


Centuries of Preserved Shipwrecks Found in the Black Sea

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An international team of sailors and scientists surveying a sector of the Black Sea for clues about how prehistoric humans responded to rising sea levels have found something much different—41 well-preserved shipwrecks spanning over a thousand years of history, from the ninth century to the 19th century.

The crew made the discovery while mapping the floor of the sea with sonar and remotely operated vehicles (ROVs). They were studying a period about 12,000 years ago when the Black Sea grew much larger, an episode that ultimately contributed to the preservation of the shipwrecks.

“When the last ice age ended about 12,000 years ago, the Black Sea was really the Black Lake,” says [Jon Adams](#), principal investigator on the project and director of the [Centre for Maritime Archaeology at the University of Southampton](#). As temperatures warmed and sea levels rose, saltwater from the Mediterranean began spilling over a rock formation in the Bosphorus Strait. Suddenly the Black Sea was fed by saltwater as well as freshwater rivers, resulting in two distinct layers of water: an oxygenated upper level with less salt and a lower saltwater level without oxygen. “The oxygen drops to zero below 150 meters, which is ideal for the preservation of organic materials,” Adams said.

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This shipwreck from the Ottoman period was discovered 300 meters below the surface of the Black Sea. It's one of a trove of ships recently found by a research vessel.

Photograph by Rodrigo Pacheco-Ruiz, Courtesy EEF, Black Sea Map

In most seawater, wood and rope are among the first things to decay. But the unusual water chemistry of the Black Sea dramatically slows rates of disintegration. Many of the shipwrecks that Adams and his team found were in depths below 150 meters, and some lay as deep as 2,200 meters below the surface.

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The wood of some ships was so well-preserved that chisel and tool marks were still visible on individual planks. Rigging materials, coils of rope, tills,



rudders, and even carved wooden decorative elements have survived the centuries largely intact.

“Nobody has seen anything quite like this before,” Adams says. While historical texts and illustrations give some information about the appearance and construction methods of merchant ships in different periods, Adams hopes the extraordinary preservation of these wrecks will allow archaeologists to independently verify those historical records.

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This ship from the cache of recently discovered shipwrecks is from the medieval period. The unusual chemistry of the Black Sea's depths has kept the ships remarkably well-preserved. The image is a photogrammetric model constructed from over 4,000 high-resolution photographs.

Photograph by Rodrigo Pacheco-Ruiz, Courtesy EEF, Black Sea Map

The earliest of the 41 wrecks appears to be from the late 800s, when the Byzantine Empire controlled much of the region. There were also many sunken Ottoman ships from the 16th through 18th centuries, several 19th-century ships, and a medieval Italian vessel that likely dates to the 14th century. “We know that the Italians were quite prominent in the Black Sea in medieval trade, but to see a vessel of a type that might’ve been recognized by Marco Polo is quite astonishing,” Adams says.

Archaeologists can tell roughly when and from where a ship sailed by analyzing the styles of clay pots in its cargo, the type of anchor, and the arrangement of its mast and rigging.

The majority of the wrecks were merchant transports carrying wine, grain, metals, timber, and other commodities. But some may be what Adams calls “oar-powered Cossack raiding vessels.” However tantalizing the hints of piracy, all the ships seem to have been sunk by storms, not by battles or buccaneers.

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This photogrammetric model of a Byzantine shipwreck shows the *Surveyor* ROV passing over it.

Photograph by Rodrigo Pacheco-Ruiz, Courtesy EEF, Black Sea Map

The team of British, American, and Bulgarian scientists on the survey lived and worked for nearly a month aboard the *Stril Explorer*, a research vessel equipped with powerful underwater mapping technologies. After identifying anomalous shapes on the seafloor with sonar, they used two ROVs, each roughly the size of a minivan and worth \$7-\$8 million, to take high-resolution photos, videos, and laser measurements of the shipwrecks.

Three-dimensional photogrammetry software then combines thousands of still photos shot

from multiple angles to create a complete digital model that can be studied and manipulated. Researchers controlled the ROVs in real time from a command center on the ship, working 24 hours a day to maximize the area of seafloor they could cover with the expensive equipment. The 41 wrecks were dispersed across roughly 2,000 square kilometers.

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The shipwrecks were astonishingly well-preserved. Here, in the detail of the stern of an Ottoman shipwreck, the carved tiller lies by the stern post and rudder. Coils of rope are still hanging from the timbers.

Photograph by Rodrigo Pacheco-Ruiz and Rodrigo Ortiz, Courtesy EEF, Black Sea Map

Sedimentary core samples taken by drilling into the seafloor will ultimately help address the project's original goal of studying how prehistoric people responded to environmental changes in landscapes now submerged by the Black Sea. The core samples will take roughly a year to analyze, and they should answer contested questions about exactly when and how quickly the Black Sea's level rose.

The team will return for a third and final season of surveying next year. But at least for now, their attention has shifted to the more recent historical drama of 41 ships lost at sea.