Historia marítima y de la navegación en el Caribe e Iberoamérica
Especialización en Patrimonio Cultural Sumergido
Cohorte 2019

Arq. en Aguas Profundas III

Part 1

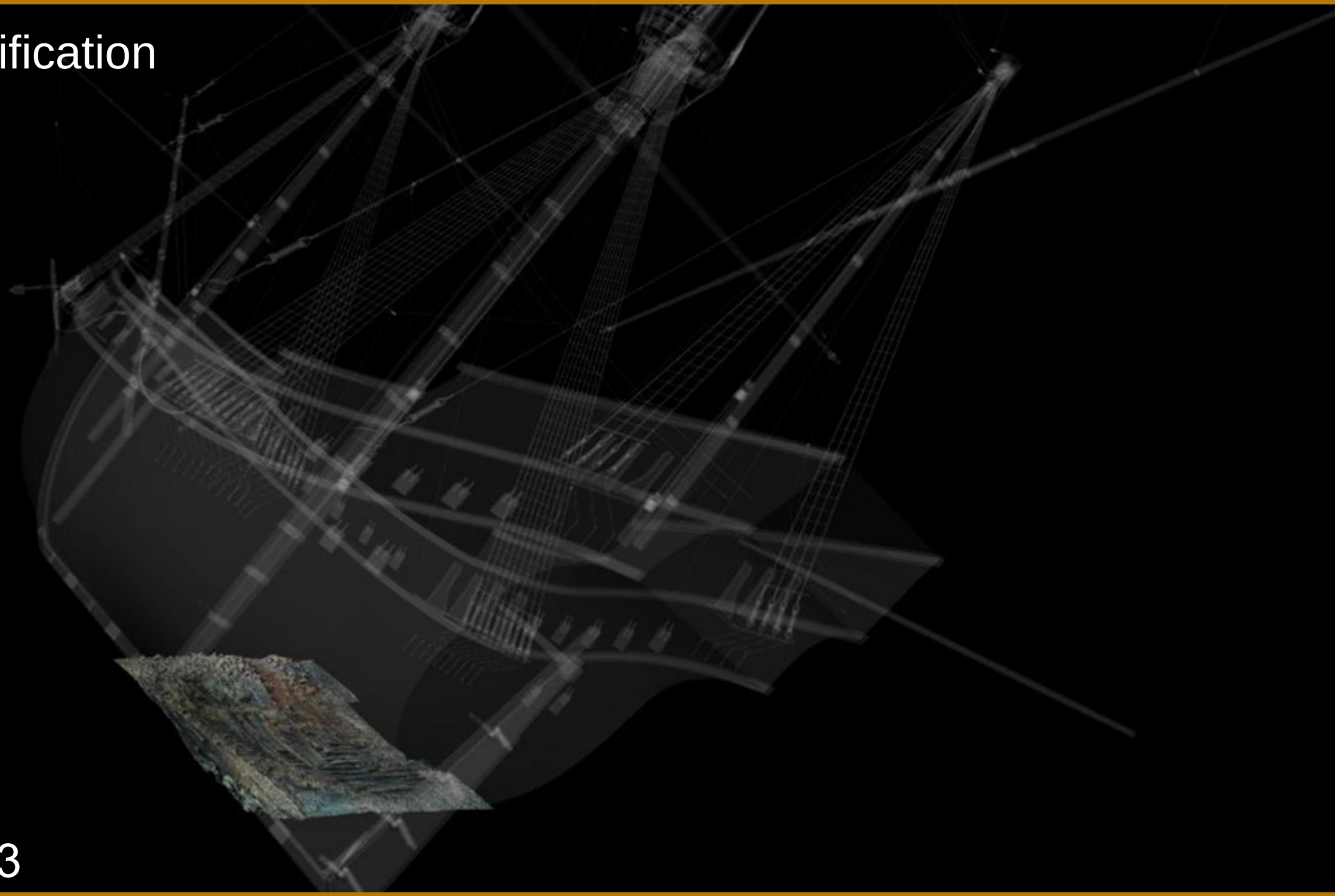
Filipe Castro
Bogotá, April 2019

J. Richard Steffy Ship Reconstruction Laboratory
ShipLAB
TEXAS A&M UNIVERSITY

1. Photogrametry

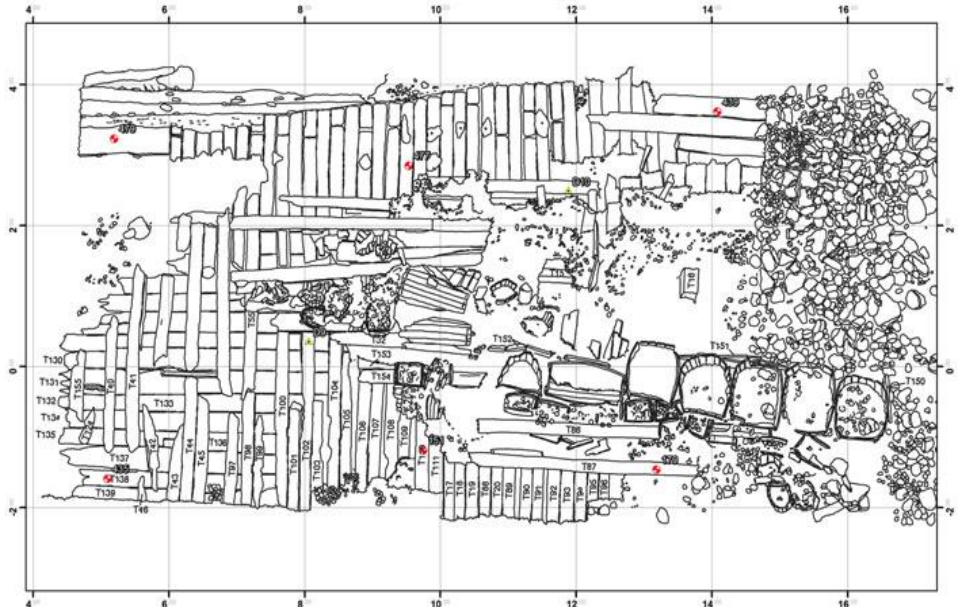
Kotaro Yamafune
Gnalić Shipwreck, 1583

2. Interpretation / identification

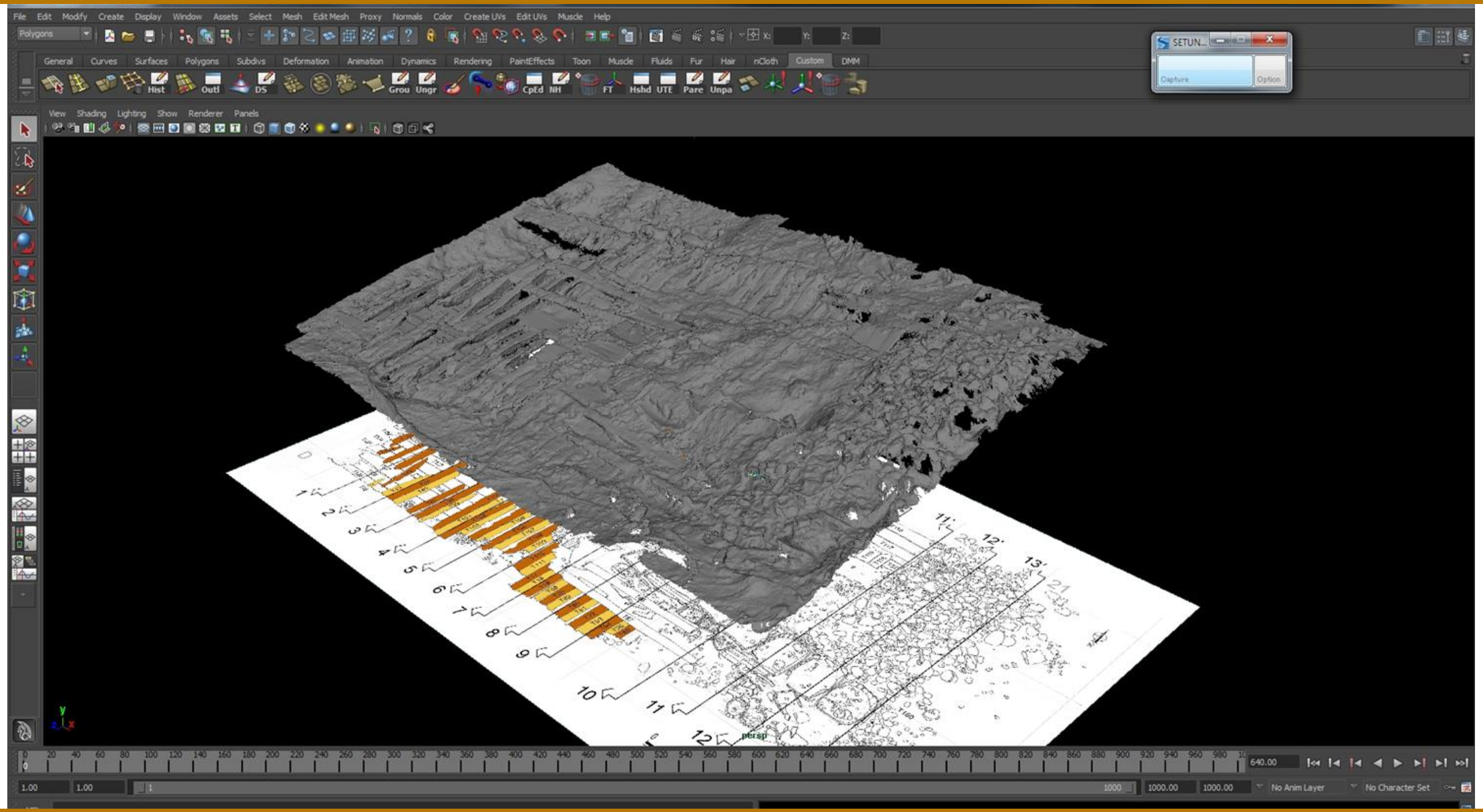


Kotaro Yamafune
Gnalić Shipwreck, 1583

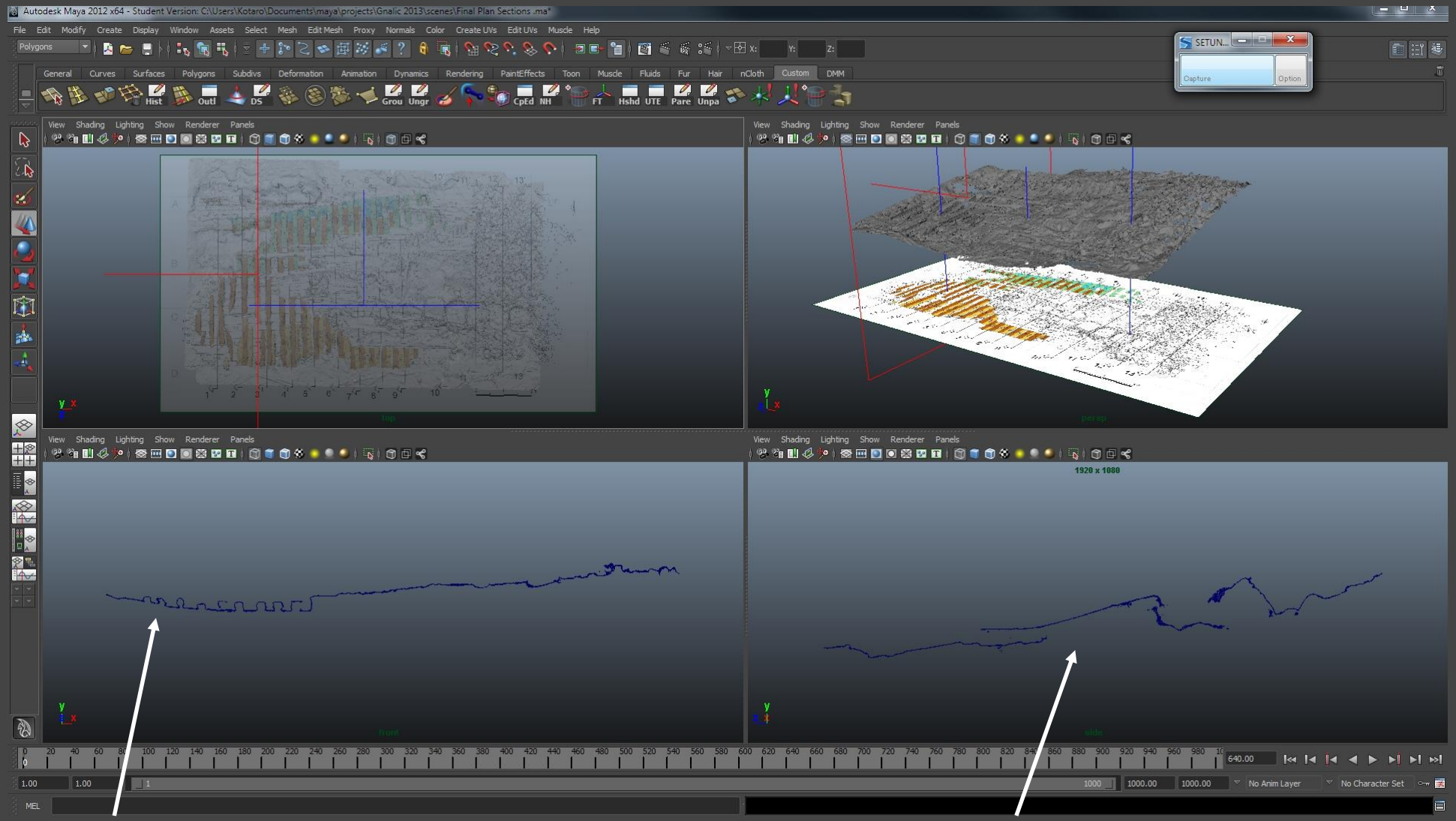
Recording Strategies



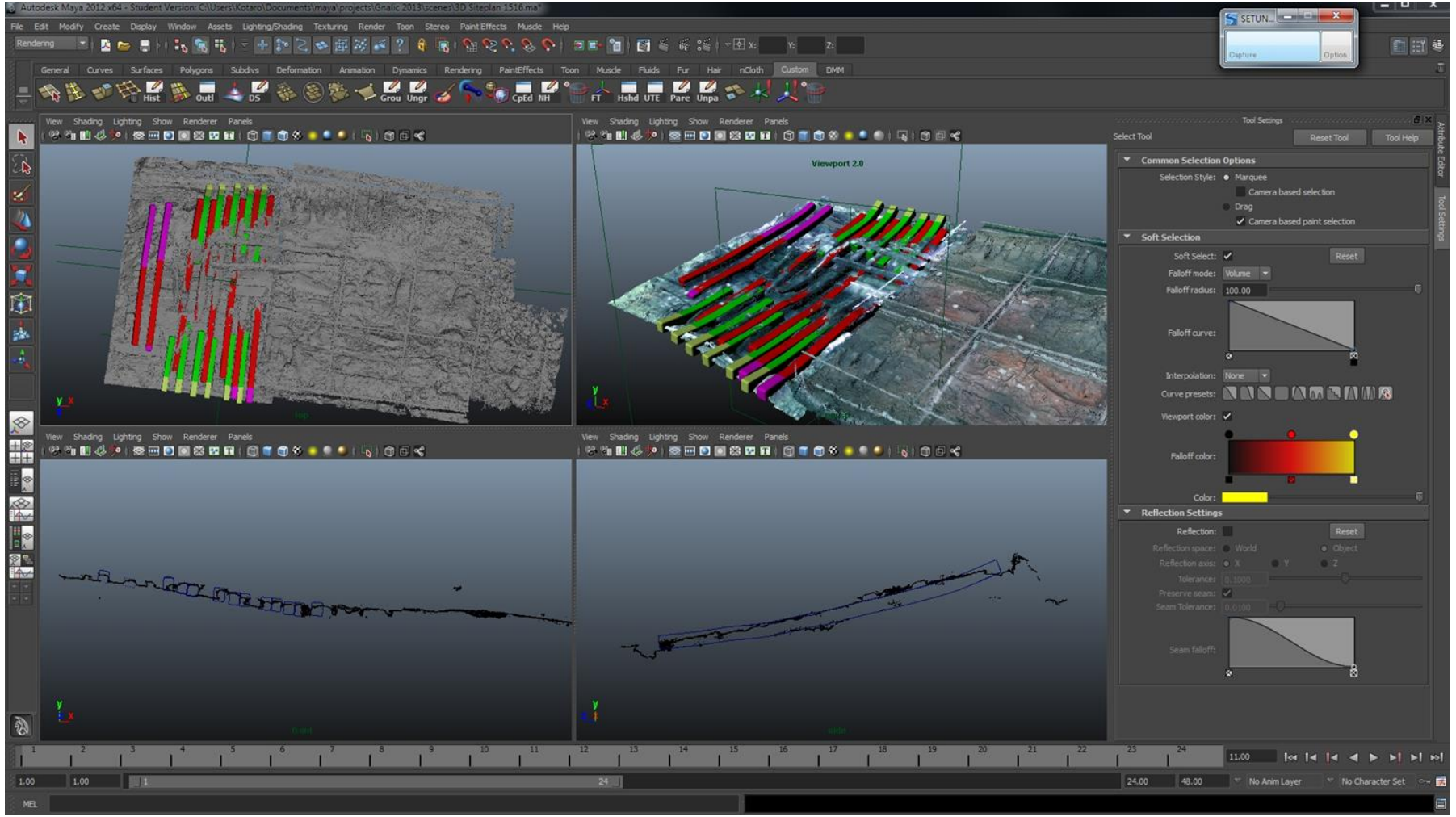
Recording Strategies



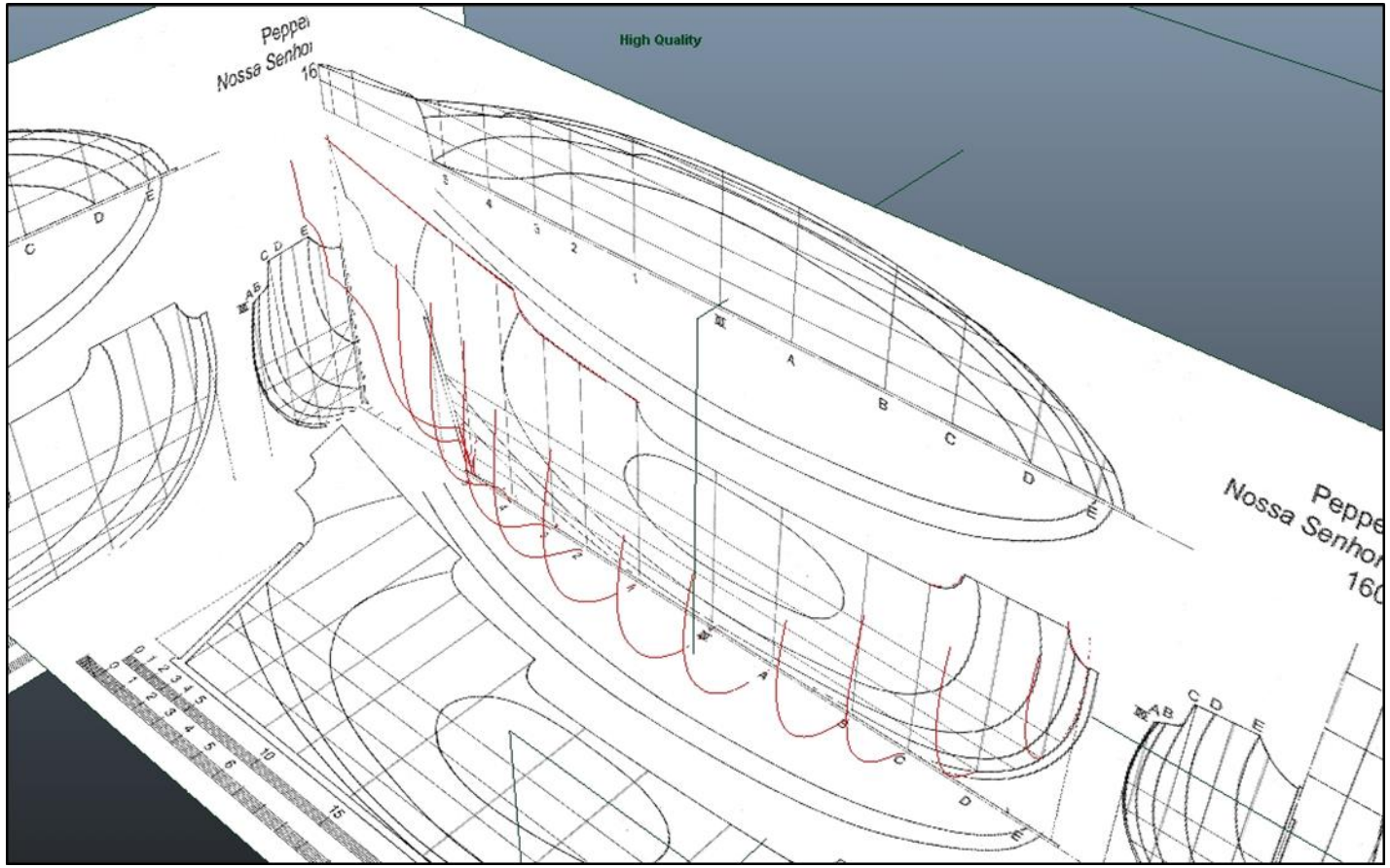
Recording Strategies



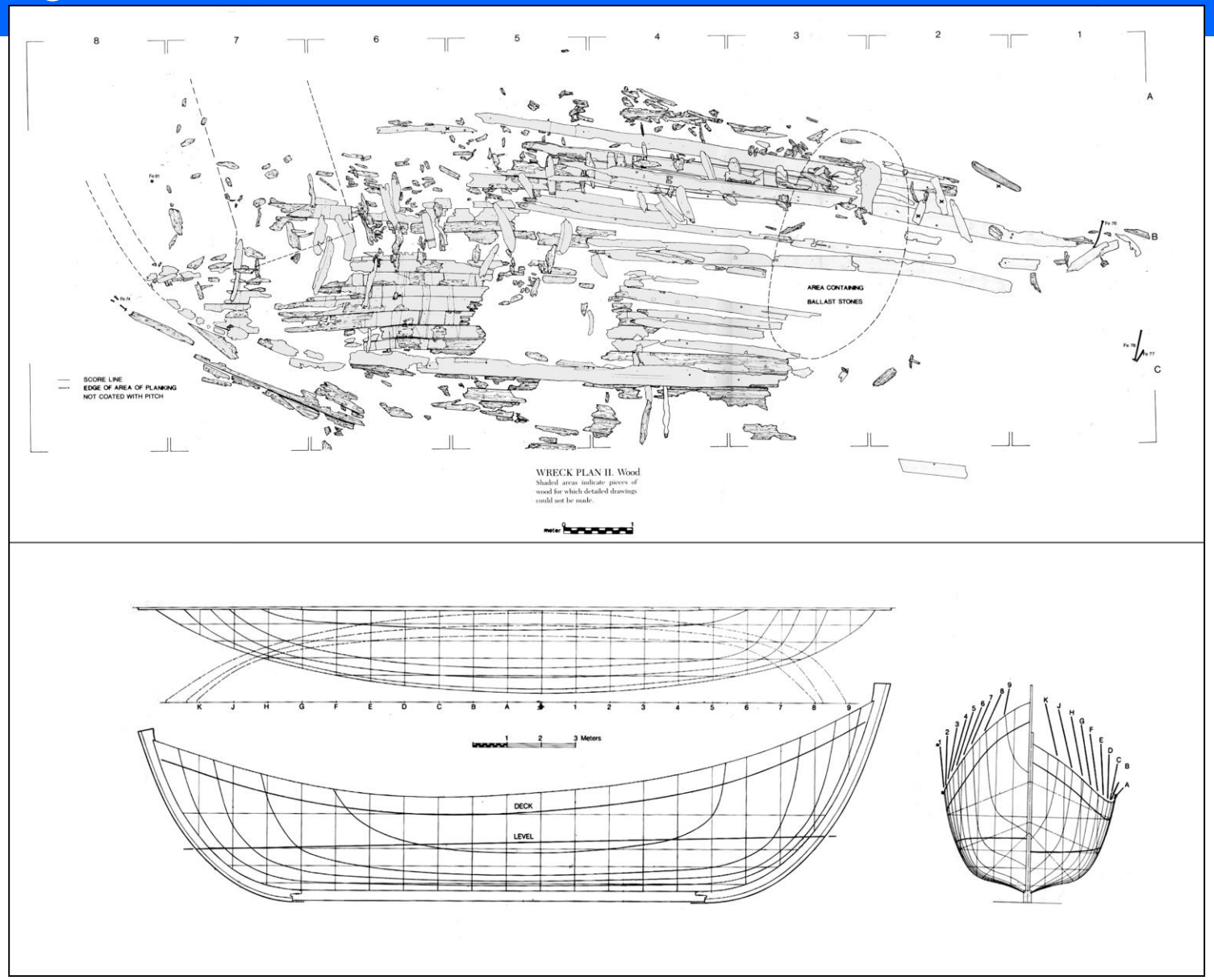
Lines Drawings and Photogrammetry



Reconstructing Strategies

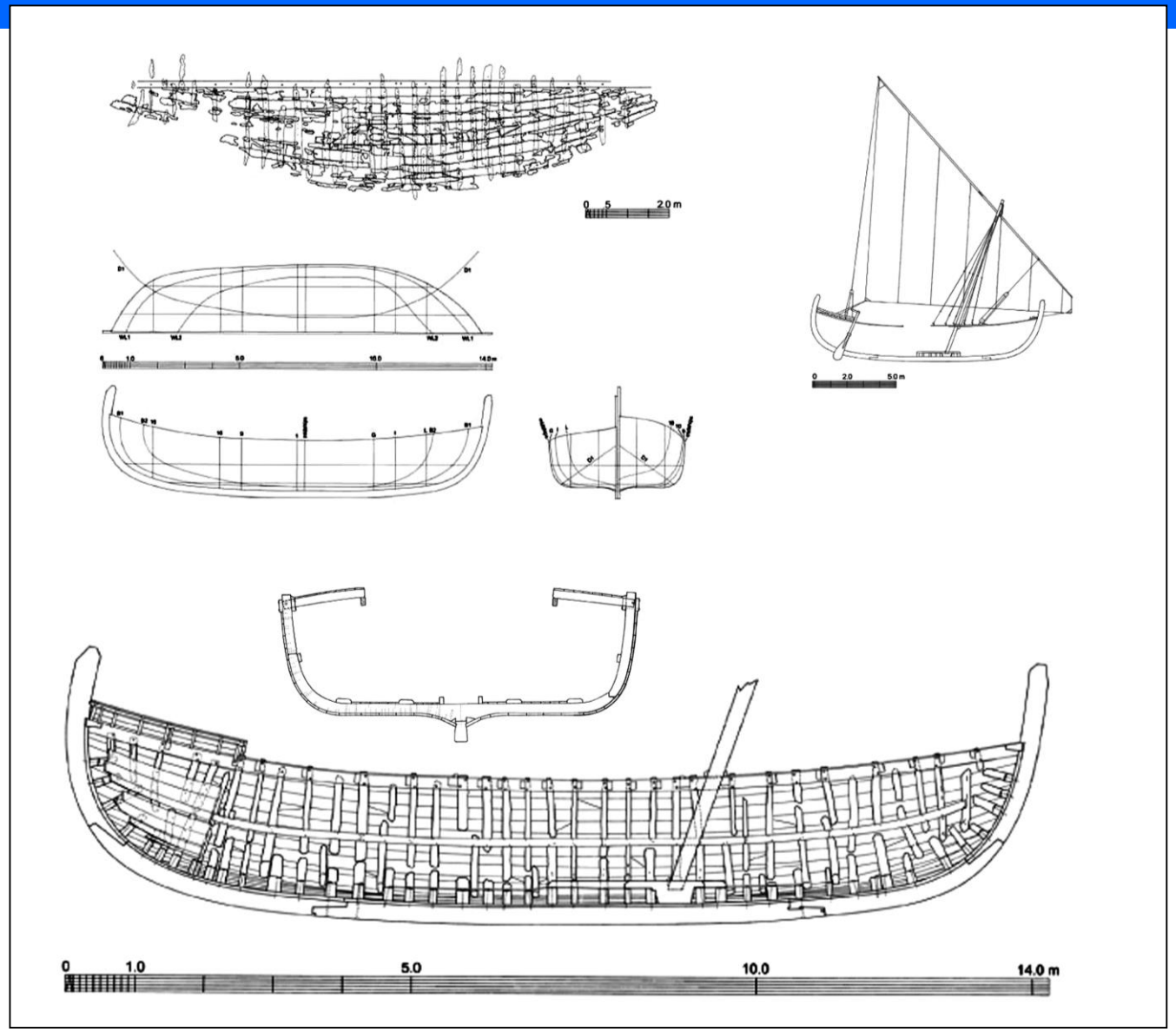


Yassıada c. 625

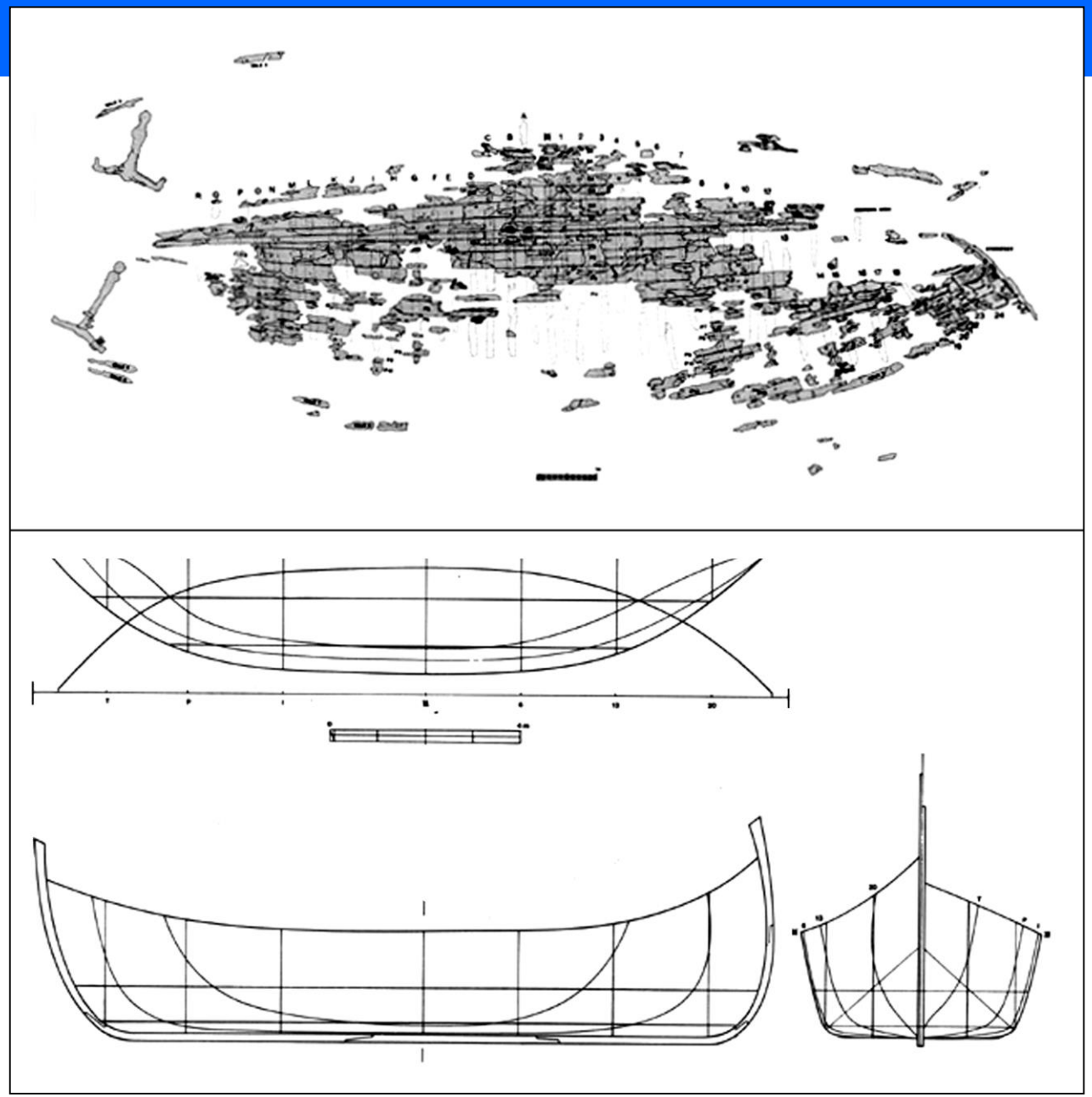


Reconstructing Strategies

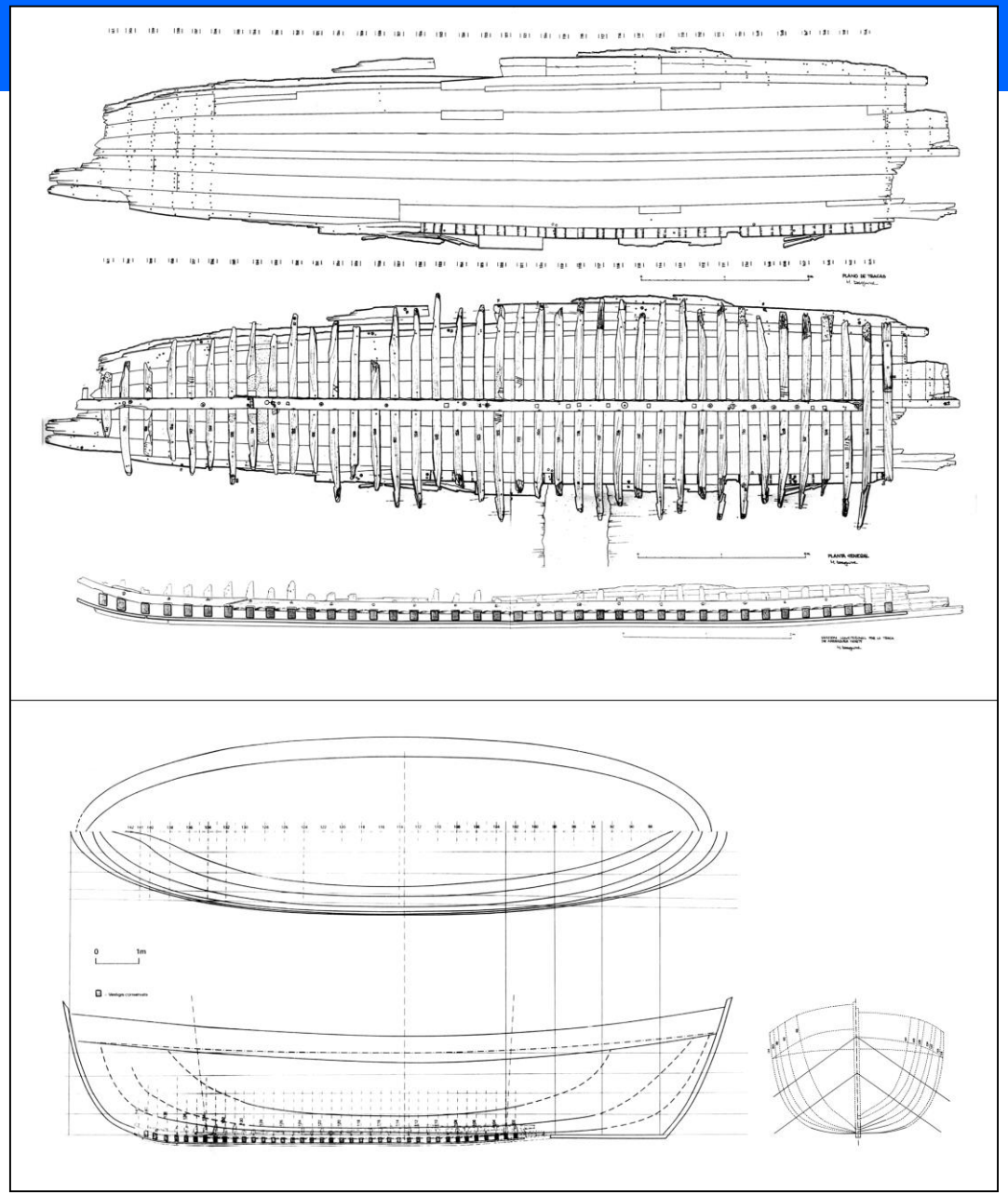
Bozburun c. 874



Serçe Limanı
c. 1025

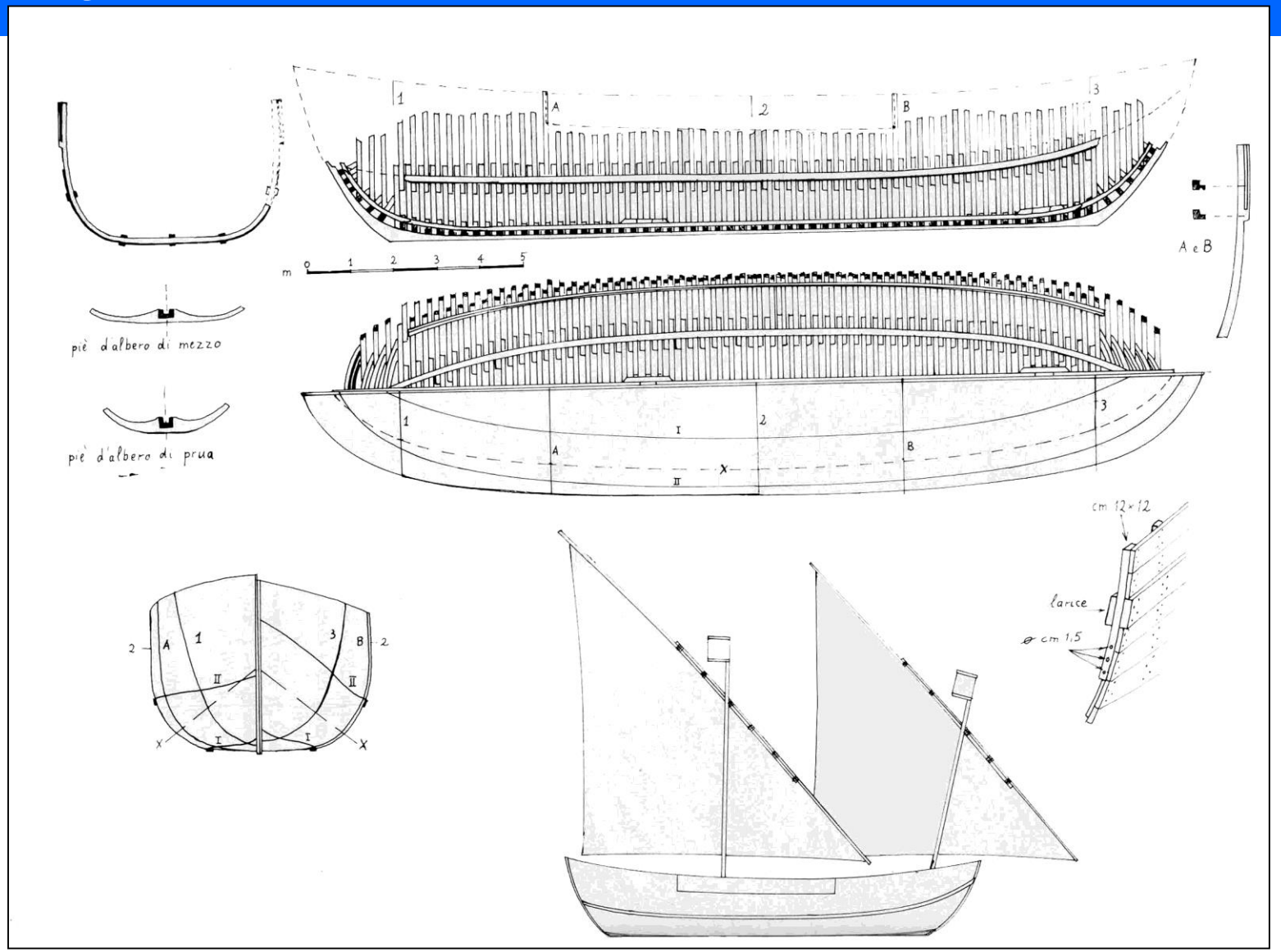


Reconstructing Strategies



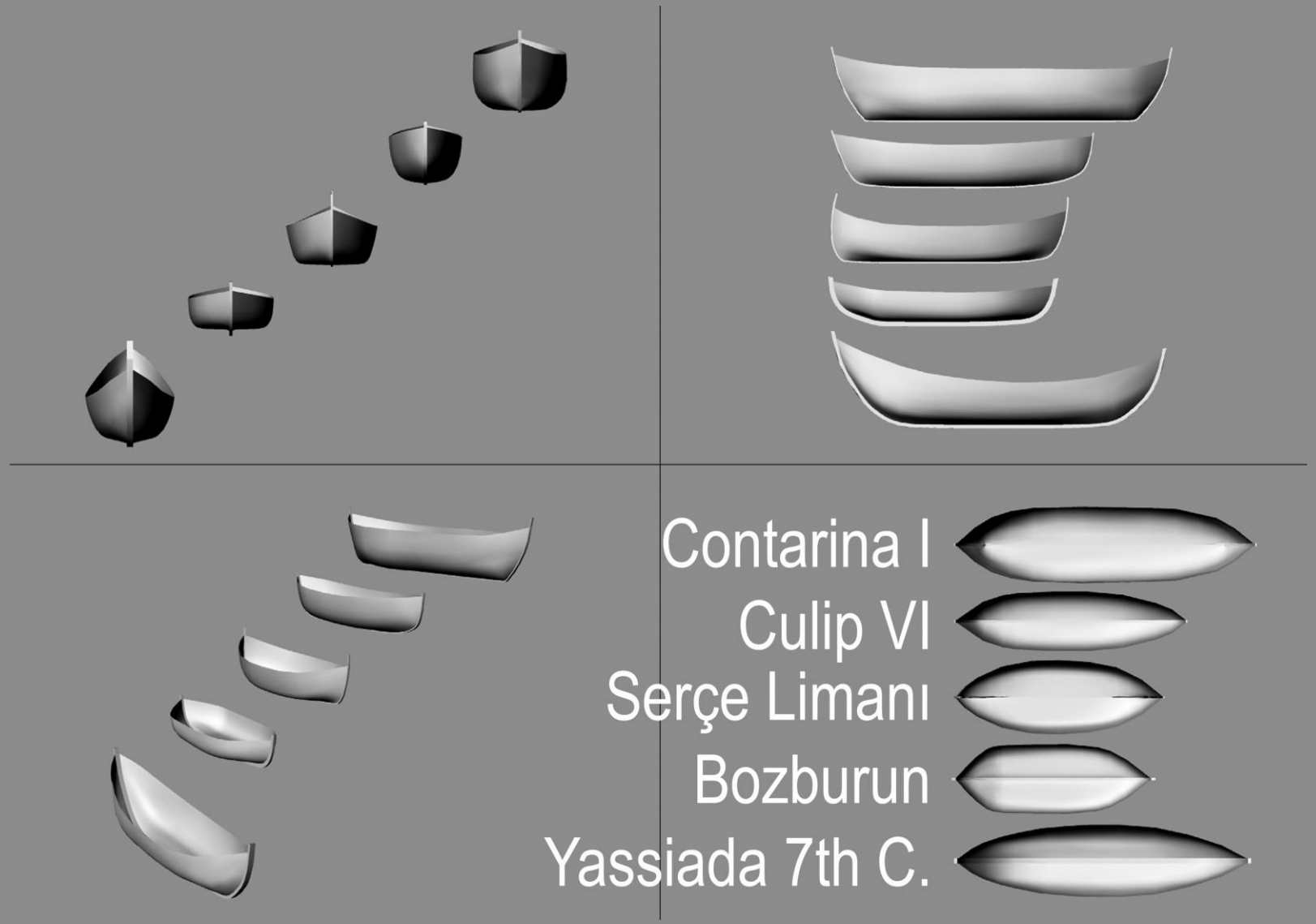
Culip VI c. 1300

Reconstructing Strategies

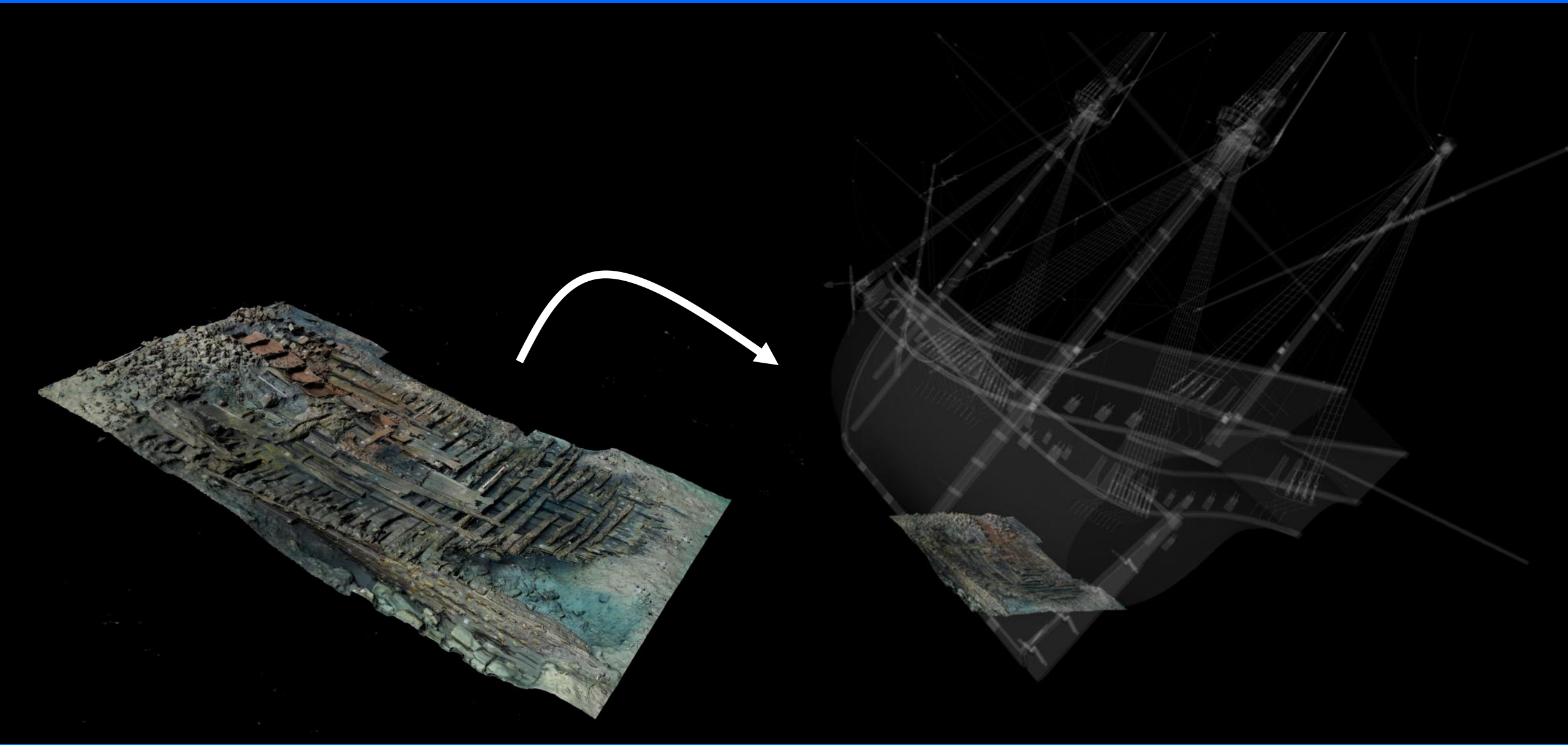


Contarina 1 c. 1300

Reconstructing Strategies

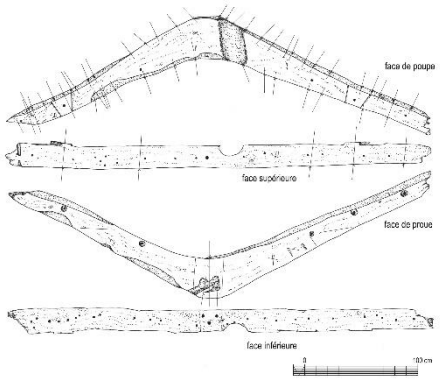


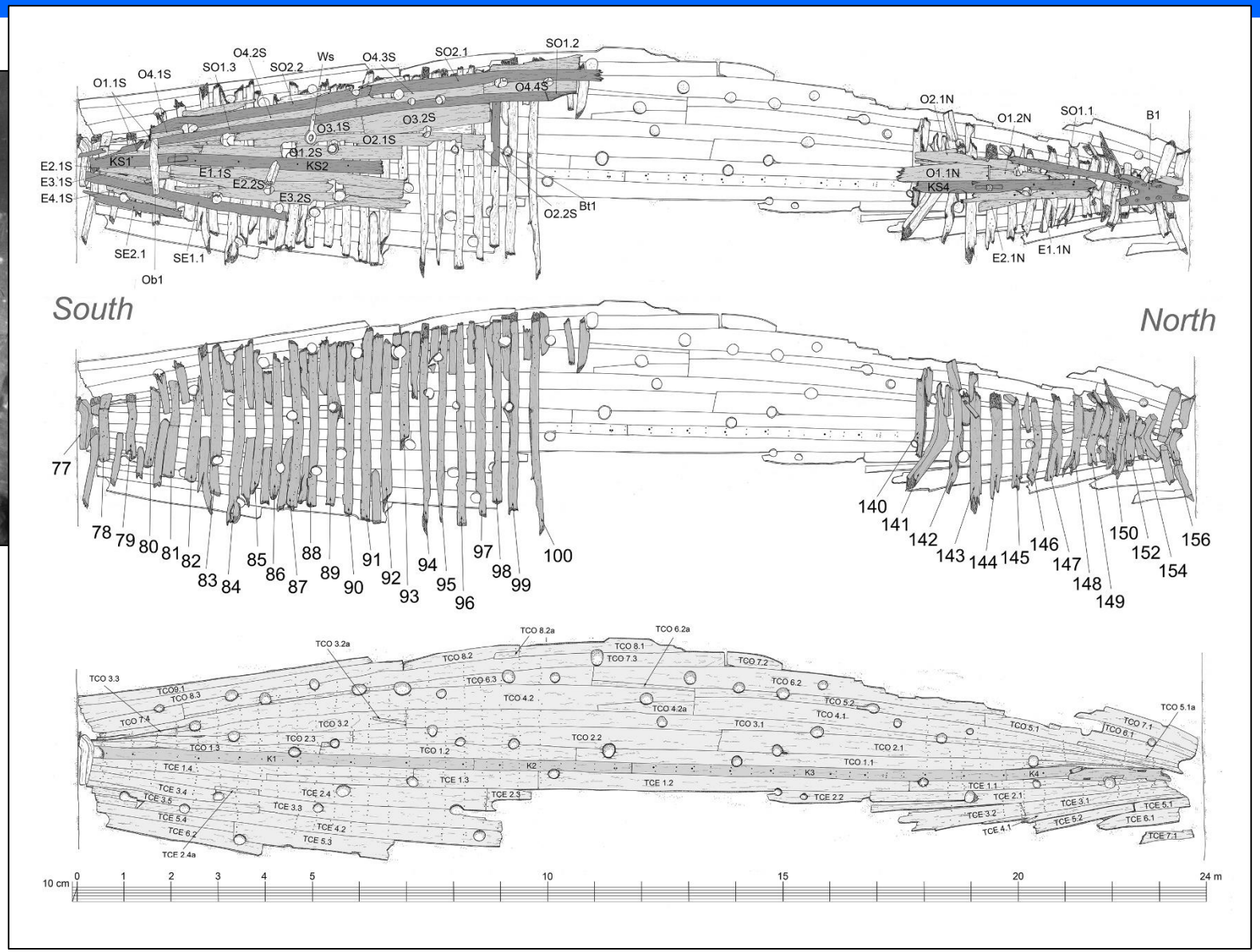
Reconstructing Strategies



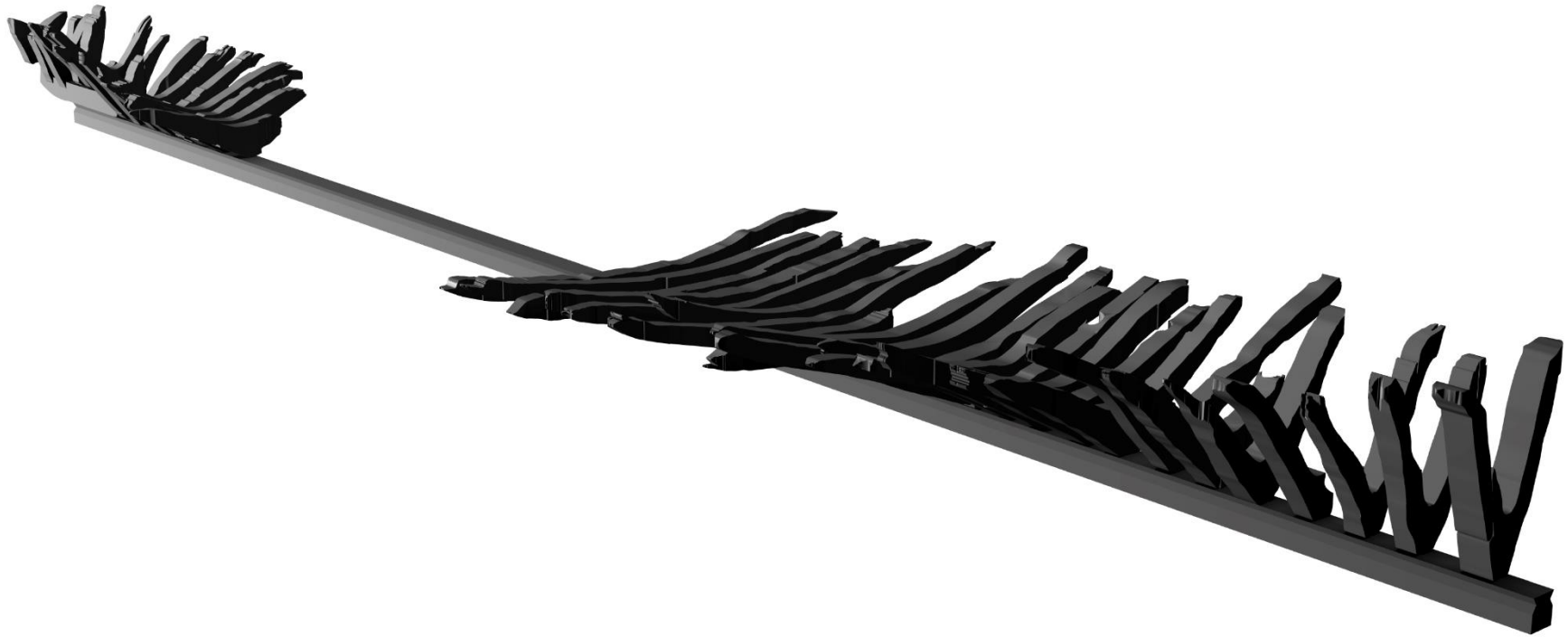
Reconstructing Strategies

Cais do Sodré Shipwreck

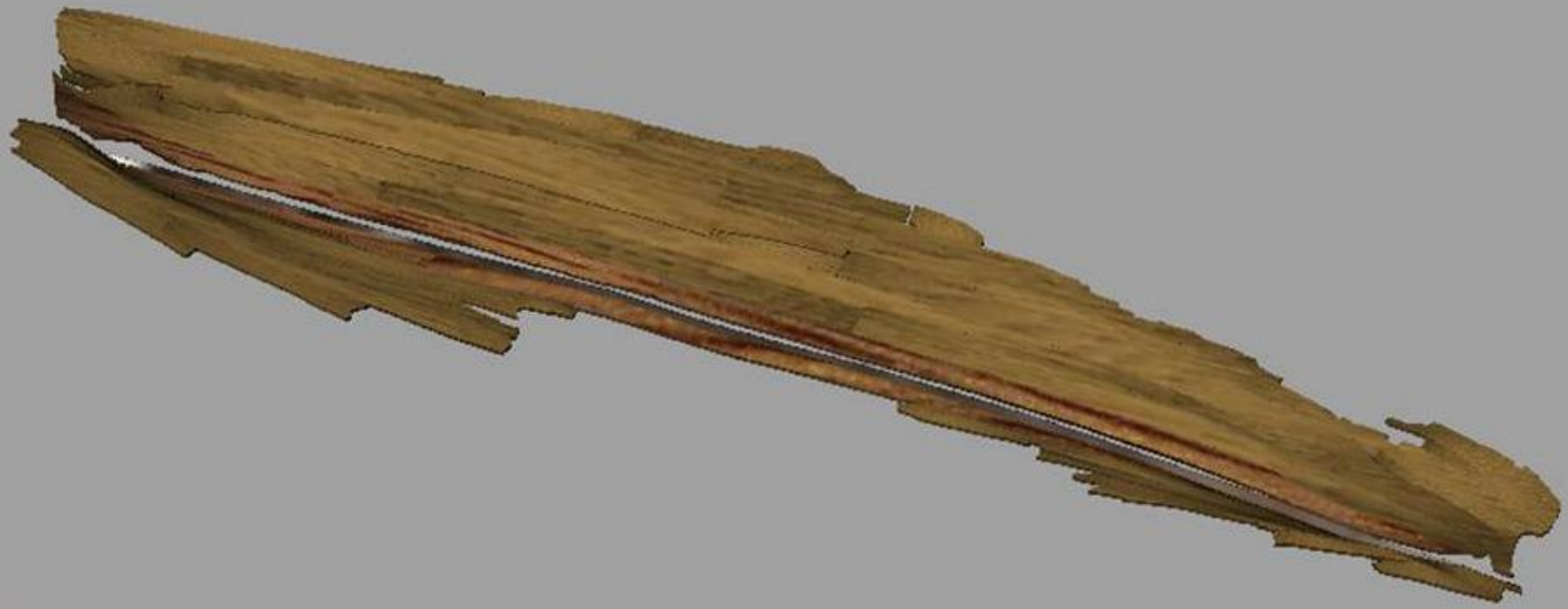




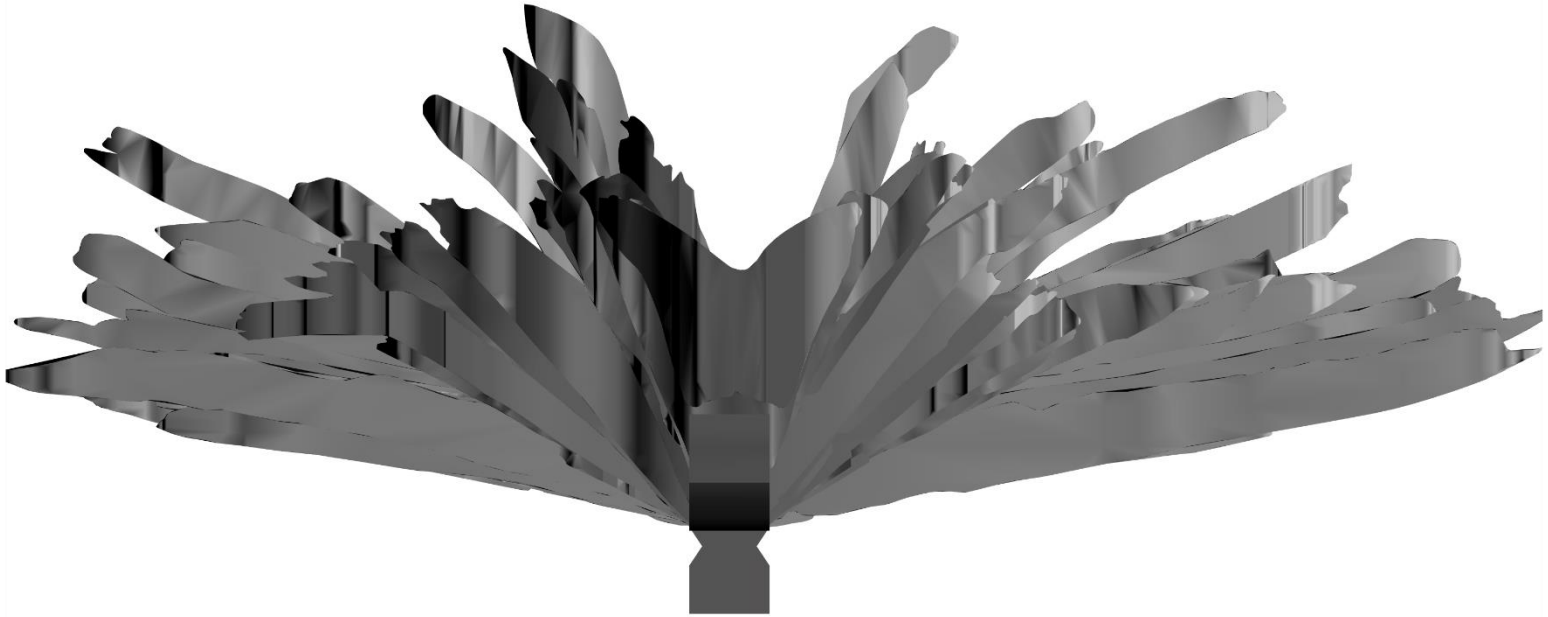
Reconstructing Strategies



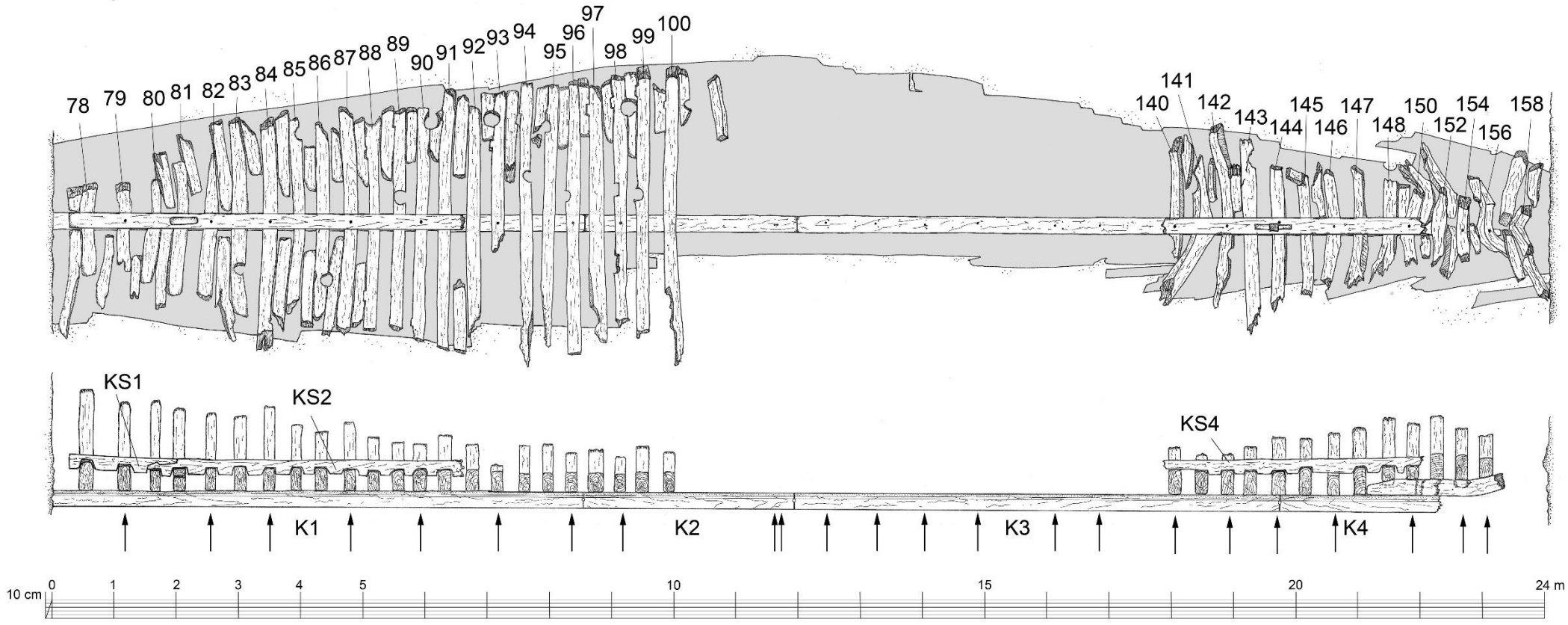
Reconstructing Strategies



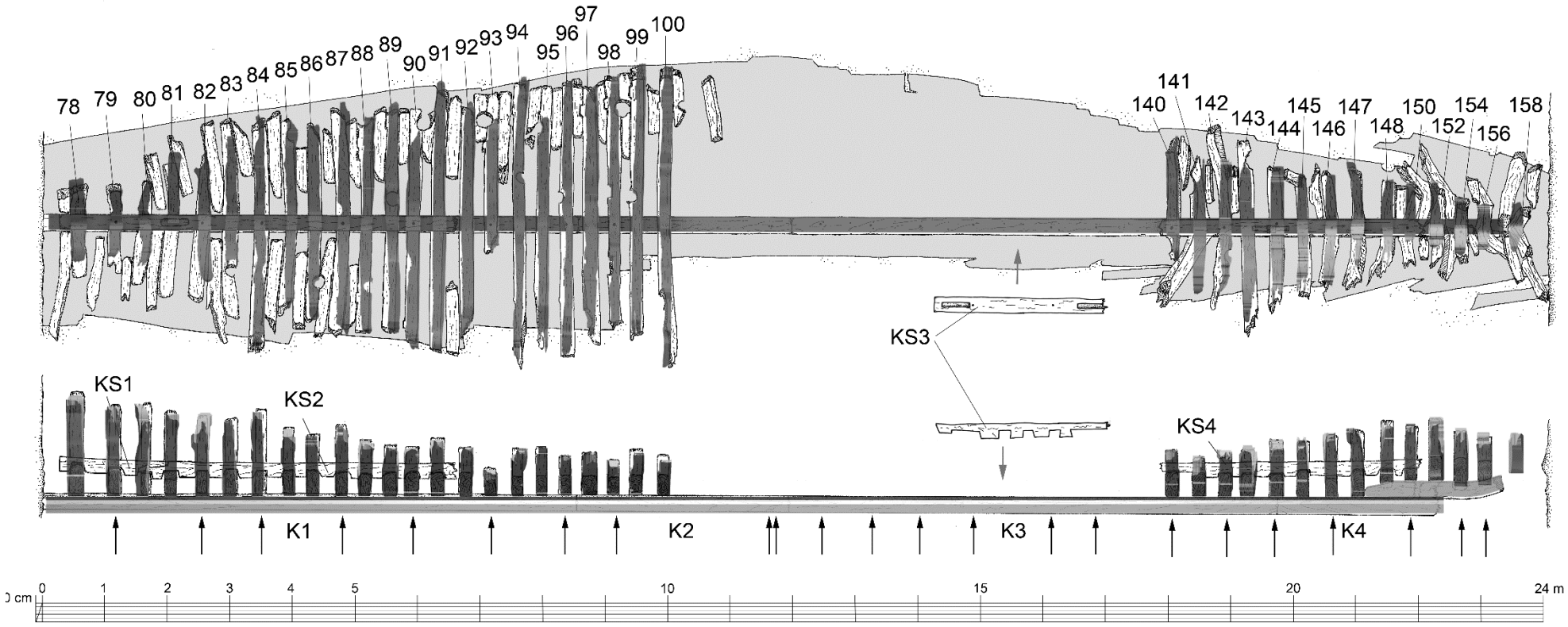
Reconstructing Strategies

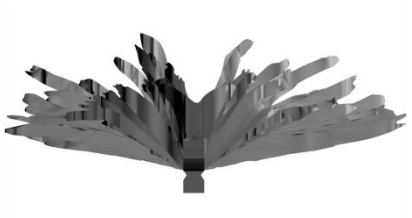


Reconstructing Strategies

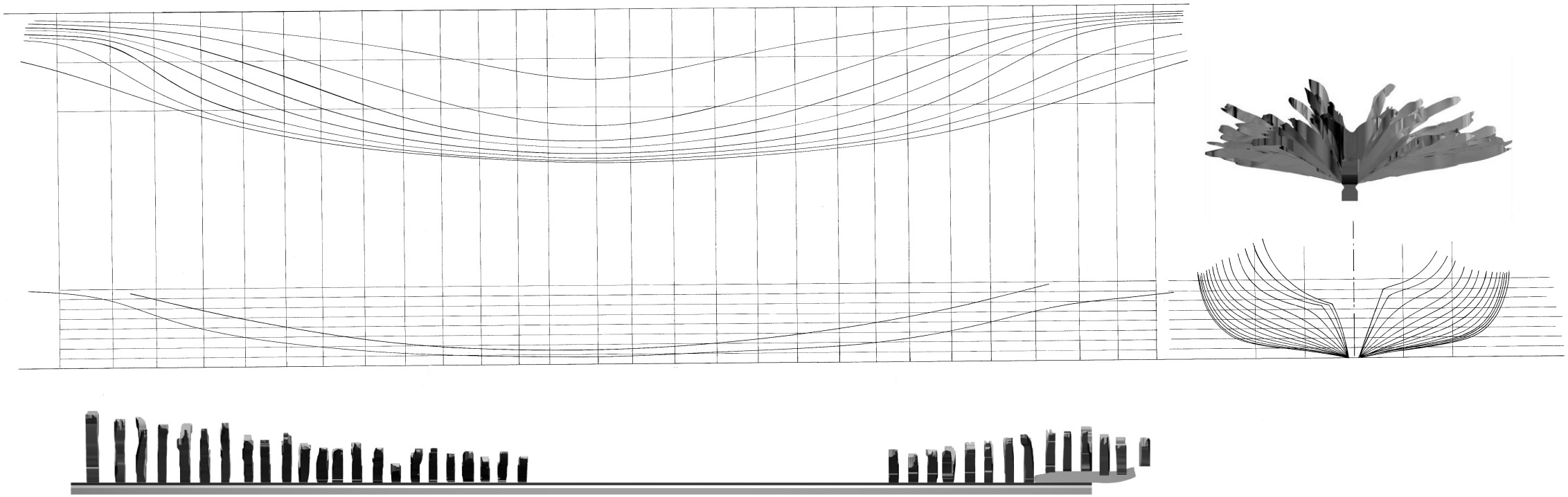


Reconstructing Strategies



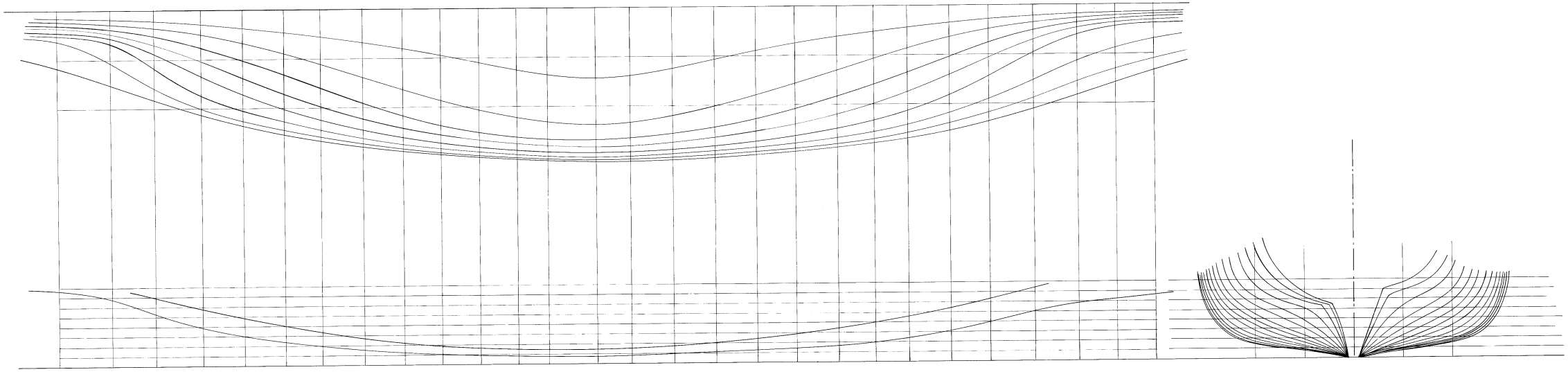


Reconstructing Strategies



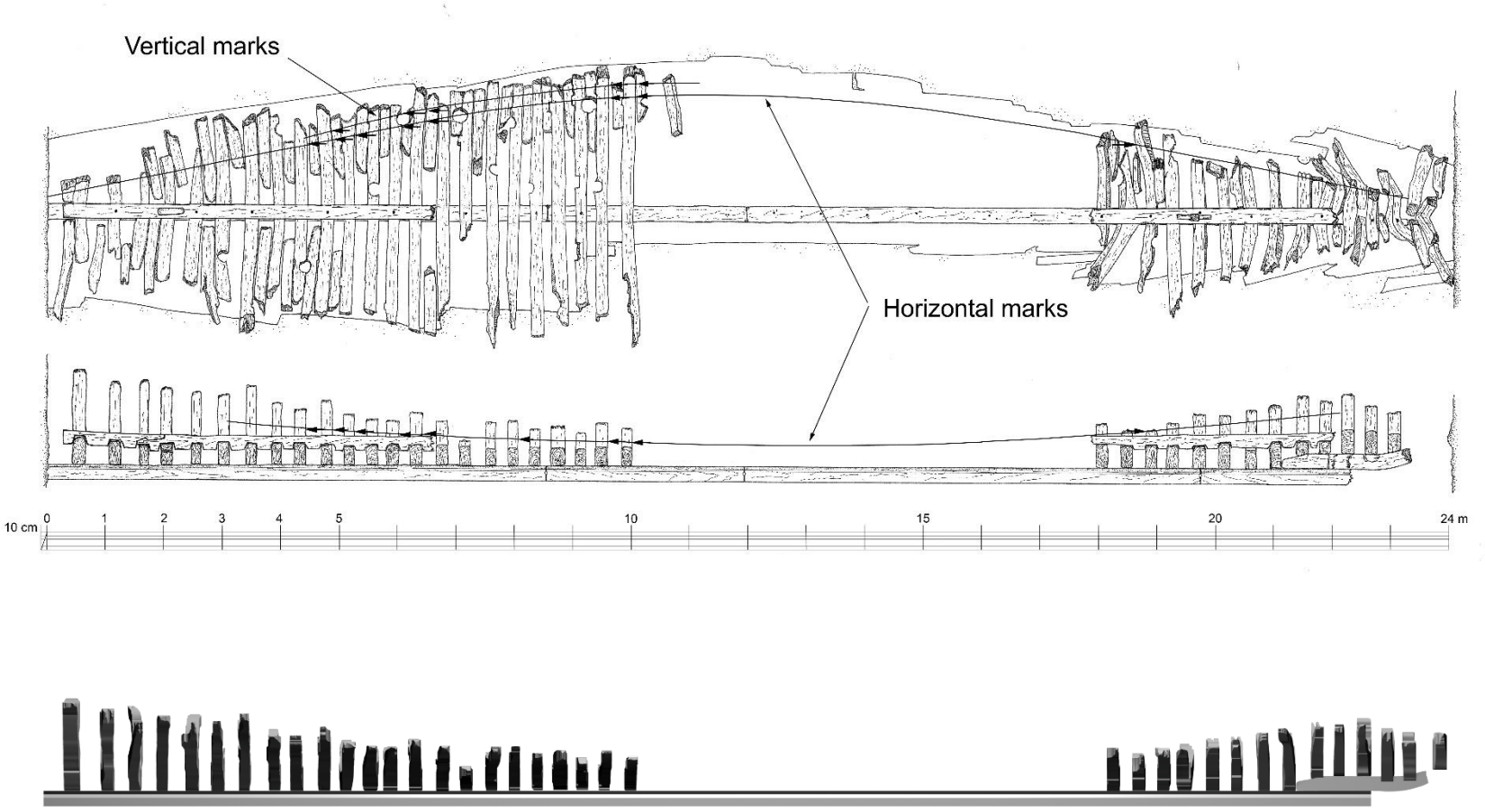
Kotaro Yamafune

Lines Drawings

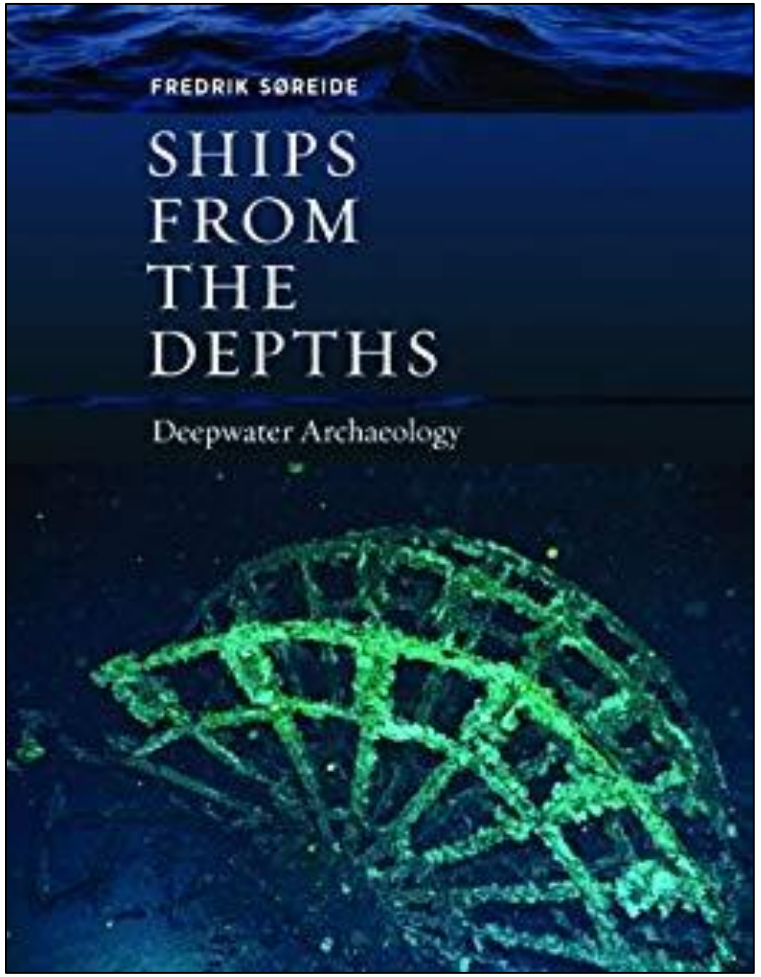


Kotaro Yamafune

Reconstructing Strategies

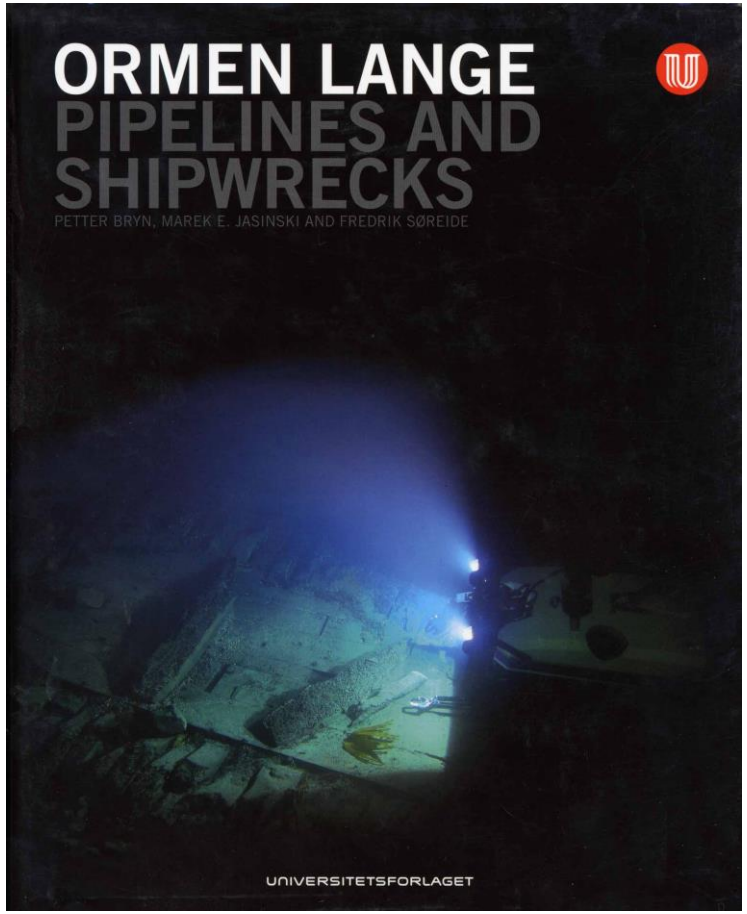


Bibliography



Soreide, Frederick, 2011. *Ships from the Depths*. College Station: Texas A&M University Press.

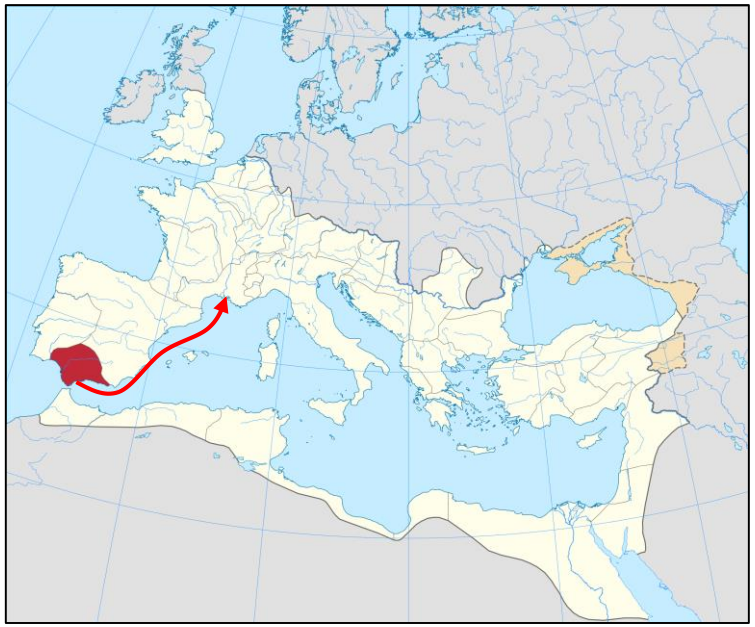
Bibliography



Bryn, Petter, Jasinski, Marek E., and Søreide, Fredrick, 2007. *Ormen Lange: pipelines and shipwrecks*. Oslo: Universitetsforlaget

Arles 4, AD 25-40

Found in 1988 and investigated in 1990 by DRASSM. It was almost 700 m deep and consisted of a 30 x 10 m mound of amphorae (about 1-2000) from Beatica.



Source: Soreide's book.

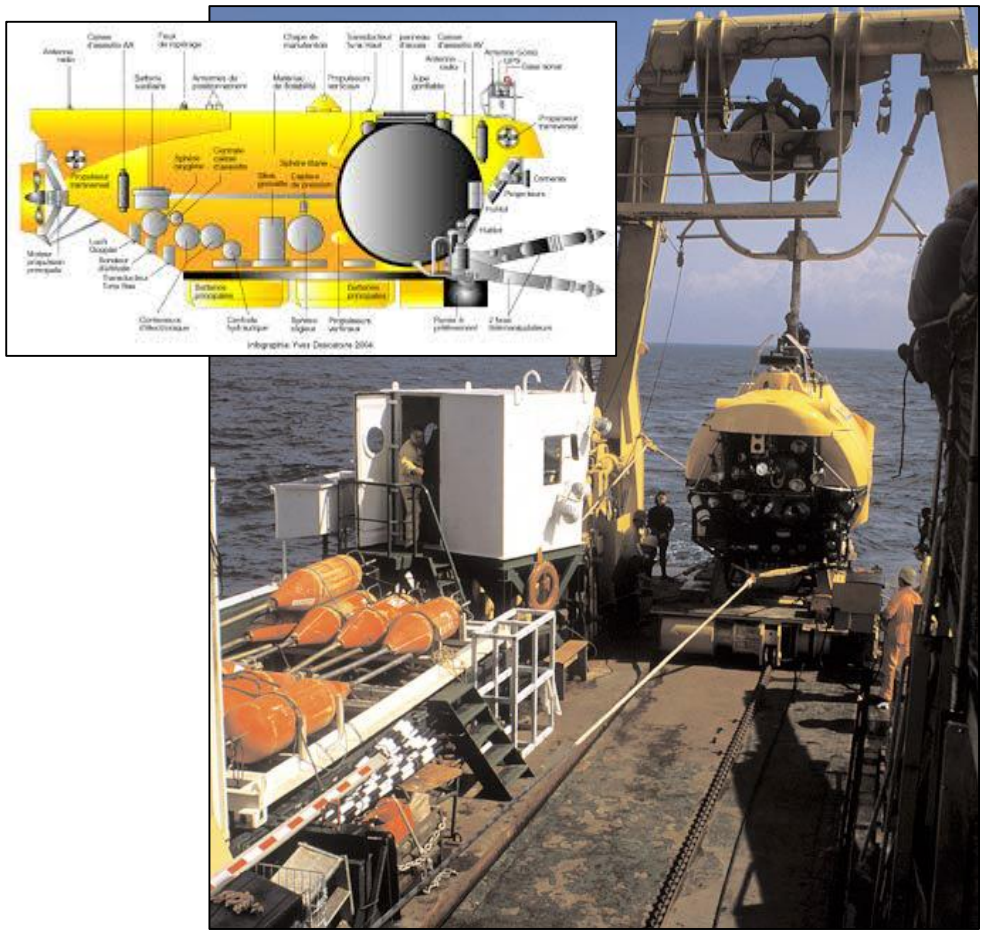
Case Studies: Arles 4

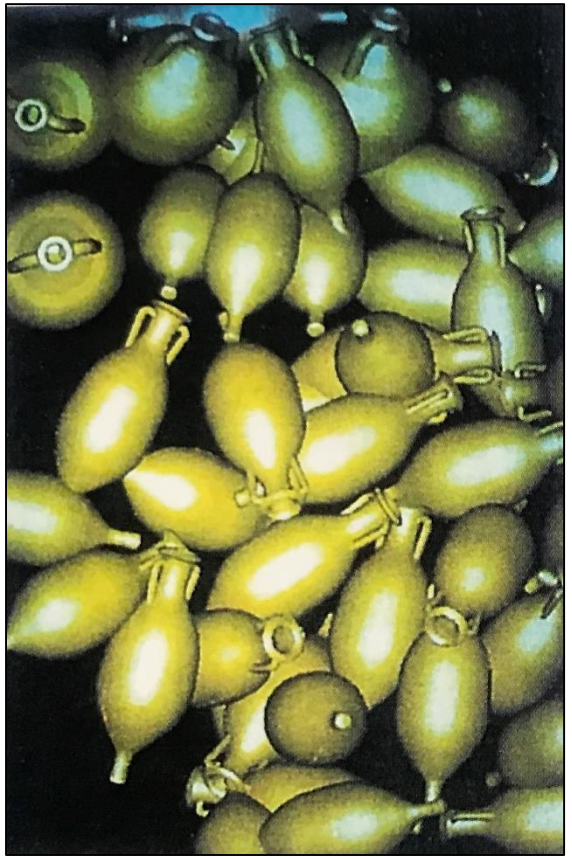
The site was inspected in 1990 with a manned submersible developed by Ifremer, named *Cyana*.

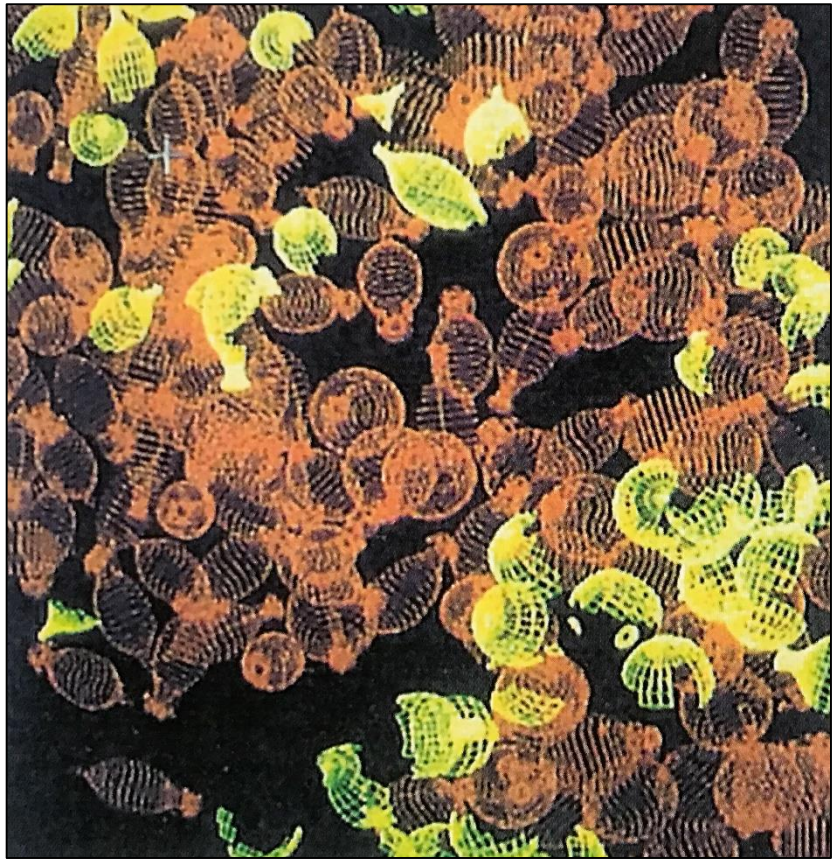
Source: Soreide's book.

Case Studies: Arles 4

In 1993 DRASSM went back to the site with the submarine *Nautile* (18 tons), equipped with photogrammetric cameras, shooting images with 60% overlap.





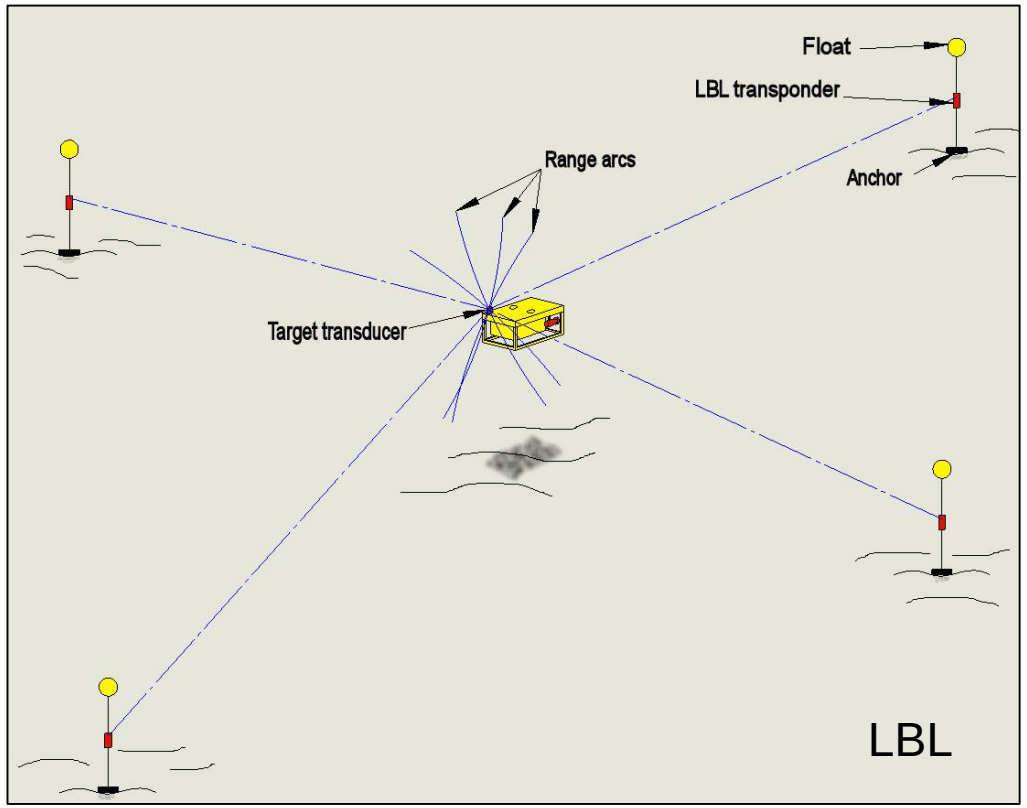


Source: Soreide's book.

Case Studies: Arles 4

The position of the camera was established within 10 cm by a LBL acoustic positioning system (transponders). A series of cubes and targets were used to develop a

Transponder emits a signal when it receives a signal. Transducer transforms a physical signal (pressure or brightness) into an electrical signal and vice versa.



Source: Soreide's book.

Case Studies: Arles 4

Long Baseline Acoustic Positioning System (LBL), Short… (SBL), and Ultra Short… (USBL):

LBL SBL USBL

Source: Xiang, X., et al., 2009, “Cooperative Acoustic Navigation Scheme for Heterogenous Autonomous Underwater Vehicles” in book *Underwater Vehicles*,

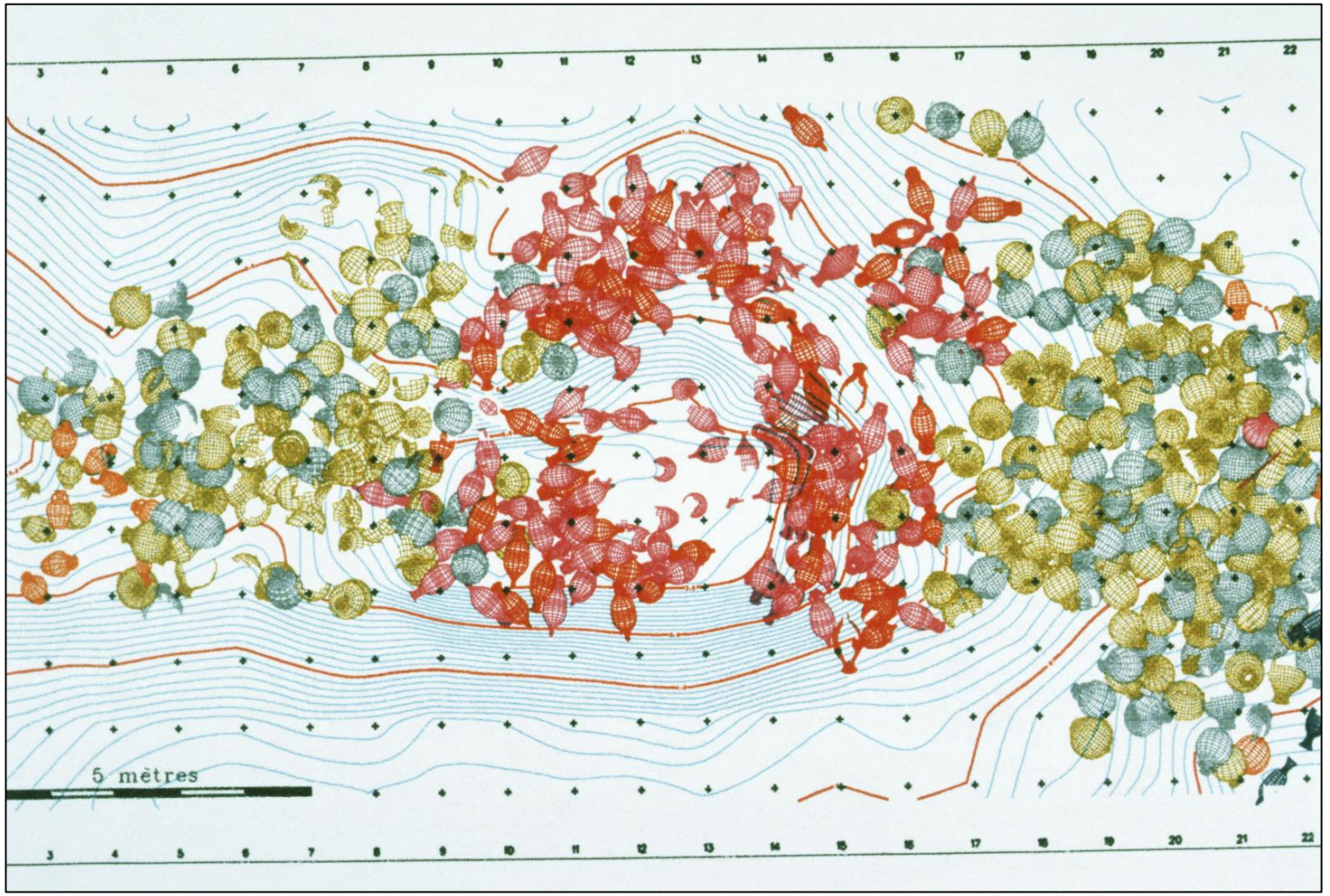
Case Studies: Arles 4

Every amphora was classified (10 different types) and poisoned. A computer model for each type was developed and stored in a computer library, and the site was assembled in 3D, amphora by amphora.

Source: Soreide's book.

Case Studies: Arles 4

A 3D model of the site with high accurate measures was developed and used to reconstruct the site.



Source: Soreide's book.

Dry Tortugas Shipwreck 1622

Found in 1965 when a shrimp trawler pulled in intact Spanish olive jars, metal artifacts, rigging and wood. In the early 1970s Robert Marx found the site dragging a cable between two boats and sold the information to a treasure hunter group for $10k and 10% of the artifacts in kind.

Source: Sean Kingsley pers. comm.

The information eventually passed to Seahawk Deep Ocean Technology and the fishing hang was ground-truthed in 1989 by that company at a depth of 405 m by ROV.

Seahawk estimated the treasure at $92m and raised $12m (?) to salvage “the treasure” (1990-1991).

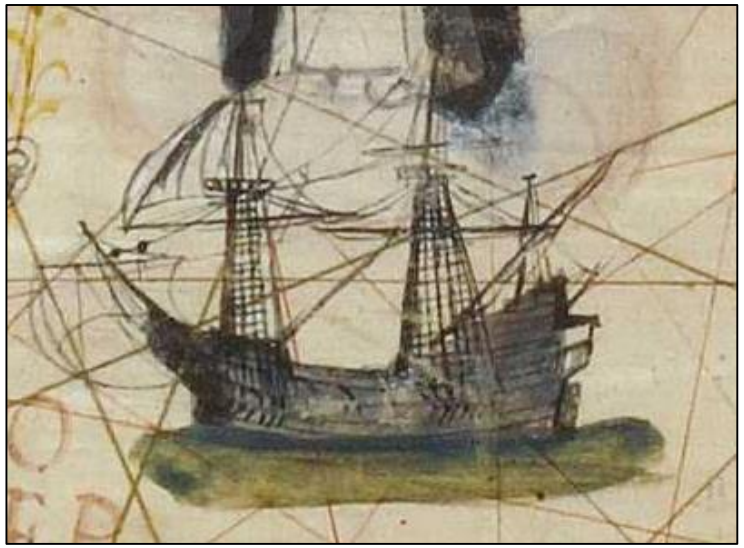
Source: Sean Kingsley pers. comm.

Case Studies: Dry Tortugas Shipwreck, 1622

The launch system onboard the RV *Seahawk* consisted of a winch, an A frame, armored tether and depressor weight that allowed ROV operations to be conducted in depths of up to 600 meters of water. The ROV was free-swimming, relying on the depressor weight connected to the armored umbilical, with a 50 meters neutrally buoyant excursion tether from the depressor that provided a 100 meters footprint for the ROV.

Case Studies: Dry Tortugas Shipwreck, 1622

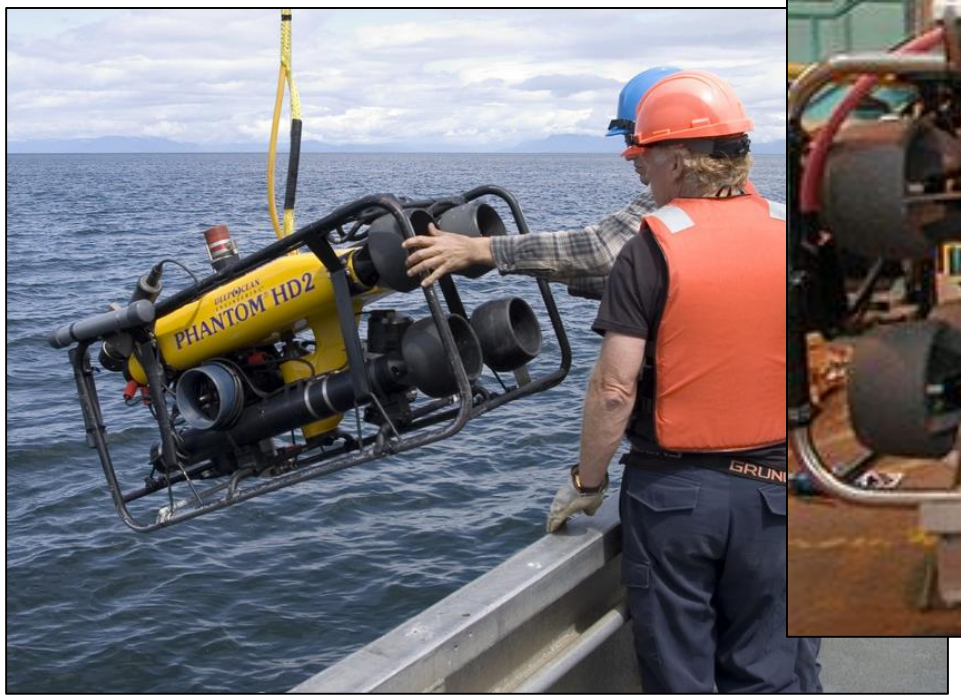
Tentative identification: the ship *Buen Jesús* departed from the River Guadalquivir in late March 1622 with the fleet of General Juan de Lara Morán for Santa Marta, Rio de la Hacha and Nueva Cordoba. The homeward bound Tierra Firme flota left Havana on 4 September and sank on 5-6 September. No coins dated after 1621 were found in this shipwreck.

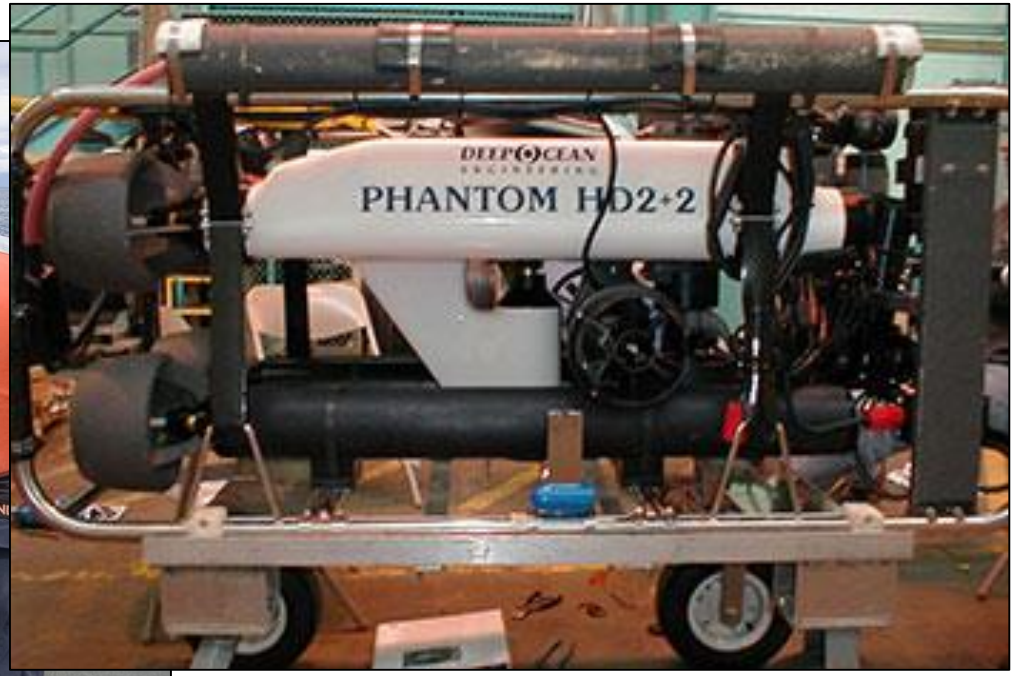


Source: Sean Kingsley pers. comm.

Case Studies: Dry Tortugas Shipwreck, 1622

Initial visual survey of the wreck site was accomplished using the Phantom DHD2 ROV, which was equipped with a Mesotech 971 sector scanning sonar and was utilized to define the location and perimeter of the site. The ROV was linked to *Seahawk* via 610 meters of shielded 42 separate conductor umbilical cable (no single wire multiplex control system was available in 1990-91) and was fitted with two 250-watt halogen lights and two Panasonic CCD low light video color cameras to illuminate the site.





https://www.shipwreck.net/tortugas-operations

For the recovery operations a new vessel the 64 m *Seahawk Retriever* was chartered and a new ROV (*Merlin*) acquired.

Case Studies: Dry Tortugas Shipwreck, 1622

Merlin was designed and constructed to the specifications laid out by Seahawk's technology team specifically for excavation in deep water.

https://www.shipwreck.net/tortugas-operations

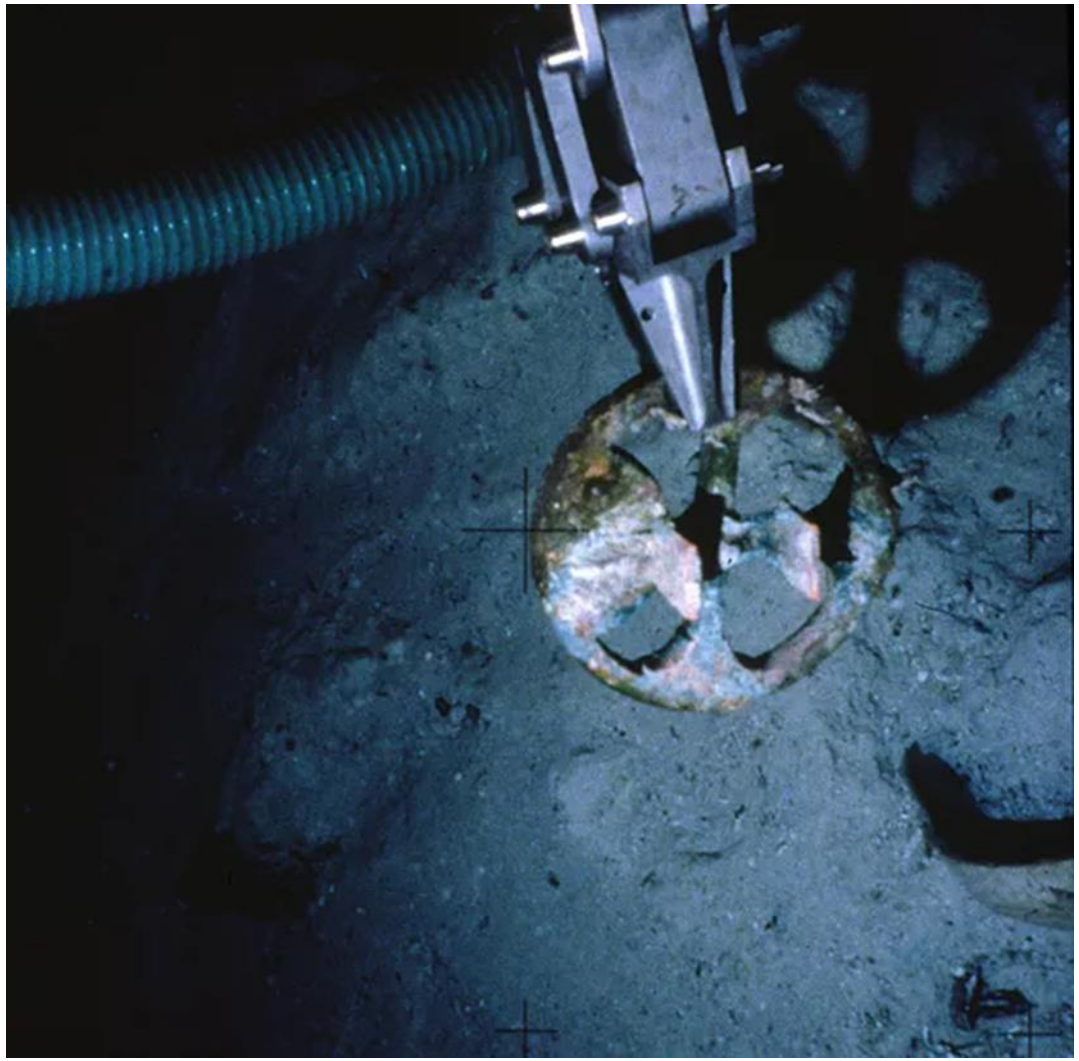
Case Studies: Dry Tortugas Shipwreck, 1622

Merlin was fitted with *Schilling* manipulators, a customized suction dredge, an acoustic long baseline positioning system and weighed approximately three tons out of water. Buoyancy blocks of syntactic foam (to resists the crushing effects of pressure at 400m) made *Merlin* 272kg positively buoyant. The ROV had six hydraulic powered positioning thrusters; vertically oriented thrusters allowed it to work above the seafloor without stirring up sand or silt.

Source: Soreide's book.

Lifting baskets were placed in sectioned off partitions in a large steel basket designed for retrieving artifacts from the sea bottom, nicknamed the 4Plex, which had a lifting capability of three tons.

Case Studies: Dry Tortugas Shipwreck, 1622



The thrusters also held the ROV steady when artifacts were lifted. Either manipulator arm could lift up to 113kg without affecting Merlin's position in the water. One of the manipulators used a system controlled by a master replica of the manipulator at the surface desk; the jaw pressure could be dialed up to 500lbs or reduced to a few ounces.

Positioning was determined and recorded by a system of long baseline transponders installed on the site, which communicated with transponders on Merlin and the ship.

Case Studies: Dry Tortugas Shipwreck, 1622

Suction devices were installed to recover ceramic jars.

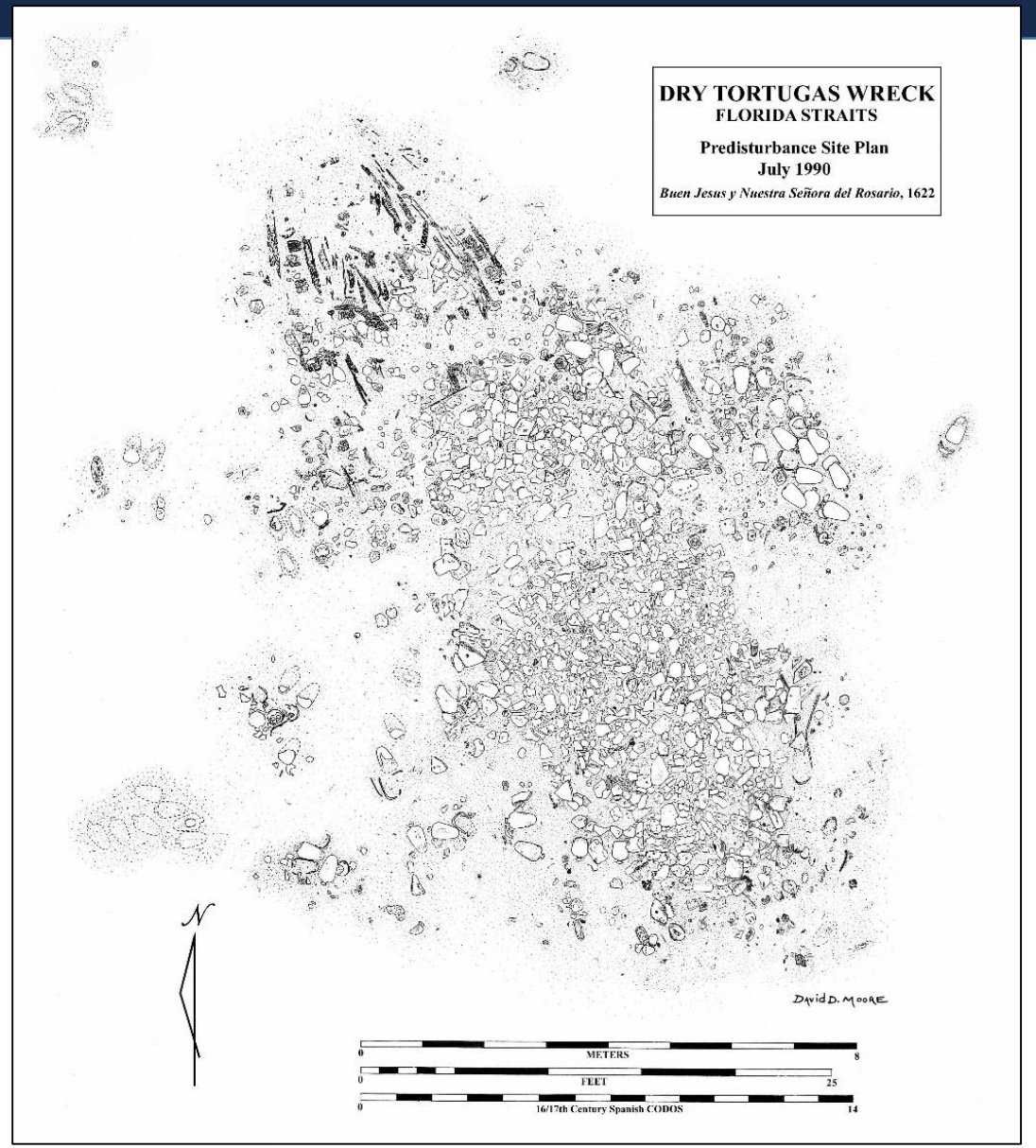
The artifact collection, which had been evaluated in $92m in 1989 was appraised by John de Bry in 1991 at $4,792,100 (he appraised the olive jars at $10,000 apiece).

In 1992 a Christie's appraiser put the collection value at $1m or less.

Case Studies: Dry Tortugas Shipwreck, 1622

In 1992 The Securities and Exchange Commission sued Seahawk. The company eventually settled and evolved into other companies, such as Deep Ocean Shipwreck Exploration and Odyssey Marine Exploration.

The hull remains were not recorded and were not covered after the salvage operations.



Archaeological Reports

Sean A. Kingsley, Michael J. Decker, &Ellen Gerth, Rome in Spain, Spain in the Americas: Amphoras, Olive Jars & the Economics of Long-Distance Trade (2014)

J. Byron Sudbury, Ph.D., & Ellen Gerth, Clay Tobacco Pipes from the Tortugas Shipwreck, Florida (1622) (2014)

Michael J. Hughes, Chemical Analysis of Pottery from the Tortugas Shipwreck (1622) by Plasma Spectrometry (ICPS) (2014)

Ellen Gerth & Sean A. Kingsley, The Deep-Sea Tortugas Shipwreck, Florida (1622): Afro-Caribbean Colonoware & Maritime Slavery (2014)

Sean A. Kingsley, Janette Flow, Ellen Gerth, & Claudio Lozano Guerra-Librero, Spanish Olive Jars from the Tortugas Shipwreck, Florida (1622) (2014)

Sean A. Kingsley, Papal Plates & Propaganda on the Deep-Sea Tortugas Shipwreck, Florida (1622) (2014)

Case Studies: Dry Tortugas Shipwreck, 1622

Sean A. Kingsley, The Deep-Sea Tortugas Shipwreck, Florida (1622): the Ceramic Tablewares (2014)

Carol Tedesco, The Deep-Sea Tortugas Shipwreck, Florida: the Silver Coins (2013)

Philip L. Armitage, The Deep-Sea Tortugas Shipwreck, Florida: the Animal Bones (2013)

Sean Kingsley, The Identity & Maritime History of the Deep-Sea Tortugas Shipwreck (2013)

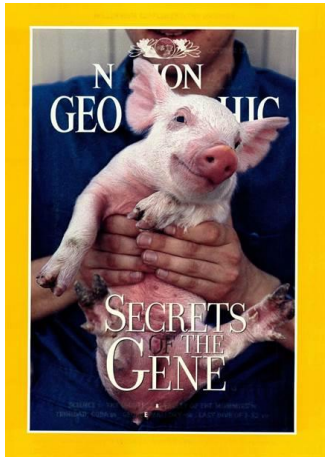
Greg Stemm, Ellen Gerth, Jenette Flow, Claudio Lozano Guerra-Librero, & Sean Kingsley, The Deep-Sea Tortugas Shipwreck, Florida: A Spanish-Operated Navio of the 1622 Tierra Firme Fleet. Part 2, the Artifacts (2013)

Greg Stemm, Ellen Gerth, Jenette Flow, Claudio Lozano Guerra-Librero, & Sean Kingsley, The Deep-Sea Tortugas Shipwreck, Florida: A Spanish-Operated Navio of the 1622 Tierra Firme Fleet. Part 1, the Site (2013)

John Astley & Greg Stemm, The Deep-Sea Tortugas Shipwreck, Florida: Technology (2013)

Case Studies: I-52

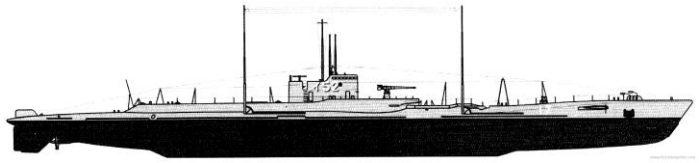
Japanese submarine lost in the Atlantic with a gold cargo, bound for Europe. It was found 5 Km deep in 1995 by Paul Tidwell.



National Geographic Magazine
October 1999

http://www.i-52.com/; http://nauticos.com/ocean-discovery/i-52-htm/

I-52

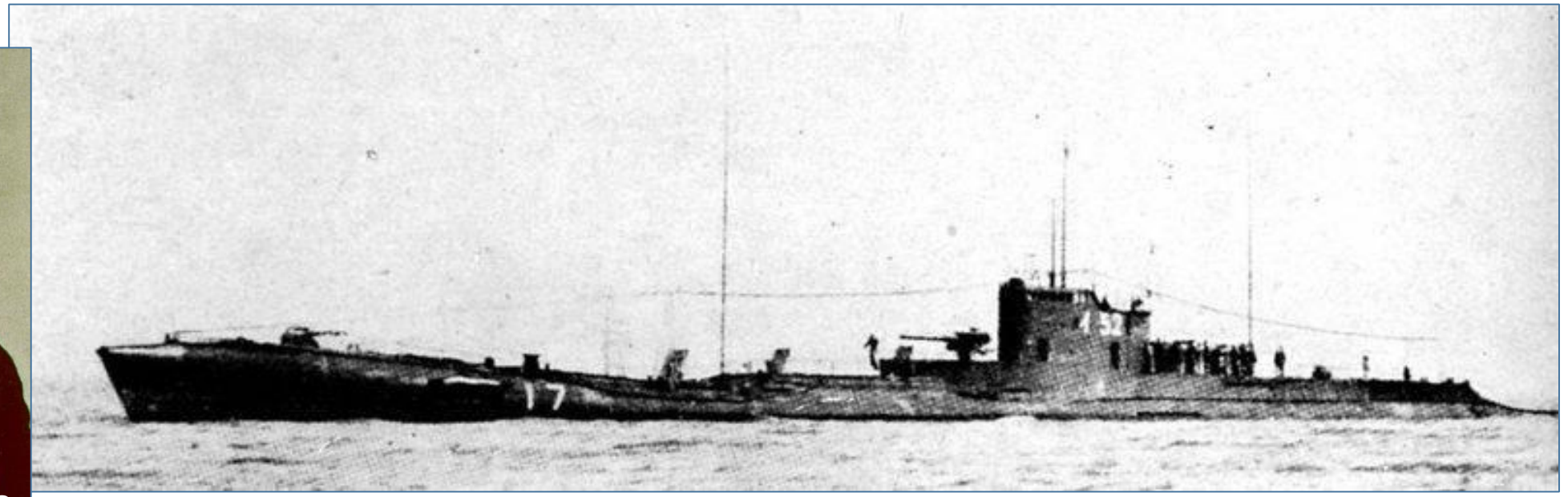


Many of the records from World War II are kept in the National Archives in Washington D.C. There historian Paul Tidwell found the actual log of the aircraft carrier *Bogue* which describes the action of events surrounding the I-52 on June 23rd and 24th, 1944.

http://nauticos.com/ocean-discovery/i-52-htm/

Tydwell also found Commander Taylor's report of how he located and sank the I-52, logs from other ships in the task force, and even the war diary of the U-530. The pages contained the secret of the location of the wreck of the World War II Japanese submarine I-52. Paul Tidwell had been looking for the I-52 and other historical shipwrecks for many years.


Uno Kameo

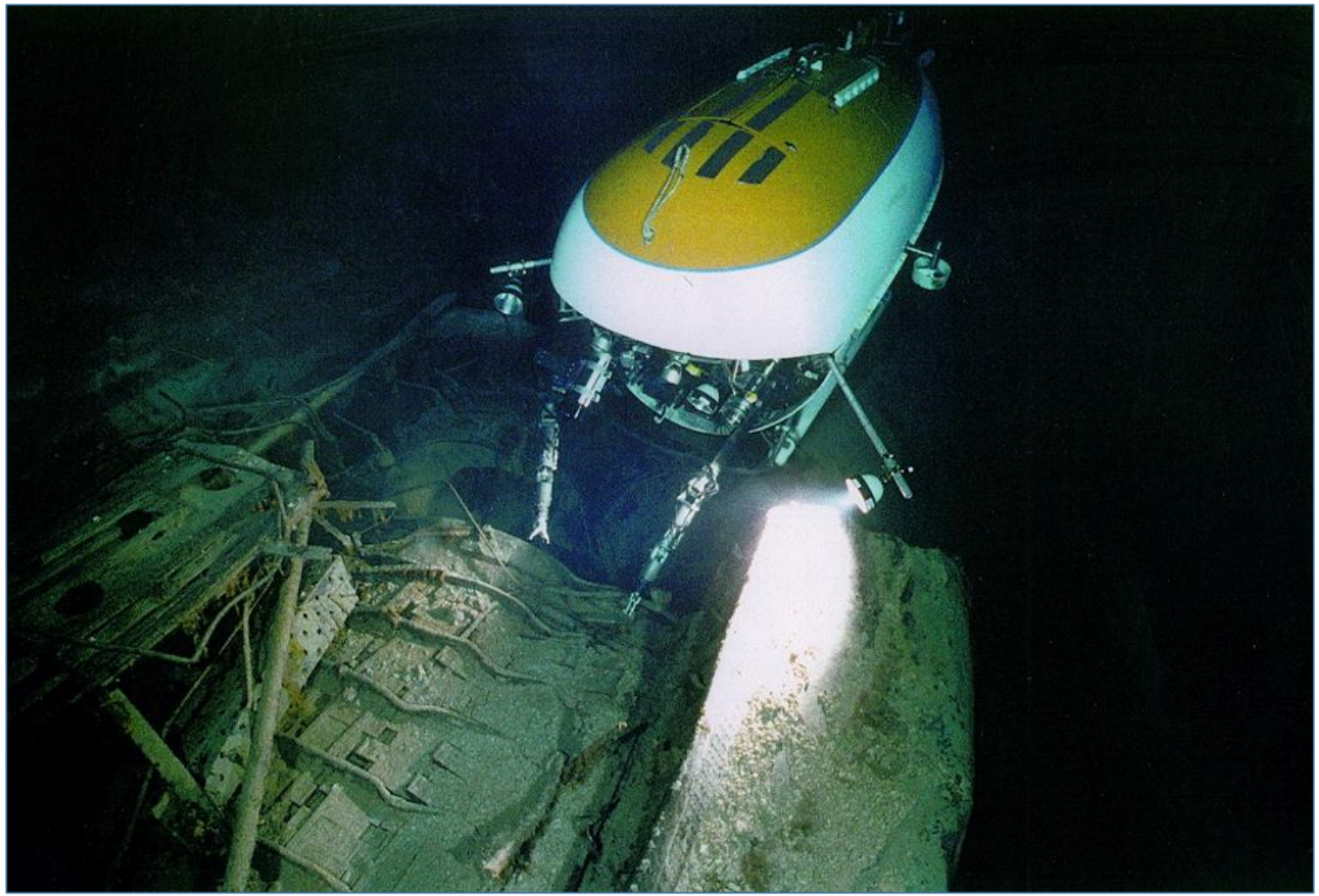


http://nauticos.com/ocean-discovery/i-52-htm/

In 1995 Tidwell sponsored an expedition to search for the sub, and hired Ted Brockett of Sound Ocean Systems, Inc. to manage the project. Ted in turn, relied on Nauticos Corporation, at the time called Meridian Sciences, to fill key roles, with Tom Dettweiler serving as Operations Director and David Wyatt responsible for the operation of the ORION sidescan sonar image processing system. Jeff Burns, Nauticos' Director of Marketing, was also aboard, standing watches and documenting the events of the cruise. Assisting Tom was Sound Ocean System's Bob Cooke, a seasoned veteran of ocean exploration. The Russian R/V *Yuzhmorgeologiya* and its equipment were used in this deep water search operation.

http://nauticos.com/ocean-discovery/i-52-htm/

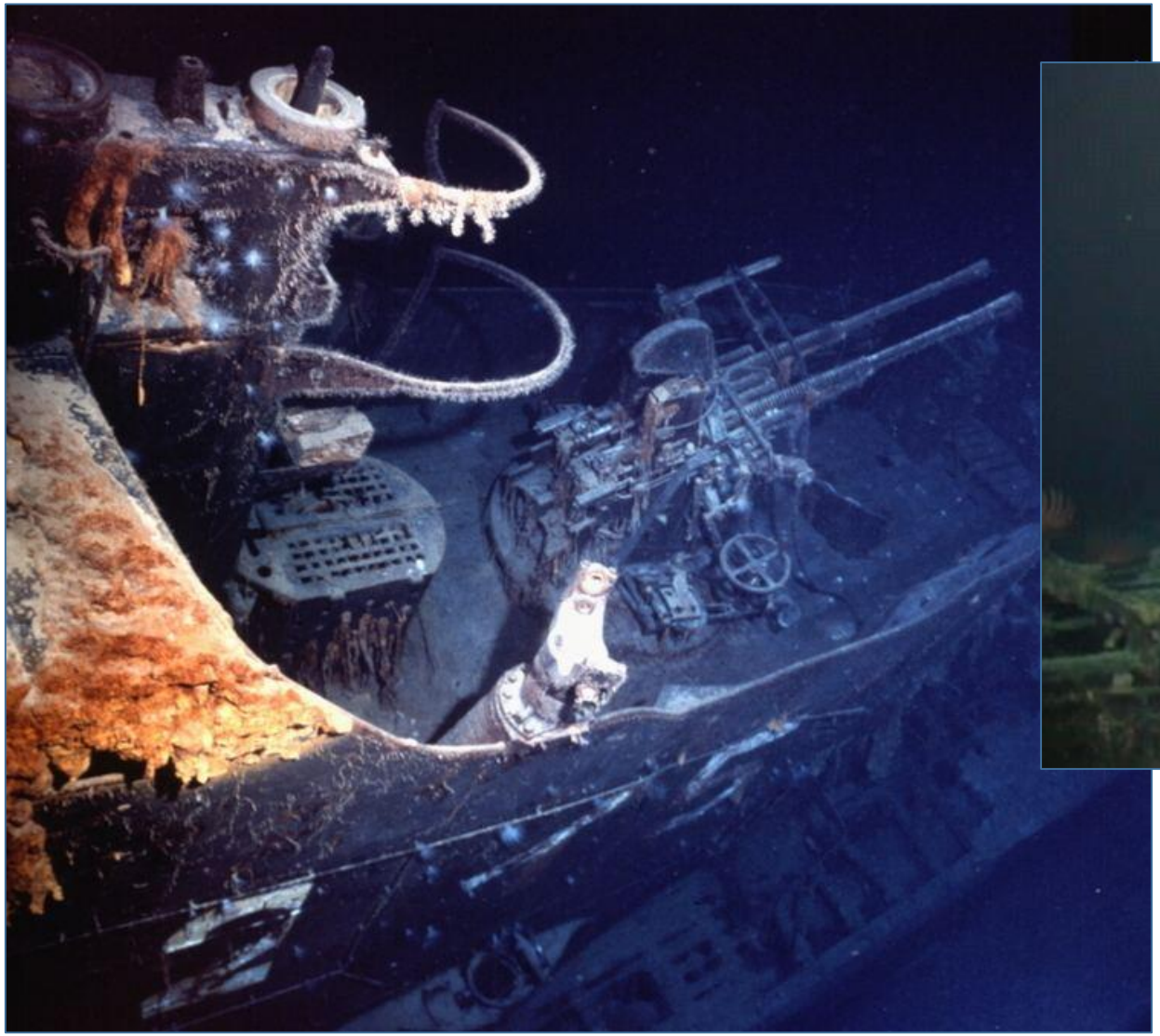
Case Studies: Dry Tortugas Shipwreck, 1622



http://nauticos.com/ocean-discovery/i-52-htm/

Tidwell eventually raised $2m to try to salvage part of the gold (in 1998). He did not find the gold.

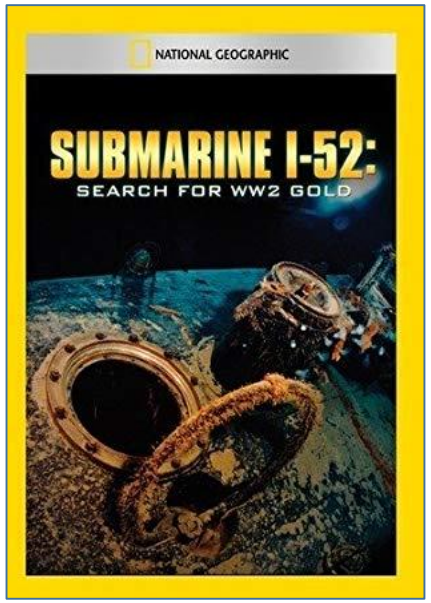
Case Studies: Dry Tortugas Shipwreck, 1622



http://nauticos.com/ocean-discovery/i-52-htm/

Case Studies: Dry Tortugas Shipwreck, 1622

Tidwell announced that he was going to recover the submarine in 2005 but there is no information on this project.

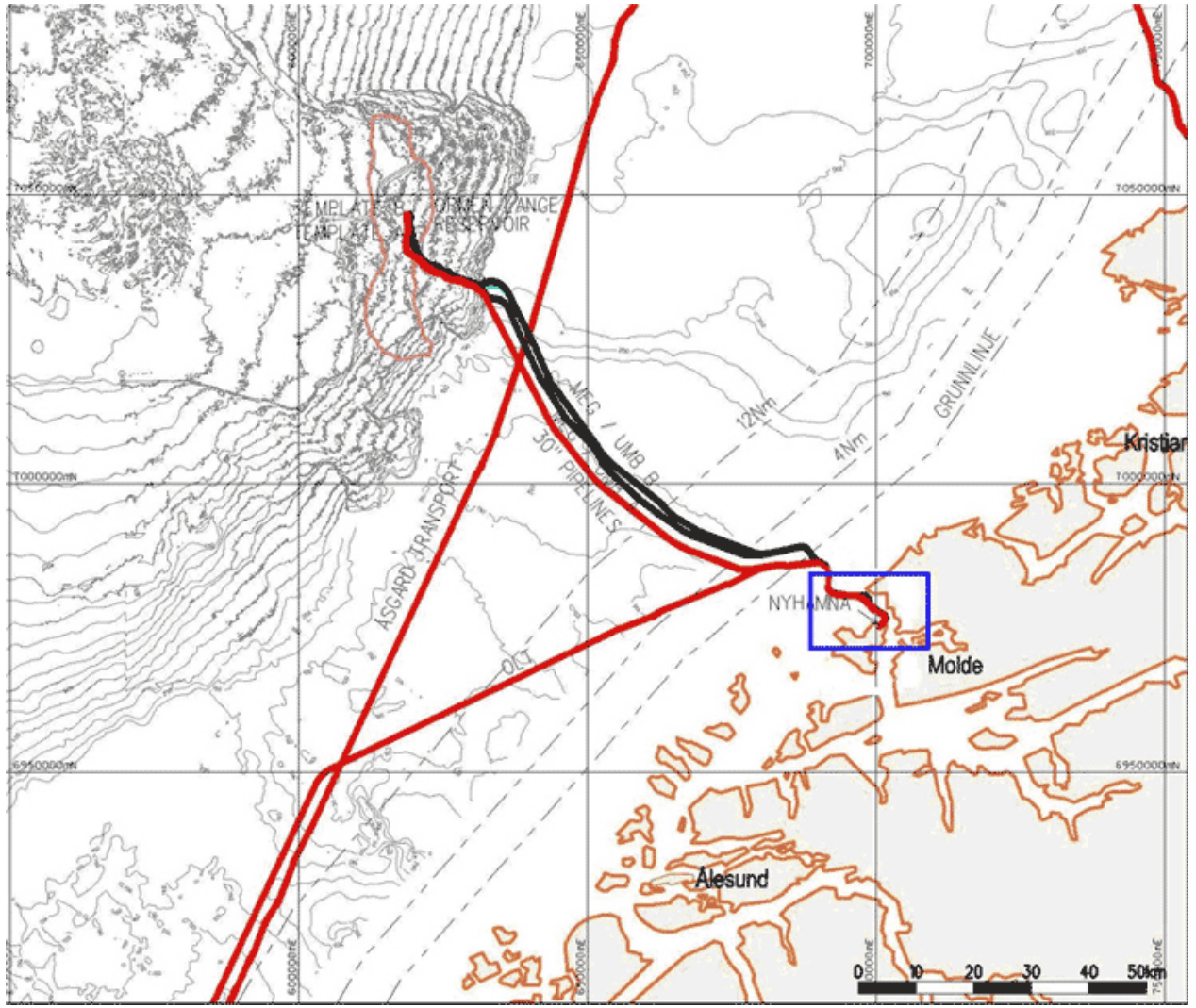


Video

The Ormen Lange Project

Norway
2003

Pipeline route.

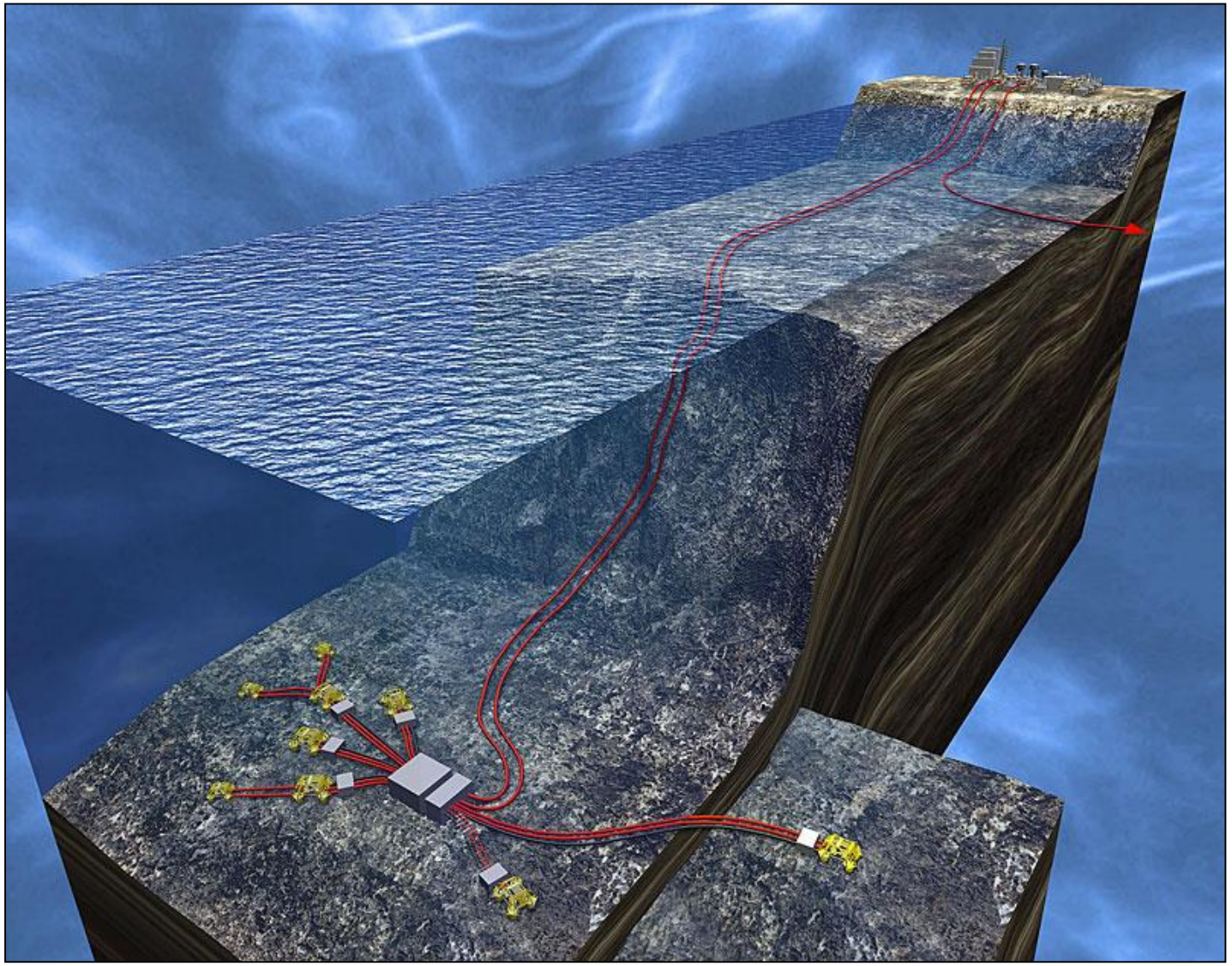


NTNU carried out a marine archaeological survey in the planned pipeline corridors in August and October 2003 to fulfil the requirements in the Norwegian Law on Protection of Cultural Heritage.

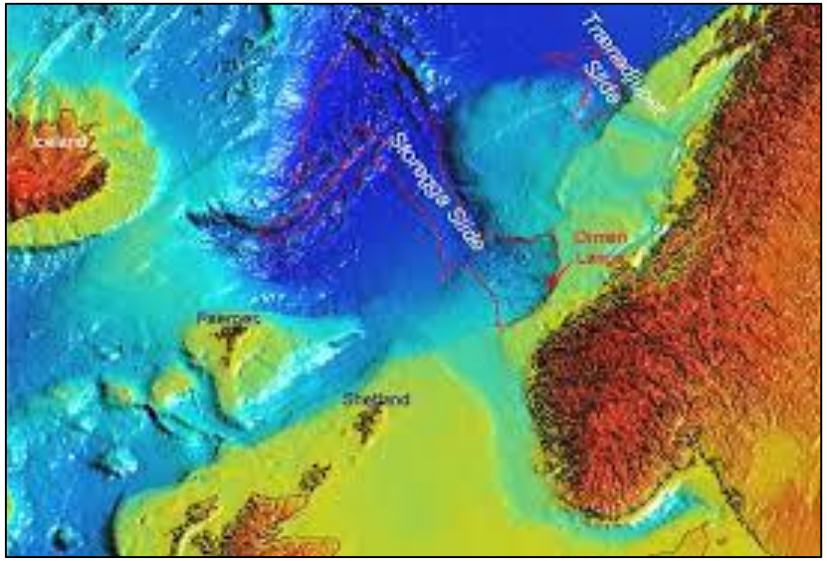
https://ieeexplore.ieee.org/document/1405629

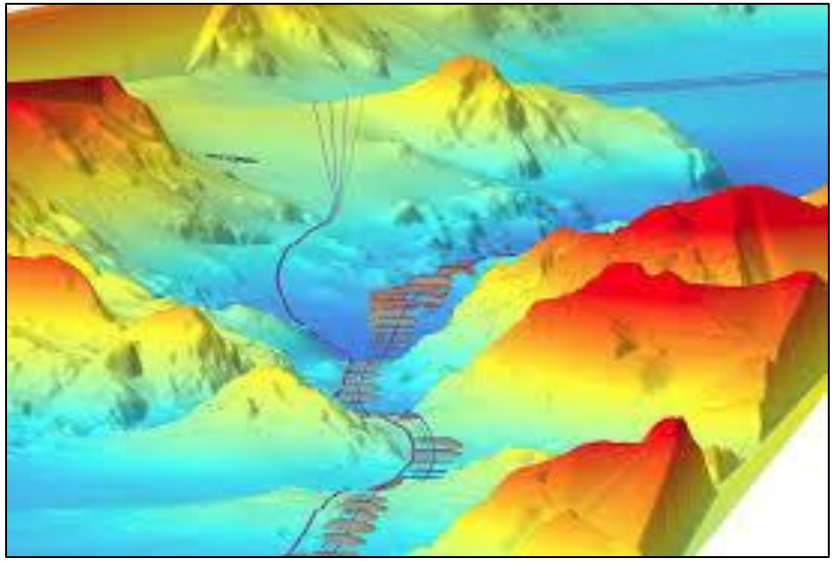
Case Studies: Ormen Lange

The sea bottom in the area dies not leave much space to move pipelines around.



The team utilised a 60-feet catamaran equipped with a Kongsberg Simrad DP system, and a Sperre ROV equipped with Kongsberg Simrad sonar and camera equipment to locate shipwrecks in the pipeline corridors.

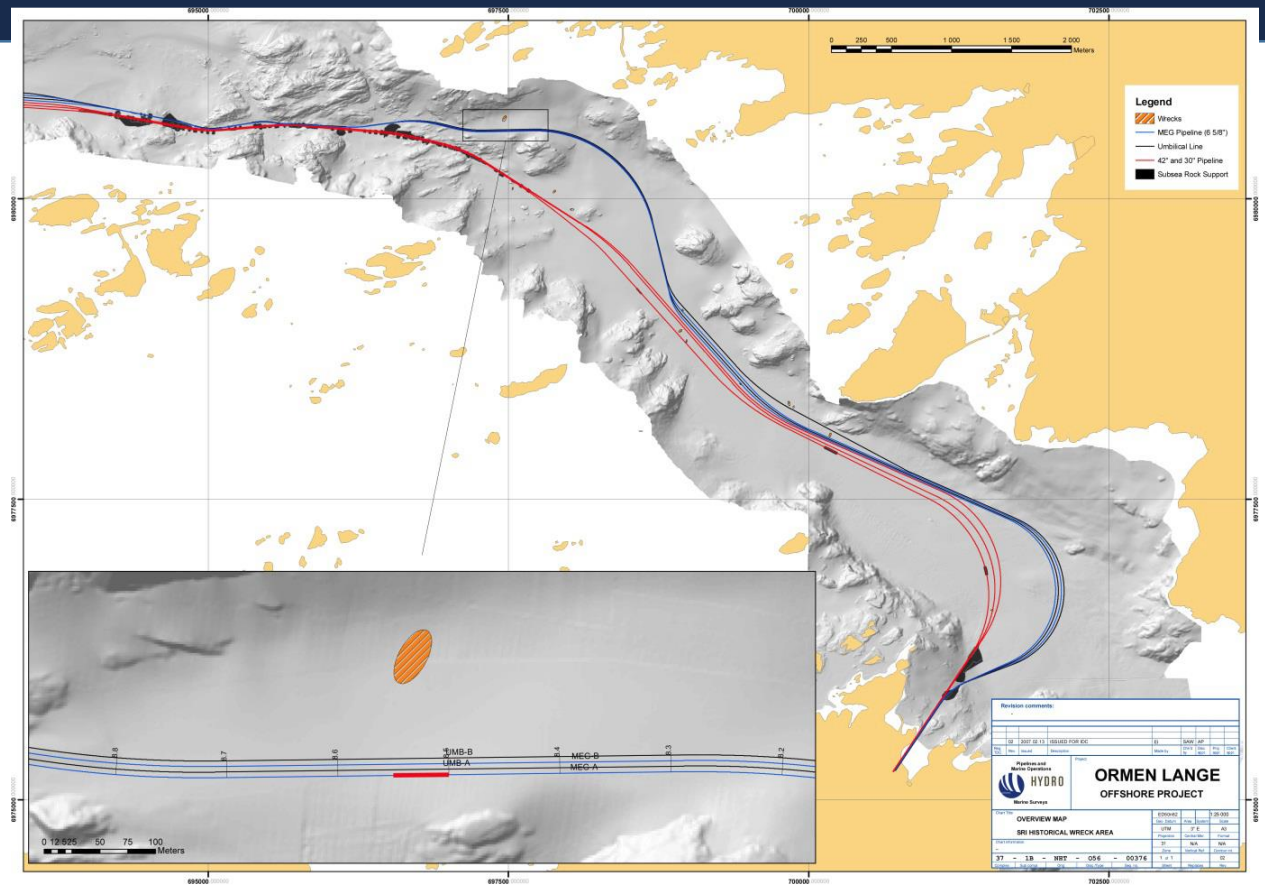




https://ieeexplore.ieee.org/document/1405629

Although the multibeam and sidescan surveys had detected eight modem shipwrecks in the area, it was decided that the existing survey data were inadequate to detect, with reasonable certainty, the presence of archaeological material in the proposed pipeline corridors.

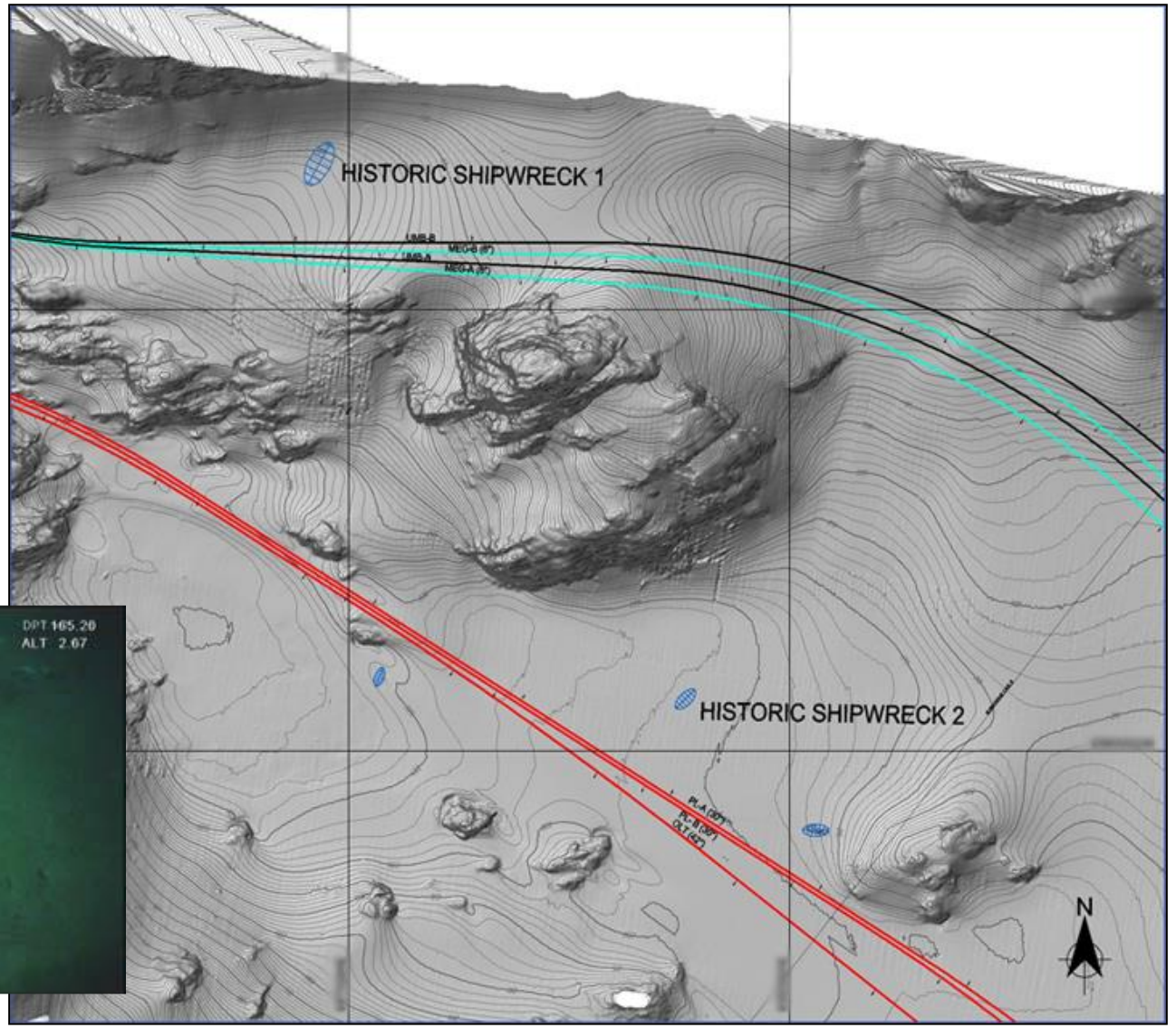
https://ieeexplore.ieee.org/document/1405629



The ROV was flown along the centerline of the pipeline routes. Sonar images were interpreted on the fly and used to locate potential targets. When an interesting target was located, the ROV was flown to it and the target was inspected using the ROV's video cameras, while the survey ship was holding position.

Archaeological Report, 2014-15

During the surveys four modern and two historical shipwrecks were discovered in or close to the planned pipeline routes.

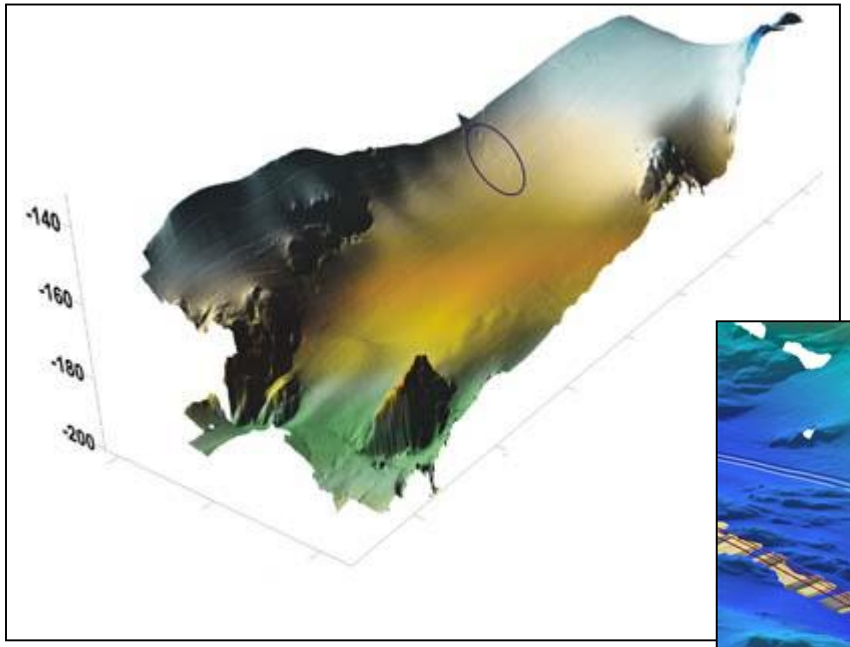


Case Studies: Ormen Lange

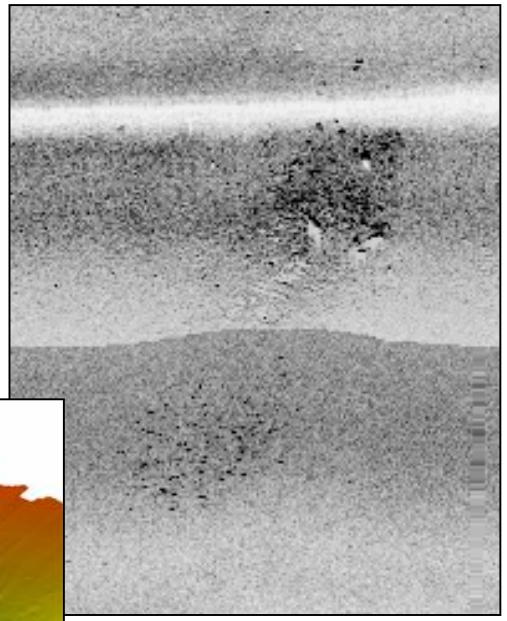
Later picture, from the monitoring program.

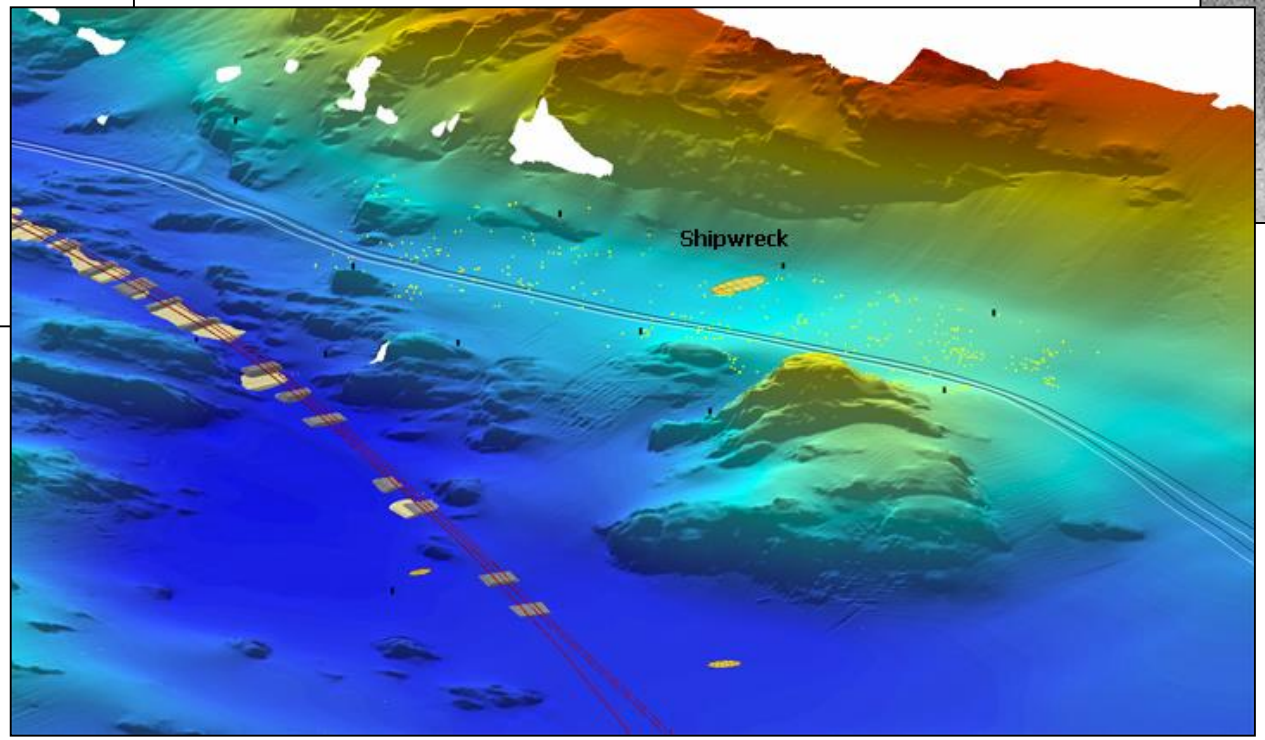
https://ieeexplore.ieee.org/document/1405629

Case Studies: Ormen Lange

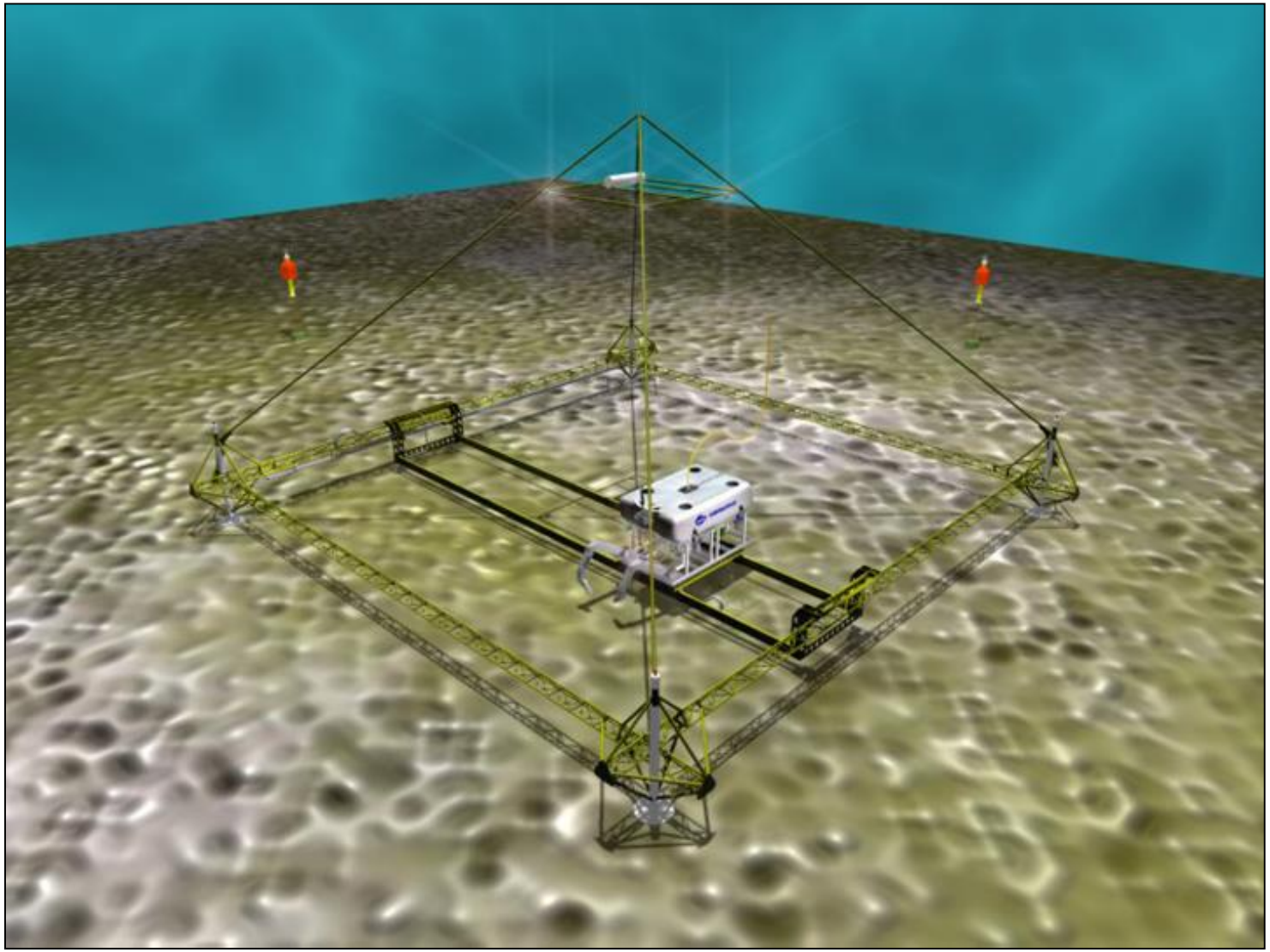


It was decided to remove part of one shipwreck, which was located too close to the pipelines.



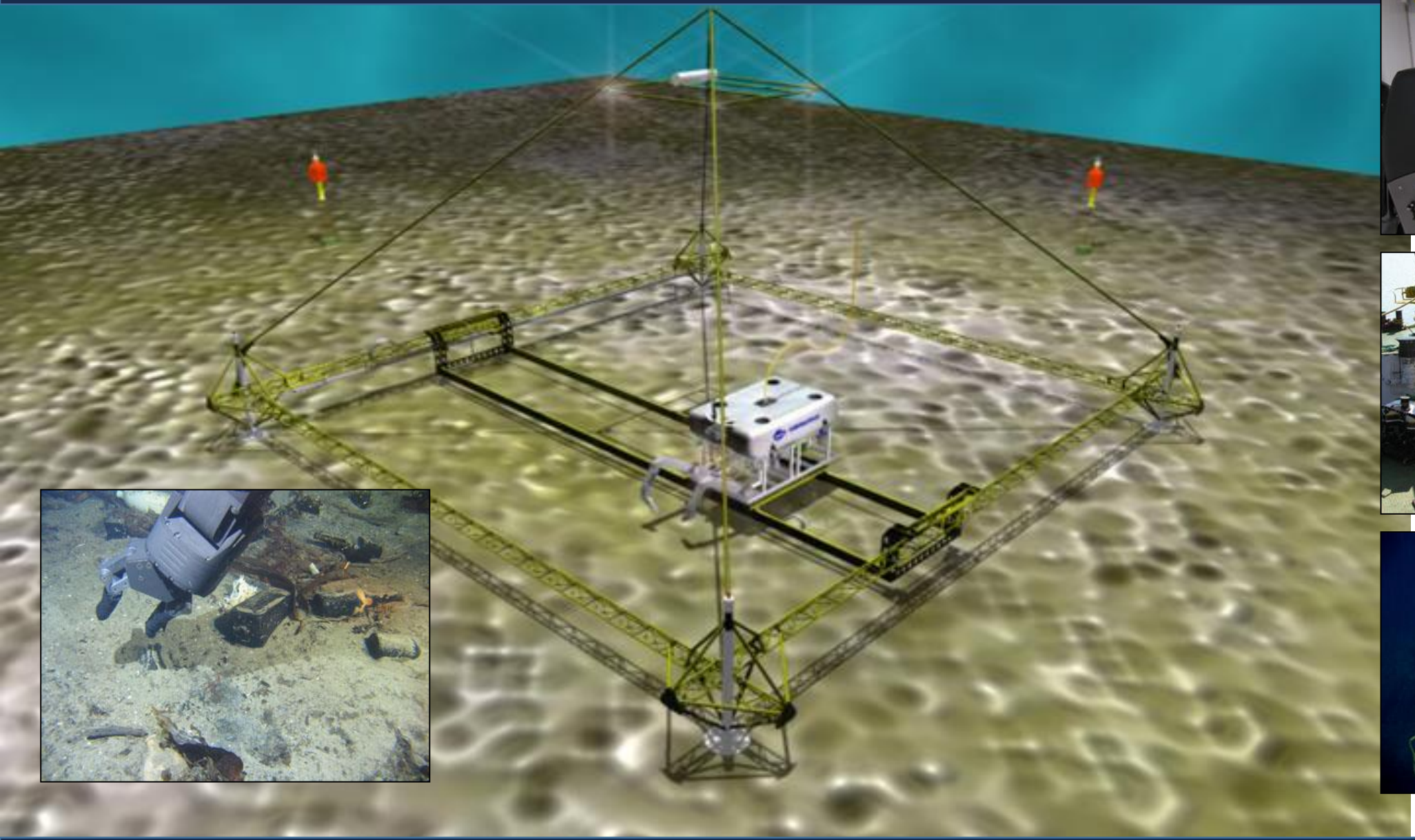


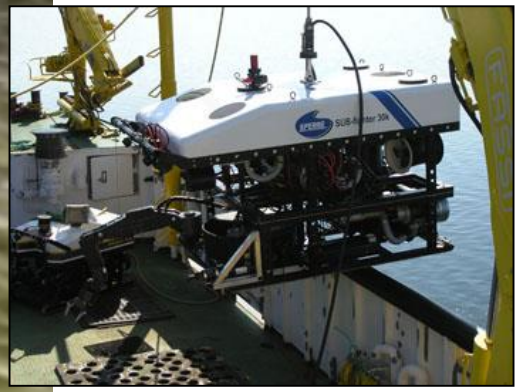
Case Studies: Ormen Lange



A frame was designed and set over the shipwreck site, and excavation was carried out with an ROV mounted on the frame.

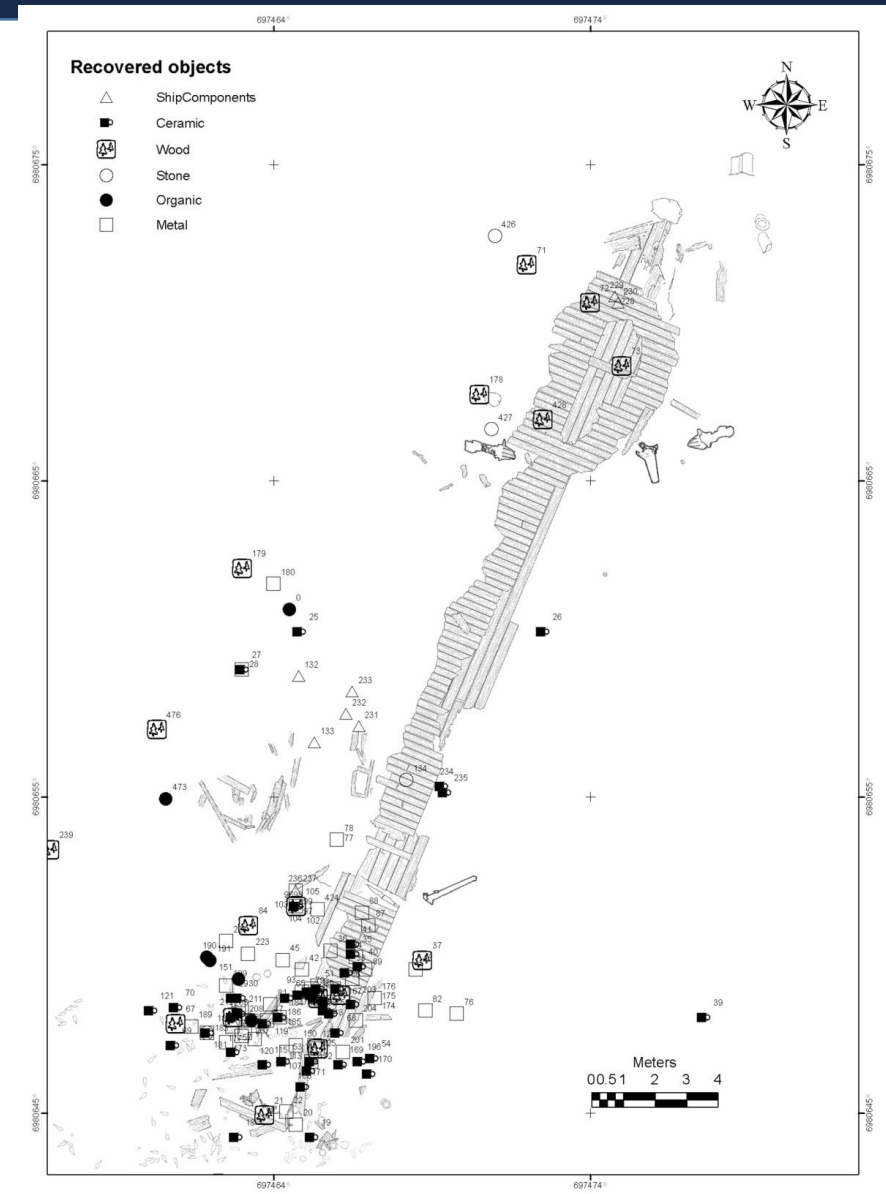
Case Studies: Ormen Lange





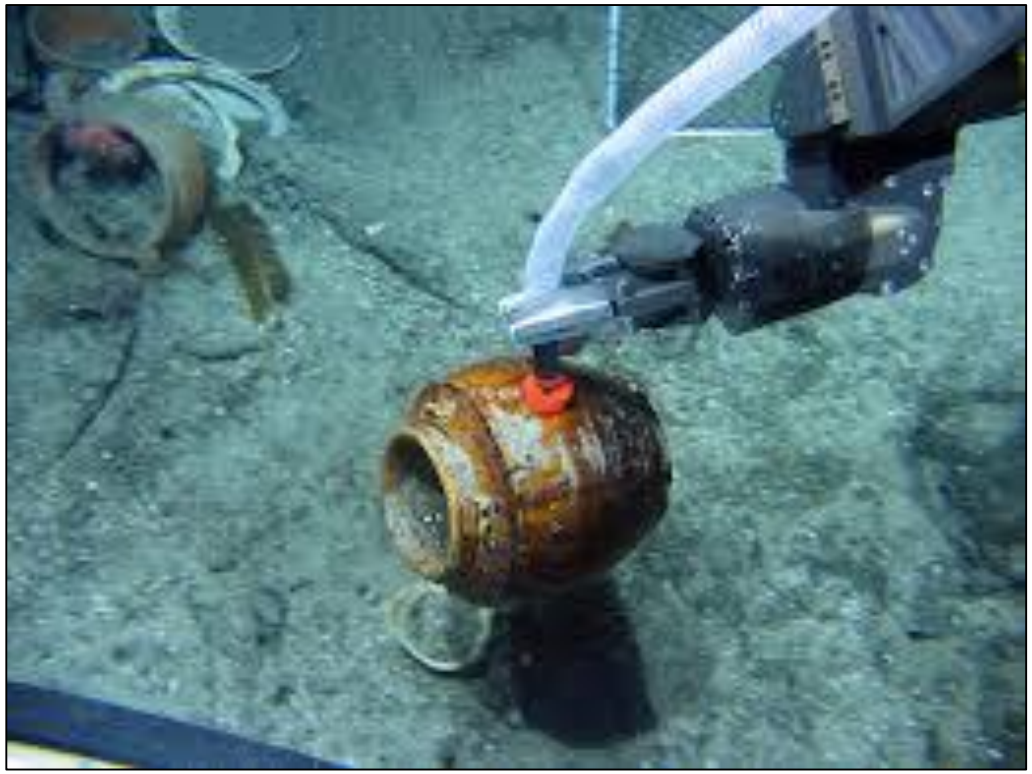
Case Studies: Ormen Lange

A large collection of bottles and porcelain, along with a large ship's bell and cannons, were observed on the seabed at a depth of some 170 meters.



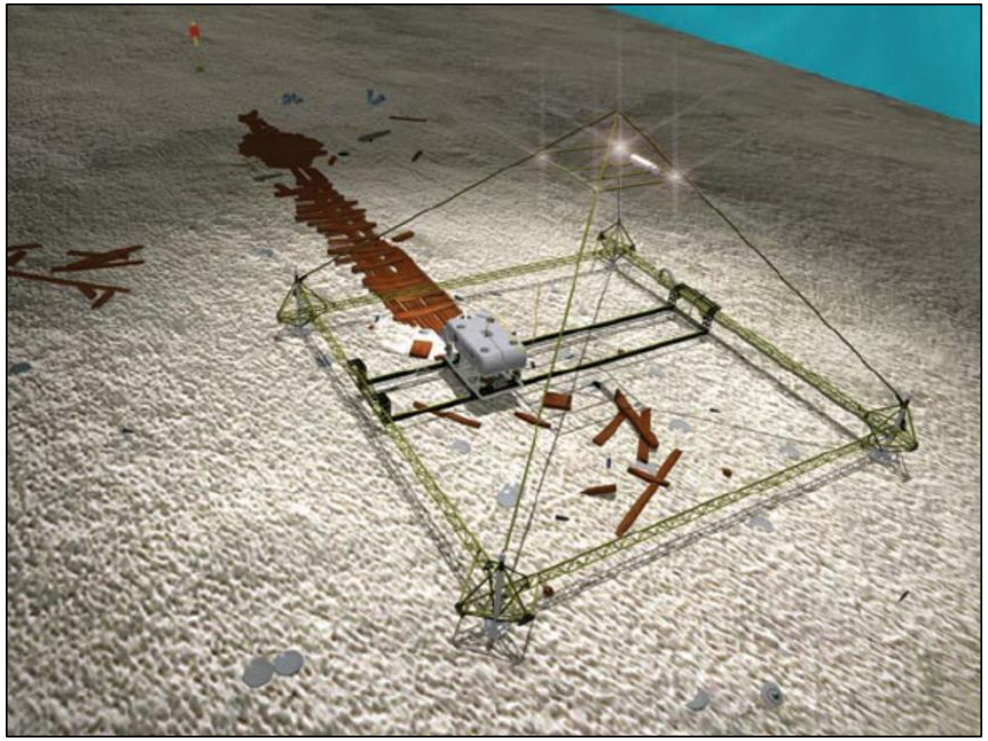
Case Studies: Ormen Lange

Underwater pictures from the site indicated that the ship probably went down in the second half of the 17th century.

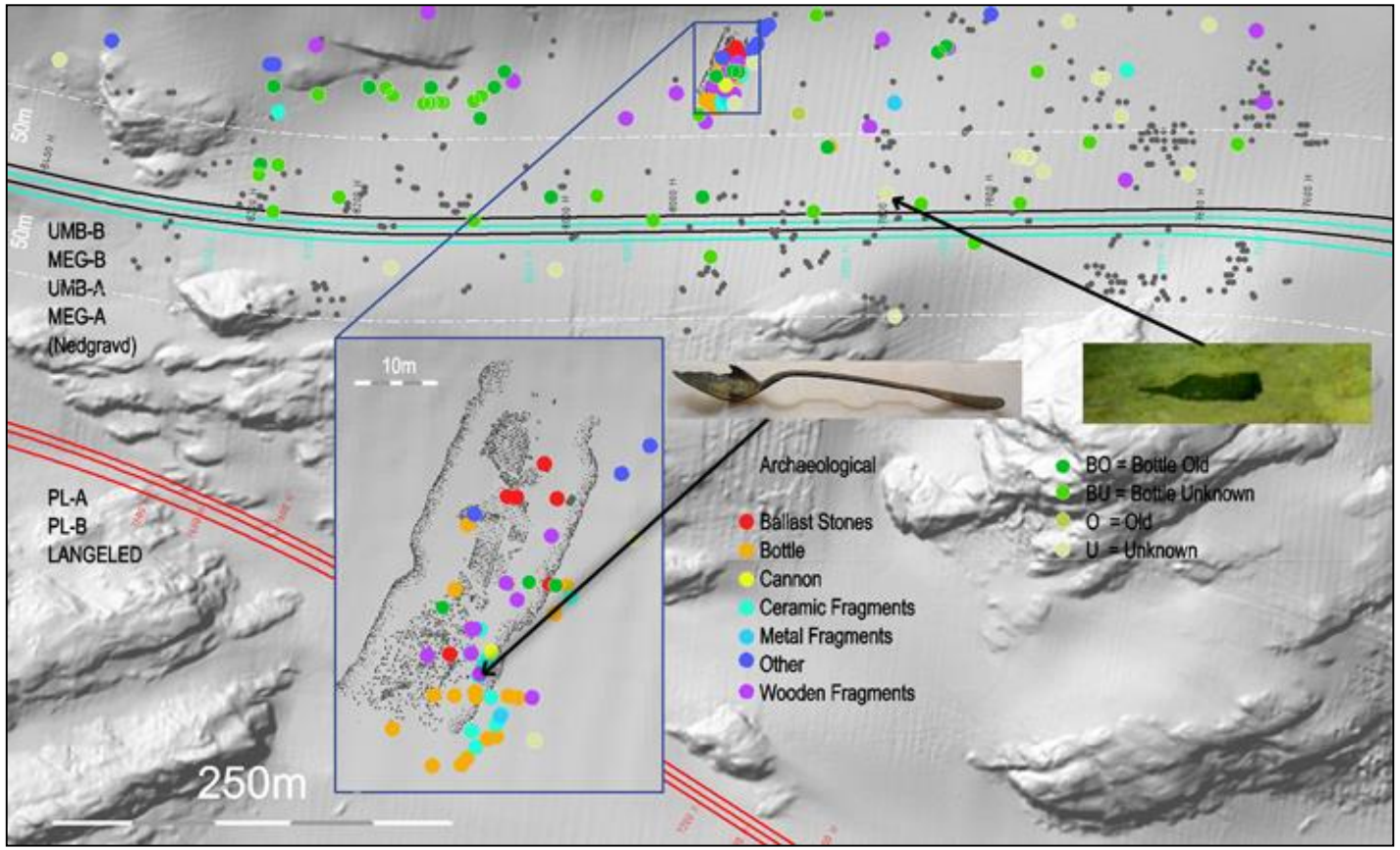


Case Studies: Dry Tortugas Shipwreck, 1622

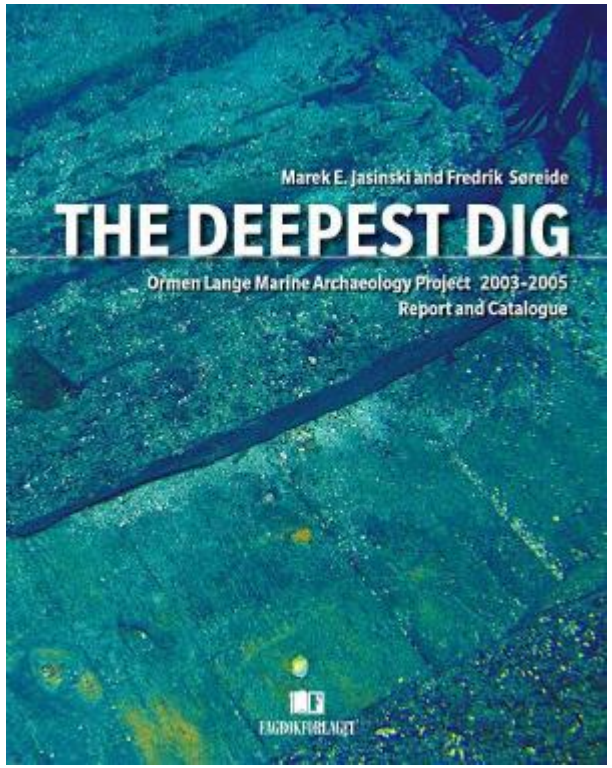
A challenging and detailed investigation of the historical site was started, including excavation of parts of the wreck site. The water depth created significant technological challenges for the archaeologists.

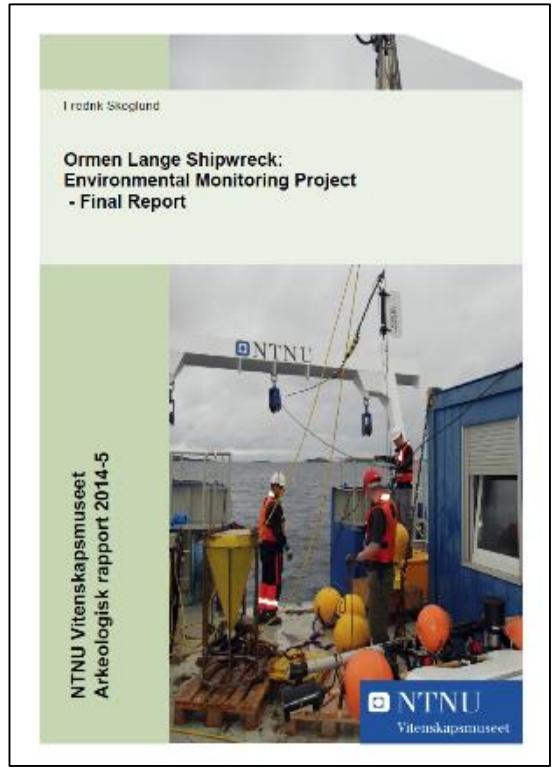


Case Studies: Ormen Lange



Case Studies: Ormen Lange

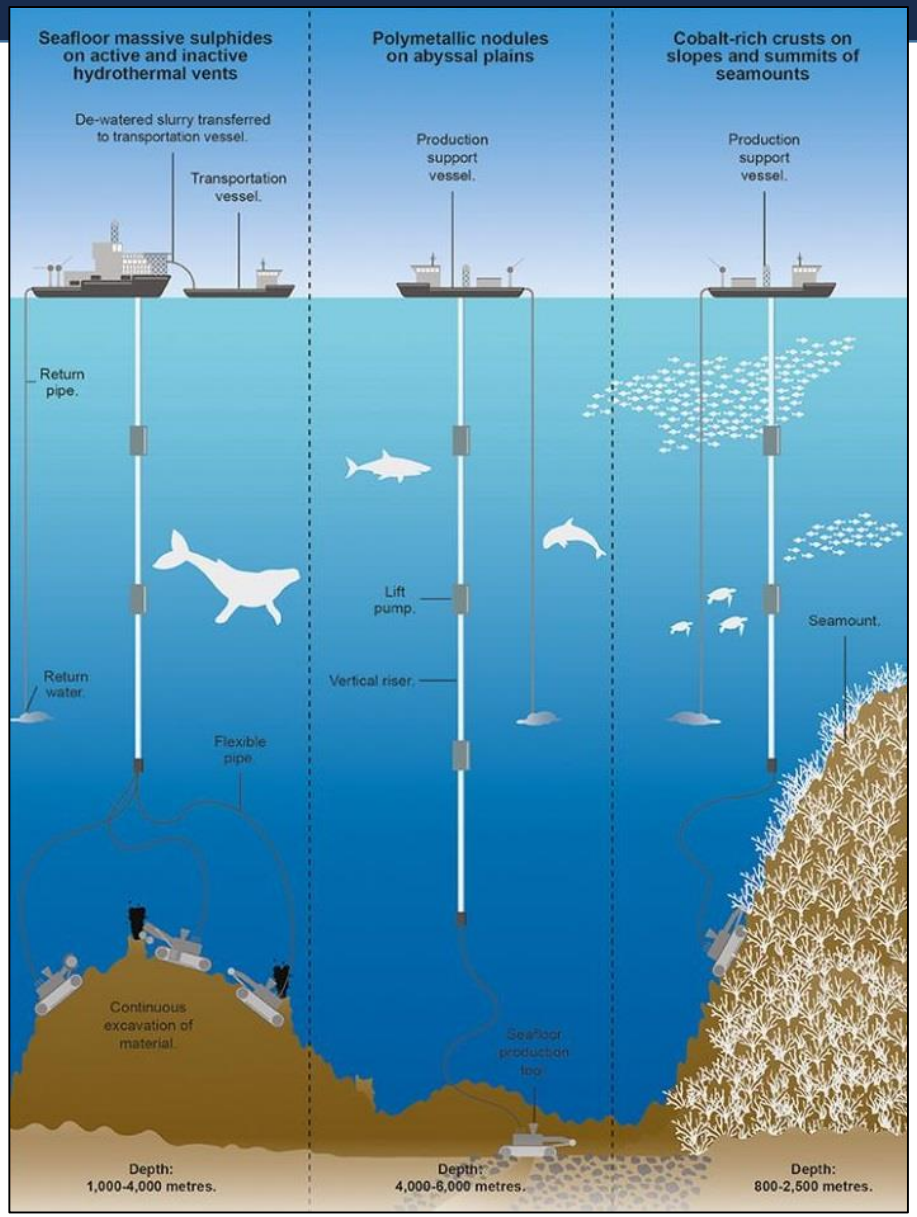




https://www.fagbokforlaget.no/The-deepest-dig/I9788245019209

The Future: Mining, Robotics and AI

In a few years, the advances on automation, marine robotics, and artificial intelligence promise to make it easy – although expensive – to plan and excavate a shipwreck site situated beyond diving depth with the same high standards used in the *San Juan* excavation.



Questions?