BYZANTIUM BENEATH THE BLACK SEA

DEEPWATER INVESTIGATIONS OF TWO BYZANTINE SHIPWRECKS, 2007

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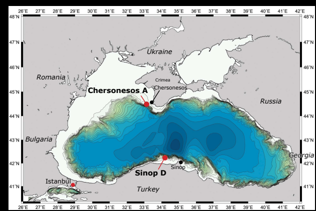
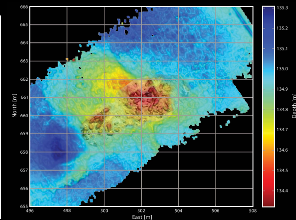
Khalde mosaic, Lebanon, 5th-6th cenuties C.E.

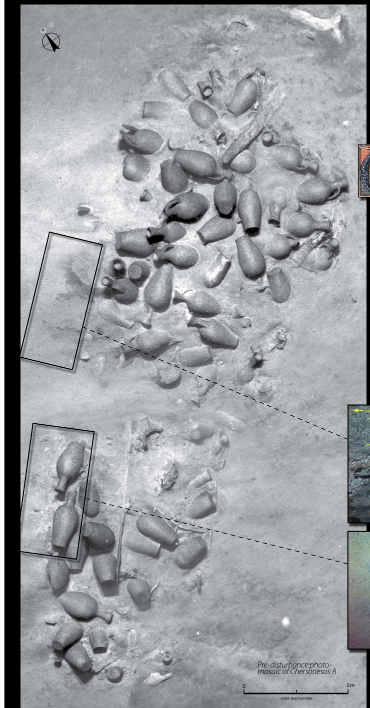
The August 2007 Black Sea Expedition of the Institute for Archaeological Oceanography at the University of Rhode Island (IAO) and the Institute for Exploration (IFE) investigated two Byzantine shipwrecks lying just outside the territorial waters of Ukraine and Turkey. Our goal was the environmental characterization 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 ability 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.

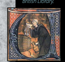


Pre-disturbance photo-mosaic of Chersonesos A

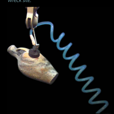
The Black Sea in antiquity supported a vibrant trade in raw materials and luxury goods between the Mediterranean and the hinterlands of Europe and Asia. In contrast to the Mediterranean, however, the Black Sea has a stratified water column with three distinct layers. The warm, low salinity, low density 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*) challenges archaeologists to consider in situ preservation as the first option. The cost and technical challenges of deep submergence excavation and artifact conservation makes this a particularly appropriate philosophy for deepwater sites in the Black Sea. In addition, CPUCH promotes public access to in situ underwater cultural heritage. Recent developments in telepresence technology are already making remote monitoring and permanent public access to deepwater sites feasible. The challenge for this new generation of 'underwater museums' is to reconcile historical investigative goals with accessibility and sustainability. (* not yet ratified)

From Aldobrandino's Li Livres du Sante, France. British Library.



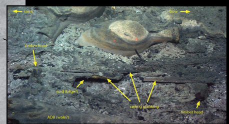
Antonova-type jar, ubiquitous throughout the Black Sea region during the 9th-11th centuries C.E.

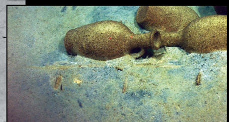


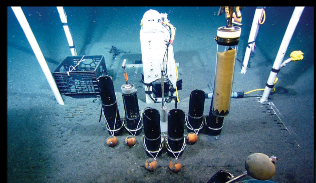
Hercules' suction tool gently lifts a jar at the Chersonesos A wreck site.

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 A jars 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).



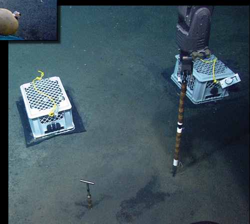




CHERSONESOS A

The 9th-11th century C.E. shipwreck 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. 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 Ottoman period.

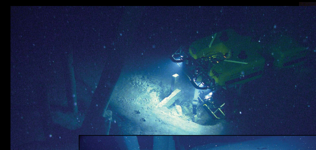
Environmental Analysis and monitoring of deepwater sites help us to understand their unique conservation requirements, both for the stabilization of recovered artifacts and for the long term safeguarding of the wrecks themselves. Sediment cores were collected to investigate changes in geomorphology and 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 collected 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.

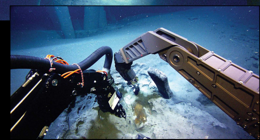


Decay Rate Experiments (called "twinkies" and "kebabs") were deployed at each site. These samples of modern wood, metal, bone, leather and grain will be allowed to decay for varying time periods. They will then be retrieved periodically and analyzed to help us understand what rates and types of decay we might expect as we excavate the ancient artifacts of each site. These simulations will also help us predict how well the anoxic deepwater environment of the Black Sea will serve as an underwater museum and how the site formation processes in the deep Black Sea compare with those of underwater sites in oxygenated waters elsewhere in the world.

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.

Hercules excavated each site using a combination of jetting and suction tools, and an assortment of paintbrushes and other equipment akin to the toolkit of an underwater archaeologist. Tethered above, IFE's ROV *Argus* provided additional cameras, as well as buffering the link between *Hercules* and our surface support vessel, the NATO ship NRV *Alliance*.

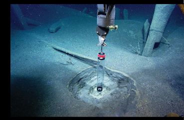




(top) *View from IFE's ROV Argus of Hercules excavating on the port side amidships of Sinop D. Several amphoras were recovered from this area in 2003, and one more in 2007. Note the notched throughbeam.* ***(above)*** *Hercules clearing sediment from around the starboard area amidships. The flat timber in the foreground is the other end of the throughbeam seen in the top image.*

SINOP D

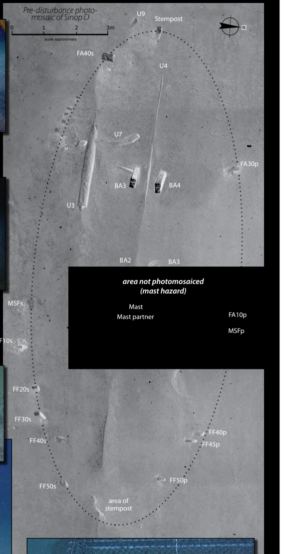
Sinop D (carbon dated to 410-520 C.E.) lies northwest of that Turkish coastal city at 324 meters. The well-defined, 17-meter long hull supports a number of prominent vertical features including a spectacular 15-meter high mast. Amphoras recovered in 2003 under the direction of Dr. Cheryl Ward (Florida State University) may have contained honey. Sinop D presents archaeologists with the unusual challenge of identifying structural features that have never before been seen intact on an ancient vessel. These include a highly unusual timber that may be the mast for an artemon (forward sail), which would certainly be a surprising discovery on a vessel previously assumed to be lateen-rigged. Our very limited 2007 excavation focused on revealing key elements of the hull construction. Fortunately the site itself is a sediment 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.

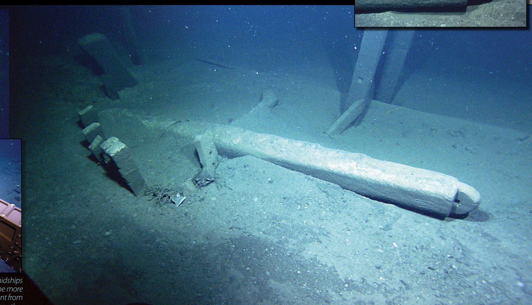


Hercules taking a push core at Sinop D's helm station, directly aft of Unidentified timber 4 (U4) and just forward of the stern post.

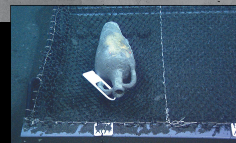
Timber head FA30p on the port quarter. Note the wooden pin that likely was used for securing rigging.

Closeup view of the forward end of Unidentified timber 3 (U3). Note the square shape of the penetration.





View looking aft on the starboard quarter of Sinop D. Note the series of timber heads on the left, aft of which is a rudder support and the stern post. A pair of bits (BA3, 4) rise from the seabed in the upper right. Unidentified timber 3 (U3) stretches aft, well beyond the perimeter of the hull. Its function remains unknown but may have been a fore-mast holding an artemon sail.



A custom designed artifact rack secures artifacts removed from the wreck during excavations in 2007.

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 oceanography.

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, which advocates sustainable archaeology through in situ preservation, as well as public accessibility, and the involvement of the coastal states. Our 2007 field season represents continuing steps of a multi-decade project to combine comprehensive archaeological investigation, including excavation, with the preservation and eventual public display of deepwater sites as underwater museums.

As deep submergence excavation technology develops, the depths of the Black Sea are likely to become one of the most significant sources of new information about the ancient world, opening up a new frontier of archaeological discovery. The legacy of 'Byzantium beneath the Black Sea' has survived for more than a millennium in an incredible state of preservation, conserved in a unique chemical environment about which we still have much to learn. Even while exploration and excavation continues, the Black Sea itself will likely remain the ultimate museum for safeguarding these shipwrecks for future generations.

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