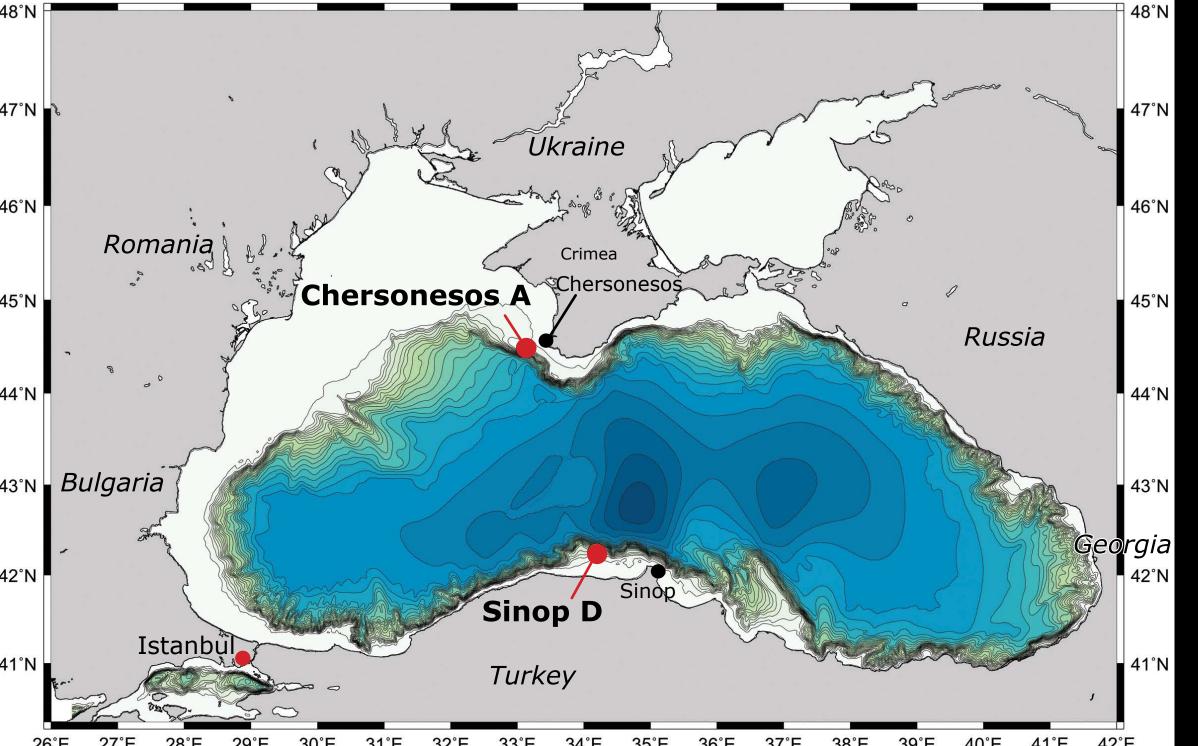
ZANTUM BENEATH THE BLACK SEA

DEEPWATER INVESTIGATIONS OF TWO BYZANTINE SHIPWRECKS, 2007 Robert Ballard (Principal Investigator) • Bridget Buxton (Chief Archaeologist) • Katherine Croff (Chief Scientist) • Dwight Coleman • Michael Brennan • Kathleen Cantner • Christopher Roman, University of Rhode Island;

The August 2007 Black Sea Expedition of the Institute for Archaeological Oceanography at the University sity of Rhode Island (IAO) and the Institute for Exploration (IFE) investigated two Byzantine shipwrecks lying just outside the territorial waters of Ukraine and Turkey. Our goal was the environmental characterization of both sites, and the implementation of long-term site monitoring, decay rate testing, and sediment analyses, in addition to archaeological recording and targeted excavation using IFE's remotely operated vehicle (ROV) Hercules. We conclude with a preliminary assessment of our abil-

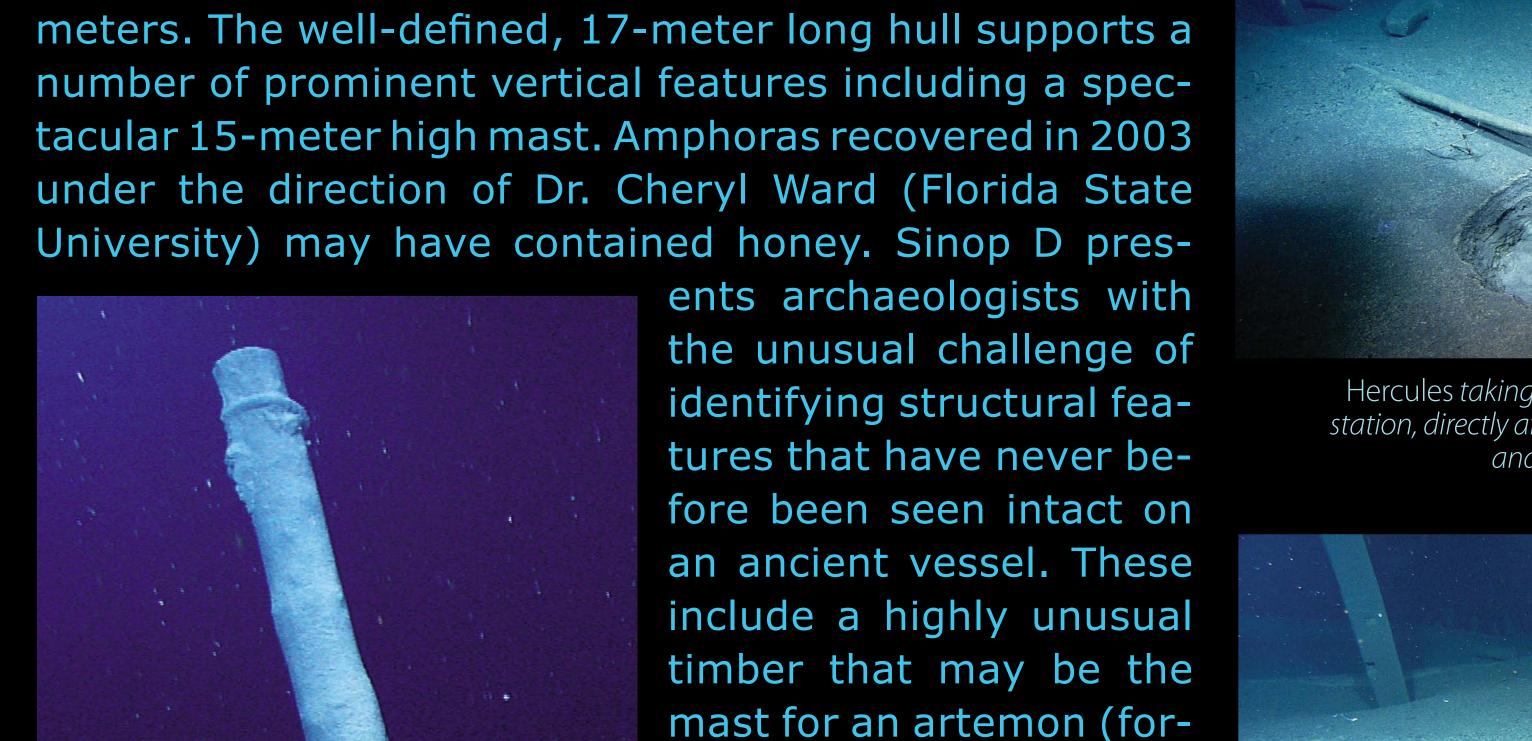
🗽 ity to record, excavate, monitor, and conserve deepwater sites as underwater museums using oceanographic tools and technology.



Bathymetric map of the Black Sea showing the locations of the two Byzantine wrecks.

Bathymetric map and photomosaic of the Chersonesos A wreck site., 2007.

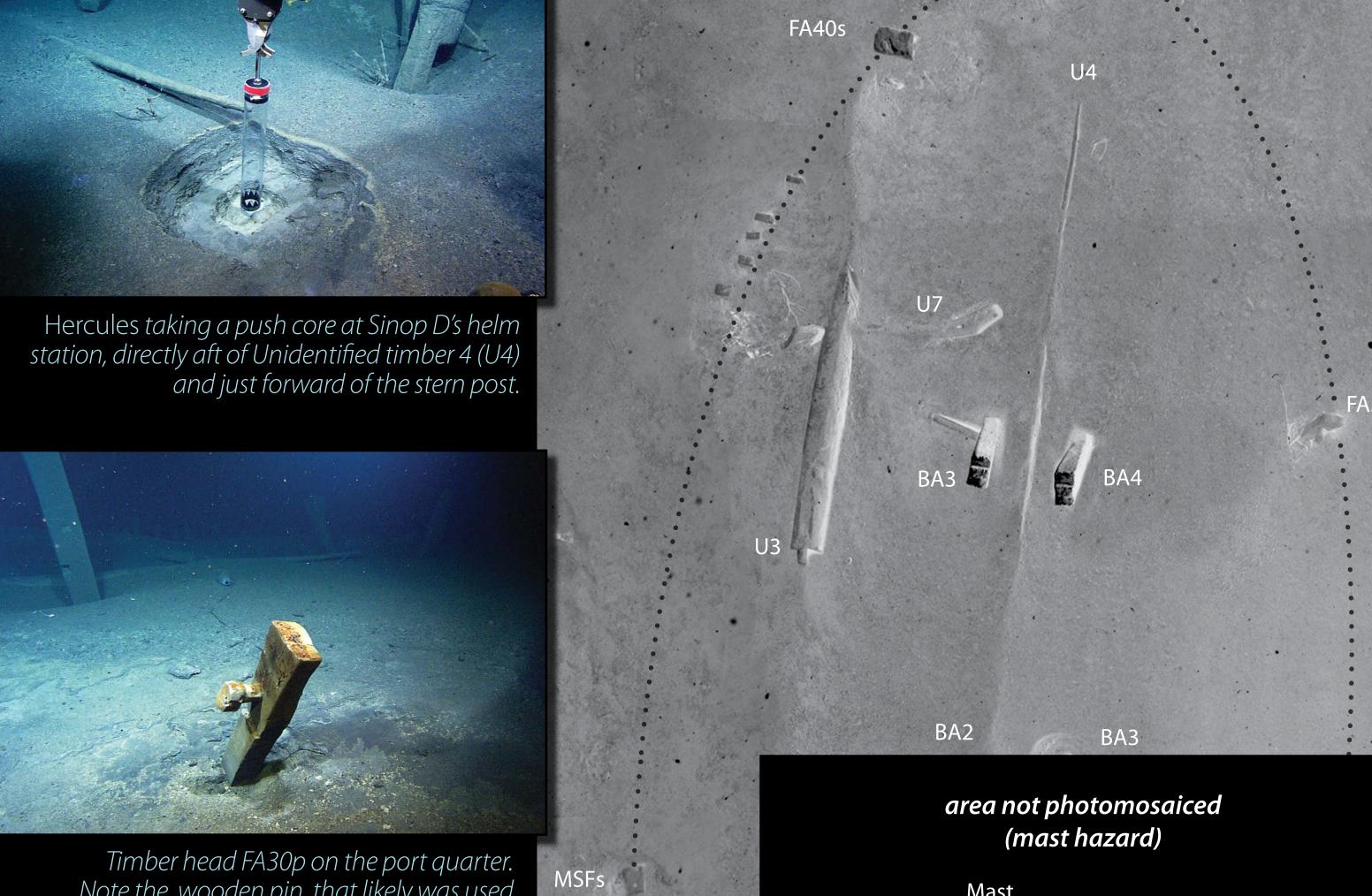
Mapping of the shipwrecks was conducted using both visual and acoustic recording, completed by flying the ROV Hercules over each site in a line pattern at a constant altitude above the seafloor. The cameras and multibeam sonar gathered data which was later processed to produce multi-image photomosaics and precise bathymetric (bottom topography) maps.



mast for an artemon (forward sail), which would certainly be a surprising discovery on a vesse previously assumed to be lateen-rigged. Our very limited 2007 excavation focused on revealing key

trap, quickly refilling excavated areas without any apparent damage to the exposed hull. Sinop D is a fragile monument and the technology to excavate it more extensively is still in development.

C.E.) lies northwest of that Turkish coastal city at 324







A custom designed artifact rack secures artifacts remov

The Black Sea in antiquity supported a vibrant trade in raw materials and luxury goods between the Mediterranean and the hinterlands of Europe and Asia. In contrast to the Mediterranean, however, the Black Sea has a stratified water column with three distinct layers. The warm, low salinity, low density surface water is oxic, or well oxygenated. Between 100 and 150 meters lies the suboxic zone, which has low levels of both oxygen and hydrogen sulfide. Finally, the anoxic layer consists of cold, dense, saline water that has no oxygen and is highly sulfidic. The lack of organisms that feed on organic material in these oxygen-starved depths provides a uniquely preservative environment for archaeological material. The Black Sea is effectively the world's largest underwater museum.

The 2001 UNESCO Convention for the protection of the Underwater Cultural Heritage (CPUCH*) chal- Hercules excavated each site using a combination of jetlenges archaeologists to consider in situ preservation as the first option. The cost and technical challenges of ting and suction tools, and an assortment of paintbrushes and deep submergence excavation and artifact conservation makes this a particularly appropriate philosophy for other equipment akin to the toolkit of an underwater archaedeepwater sites in the Black Sea. In addition, CPUCH promotes public access to in situ underwater cultural heri- ologist. Tethered above, IFE's ROV Argus provided additional tage. Recent developments in telepresence technology are already making remote monitoring and permanent cameras, as well as buffering the link between Hercules and public access to deepwater sites feasible. The challenge for this new generation of 'underwater museums' is to our surface support vessel, the NATO ship NRV Alliance.

reconcile historical investigative goals with accessibility and sustainability.

Two Byzantine Shipwrecks were the focus of our 2007 field season. The early medieval Chersonesos A shipwreck sank in suboxic depths south of the Crimean peninsula, and the well-preserved early Byzantine Sinop D shipwreck lies fully in the anoxic zone off the coast of Sinop, Turkey. Our ongoing investigation addresses deepwater preservation under differing levels of oxygen depletion, with a view to understanding the condition and conservation requirements of both shipwrecks. At deepwater sites such as Chersonesos A and Sinop D, the wealth of information (including ancient DNA) that we would like to recover and analyze must always be balanced against the cost and (at this early stage) unpredictability of the successful long-term conservation of a large ceramic cargo. This season we recovered two Chersonesos ars at the request of the coastal state (Ukraine), and we anticipate exploring a 'catch and

release' strategy on future expeditions. After the jars and their contents have been recovered and analyzed (a relatively swift and easy operation given the lack of marine concretion) they will be returned to the area of the site, and secured on custom-designed racks as part of an evolving interpretive display.

At each shipwreck we deployed conservation experiments and applied a different model of nautopsy, a set of protocols for site recording, environmental characterization, targeted excavation, and sample recovery. The guiding principle of nautopsy is to combine archaeological and scientific investigation with sustainable archaeology, with a view to either preserving a shipwreck intact on the sea floor (Sinop D)

> or excavating and reconstituting the site as an underwater museum (Chersonesos A).

Environmental Analysis and monitoring of deepwater sites help us to understand their unique conservation requirements, both for the stabilization of recovered artifacts and for the long term safeguarding of the wrecks themselves. Sediment cores were collected to investigate changes in geomorphology and geochemistry in proximity to the shipwrecks. Hercules obtained push cores directly adjacent to the wrecks and up to 10 meters distant. These will be freeze dried and analyzed for micromorphology, mineralogy, and organic content. Water samples were col-

lected with a Niskin bottle to quantify trace elements in the water column, and wood cores were

obtained using an increment borer. Sensor packages containing temperature, salinity, depth, oxygen, and current meters were left in place at both anoxic and suboxic locations near the Sinop D site for year-round data collection.

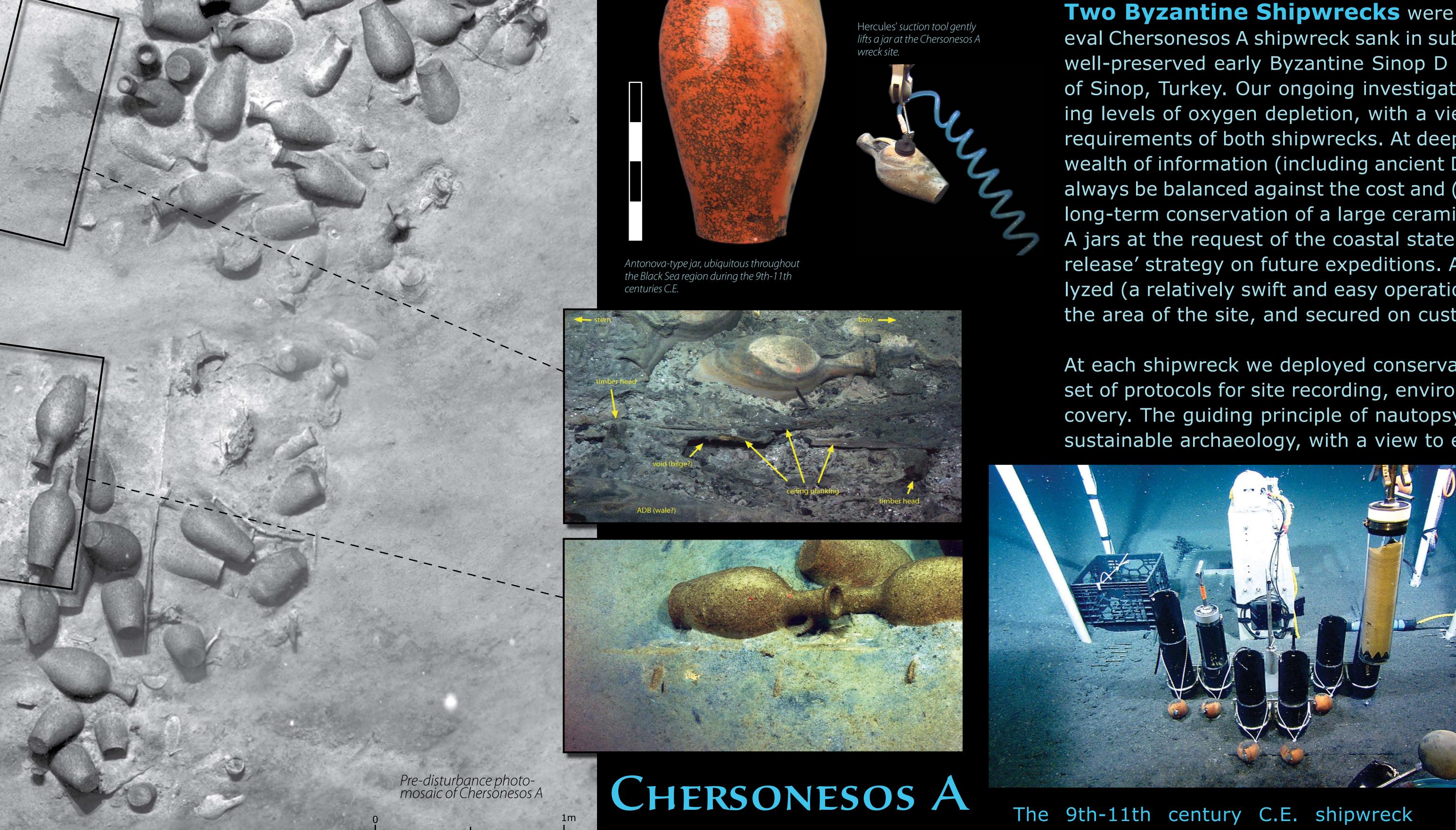
for varying time periods. They will then be retrieved periodi- deepwater sites as underwater museums. cally and analyzed to help us understand what rates and types water sites in oxygenated waters elsewhere in the world.

Sustainability, Accessibility, and Archaeological Oceanography

As private enterprise moves into the deep sea with budgets that far outstrip the resources usually available to public institutions, it is imperative for the safeguarding of humanity's underwater cultural heritage that archaeologists find a way to keep pace. One option available to archaeologists is to join forces with marine scientists, accessing oceanographic budgets and tools by combining historical and scientific research questions with ocean exploration and experimental technological development. These goals are integral to the emerging interdisciplinary field of archaeological

While recognizing that complete excavation is the best way to understand an ancient shipwreck, for the majority of deepwater sites this is neither feasible nor justified. The concept of 'nautopsy' is a research model suitable for the investigation of deepwater sites using current technology. In designing long-term research and site management plans for Chersonesos A and Sinop D, we were also guided by the principles outlined by the Annex to the UNESCO CPUCH, **Decay Rate Experiments** (called "twinkies" and "ke- which advocates sustainable archaeology through in situ preservation, as well as public accessibility, and the involvebabs") were deployed at each site. These samples of modern ment of the coastal states. Our 2007 field season represents continuing steps of a multi-decade project to combine wood, metal, bone, leather and grain will be allowed to decay comprehensive archaeological investigation, including excavation, with the preservation and eventual public display of

of decay we might expect as we excavate the ancient artifacts. As deep submergence excavation technology develops, the depths of the Black Sea are likely to become one of the of each site. These simulations will also help us predict how most significant sources of new information about the ancient world, opening up a new frontier of archaeological diswell the anoxic deepwater environment of the Black Sea will covery. The legacy of 'Byzantium beneath the Black Sea' has survived for more than a millennium in an incredible state serve as an underwater museum and how the site formation of preservation, conserved in a unique chemical environment about which we still have much to learn. Even while exprocesses in the deep Black Sea compare with those of under- ploration and excavation continues, the Black Sea itself will likely remain the ultimate museum for safeguarding these shipwrecks for future generations.



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Chersonesos A, discovered in 2006, lies at 135 meters depth off Sevastopol. This small ship (8 x 3 meters) carried a primary cargo of about 200 flat-bottomed, one-handled jars, 23 of which were tagged, placed in a depot area and catalogued. Two were raised for analysis and sent to Kyiv for conservation. The hull remains are surprisingly well-preserved, with the tops of eight timber heads (frames) and other wooden elements visible in the initial mosaic. Center for Coastal and Ocean Mapping, University of New Hampshire; French Research Institute for Exploitation of The removal of some of the jars revealed additional timbers, including more timber heads, side strakes, ceiling planks, possible deck planking and a probable spar or wale. The type of joinery remains unknown. Future work on this vessel and Sinop D will provide the data we require to form a picture of Black Sea shipbuilding traditions which remain virtually unknown before the Otto-

