in front and behind us, we managed enough leverage for one mighty heave. Three sharp whistles from the deck officer signaled that the yard was adjusted sufficiently. After securing the brace we were allowed to return to our sleeping spots on the deck, ready at any moment to jump up on command. I couldn't help but smile as I lay down, resting my head on a coil of line. Although we weren't exactly sailing an eighteenth-century sloop through the West Indies, I was beginning to understand what it was like to work on a ship during the age of sail.

I was crewing on the 109-meter long *Dar Mlodziezy*, or "Gift of Youth," a steel-hulled, three-masted square rigger used as a training vessel for the Polish Merchant Marine Academy in Gdynia. She was one of nearly a hundred vessels participating in the 1995 Cutty Sark Tall Ships Race. Cutty Sark Scots Whisky became the race's official sponsor in 1972,

ensuring the survival of the largest international sailing event in the world. I was aboard courtesy of Cutty Sark, which held a contest to recruit candidates for the first American crew to participate in the Tall Ships Race since its inception in 1956. Nearly two thousand candidates applied, but only eight were selected.

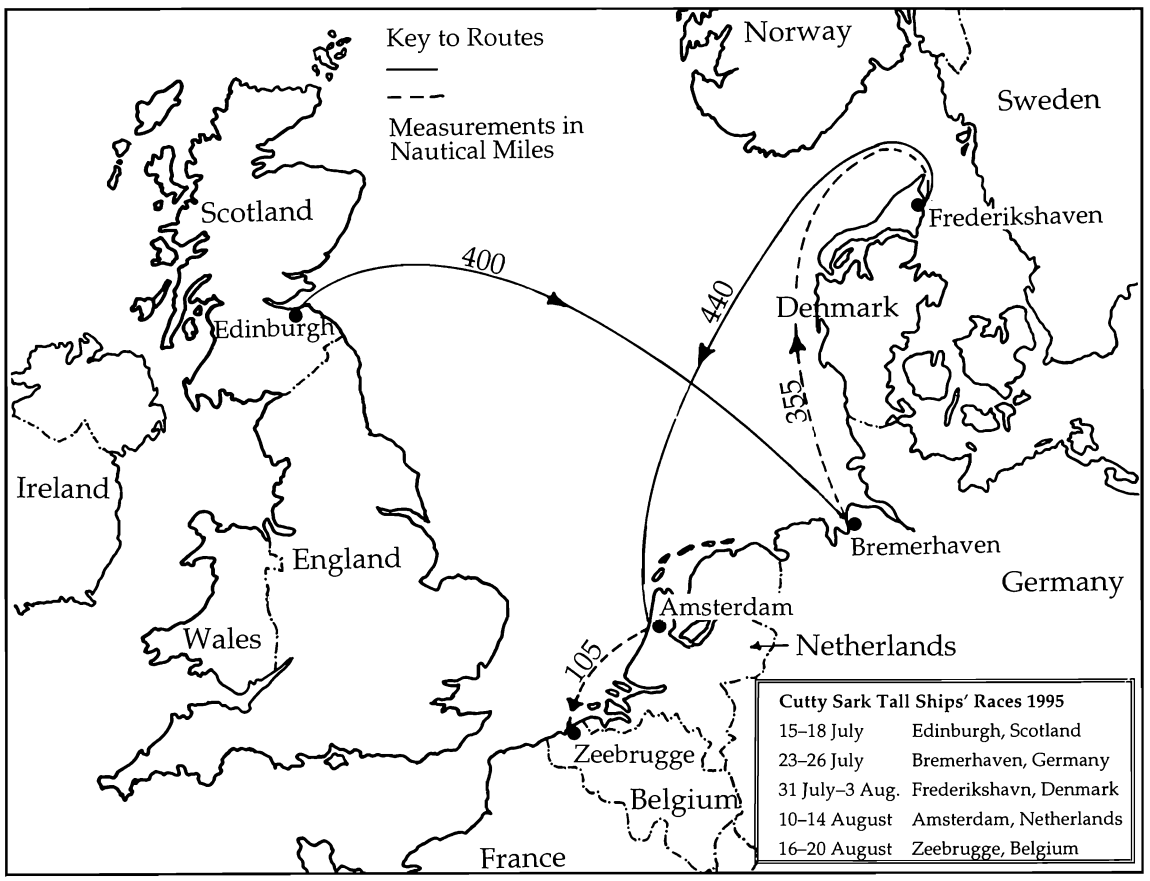
The race was divided into four stages: setting off from Edinburgh, Scotland and sailing across the North Sea to Bremerhaven, Germany; then to Frederikshavn, Denmark; next to Amsterdam; and finally finishing in Zeebrugge, Belgium. To allow a maximum number of participants, ships typically changed crews at each port. The American crew sailed during the first stretch of the race, 400 nautical miles from Edinburgh to Bremerhaven.

The objective of the Cutty Sark Tall Ships Race is not necessarily to be the first ship to cross the finish line. Instead, it is to provide men and women of all ages and nationalities an opportunity to sail together in a spirit of friendly competition. No previous sailing experience is necessary. The Cutty Sark trophy is awarded to the crew that is voted to have contributed the most to international understanding and friendship.

Our adventure began at the South Street Seaport in New York, where the American crew assembled for preliminary sail training and promotional activities including interviews on "Good Morning America." We arrived in Edinburgh a few days later to begin training on *Dar Mlodziezy*. The days before the race were filled with parades, celebrations, and receptions within the fleet as well as the city.

Finally the day of the race arrived. The parade of sail outside Edinburgh was impressive, with scores of full-rigged ships, barks, brigs, schooners, and sloops from all over the world saluting each other in a myriad of languages and fashions. The haunting sound of bagpipes emanated from a Scottish sloop. An Australian crew sang a vulgar ditty while dancing the can-can as their schooner passed nearby. One hundred well-disciplined Russian cadets on the four-masted *Kruzenshtern* bellowed a Slavic challenge with the force of a broadside. A final pass by the *Queen Elizabeth II* led to the open sea and the beginning of the race.

The Americans were quickly integrated into the 200 member crew of *Dar Mlodziezy*. Our Polish mates proved



Map: C. A. Powell

Fig. 2. *The routes for the Cutty Sark Tall Ships Races 1995.*

Fig. 3 (left). *Crewmembers relaxing on deck. Photograph courtesy of Cutty Sark Scots Whisky.*

Fig. 4 (below). *The crew goes aloft to unfurl the sails at the beginning of the race.*

extremely friendly and hospitable. They taught us the Polish terms for masts, yards, and common orders that we needed to know, laughing at our awkward pronunciations. I joined the first watch, which the cadets dubbed the *vampyre* watch. Our day began at midnight, assembling on the deck and standing by to haul on lines or going below to peel hundreds of potatoes for the next day's meals. When not working, we huddled on the deck and tried to sleep. The second watch relieved us at 4 a.m., when we retired to our bunks. At 7 a.m. the *vampyre* watch conducted their daily ritual of climbing 50 meters up the ratlines for morning calisthenics. After breakfast, we spent time with the crew until noon, when we assembled for our day watch. Four hours of polishing brass fixtures, painting davits and other chores ensued, punctuated by bursts of the officers' whistles calling us to haul on lines for sail and yard adjustments. We ate a quick dinner, then relaxed and tried to catch up on sleep before reporting at midnight for night watch.

The work grew tiresome as our voyage continued. The officers considered us to be normal crew, so we were obligated to perform on the same level as any other merchant cadet. It seemed impossible to get sufficient sleep. Still, I spent the voyage in a constant state of fascination. I strived to absorb every experience, regardless of how trivial, during my stay on board this living ship. All too soon we approached Germany. We assembled for the last midnight watch feeling melancholy as the voyage neared its end, yet anticipating the activities awaiting us in Bremerhaven.

Photo: G. D. Cook

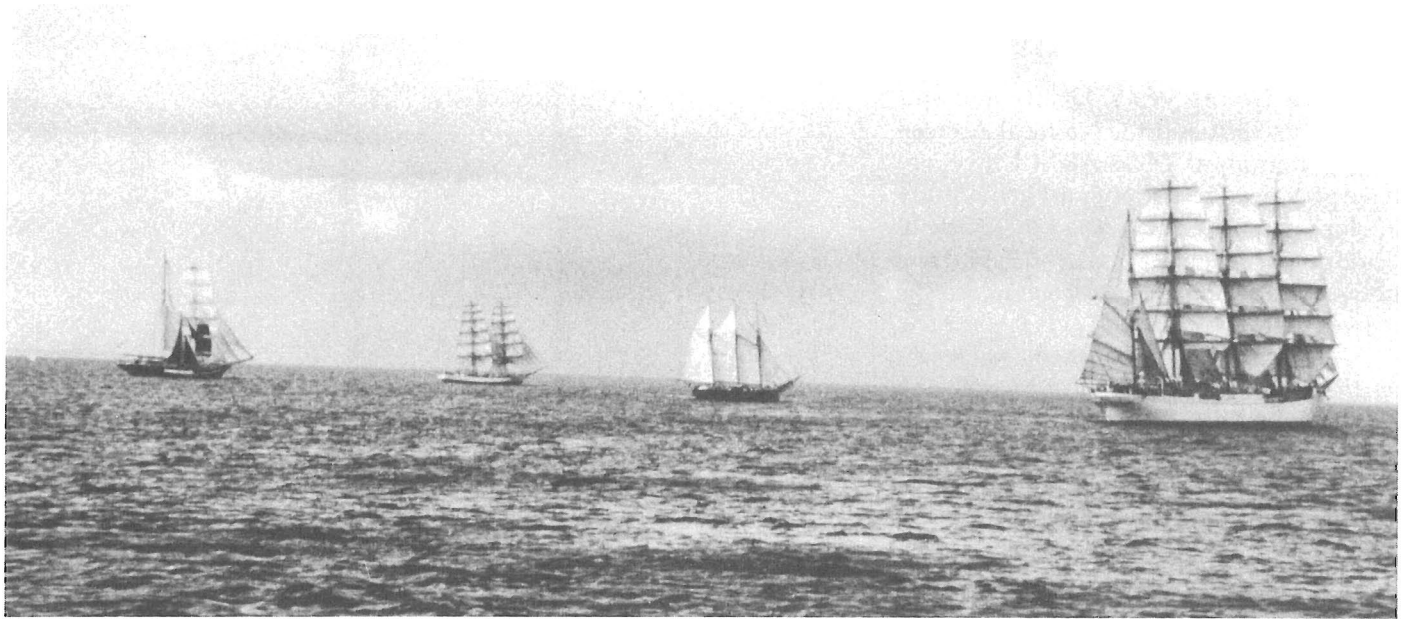


Photo: Gregory D. Cook

Fig. 5. *Ships of various types, sizes, rigs, and nationalities participate in the race every year.*

The deck officer assigned me port watch. This meant that I would be stationed on a small platform which extended outboard of the ship's side, constantly scanning the horizon for any other vessels. The cadets hated this post, since it was impossible to take a nap during the watch. Many considered it a boring duty, but I'll never forget that night. Just a slight wind propelled *Dar Mlodziezy* toward Germany. I could look down between the boards of the watch platform and see the dark water slipping by below me. The gentle creaking of the rigging was all that disturbed the silence. Only the dark, scattered forms of the crew sleeping on the deck reminded me that I was not alone. Due to our northern latitude the sun never quite disappeared, but cast a continuous, beautiful glow on the horizon. Eventually the second watch took over. I was relieved of my position, and I spent the rest of the night lounging on the deck, listening to the splash of water on the bow and the sails flapping gently above.

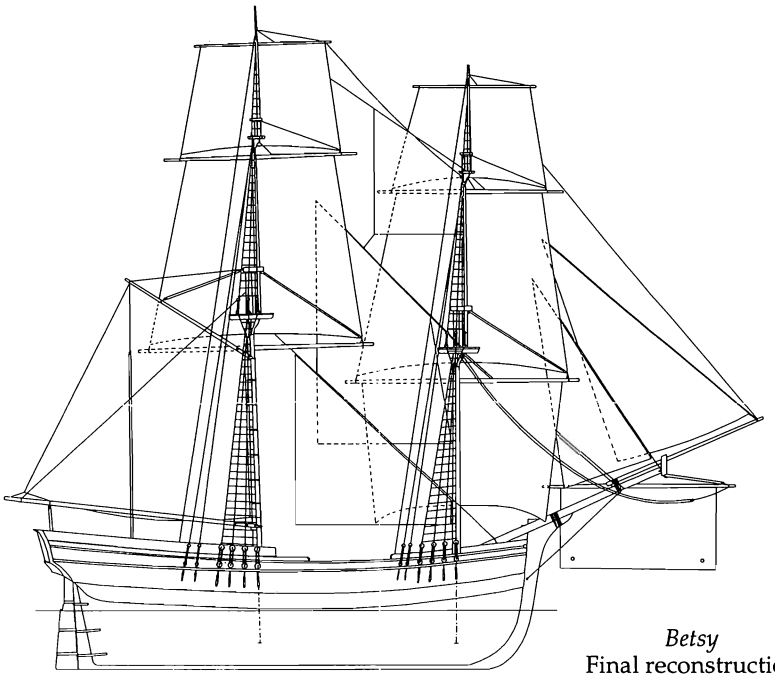
By daybreak we had arrived in Bremerhaven. We climbed high into the rigging one last time, inching out along the yards to furl the sails. After docking, we set out with our mates to explore Bremerhaven and attend parties being held on ships which we had been racing against only hours before. We spent the day and night celebrating with crews from all over the world. Our bus arrived the next morning, and we reluctantly packed our things and headed to the airport. I took one last look at *Dar Mlodziezy* before boarding the bus, as the *vampyre* watch took to the shrouds for their morning climb up the masts without me.

It wasn't until our plane took off for New York that I realized I hadn't slept for over forty-eight hours. As I closed my eyes, my mind focused on things I had learned on the voyage; the importance of teamwork and discipline, the comraderie of crewing on a vessel, the drudgery of peeling potatoes for hours in the middle of the night, and the exhilaration of going aloft where the sounds of the deck are drowned out by the wind flowing through the rigging. And finally I thought about a small sloop lying in its Jamaican grave, and what it may have been like to sail her two hundred years ago.

Acknowledgements. I would like to thank the officers and crew of *Dar Mlodziezy* for taking us under their wing and giving us the honor of sailing with them. It was a great pleasure to share this experience with my American mates: Colleen Burke, Todd Jarrell, Ramona Lum, Michael Martinsen, Tom Rickard, Greg Stark, and Thor Torgersen. I am especially grateful to Mr. and Mrs. John Rudd, Paul Bermudez, Ciaran Coakley, and Amanda Suckling of Cutty Sark Scots Whisky as well as Joseph Block, Tracy Garfinkel, and Beth Jabick of Block and Nardizzi for their kindness and hospitality during every stage of the adventure.

Yorktown Project *Final Report* Now Available

by Christine A. Powell



Betsy
Final reconstruction

For twenty years, faculty and students from INA and the Nautical Archaeology Program at Texas A&M University have played an important part in the study of ships associated with the 1781 Battle of Yorktown (see *INA Newsletter* 6.3, 7). They now—finally—have the chance to see the fruit of their labors.

In the recently published *Final Report on the Yorktown Shipwreck Archaeological Project*, John D. Broadwater has provided nautical archaeologists an object lesson in perseverance. From 1978 to 1990, he was the Director of the Yorktown Project, an ambitious effort to survey and excavate one of the most significant historical sites in the country. The Project itself was remarkable, but what followed is truly amazing. Without the determination of Broadwater and a number of other unpaid heroes, the Yorktown Project could have become a tragic act of vandalism. The *Final Report* is noteworthy as proof that this disaster was averted, but is still more important as a major resource for research into late 18th-century seafaring.

In the summer of 1781, the largest British army in the southern colonies assumed a fortified position on a peninsula at Yorktown, Virginia, flanked by the Chesapeake Bay estuaries of the York and James rivers. American control of the countryside had forced Major General Charles, Earl Cornwallis, to retreat to the coast, where the Royal Navy could provide supplies and protection. The fleet had been stretched very thin since France and Spain joined the war as American allies. By the end of August, 26 French warships under Admiral de Grasse had escaped the British blockade of Brest and prevented entrance to Chesapeake Bay, while General Washington's army had moved south to block the land approaches. Cornwallis was outnumbered nearly three to one.

Realizing that the French squadron prevented any hope of escape by sea, Lord Cornwallis scuttled a number of his transports in the shallow water off the York River beach to hinder an anticipated amphibious landing. As it turned out, a full-scale assault was unnecessary. By the time he had lost 156 dead out of his force of 5953, the combination of naval blockade and artillery barrage had convinced Cornwallis that further resistance was futile. Equipment that might be valuable to the enemy, including much of what remained of the supply squadron, was destroyed. The British army surrendered on October 19 after roughly a month of siege. This defeat forced the British Government to seek peace with its opponents, at the price of conceding independence to the United States. The Battle of Yorktown is thus one of the most important events in all American history, and the naval aspects of that battle were crucial.

Under the terms of surrender at Yorktown, the French took possession of the British vessels. Some were still afloat and were sold. A few more were salvaged, but as many as 26 remained on the bottom of the York River. Interest in the ships bloomed in the 1970s. Virginia adopted a pioneering Underwater Historic Properties Act to protect the wrecks, and they were among the first underwater sites in America named to the National Registry of Historic Places.

In 1976, an INA team under the direction of Dr. George Bass was the first to conduct a scientific investigation of one of these wrecks (see *INA Newsletter* 3.4). This was a warship or large transport sunk just offshore from the cave on the Yorktown waterfront where Cornwallis is believed to have had his final field headquarters. In 1978, Virginia hired John Broadwater as State Underwater Archaeologist to direct the Yorktown Shipwreck Archaeological Project. Surveys and test excavations located a total of eight additional surviving wrecks from the Battle of Yorktown. One was investigated in 1980 by a field school team from the Nautical Archaeology Program at Texas A&M and identified as the 44-gun warship HMS *Charon* (see *INA Newsletter* 7.4).

The other seven ships include three that have been eroded by tidal currents. These still badly need either stabilization or a complete study before they disappear. The remaining four were buried in sediment and appear to have survived for two centuries in relatively good condition. The best-preserved was selected for a complete excavation. The

site was daunting, with strong currents, visibility under 12 inches, high-speed powerboats, and stinging jellyfish. On the suggestion of Dr. Bass, a cofferdam was built around the site to protect it from currents, boats, and jellyfish; the enclosed water was filtered to improve visibility to as much as 30 feet. Since the site was accessible vía a wooden pier, it was possible to offer thousands of visitors an unusual close-up view of underwater archaeology. Between 1982 and 1988, Broadwater's team, including graduate students from East Carolina University as well as a number of students and former students from Texas A&M, completed excavation within the hull. Ceiling was removed from the starboard side, and about 95% of the hull construction was recorded.

This research allowed identification of the wreck as the collier brig *Betsy*, built in 1772 in Whitehaven, Cumbria, England. The excavation provided invaluable information about 18th-century naval architecture and merchant shipping. Sources for a study of cargo carriers are scarce. British warships were extensively documented by the Admiralty, but most contemporary merchant vessels remain unknown. *Betsy* appears to have been an ordinary example of a small ship built to carry bulk cargo, so the excavation provides vital data for future research into the ships that tied Europe to its colonies.

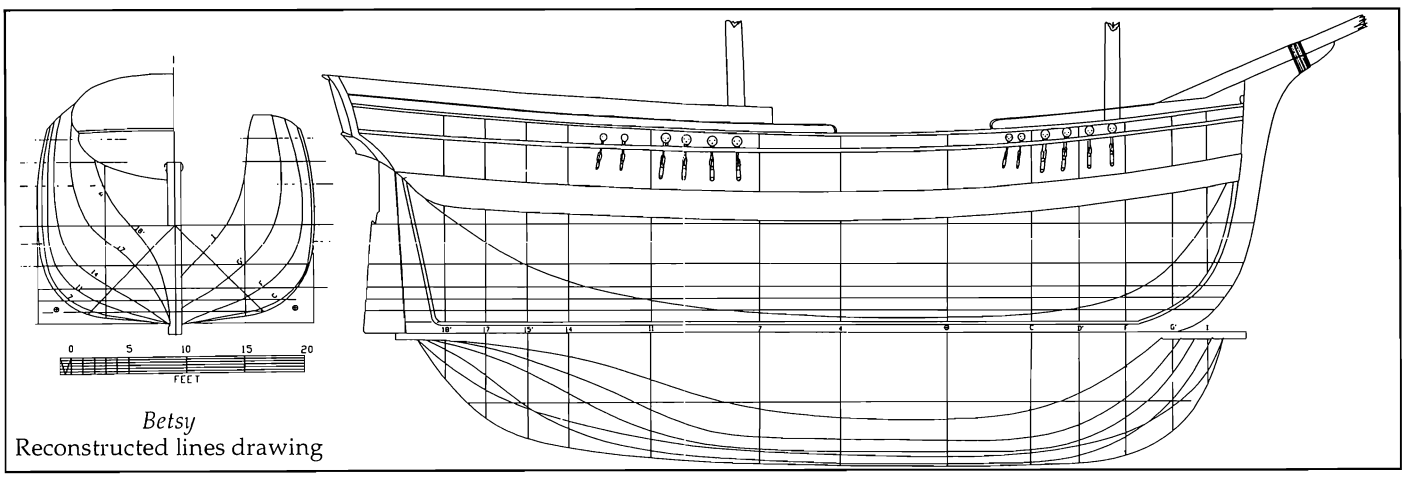
In 1990 the disturbed and partially dismantled wreck was exposed on the bottom, many artifacts had been removed but not given conservation treatment, and volumes of raw data had been collected but neither studied nor published. At precisely this sensitive moment, a budget crisis led Governor Doug Wilder to abolish the state's entire underwater archaeology program. It has proved difficult to convince the public or their elected representatives that archaeology involves more than just "digging stuff up." A public project therefore runs the risk of defunding as soon as artifacts are recovered. It appeared likely that *Betsy*, the best-preserved veteran of an epochal moment in history, had been sacrificed, and 25,000 hours of volunteer labor expended, to absolutely no purpose.

Fortunately, John Broadwater would not give up the ship. While serving out his termination notice, he mobilized volunteers and alternative funding sources to complete excavation, recording, and backfilling of the site. The cofferdam had been planned to provide a permanent interpretive and teaching resource. Instead, it was cut up and used to help cover and protect the remains. A local museum agreed to fund conservation and perpetual curation of the artifacts. That left only the need for a definitive study and publication of the Yorktown Project findings.

Virginia's first (and apparently last) State Underwater Archaeologist had learned from Dr. Bass that "An unpublished site is a looted site." Broadwater therefore obtained individual funding from the National Endowment for the Humanities to complete publication of the 1407-page *Final Report*. The report is designed to be as comprehensive as possible. This will allow professional archaeological readers to reach their own judgment as to whether the data supports the conclusions suggested. Notwithstanding the depth of detail, the report remains informative for even a non-specialist reader. The presentation is extremely readable without compromising the scholarly analysis. Broadwater did an excellent job of selecting and editing the specialists whose 26 reports occupy three of the five volumes (Volume I is a summary and Volume V the catalog of artifacts). There are 333 illustrations and five plates. It is amazing that Broadwater was able to accomplish all this in time off from his new job.

Because of its bulk, the complete *Final Report on the Yorktown Shipwreck Archaeological Project* will be available only in selected repositories around the world, including the Nautical Archaeology library in College Station. It is hoped that a condensed version of the report will be published and more widely distributed in 1997. The editor of the *Final Report* welcomes comments and inquiries. These should be directed to: John D. Broadwater, 295 E. Queens Drive, Williamsburg VA 23185, or e-mail:

jbroadwater@ocean.nos.noaa.gov.



Betsy
Reconstructed lines drawing

News & Notes

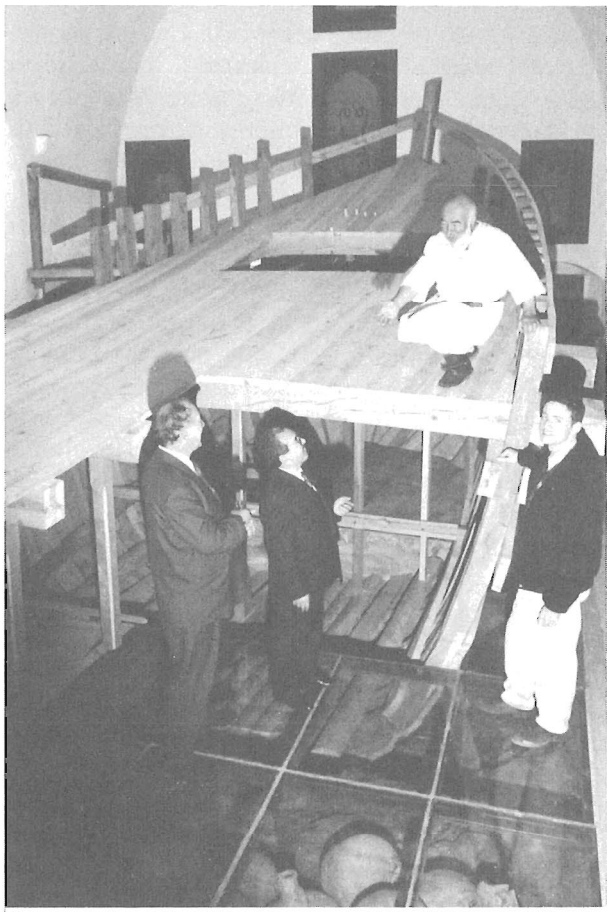


Fig. 1 (above). *A February preview of the* Yassıada *exhibit in the Bodrum Museum of Underwater Archaeology. Left to right, Dr. Oğuz Alpözen (Museum Director), Dr. Oğkan Karaög (President of the Bodrum Lions Club, which has supported the exhibit), Cevat Tarim (dressed as "Captain Georgios"), and Dr. Frederick Hocker (INA President) examine the full-scale replica of the 7th-century ship. Photo by D. Frey.*

Egyptian Survey reveals new sites

INA–Egypt, under the direction of Douglas Haldane, is currently undertaking the first shipwreck survey of the Egyptian Mediterranean coast. The survey extends along the northwest coast from Sidi Abd al-Rahman to Ras Hawala, a distance of about 130 kilometers. The purpose of the survey is twofold: first, to investigate seventeen sites reported as containing amphoras for possible shipwreck remains, and, second, to devise a survey strategy for future exploration in the Mediterranean.

To date, INA–Egypt has investigated twelve submerged sites, including five ancient harbors and one anchorage, and seven coastal land sites, two previously unknown. Material evidence for seafaring discovered during the survey so far ranges in date from the 4th century B.C. to the 7th century A.D. Eight intact amphoras, a stone anchor, and six coins were returned for conservation to the Alexandria Conservation Laboratory for Submerged Antiquities in the National Maritime Museum.

INA–Egypt plans to return in the fall of 1996 to investigate several areas for shipwreck remains in its quest to find a Bronze or Iron Age shipwreck in the Egyptian Mediterranean.

Prof. Wachsmann honored

Shelley Wachsmann, Meadows Assistant Professor of Biblical Archaeology, recently received Level III status with the Explorers Club for the Tantura Lagoon Expedition, which is excavating a Byzantine-era shipwreck in the ancient harbor of Tel Dor, Israel.

Albanian archaeological delegation visits Bodrum

Between 29 February and 3 March 1996 Dr. Namik Bodinaku, Director of the Institute of Archaeology in Albania and Dr. Faik Drini, Chief of the Classical Archaeology Department of the Institute visited INA's headquarters in Bodrum (Fig. 2). They were accompanied by Elizabeth Greene, who has been spending the year in Tirana on a Fulbright Grant studying Albanian prehistory and making plans for a coastal survey along the Ionian and Adriatic coasts of Albania this summer. The visit was arranged with an eye towards clarifying INA's collaboration with the Albanian Institute of Archaeology, and to demonstrate the potential development of a similar museum and research facility in Albania.

Fig. 2 (right). *INA at Bodrum played host to a delegation of Albanian scholars. Back row, from left to right: Dr. Namik Bodinaku, Dr. Frederick Hocker, and Dr. Faik Drini. Front row: Mrs. Nexhmije Bodinaku, Elizabeth Greene, and Mrs. Irma Drini. Photo by C. A. Powell.*

IN MEMORIAM

Richard A. Williford, 1934–1996

It is with great sadness that we report the untimely death of Richard Williford, Chairman of the Board of Directors of INA, in an aircraft accident on 25 April 1996. His wife, Mollie, who was also in the accident, survived with minor injuries. He is also survived by a son, Richard, Jr., a daughter, Monica Williford Powell, and three grandchildren.

Richard was born in Galveston, Texas on 24 December 1934. He attended Texas A&M University, graduating in 1955. He embarked on a career in business, and built a group of successful companies in the fields of energy, real estate, and aviation, headquartered in Tulsa, Oklahoma.

Richard and Mollie believed strongly in public service, and were devoted to using their success to help others. They were tireless in support of important causes in the Tulsa area, and passionately devoted to Texas A&M. They endowed a professorship in the College of Geosciences and Maritime Studies, as well as a number of scholarships. Richard served the University in a number of advisory posts over the years, from President of the Association of Former Students to Chairman of the Board of Trustees of the Texas A&M University Development Foundation during its successful Capturing the Spirit Campaign to raise half a billion dollars for the University.

It was through Texas A&M and his friendship with other Tulsa-based Directors that Richard became aware of and involved in INA. An avid diver, he visited INA's Turkish operation with Mollie, where he dived on the Uluburun wreck. Last year, he and Mollie participated in the dedication of the new headquarters in Bodrum, and visited the Bozburun excavation for another dive. He joined the Board of Directors and Executive Committee in 1993. His calm, reasonable approach to INA's needs was a welcome asset to the management of the Institute in our recent years of expansion. When asked to serve as Chairman, he willingly took on the task with the particular goal of assuring a stable financial future for the Institute. He hoped to bring his extensive experience in fund raising to bear, and had already set to work building the necessary infrastructure, as well as strengthening INA's ties with Texas A&M. In all of these activities, he saw clearly where INA needed to go, and acted to take us there. As Jack Kelley, who preceded him as Chairman, said, "He was exactly the right guy at exactly the right time."

In person, Richard was often quiet (although not at Aggie football games), friendly, and an excellent listener, hearing not just the words spoken but the mood and intent of the speaker. He cared about making the world around him a better place. When he died, he was on his way to College Station to help others. We wish Mollie a speedy recovery, and offer our deepest sympathy to her and the rest of their family and friends.

INSTITUTE OF NAUTICAL ARCHAEOLOGY