

A diver in a dark blue tank is shown underwater, holding a small, ornate metal vessel. The diver is illuminated from below, creating a bright glow around their hands and the vessel. The background is a deep blue, slightly hazy underwater environment.

*Edited by George F. Bass*

*BENEATH  
THE  
SEVEN  
SEAS*

*Adventures  
with the  
Institute of  
Nautical  
Archaeology*

# Resurrecting an Ancient Greek Ship: Kyrenia, Cyprus

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“The bow plank that was a glowing golden color just last week...it’s turning brown. Oxygen must be getting to the wood. We don’t dare leave that hull on the bottom over another winter. But how are we going to raise her?” Laina Wylde Swiny, architect in charge of mapping the ancient ship, up from her morning dive, voiced our worst fears. Were we about to lose the precious treasure lying 27 m (90 ft) below...the most perfectly preserved ancient Greek ship ever found?

It all began in the autumn of 1965. Town councilman Andreas Cariolou, diving for sponges, chanced upon a mound of 80 graceful amphoras emerging from a carpet of eel grass on the flat seabed less than a mile from Kyrenia, his home on the north coast of Cyprus. For two years he kept his secret until meeting my husband Michael Katzev and me and guiding us over the wreck. In the most dramatic dive of our lives we were alone with the ancient jars, now homes for darting squirrelfish, untouched by man for 2,300 years.

Two summers of excavation peeled away layers of cargo, dining wares, tools, ship’s rigging, and even four bone eyelets from a sailor’s sandals. Cradling them like open hands was the still curving ship that had borne them from foreign ports and at last took them to the sea floor. Sixty percent of the ship and more than 75 percent of her representative timbers lay exposed. How could we raise the softened wood before the coming autumn storms?

The ship had sunk on an even keel, her cargo intact, striking the soft bottom and then rolling onto her port side. While currents slowly buried and preserved that side, the bow and stern broke away under the weight of an anchor, amphoras, millstones, and iron ingots. Then the exposed starboard side, easy prey to teredo worms, fell

## Kyrenia

**Built** c 325–315 bc

**Sunk** c 295–285 bc

**Depth** 27–30 m (89–99 ft)

**Found by** Andreas Cariolou

**Excavation** 1968–1969

**Conservation** 1969–1974

**Team** 54 (international)

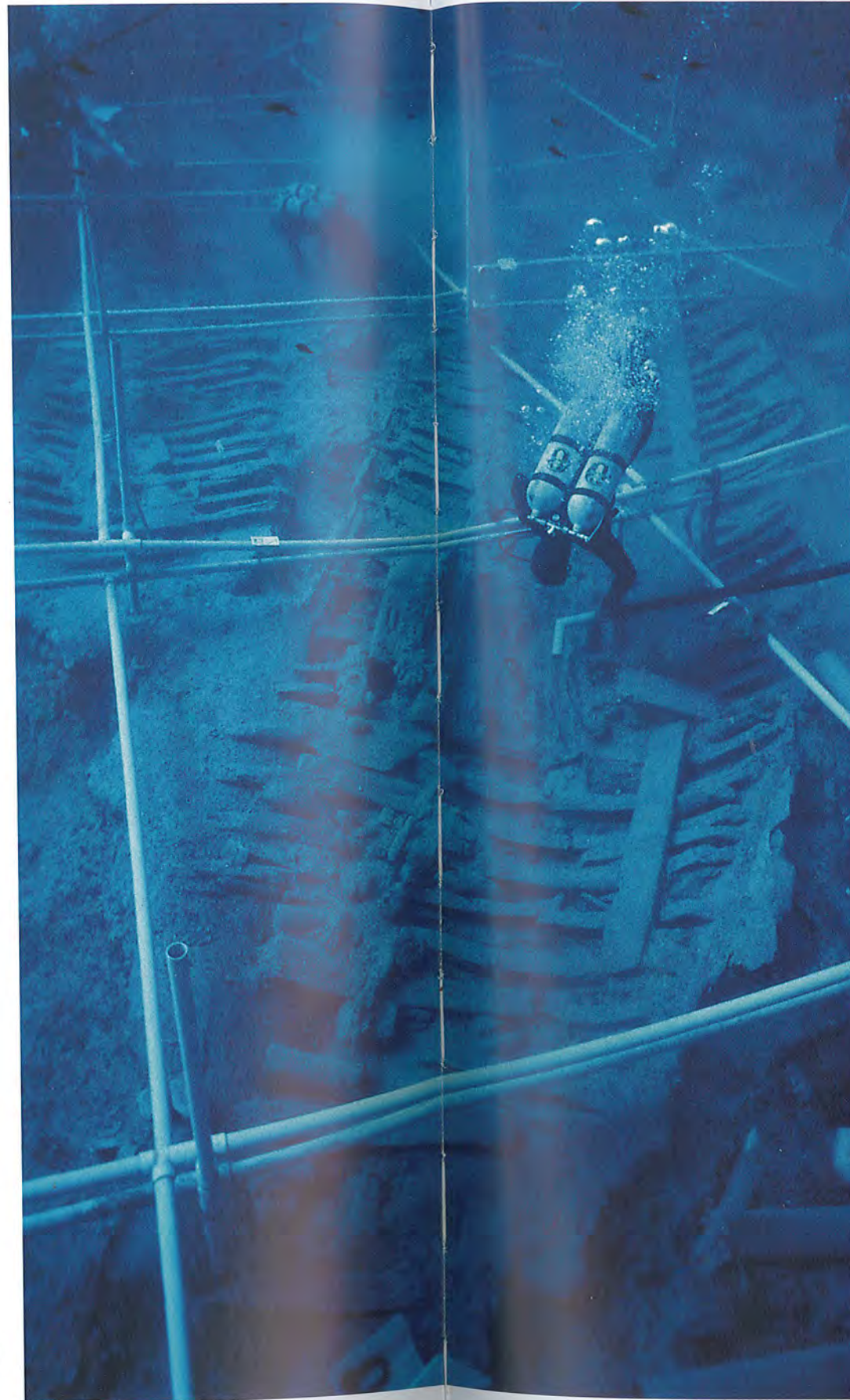
**Total cost** \$300,000

**Hull** 14 m (47 ft) long,

4.2 m (14.5 ft) wide

**Right** With plastic grid frames and one last amphora still in place, the preserved hull is ready for lifting. This bow view shows how the ship broke apart. To the right on the better preserved port side jagged lead sheathing projects beyond the ribs. A few years before sinking this last repair was meant to keep her watertight.

**Opposite above** The author’s first dive over the mound of amphoras from Rhodes that was the tombstone for the Kyrenia Ship.



outward, breaking off from the keel and leaving most of the cargo compressed in the better-preserved port side. Could we raise each side intact? We learned through the American Embassy that no helicopter in the Mediterranean was capable of hoisting 5 tons of our ship off the bottom. We would have to take the delicate hull apart piece by piece.

With rolls of Dymo tape, Laina labeled every scrap of wood. Using three different methods of mapping for insurance, our 54-member team recorded the hull with stereo photos, manual triangulation, and a new invention of movable vertical rods called “the cheesecutter”.

As the first autumn storm strained the moorings of our diving barge, the last lifting trays of wood broke surface and reached the safety of a fresh-water holding pool inside a vaulted gallery of the massive Crusader castle that dominates Kyrenia harbor. Like first parents we scrubbed, bathed, and photographed each timber, then catalogued and made full-scale tracings of each side until thousands of pieces of the old ship were safely recorded. It took seven people five years. Our goal was to preserve and reassemble the original ship inside this gallery.

“We cannot settle for less than 100 percent saturation,” said conservator Frances Talbot Vassiliades, fresh from studies at London University. “Look how this test piece twisted and shrank at lower concentrations...we cannot risk doing that just to save time. So let’s start figuring on years, not months of treatment.” The saturation would be with a water-soluble wax called polyethylene glycol, PEG for short. Visits to European labs had shown that PEG was our only hope. But no one had yet reached 100 percent saturation. So riddled was our ship’s Aleppo pine with ancient teredo worms that the timbers easily soaked up the preservative in heated tanks. Almonds treated in seven months, but hull members demanded over a year for each tank load.



Far left Unloading tanks of now waxy wood, team members Laina Wylde Swiny (left), David Steffy, author Susan Katzev and Netia Piercy sponge off excess wax, then bag the timbers to cool slowly. Left Pieces of the ship's flooring lie atop full-scale tracings on archival mylar. Found fragmented from the weight under water of the millstones and amphoras, these planks bear 22 carved Greek letters, their meaning a mystery. Right Masking tape alignments guide Dick Steffy as he drills a long stainless steel rod to join the wax-filled original timbers. Far right The late excavation director Michael Katzev (left) discusses the ship's original lines with Dick Steffy. Katzev's 30 years of research on the ship will be published in INA's Nautical Archaeology Series by a team of specialists.



At the end, 6,000 separate pieces of the Hellenistic ship lay successfully preserved on shelves in the castle. But who could put Humpty-Dumpty back together again?

Just as Michael Katzev's first lecture in Cyprus had brought the tip leading to Andreas and this spectacular wreck, Michael's lecture in Lancaster, Pennsylvania, attracted the attention of electrical contractor J. Richard Steffy. Dick Steffy's basement models were already testing construction theories for the Yassiada Byzantine ship, but the chance to work on an actual hull sparked him to leave his comfortable business, move with his wife and two sons to Cyprus, and immerse himself in unraveling the secrets contained in the ship's timbers.

### The Ship Speaks

Over four years, aided by Michael and apprentices Robin Piercy and Chip Vincent, Dick pieced the Kyrenia ship back together, pinning the brittle wax-treated timbers to each other using stainless steel rods. "The men who built the Kyrenia ship were real craftsmen," he says. "In fact they were sculptors. Today we are in a hurry and we penny-pinch to use the least materials. So we start a ship by building a skeleton of ribs, or "frames," bolted to the keel, and then we wrap sawn boards around the outside to plank the ship. Kyrenia's builders adzed those outer planks first. They carved away over 70 percent of the original wood to sculpt the entire outer shell, without an interior framework."

Like weaving a basket upwards, the shipwrights joined the first carved plank to the keel using mortise cuttings linked with oak tenons spaced every 12 cm (4.7 in). Pegs locked them together. It took nearly 4,000 mortise-and-tenon joints to attach all the



Above The hull fully reconstructed, representing over four years' work by Dick Steffy and his apprentices.

pre-carved planks edge to edge over the whole 14 m (47 ft) length of the ship, fitting them so tightly that no caulking was needed. Only after eight or nine of the 13 planking rows were securely linked did the Greeks shape the first ribs to fit inside the shell. Driving pure copper spikes from outside through the ribs and clenching them down like staples, the builders locked the ribs in place to stiffen the ship. But the shell of planks was the ship's true strength.

### Life on Board

Launched close to the year Alexander died, 323 BC, our merchantman must have moved tons of cargo through the eastern Mediterranean in the turbulent years when Alexander's surviving generals were carving his empire into kingdoms of their own.

Rhodes, the most prosperous island in the region, whose merchants the orator Lycurgus said, "sail the entire civilized world for trade," used her navy and diplomacy to remain independent of the generals. I believe our merchant captain could have homeported in one of her thriving harbors and that his name began with the letters EUP, which he scratched into the base of a plate designed for dipping tidbits of fish into a spicy sauce. He needed to be literate to keep his books and deal with harbor documents. We found his inkwell and perhaps a personalized wine amphora marked EU. Much of the ship's black glazed pottery lay in two distinct areas – the far bow and stern. A short deck in the bow carried a wooden anchor, its stock filled with poured lead as on the Tektaş Burnu ship (see page 69). Clusters of small folded lead weights tell us that one of two fishing nets was on this deck. In foul weather, the crew slept in the open space below, among seven amphoras from Samos filled with over 10,000 almonds.



Above Jill Scott Black holds the smallest of the ten types of amphoras. The different shapes identified the city or island producing them and can even reveal the approximate date.

Below The ship's pottery served a crew of four. Behind the ladle is a specialty plate designed for dipping tidbits of fish into sauce in the center depression, its base inscribed EUP. Above it, the captain's inkwell.



How many men lived aboard this trader, 14 m (47 ft) long by 4.2 m (14.5 ft) wide? Four oil jugs, four identical drinking cups, four salt dishes, four wine pitchers and four wooden spoons tell the story of a captain and three sailors.

Aft of the foredeck rose the single mast carrying a broad square sail, which reefed upwards through lead brail rings like a Venetian blind. Beside the mast lay logs useful for making on board repairs and iron tools to shape them. Dick thinks a ton or two of cargo is missing from the bow, probably perishables such as food stuffs or cloth.

### Loading Up

I picture our captain and crew at Rhodes loading for their last voyage. They already had the almond-filled Samian jars stowed bow and stern, along with the perishables mentioned above, and a leftover shipment of 29 heavy millstones fashioned on the nearby volcanic island of Nisyros. The odd number, and a lack of matching pairs, suggests that they were sold singly to replace bakers' broken stones, meanwhile serving as ballast in three rows centered over the keel.

Now they filled the open hold with Rhodian amphoras, their conical shape handy for wedging in across the wide-bellied ship. Some jars were stamped on their handles with names of potters, magistrates, or traders, and all had been swirled inside with hot, black pine pitch to make them watertight. The wine they carried – most likely the popular table wine Rhodes exported north to the Black Sea and south to Egypt – took on the resin flavor that survives as “retsina” in modern Greece.

Each full amphora weighs 41 kg (90 lb). We think a circular bronze strap and ring were the end of a hoist our crew used to lift each jar off the dock, swing it inside, and lower it into the neat stacking pattern we found. On Cyprus we made replica amphoras and practiced loading them with all 17 tons of cargo found on the original ship into a sailing replica named *Kyrenia Liberty*. *Liberty* is equipped with her own hoist, called a “mast derrick.” Using pulleys and a hook just like one found in excavation, a crew of four could load a grain mill or offload a full amphora in just 20 seconds. At this rate the entire cargo could easily be loaded in a morning. All together over 380 amphoras in ten different shapes were aboard when the ship left harbor heading east to Cyprus. Just-harvested millet, grape seeds and almonds tell us the season was September or October, and coins and amphoras indicate the year was about 295 to 285 BC.

The helmsman on the aft deck steered with two oars called “quarter rudders.” We found the blade of the starboard rudder lying outside the collapsed stern. Through the hatch near his feet, the captain could drop down into the only closed cabin. Here was a cargo of nearly pure iron ingots; a spare sail, its many lead rings sewn in rows; spare rope and tackle; and a bow drill and other ship's tools. All were preserved inside a large concretion that formed around the iron ingots. A tiny votive lamp, the captain's inkwell, an elegant bronze ladle ending in a duck's head, a fish hook, and many studded nails, possibly decorating a wooden box, were cemented in the mass. The captain's drinking cup and inscribed plate lay nearby.

Here, too, was a marble ceremonial basin resembling a modern birdbath. Such basins are found in sanctuaries and shipwrecks, reminding us of references to ceremonies asking and thanking Poseidon for safe passage. Perhaps our captain was prepared to give thanks for safe arrival in Kyrenia. Whether he ever entered the harbor we will never know.

### Why Did She Sink?

“All those years of voyaging had taken their toll,” Dick learned. “The Kyrenia ship was tired and weak.” After many repairs, with a patched bow and years of teredo worm damage, she had been sheathed in lead as a last effort to keep her watertight. The golden plank Laina had seen was a recent repair. But under the millstones, years of bilge water had softened the old ship's backbone, and the lack of attachment between ribs and keel proved the ship's “Achilles heel.”

Did the captain, knowing of the accumulated ravages from decades at sea, decide to give it all up and scuttle his ship to cover up some shady deal?

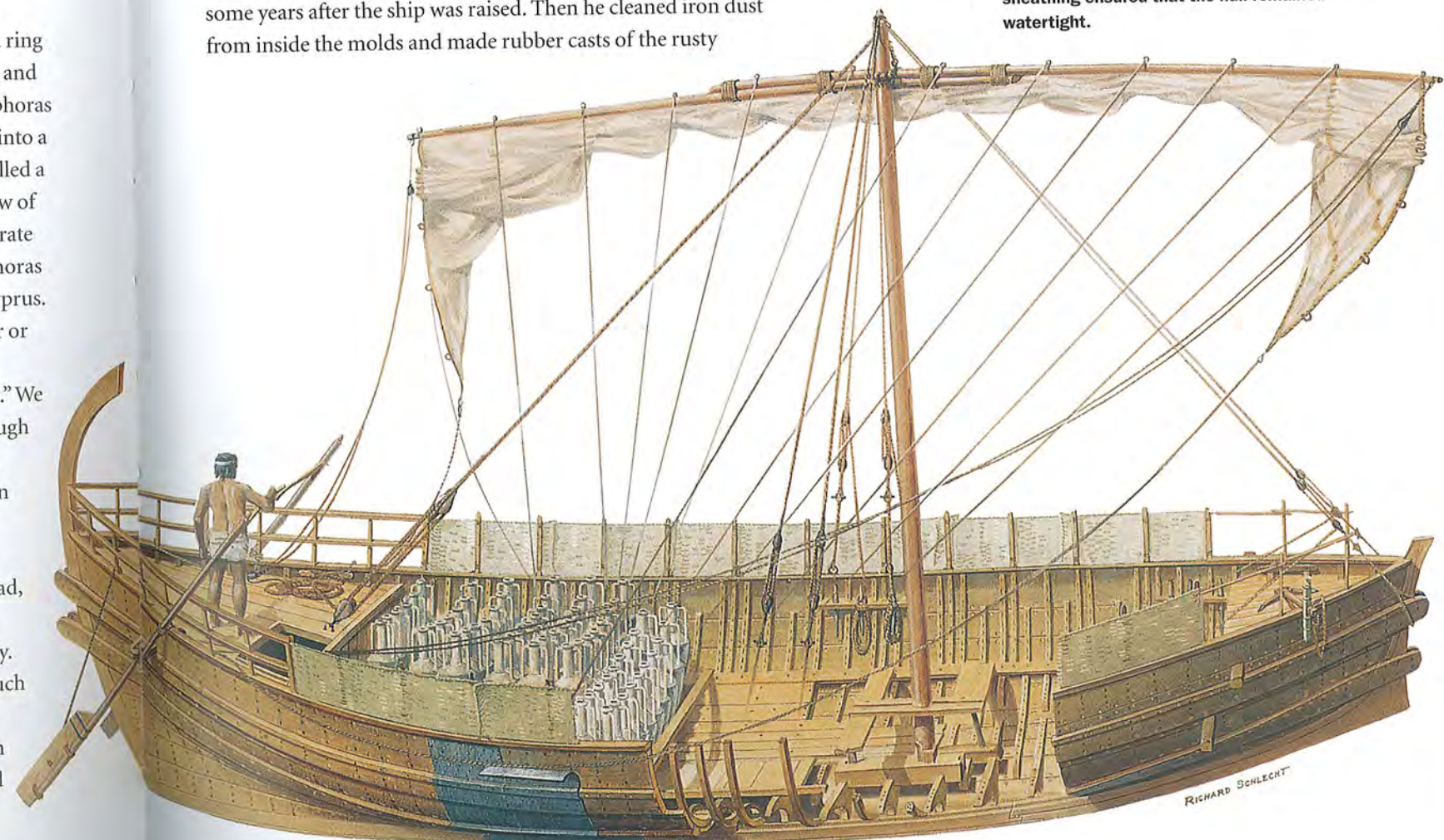
The riddle of her sinking, within sight of Kyrenia, remains unsolved. Violent storms drive down from the Taurus mountains of southern Turkey without warning, and Kyrenia's ancient harbor may have been dangerously exposed. Before the modern breakwater was built the locals always put to sea in the face of incoming storms. Perhaps our merchantman was attempting this maneuver when her old hull finally failed. With no natural hazards to wreck her, this seemed the best explanation until, years into studying the artifacts, we came upon unexpected finds.

“Spears! These are spearheads or maybe javelin tips, and there are eight of them. Look, four have lead sheathing, even scraps of wood attached, and one tip is bent. What were spears doing underneath the hull?” Michael had just sawn apart small lumps of iron concretion that had lain on our storeroom shelves since being found some years after the ship was raised. Then he cleaned iron dust from inside the molds and made rubber casts of the rusty



Above Found beneath the hull, eight iron spearhead or javelin tips survived to be cast in these rubber replicas. Their presence hints at piracy to explain the ship's sinking.

Below A reconstruction of the ship as she may have looked, with cutaway areas to show the cargo and construction techniques used. Lead sheathing ensured that the hull remained watertight.





*Left* Fitting outer planks together over close-spaced tenons, shipyard owner Manolis Psaros (below) and master shipwright Michaelis Oikonomou of Perama, Greece, recreate ancient shell-first construction.

originals – light javelin heads. Had the ship sunk on the site of a previous naval battle? Unlikely. But what if these javelins had been imbedded in our hull during a pirate attack? In a Greek vase painting a pirate ship appears ready to ram a merchantman in her starboard bow. In this area of our ship no wood survived, but our worm-riddled bow would have offered little resistance. Possibly attackers drove javelins into the hull to pull their craft alongside for boarding. With the bow slowly taking water, there would have been time for pirates to snatch up valuables and take captive the four mariners, leaving the ship to sink. Slave markets prospered in Delos, Crete, Syria and the nearby south Turkish coast. But in a kinder scenario, captives could also be ransomed back to their families.

In Alexander's wake, his Macedonian general Antigonos, with his son Demetrius, were now at war with the Egyptian general Ptolemy I. Caught between were the islands of Cyprus and Rhodes. In 306 BC Demetrius captured Cyprus from Ptolemy, then turned his attention to independent Rhodes, sending ships to seize any merchants sailing to Egypt from Rhodes. When the Rhodians refused to yield, Demetrius besieged their island for a year, spreading the noose of his navy and pirates to intercept Rhodian shipping. With Ptolemy's aid the Rhodians broke the siege, preserving their sovereignty. But the seas of the eastern Mediterranean teemed with pirates for years to come.

Piracy would explain why certain things one might expect to find are missing from the wreck. Only seven bronze coins minted 306 to 294 BC were found. These were small change, not the high values needed for business. And how could a ship trade without several sizes of bronze balance scales and sets of weights? This most basic equipment found on other wrecks is absent in ours. What happened to the

*Left* Inside a full-scale section of the hull made for the ship's museum, builder Robin Piercy adds the central flooring known as "limber boards."

*Below* *Kyrenia II*, sponsored by the Hellenic Institute for the Preservation of Nautical Tradition in Athens (president: Harry T. Tzalas), cuts through the Aegean on an experimental voyage from Cyprus to Athens. Spanning the open hold are two pairs of oars for use in harbor. All four crewmen are on the aft deck above the single cabin. Lead rings sewn to the outside sail guide the brail lines that raise and lower it. The eye, seen in Greek vase paintings, stares down evil and sees the course ahead. Two marble eyes were found in the bow of the 440–425 BC merchantman at Tektaş Burnu.

personal possessions of our crew? Four sandal eyelets and two bronze beads were hardly the belongings of four men.

Another sinister surprise waited on the storeroom shelves. A folded lead sheet known as a "curse tablet" had been slipped inside a lead envelope and pierced with a copper spike. Its find spot suggests the spike was driven into the ship's main crossbeam, then clenched downward to hold the curse in place.

Similar tablets found throughout the Greek and Roman world were inscribed with morbid spells naming the curser's enemies and begging gods of the underworld to wreak miseries upon them and their families, dragging their tortured souls down into hell. Tablets found uninscribed, like ours, are thought to be the work of illiterates. Inside our tablet were two pieces of white string, perhaps to bind the accursed down. All materials for the tablet were on board... fish net string, lead sheathing, and the copper spike. Was a seaman disgruntled with the captain? Or had illiterate pirates incanted a spell to bind the sinking ship into the sea? If so, they succeeded... but only for 2,300 years. The old ship has risen to display again the masterful craftsmanship of her builders, and to honor the men who shared her life.

