

YENİKAPI SHIPWRECKS PROJECT



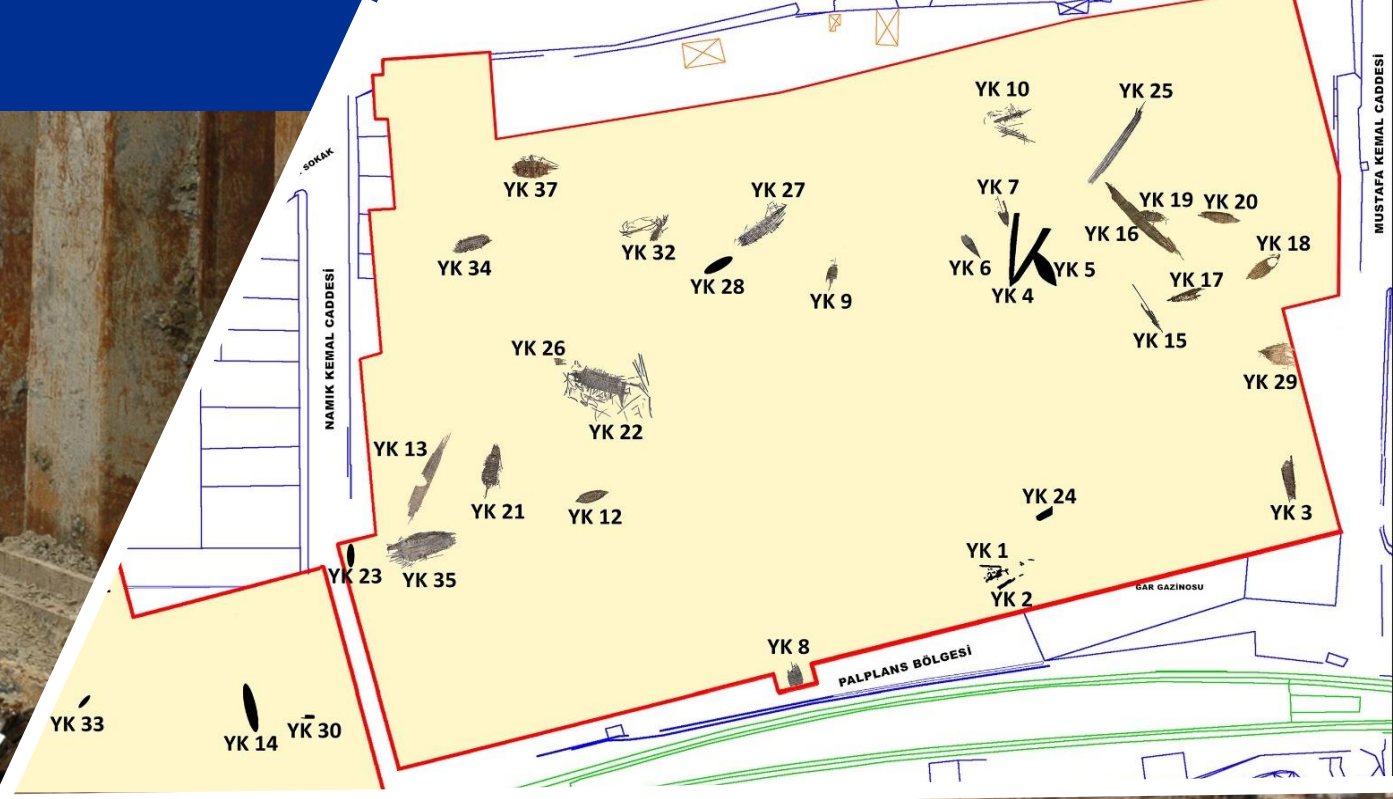
© A. Tayfun ÖNER

The Shipbuilding Techniques of 9th Century East Roman Merchant Ship YENİKAPI 12



Ufuk KOCABAŞ & Işıl ÖZSAİT-KOCABAŞ
Istanbul University, Division of Conservation of Marine Archaeological Objects

Overview



Theodosian Harbour



Yenikapı Galleys, Istanbul University

Flat-floored
at the cross-section amidships

4 wrecks with planking edge-dowels



Galley YK36

Survived dimensions: 30x10m
scattered across an area



Galley YK13

Survived dimensions: 20.80x2.80
Date: AD 690-890



Galley YK16

Survived dimensions: 22.50x2.40m
Date: AD 721-895



Galley YK25

Survived dimensions: 19x1.50m
Date: 10th century AD



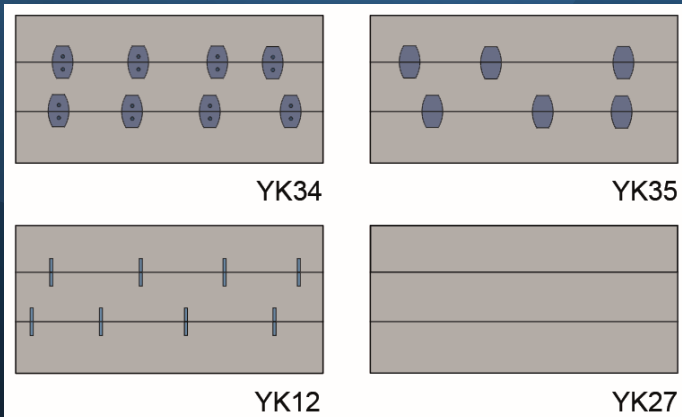
Yenikapı Cargo Ships and Boats, Istanbul University

Flat-floored or wineglass-shaped at the cross-section amidships

4 wrecks with mortise-and-tenon

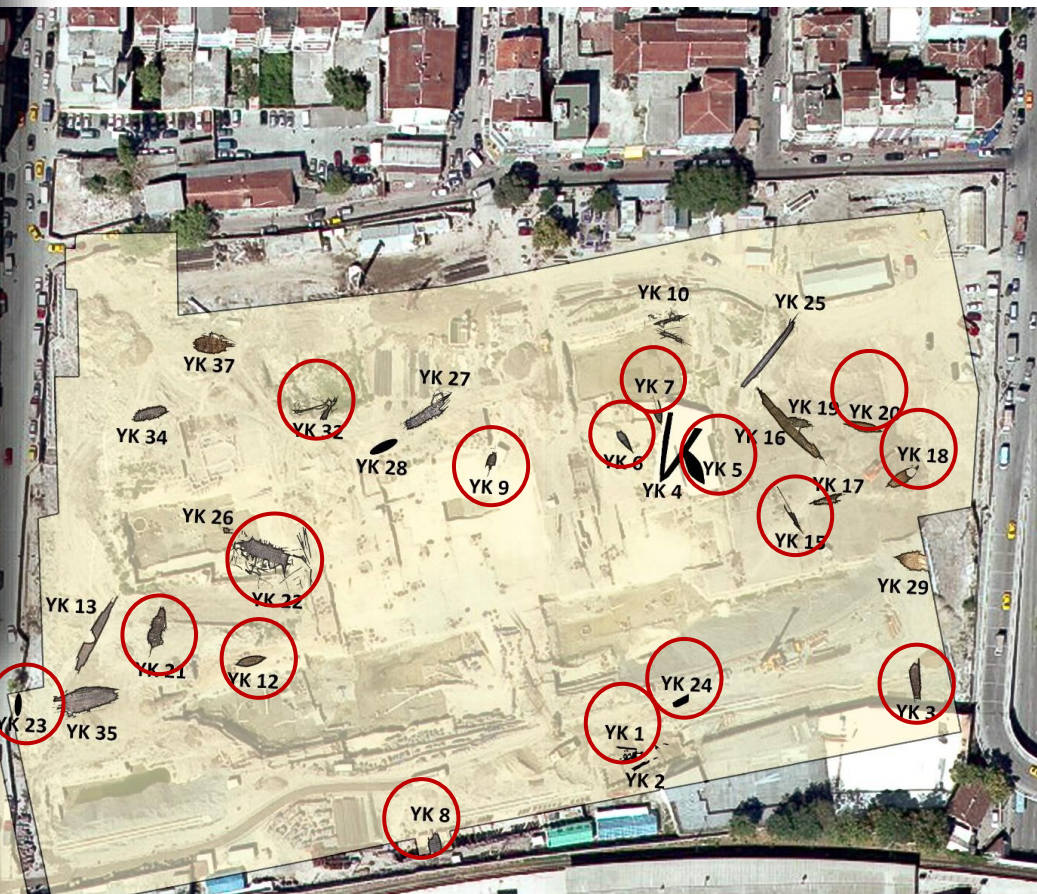
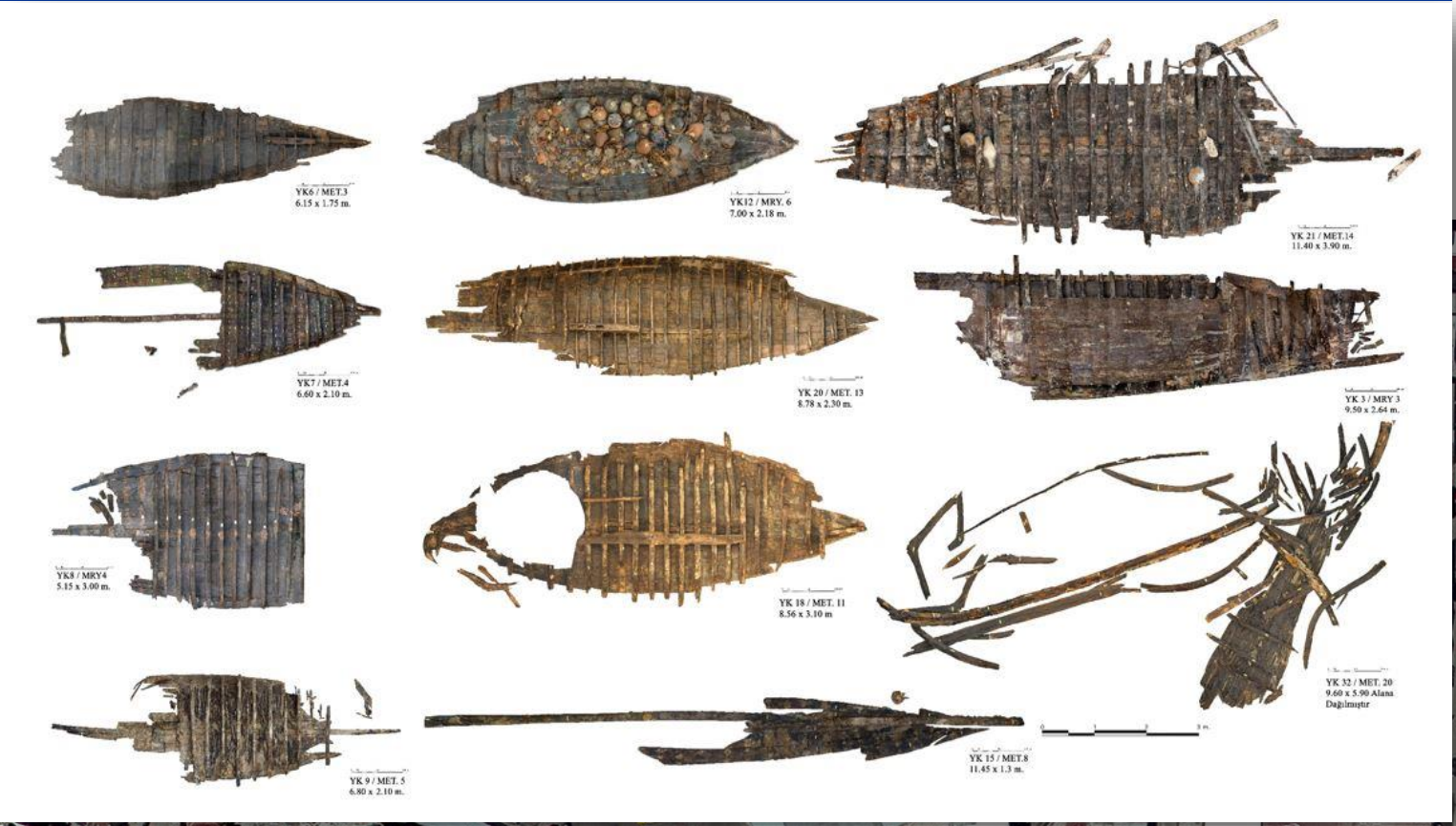
13 wrecks with planking edge-dowels

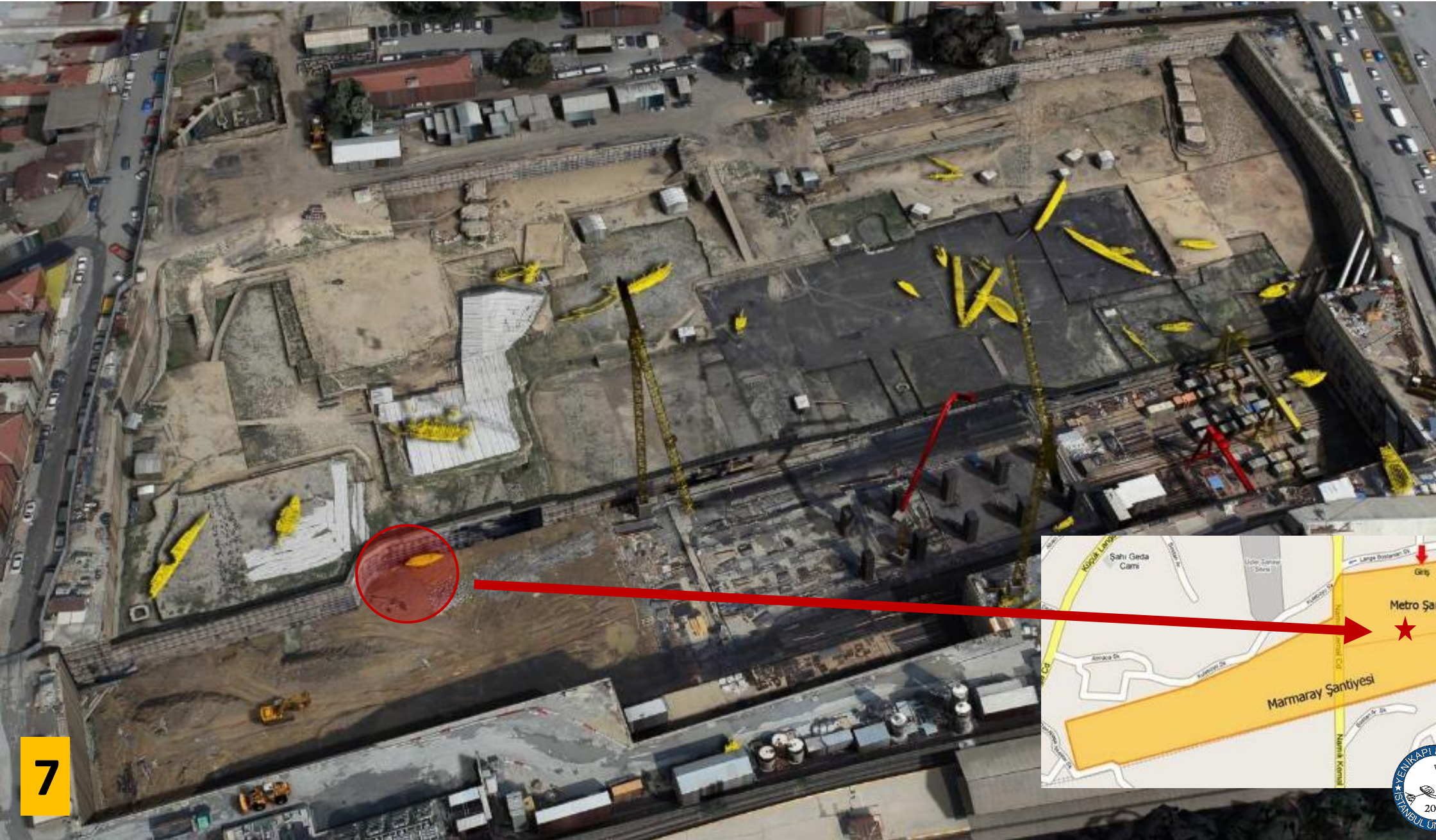
6 wrecks without planking fasteners

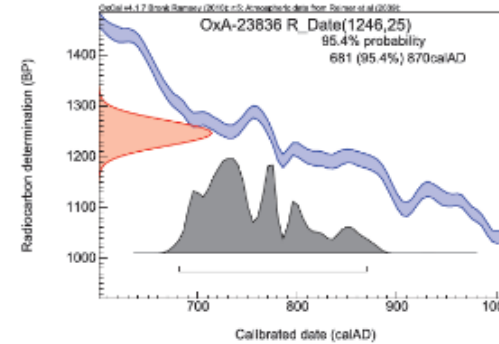
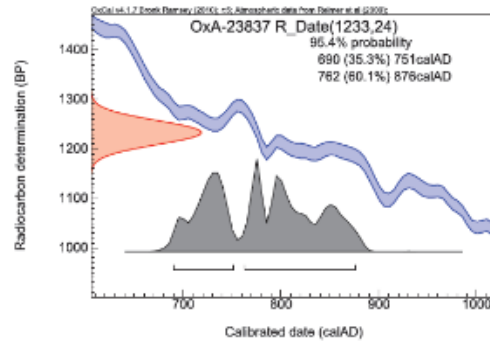
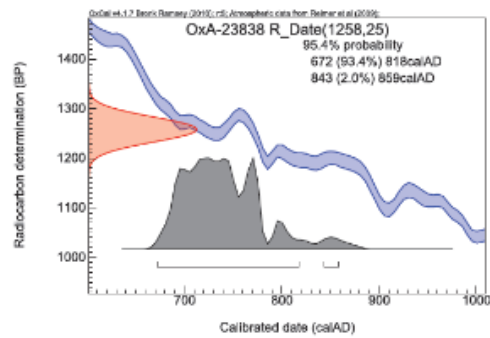


Vessel	Level (m)	Date (AD)	Extant Length (m)	Cross-section amidships	Planking edge-joints
Small merchantmen					
YK6	-0.67/-0.90	Str. 10th	6.20	Flat-floored	Dowels
YK7	-0.91/-1.02	Str. 10th	6.60	Flat-floored	Dowels
YK8	-0.90/-1.26	Str. 10th	5.00	Flat-floored	Dowels
YK9	-1.40	Str. 10th	6.54	Flat-floored	Dowels
YK12	-1.30	¹⁴ C: 672-876	7.00	Flat-floored with hollow garboards	Dowels
YK18	-1.42/-1.50	Str. 10th	8.25	Flat-floored with hollow garboards	Dowels
YK19	-1.40	Str. 8th	7.30	Flat-floored	No edge-fastener
YK20	-0.70/-1.00	¹⁴ C: 687-975	8.76	Flat-floored	Dowels
YK26	-3.50	Str. 5th-6th	2.60	?	Unpegged mortise-and-tenon
YK30	-2.20	Str. 8th-9th	scattered	?	?
Medium merchantmen					
YK3	-0.69	¹⁴ C: 668-987	9.12	Flat-floored with hollow garboards	Dowels
YK10	-2.29/-2.37	Str. 8th	8.90	Flat-floored	No edge-fastener
YK15	-1.90	Str. 8th-9th	11.45	Flat-floored	Dowels
YK17	-2.18/-2.40	¹⁴ C: 652-870	8.20	Flat-floored	No edge-fastener
YK21	-0.70/-0.60	Str. 9th-10th	11	Flat-floored with hollow garboards	Dowels
YK27	-2.20/-3.15	¹⁴ C: 672-869	12.00	Flat-floored	No edge-fastener
YK28	-2.00/-2.40	-	scattered	?	No edge-fastener
YK29	-2.40	Str. 8th	7.90	Flat-floored with hollow garboards	No edge-fastener
YK31	-1.50/-2.20	Str. 9th	5.00	?	No edge-fastener
YK32	-1.55	Str. 8th-9th	9.30	Shallow wineglass-shaped	Dowels
YK34	-2.30	Str. 5th	7.60	Wineglass-shaped	Pegged & unpegged mortise-and-tenon
Large merchantmen					
YK22	-3.60/-4.00	¹⁴ C: 430-606	15.00	Wineglass-shaped	Unpegged mortise-and-tenon
YK35	-4.11/-5.23	Finds: 5th	15.00	Wineglass-shaped	Unpegged mortise-and-tenon

Yenikapi merchantmen with planking edge-dowels





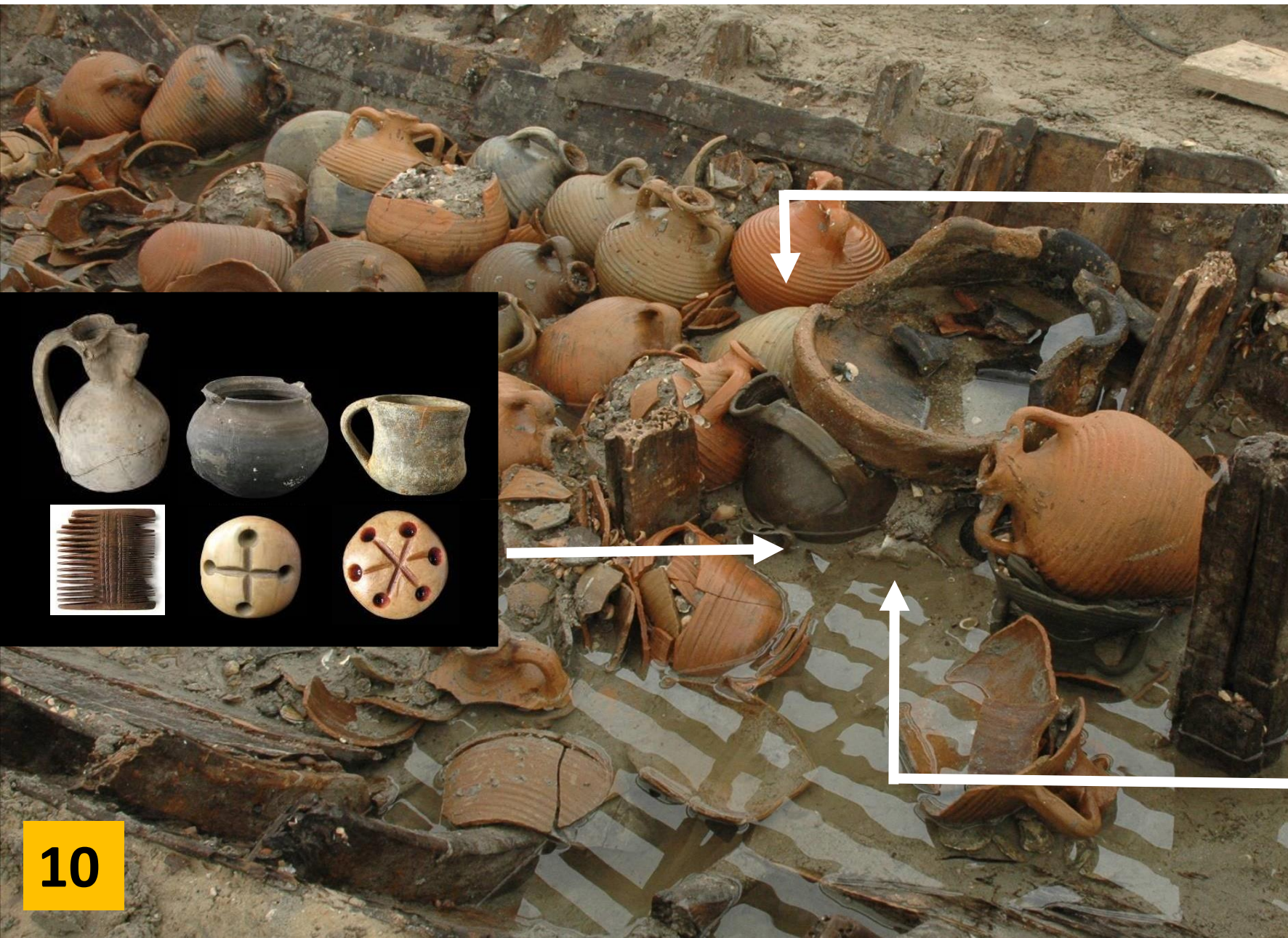


¹⁴C : 672 - 876 AD
Coin: 9th century AD

Sample ID	Timber type	¹⁴ C age years BP	Calibrated	Probability	Wood species
OxA-23836	Floor timber 11	1246 ± 25 BP	cal AD 681–870	95.4%	White oak
OxA-23837	Plank PS7-2	1233 ± 24 BP	cal AD 690–876 cal AD 762–876	95.4% 60.1%	Anatolian chestnut
OxA-23838	Keel 3	1258 ± 25 BP	cal AD 672–859 cal AD 672–818	95.4% 93.4%	Oriental beech

Excavation of YK12





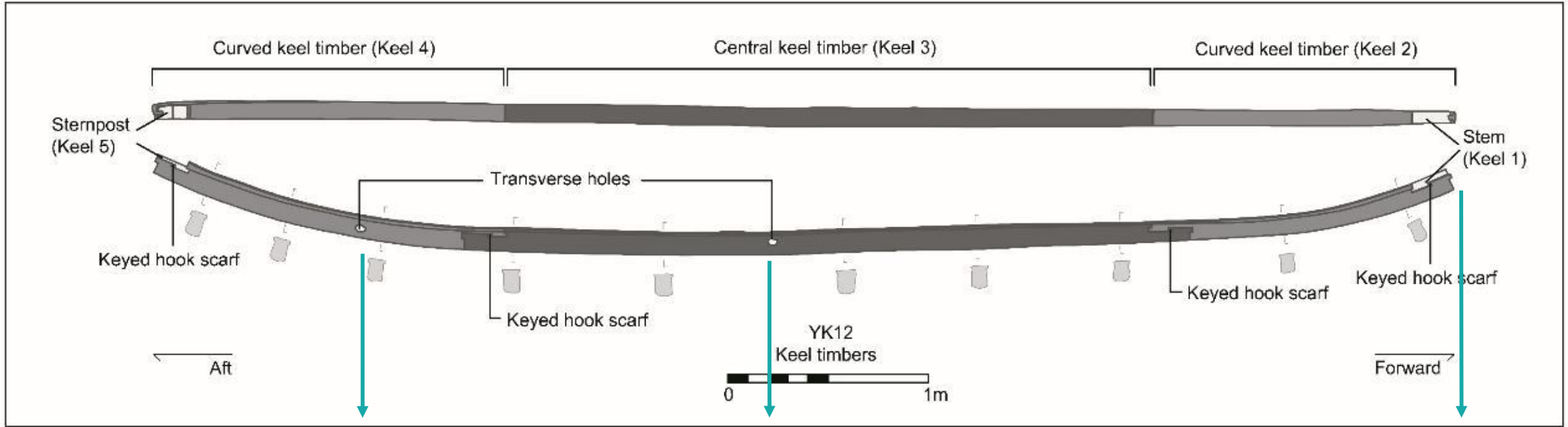
Olive seeds



Cherry basket







Transverse holes

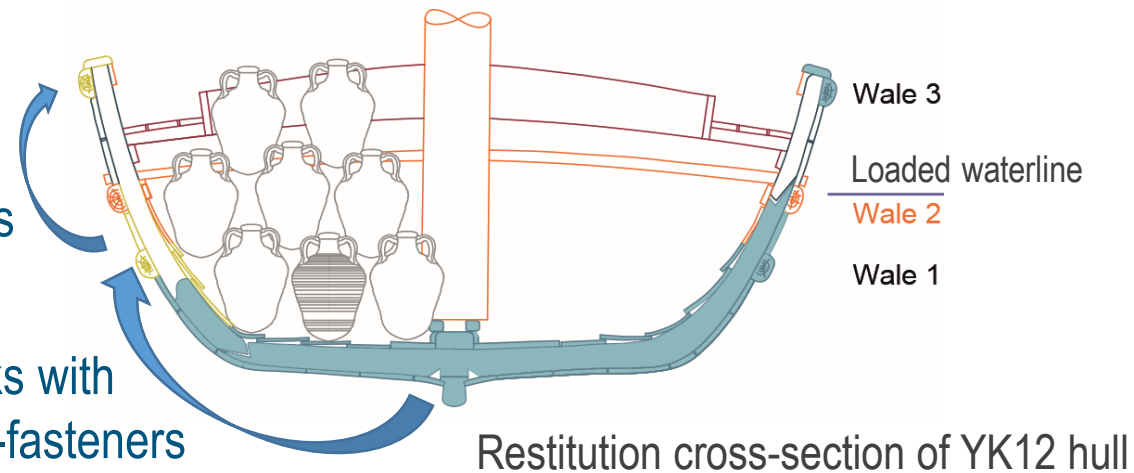


Keyed hook scarf

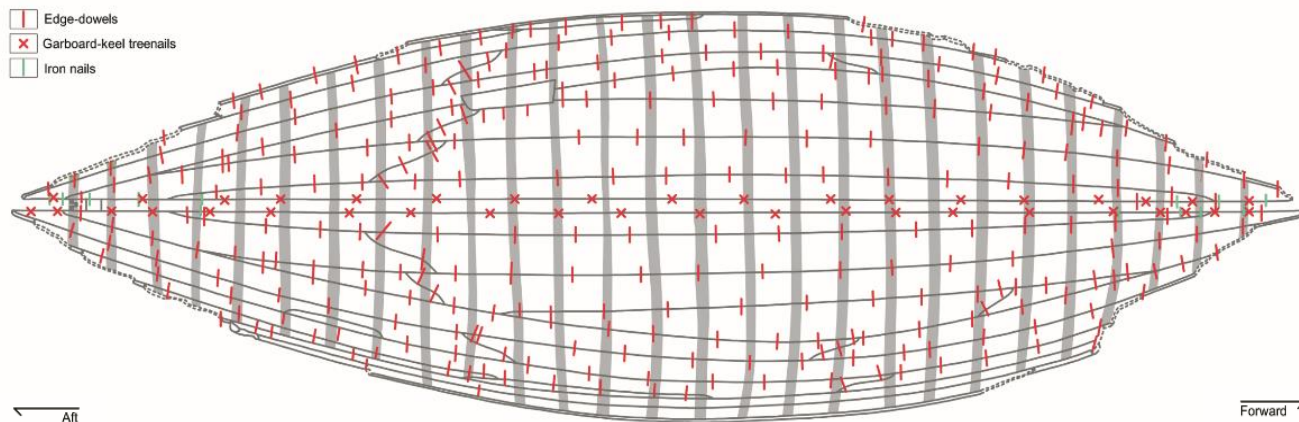


Planks no edge-fasteners

Planks with edge-fasteners

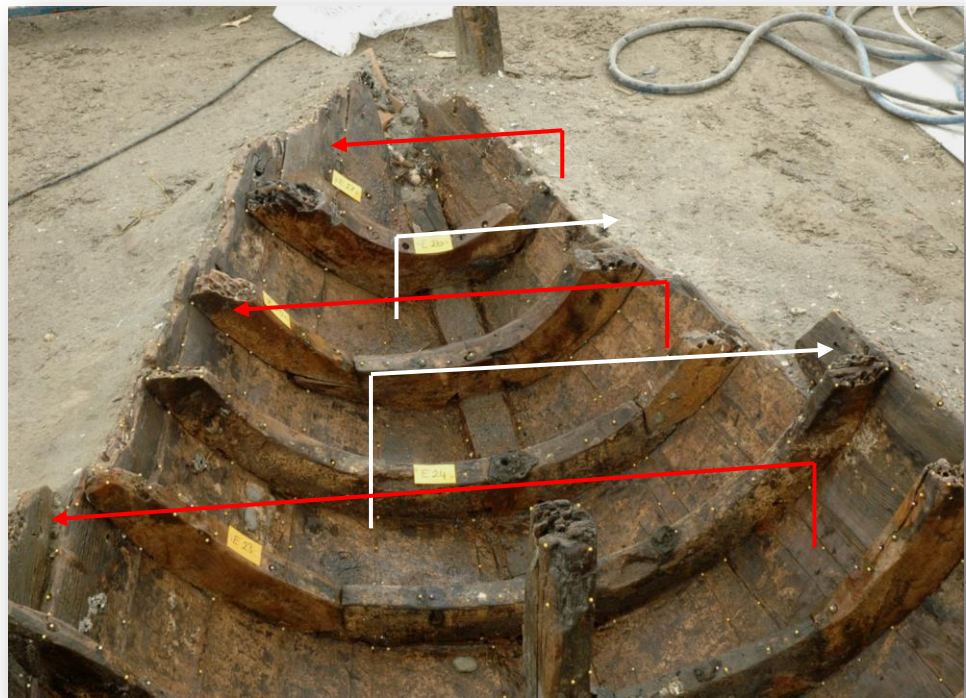


- Edge-dowels
- Carboard-keel trenails
- Iron nails



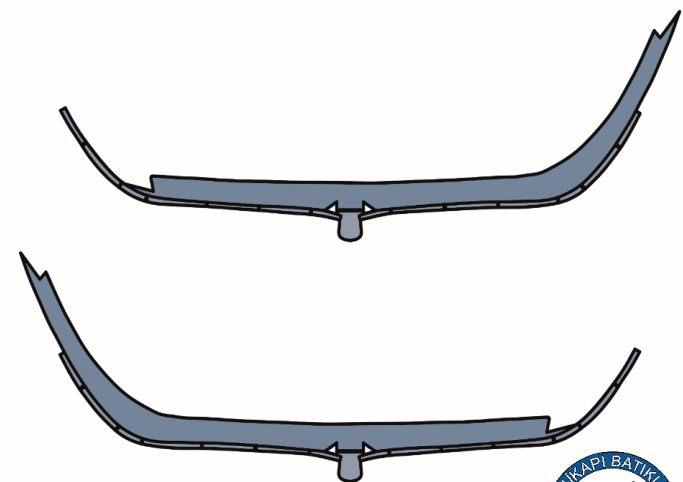
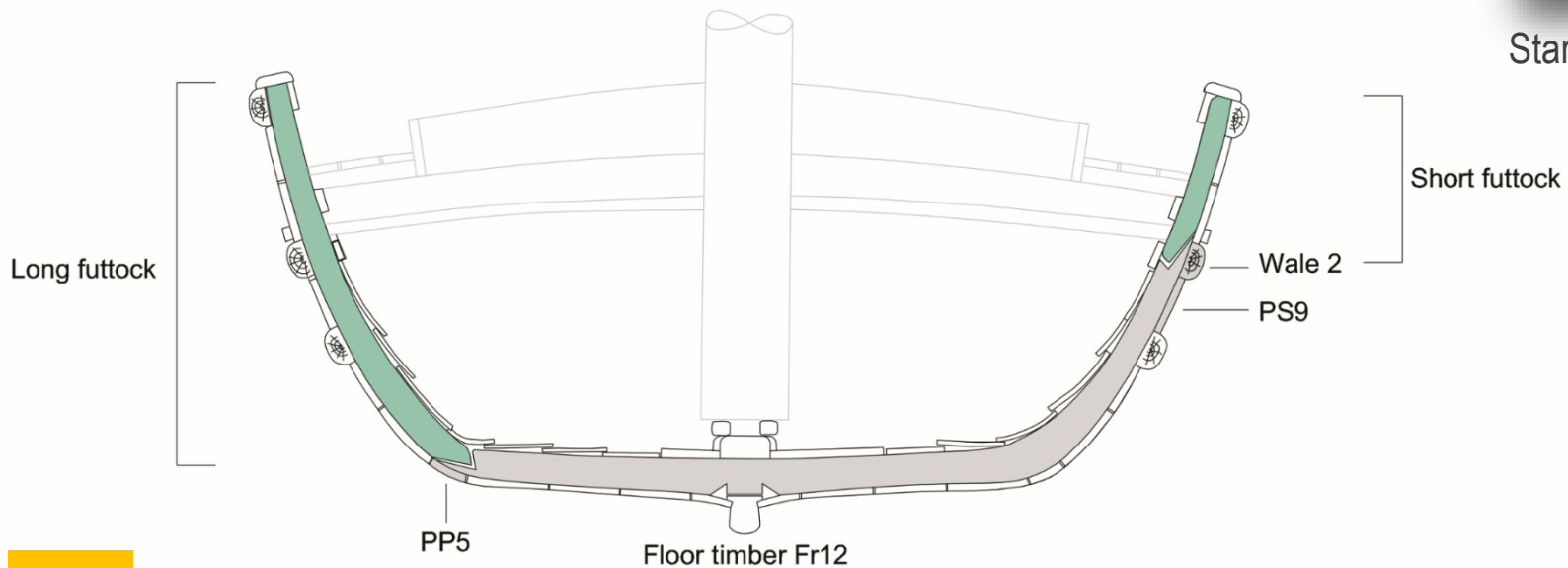
Framing pattern

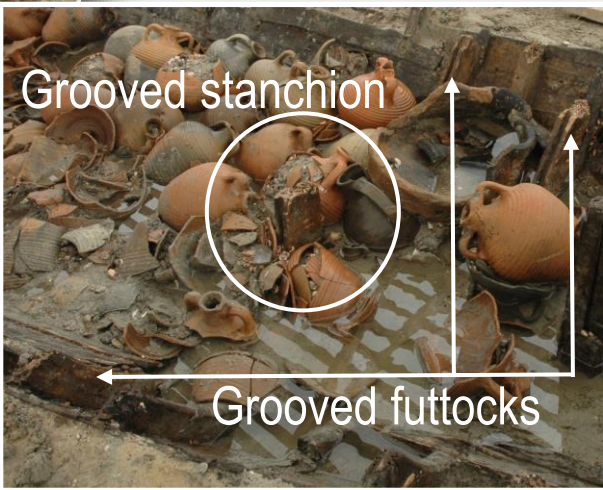
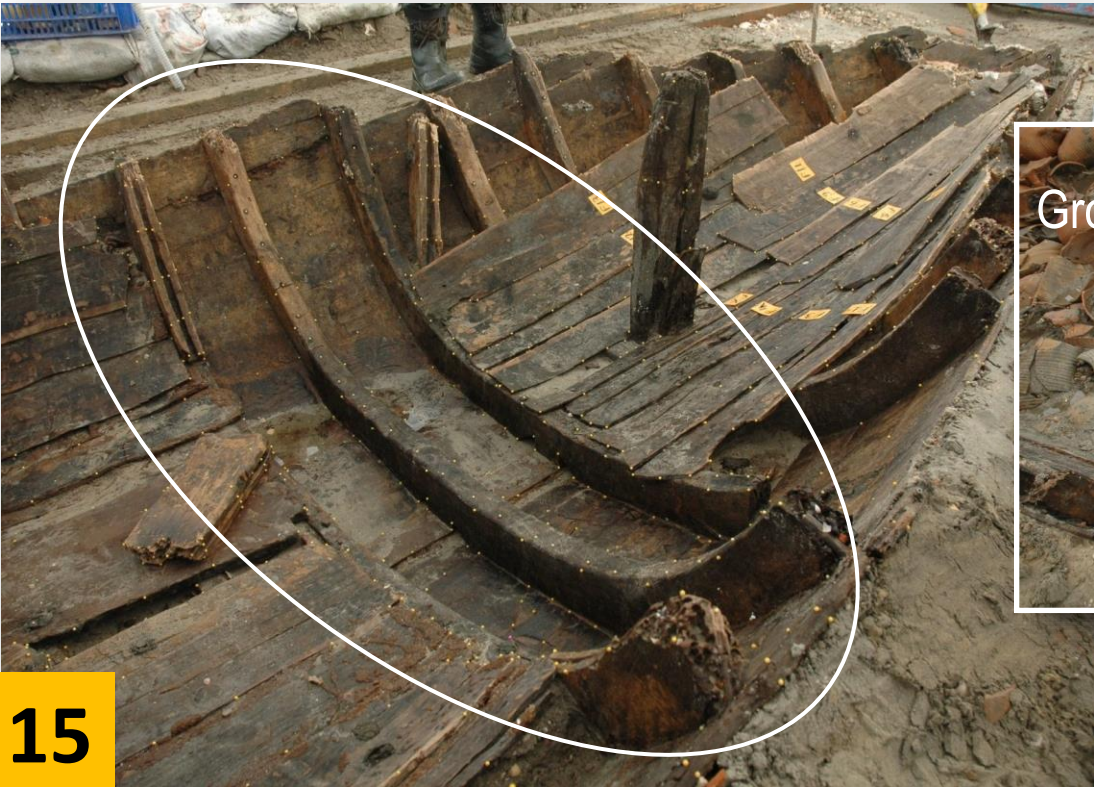
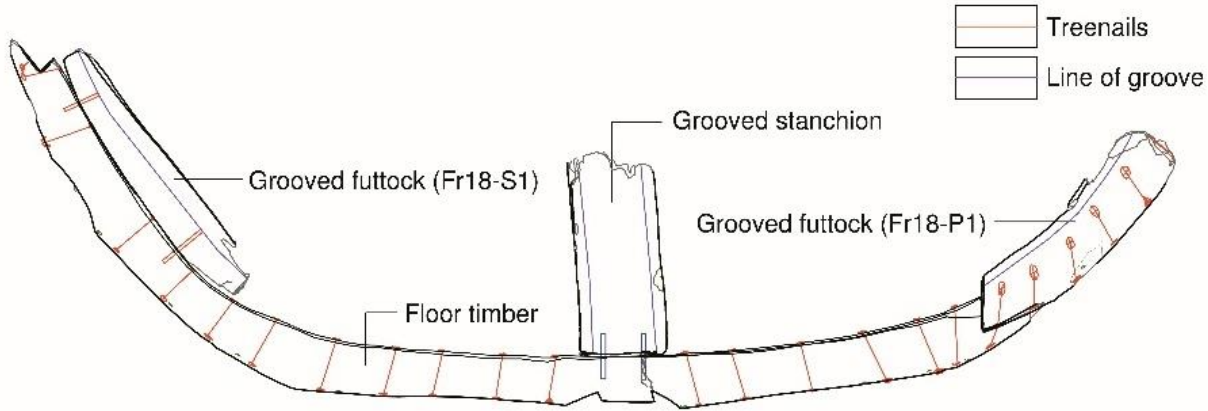
The framing pattern is floor-timbers with long arms alternating to port and starboard

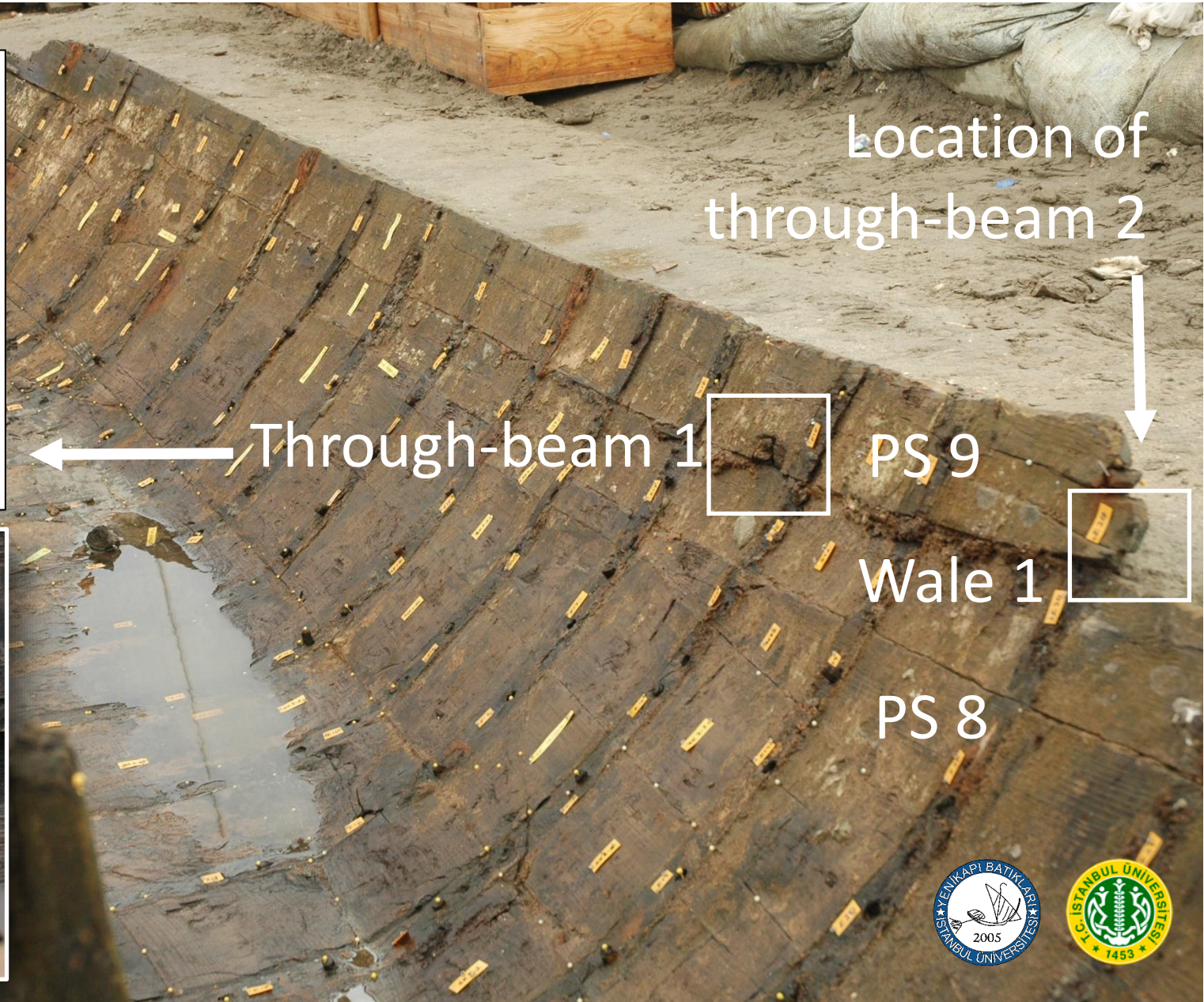
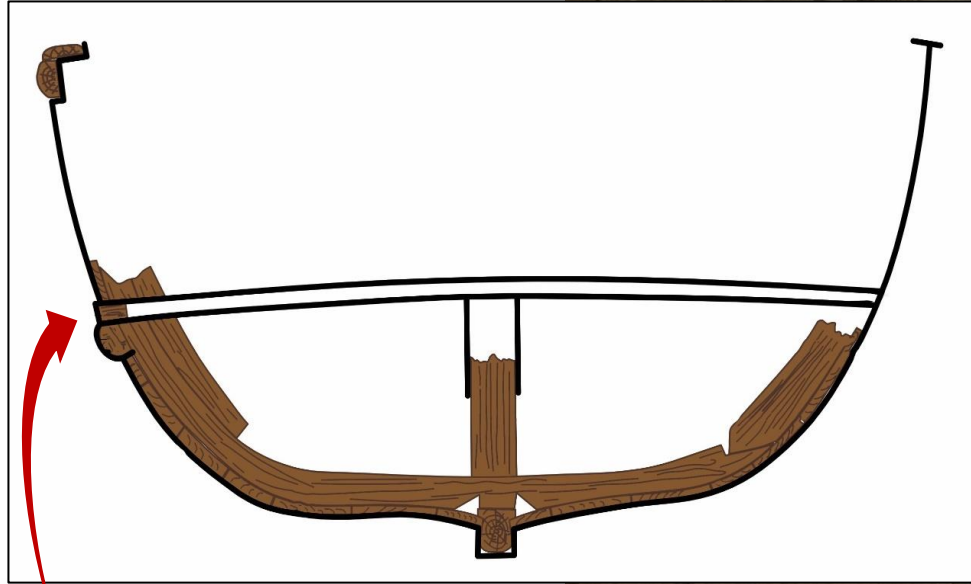


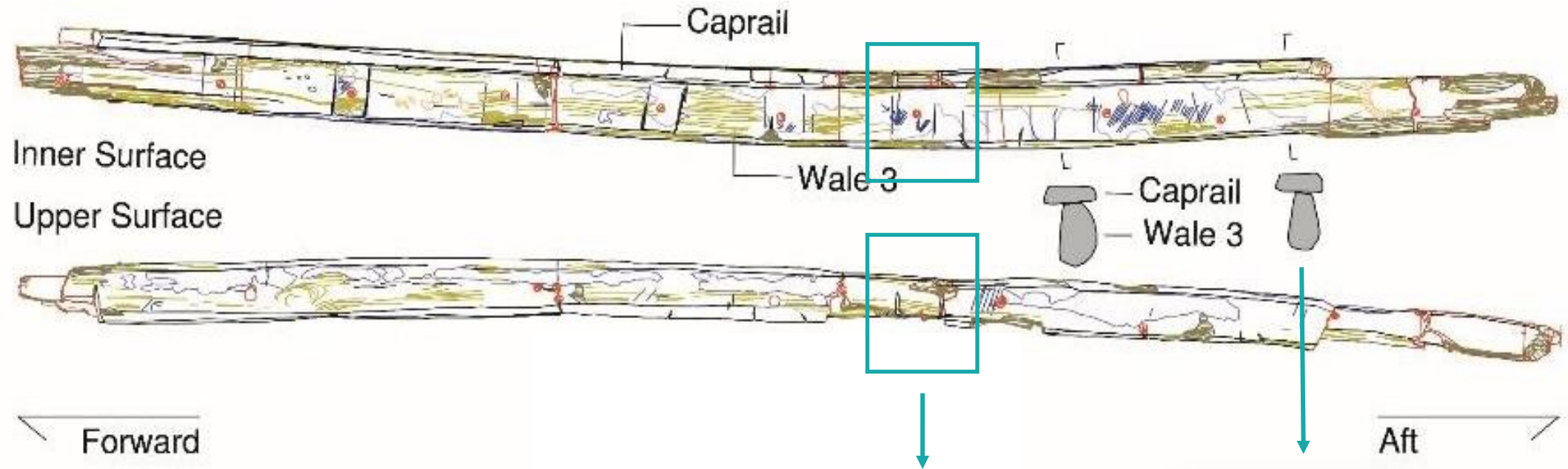
Starboard side

Port side

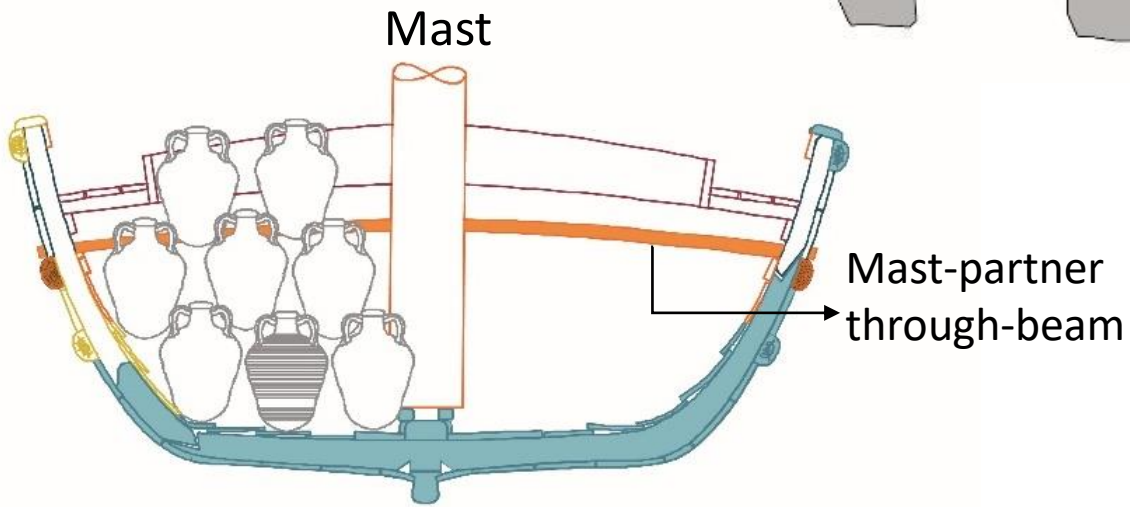
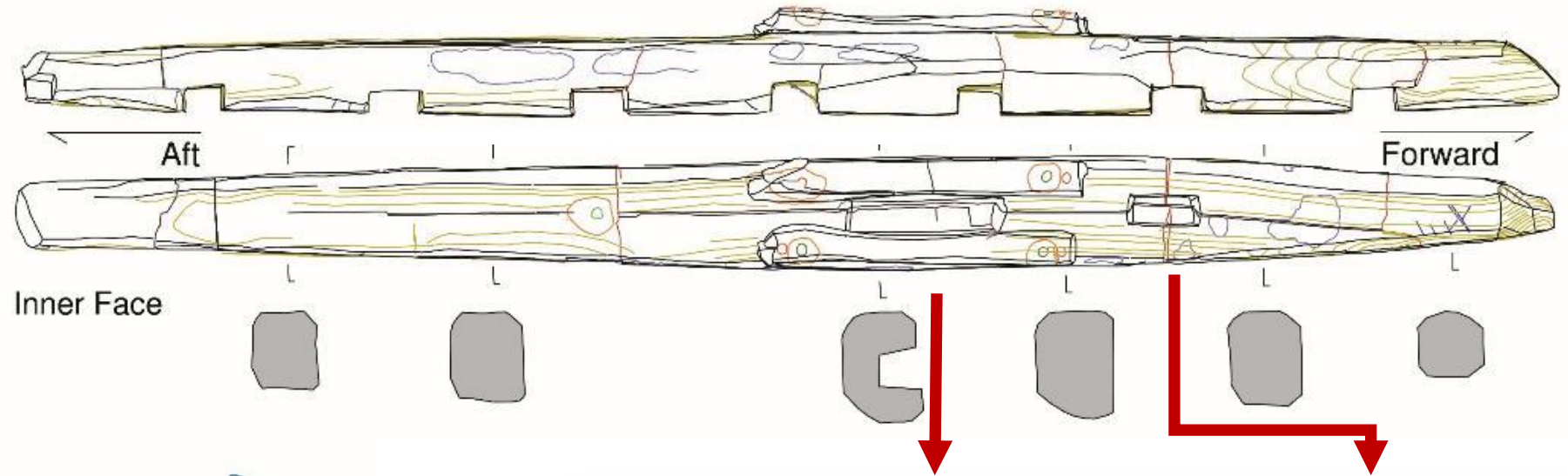








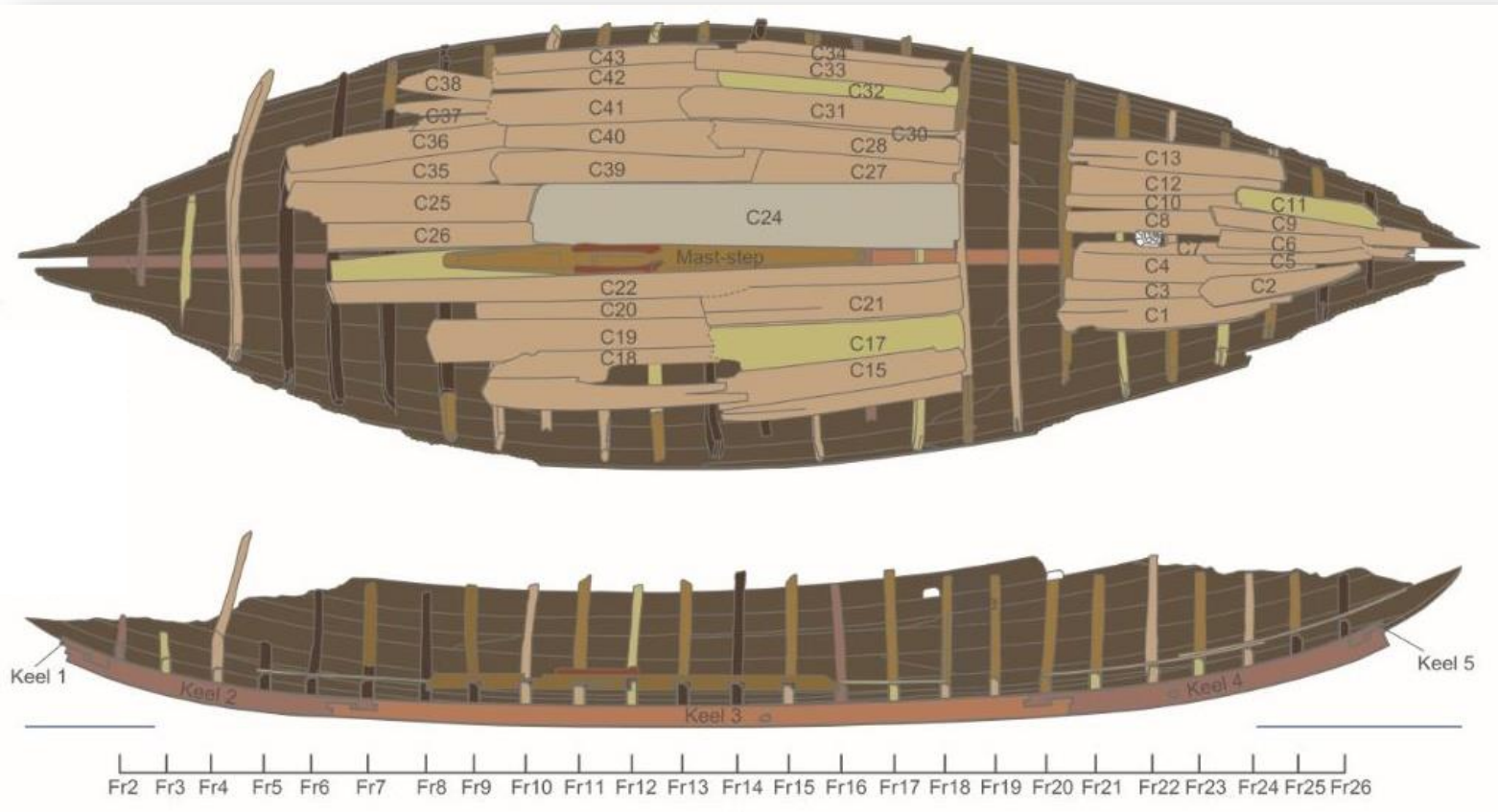
Mast-step timber



Two mortises are on the upper surface of the YK12's mast-step timber. One is the step for the mast, the other a small rectangular mortise forward of the step. The small mortise is made for the mast-partner through-beam's stanchion.

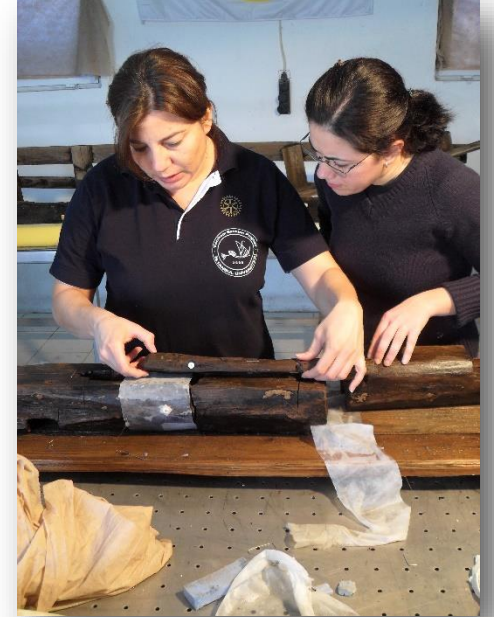
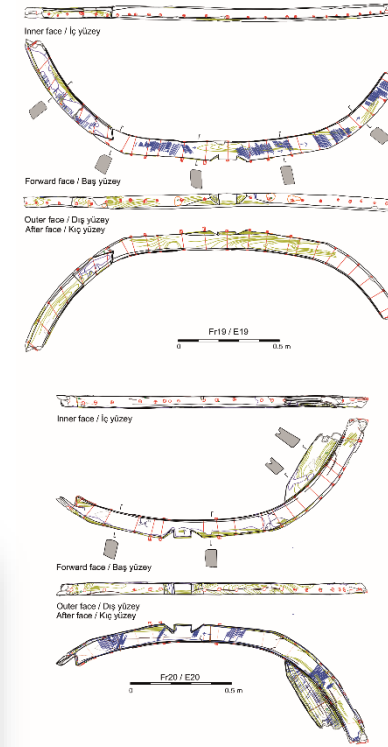
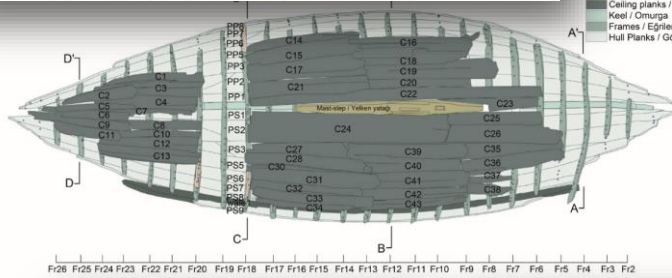
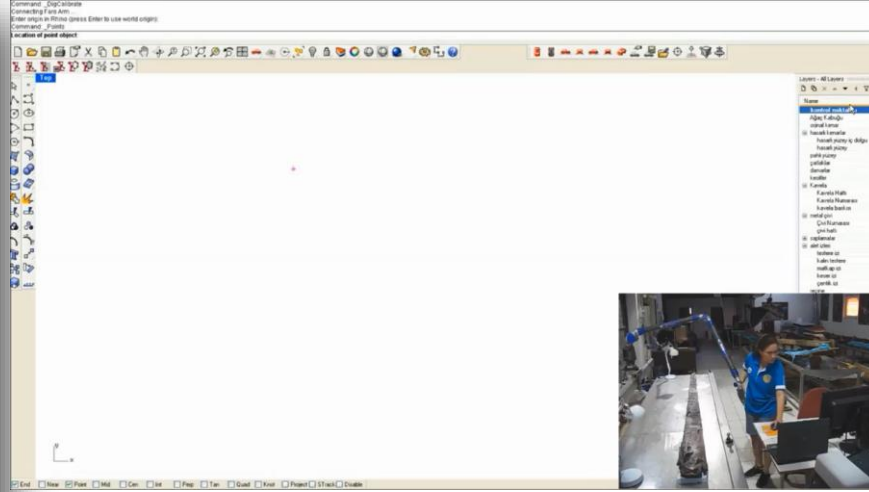
Ceiling planks

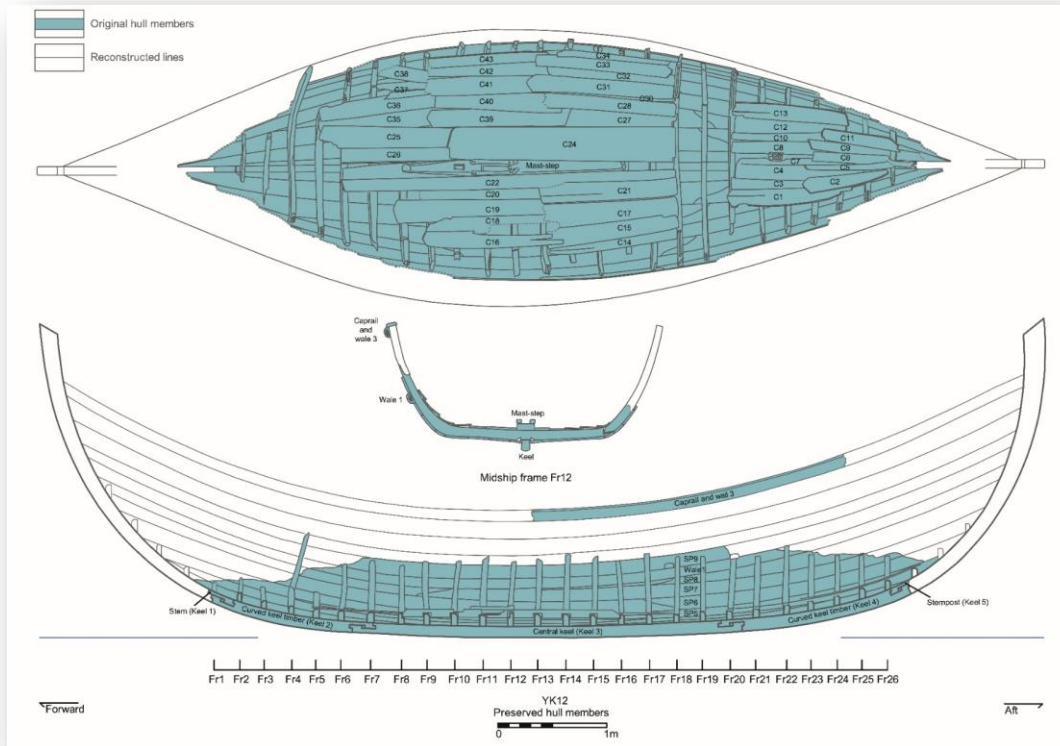




Wood species of YK12	
Oak	Some floor-timbers, ceiling, wales, treenails
Hornbeam	Posts, some floor-timbers, dowels
Beach	Central keel timber
Chestnut	Planks
Walnut	Some floor-timbers
Ash	Futtocks, bulkheads, mast-step
Plane	A repair ceiling timber







Preserved parts

The central keel timber, two curved keel timbers and pieces of stem and stern post

17 planks

25 floor-timbers

15 futtocks

2 wales and a piece of caprail

41 ceiling planks

Bulkhead members

Missing parts

The majority of the futtocks

The upper parts of the hull

Deck and upper elements

Mast, rigging and steering components

A. Evidences from archaeological remains of YK12

- Identification of the missing parts based on the proofs of original hull members
- Replication of the symmetries of the original parts
- Extension of the strakes' ends and planking seams

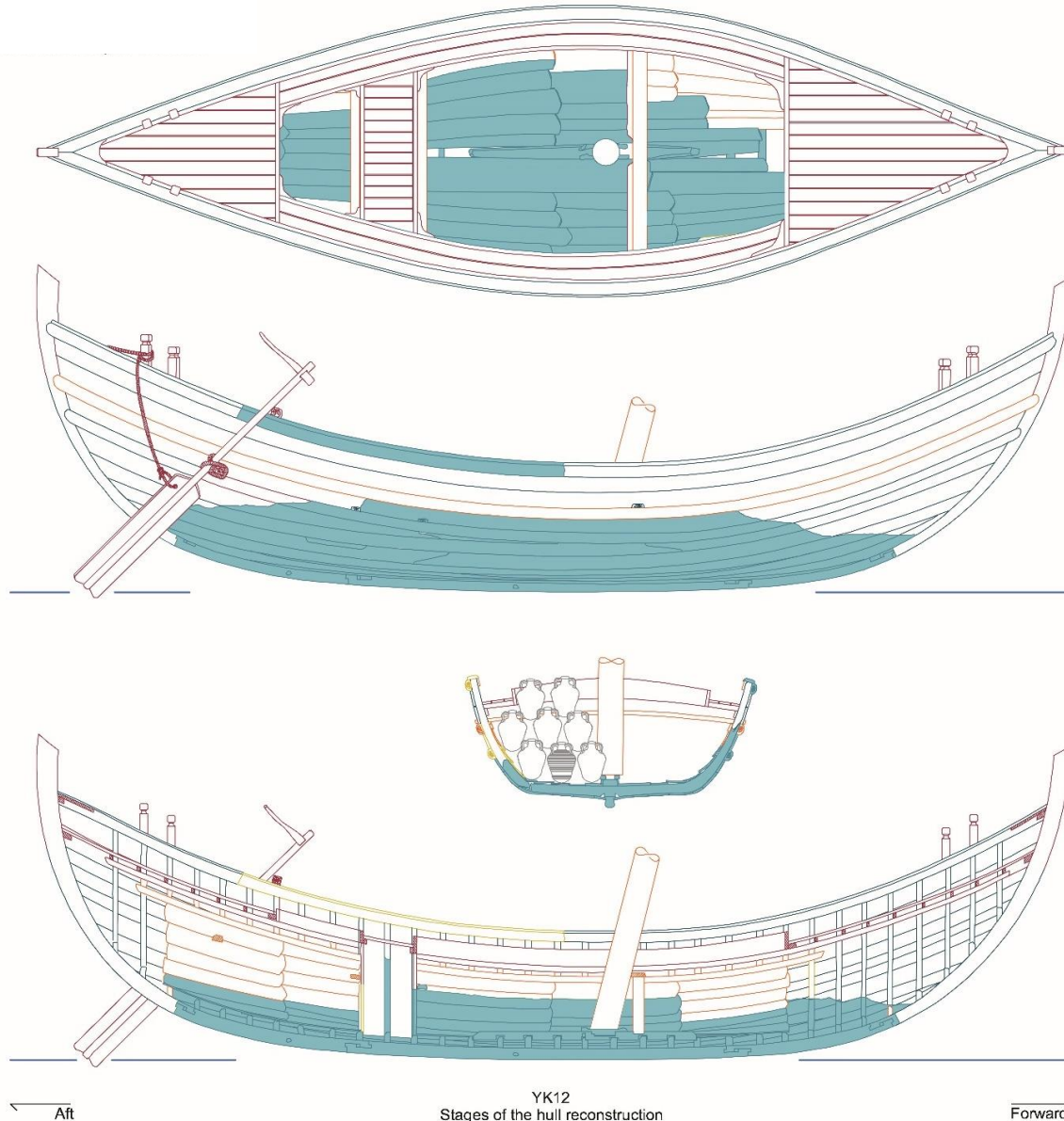
B. Corroborated acceptable suggestions

(for the vessel members which their locations are determined but upper parts are missing)

- Completion based on Yenikapi shipwrecks
- Completion based on traditional vessels from Marmara and Black Sea regions
- Reconstructed hulls of the Mediterranean shipwrecks

C. Entirely hypothetic suggestions

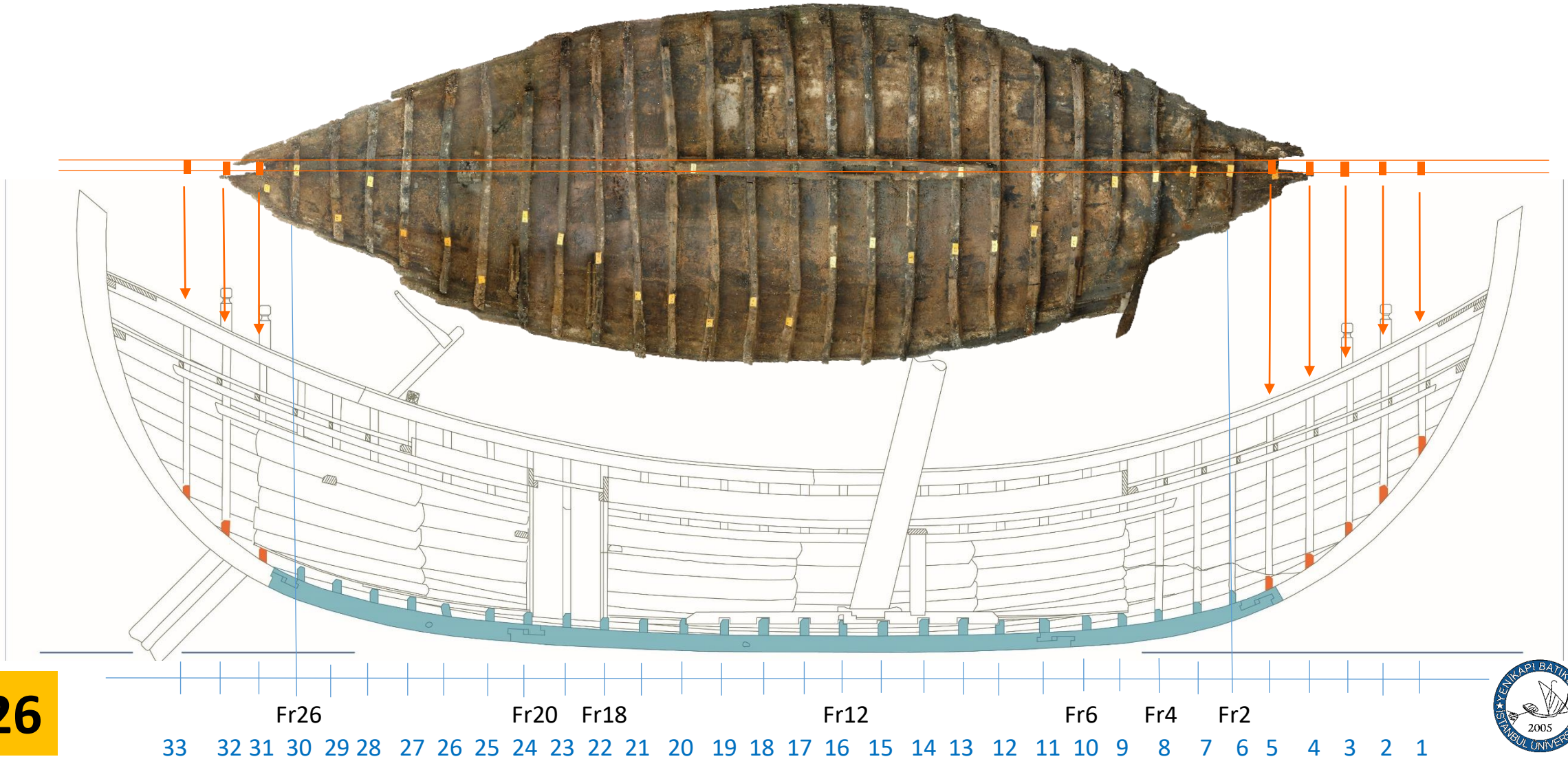
- Based on the image depicted on a 9th-century amphora found in a ship with a Lateen sail in the Yenikapi site
- Based on ship images on 9th-century manuscripts
- Based on the Byzantine sources



Evidences from archaeological remains of YK12

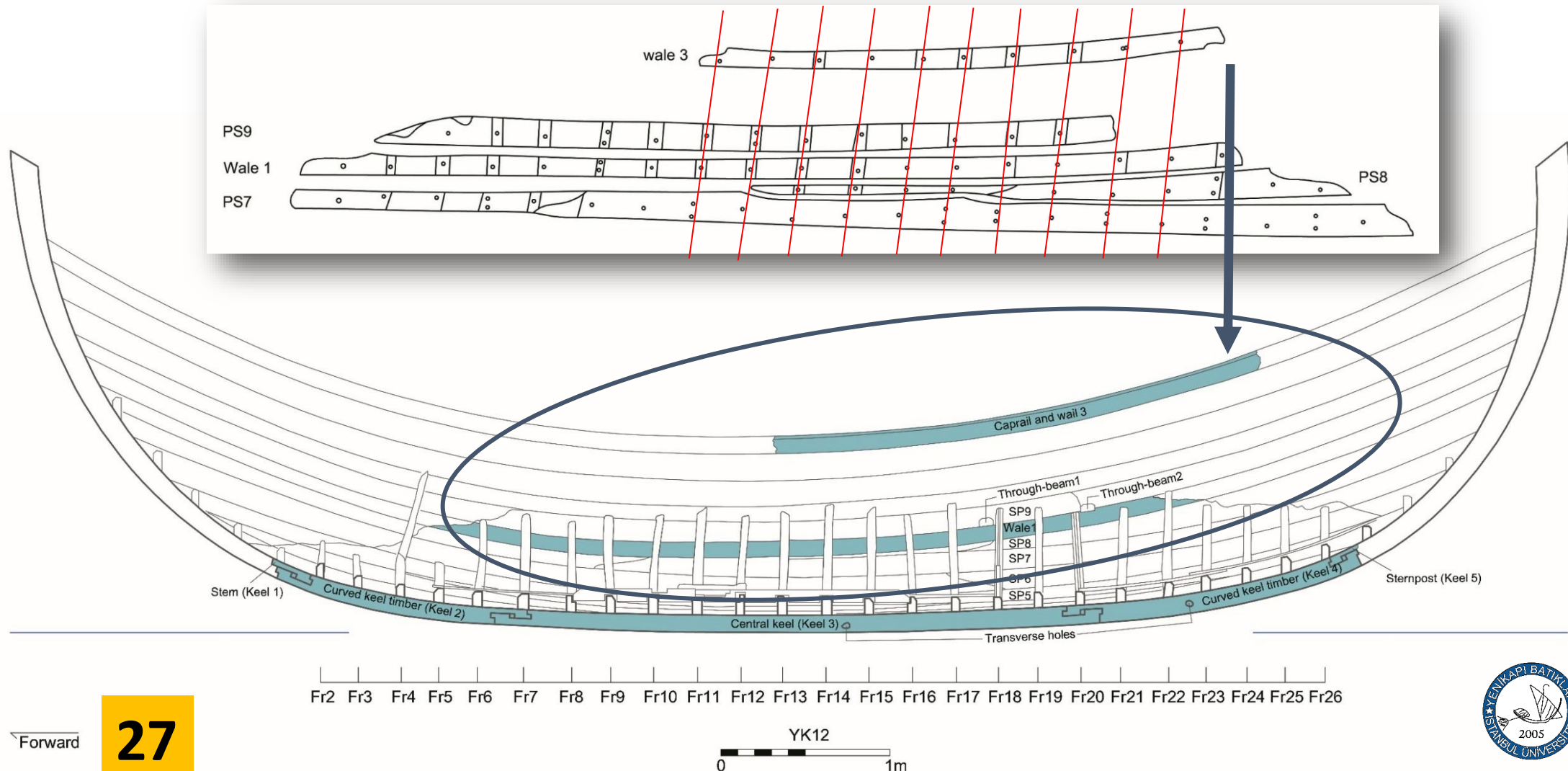
Missing frames-frame stations

25 preserved floor timbers, all remained in their original location. Room & space: c. 25 cm



Location of wale 3 and caprail

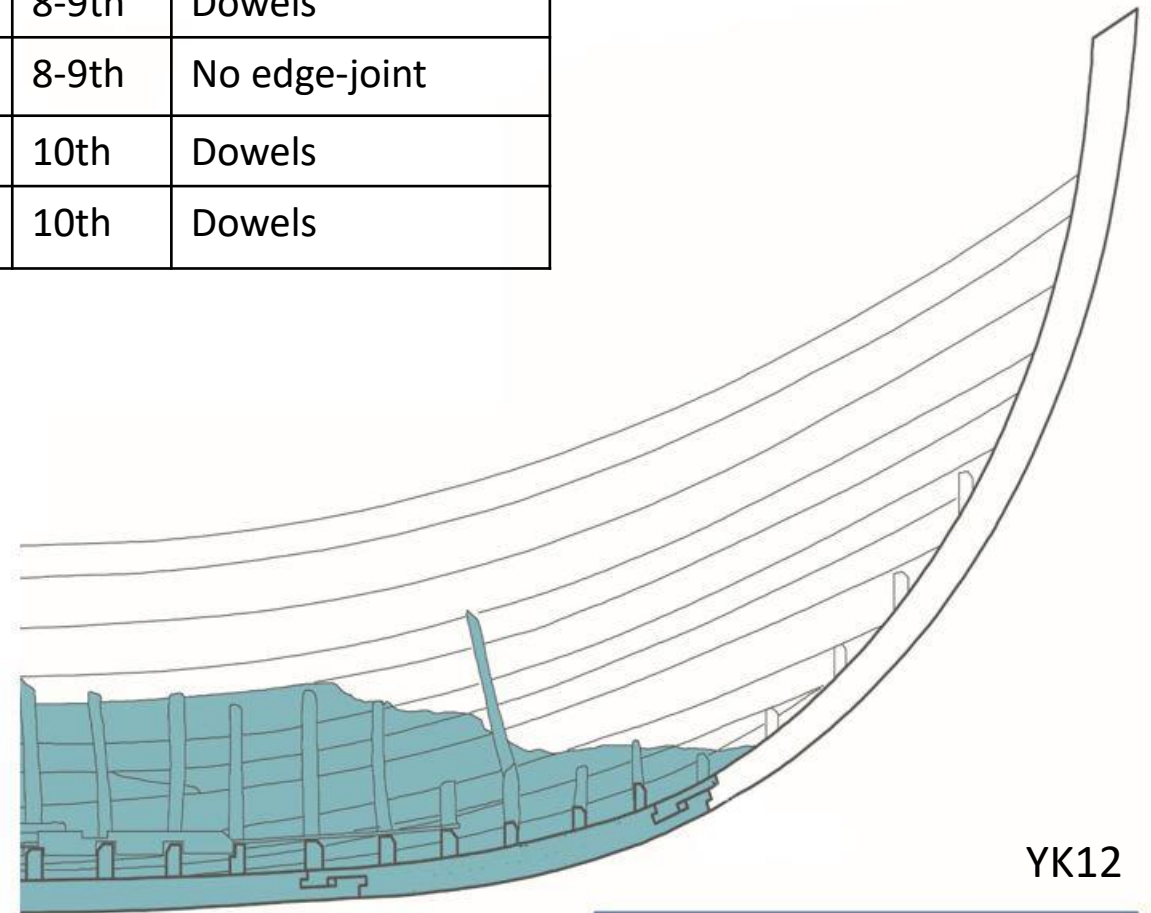
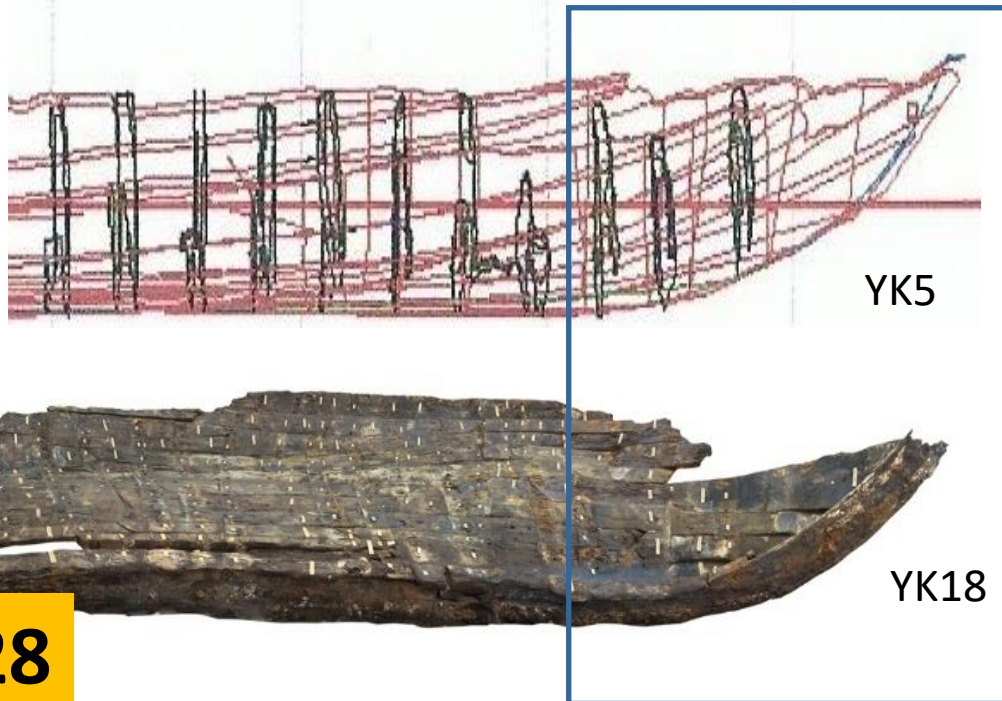
The original location of the wale 3 and caprail are proposed by matching the nail holes, intervals of frames stations and sheer line curvature.



Based on Yenikapı shipwrecks

Determination of the dimensions and the forms of the posts

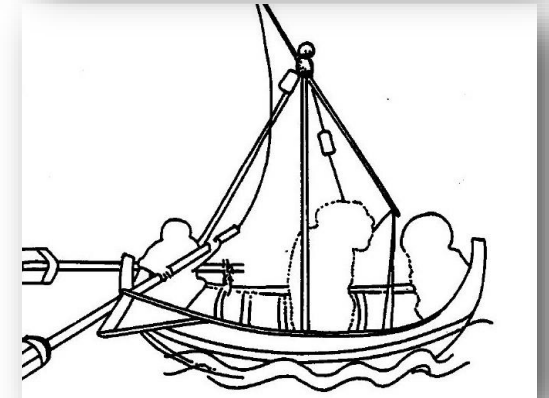
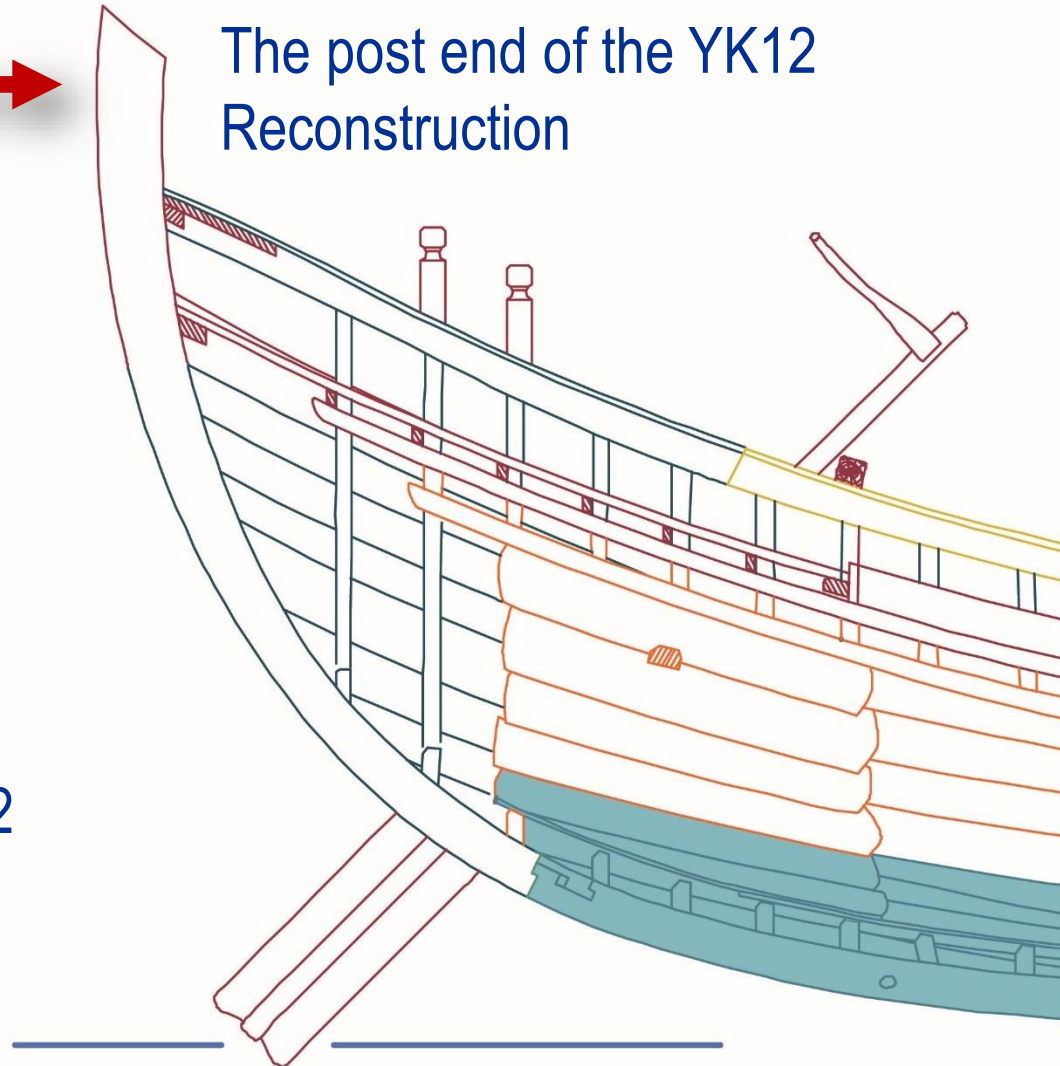
Shipwreck	Survived keel parts	Date	Type of edge joint
YK32	Central keel timber, curved keel timbers, a post	8-9th	Dowels
YK29	Piece of the keel, a curved keel timber, piece of stem	8-9th	No edge-joint
YK18	Keel, curved keel timbers, piece of stem	10th	Dowels
YK5	Keel, curved keel timber, piece of stem	10th	Dowels



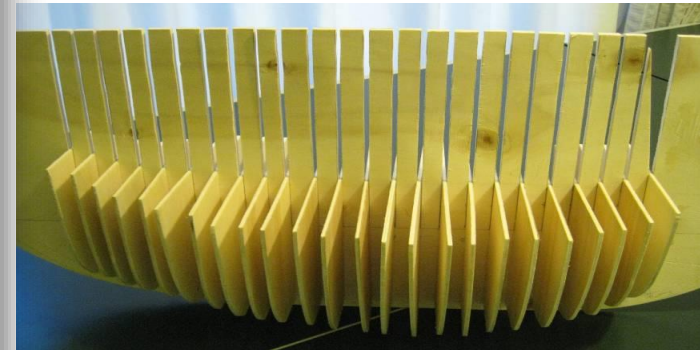
For the post shapes, especially YK32's post, and the double-ended vessels in iconographic depictions were taken as references.



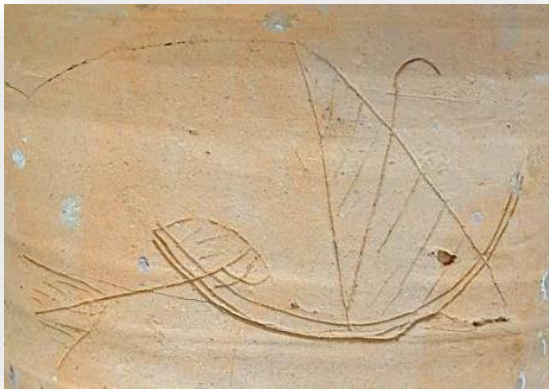
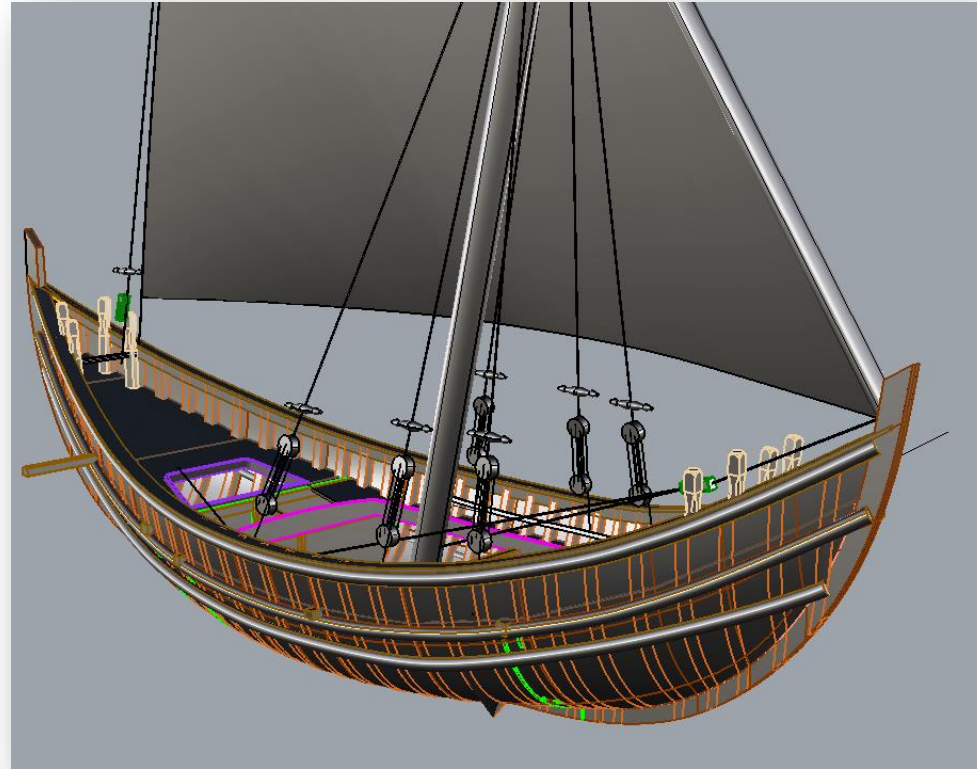
The post end of the YK32



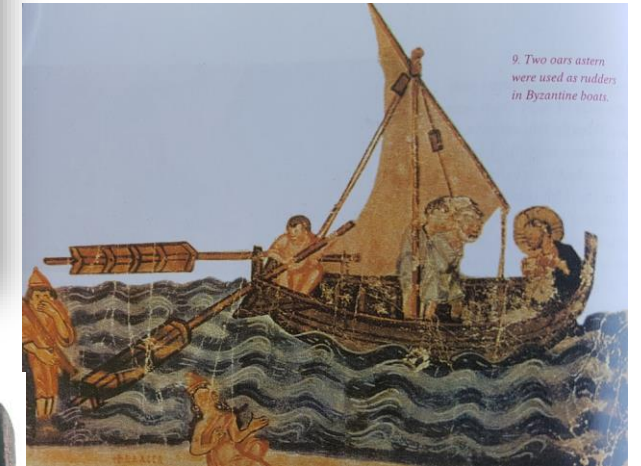
Omont, H.A., 1929, *Miniatures des Plus Ancients Manuscrits Grecs de la Bibliotheque Nationale*. Plate CXVII.16, LII. Paris.
Shchepkina, M.V., *Miniature of the Chludov Plaster*. Fig.96. Moscow.



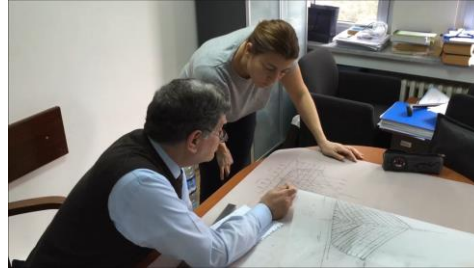
The rigging evidences based on the archaeological artifacts and the Byzantine ship images



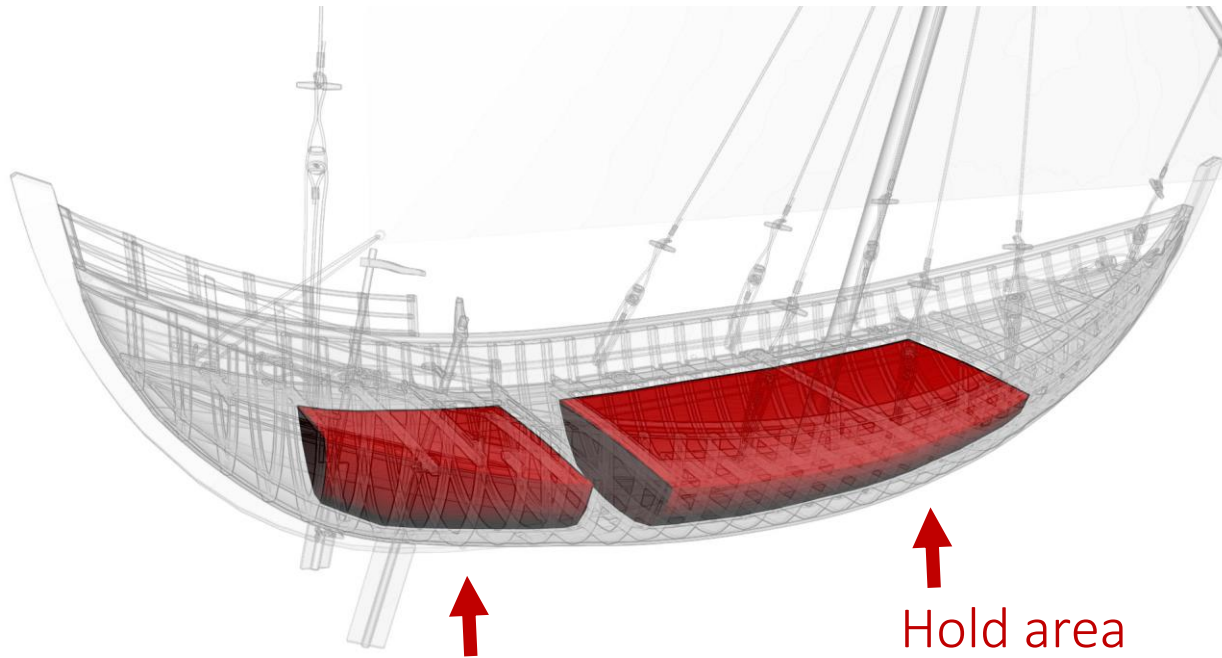
Hypothetic rigging system of YK12



Line plan & hold volume of the YK12

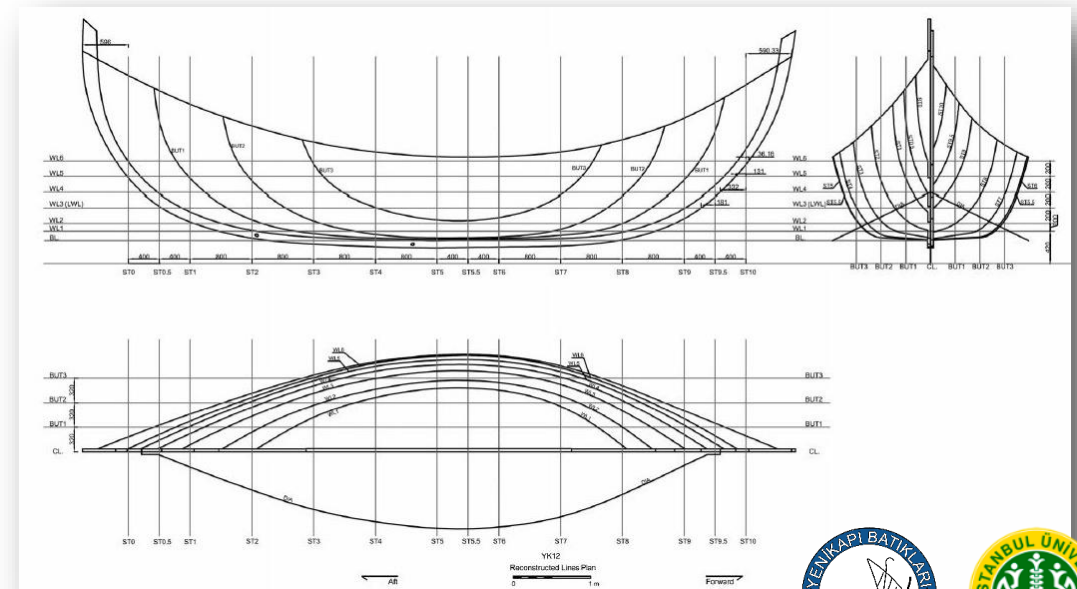


Length overall (LOA)	: 9,24 m
Beam (Bm)	: 2,64 m
Depth (D)	: 1.10 m
Length-to-beam ratio	: 3.5:1
Length of hold	: 3,20 m
Load bearing capacity	: 3.26 tons (WL3)
Displacement	: c.5.2 tons



The area under of the stern half-deck

Hold area





Yenikapi 12 Rekonstruktion

Propulsion: Lateen sail

Steering: A pair of quarter rudders

Deck: Half decks at the bow and stern

Hold: Open hold

Hull shape: Flat-floored

Navigation: Coastal waters

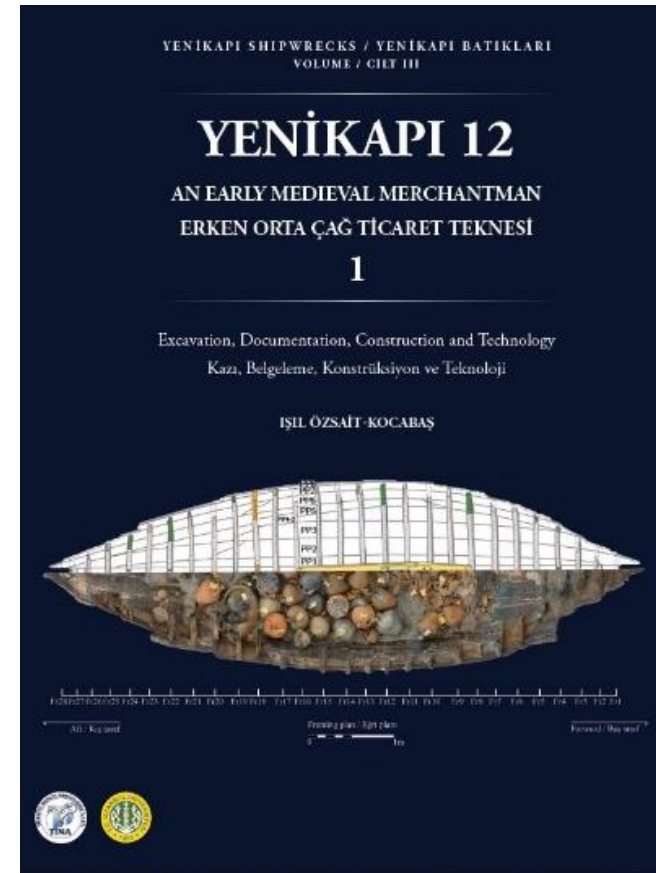
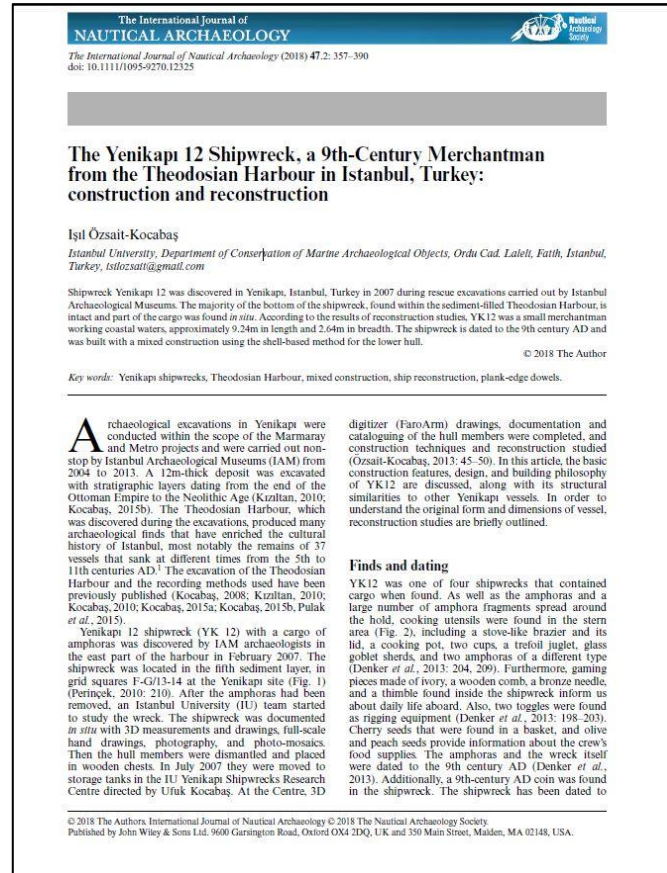
Date of construction: 9th century AD

Construction tradition: Mediterranean-Black Sea

Building method: Mixed construction

International Journal of Nautical Archaeology
Volume 47, Issue 2/September 2018/Pages 357-390

Yenikapı 12. An Early Medieval Merchantman
Istanbul, 2022, Ege Publications/342 pages



Thanks to TINA
Turkish Underwater
Archaeology
Foundation for
supporting book
publication...





Building of YK 12 Replica

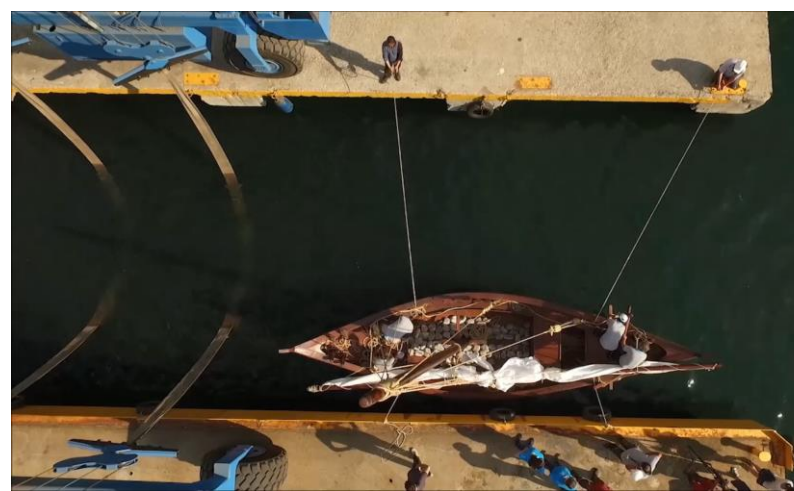
The full-scale sailing reconstruction of YK 12 was built at the RMK Marine shipyard. It was built according to the original hull shape, dimensions, wood types.



Construction of YK 12 Replica



Launching of YK 12 Replica



Sailing with Yenikapı 12

YENİKAPI SHIPWRECKS
PROJECT



The first sailing
22 knot wind



*Fair winds and following seas Yenikapı
12!*



It was launched in 2017 and tested its buoyancy, maneuverability, quarter rudders, and rigging.





Istanbul Archaeological Museums



Main differences between Mediterranean and Nordic shipbuilding

Yenikapı 12 & Viking Ships

- Planking construction
- Fastenings
- Frame shape
- Inner construction of the hull
- Post shape
- Processing of wood
- Rigging

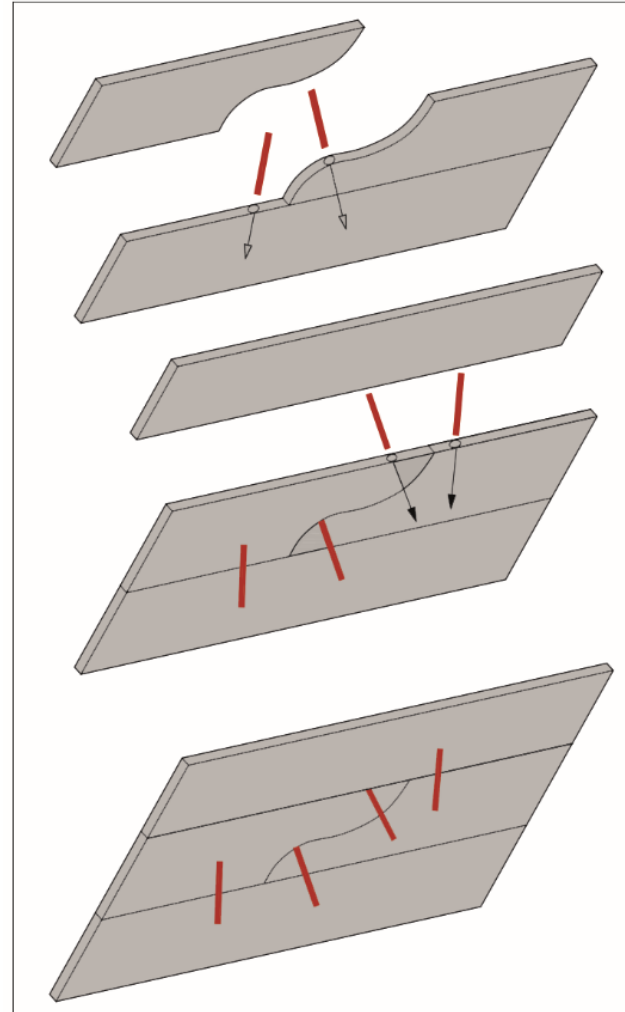


Yenikapi 12 & Viking Ships

Planking construction and fastenings

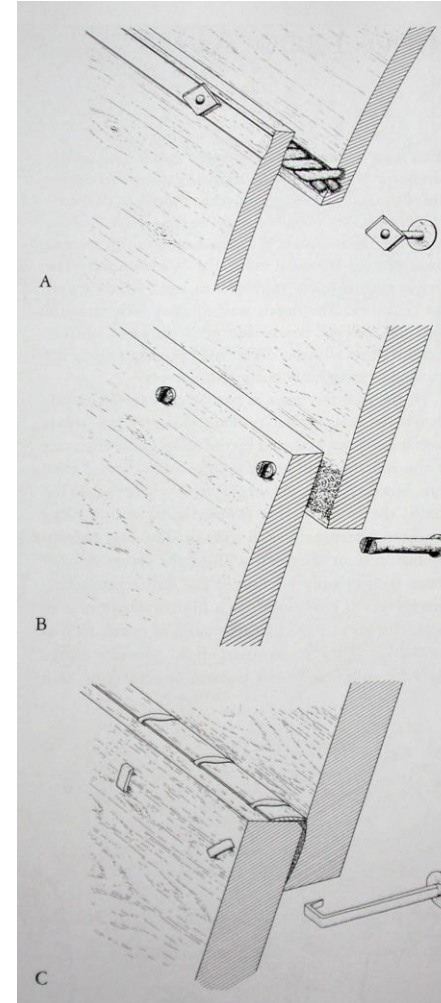
Yenikapi 12 Vessel

Carvel planking
Wooden edge-dowels



Viking Ships

Clinker planking
Copper or iron rivets

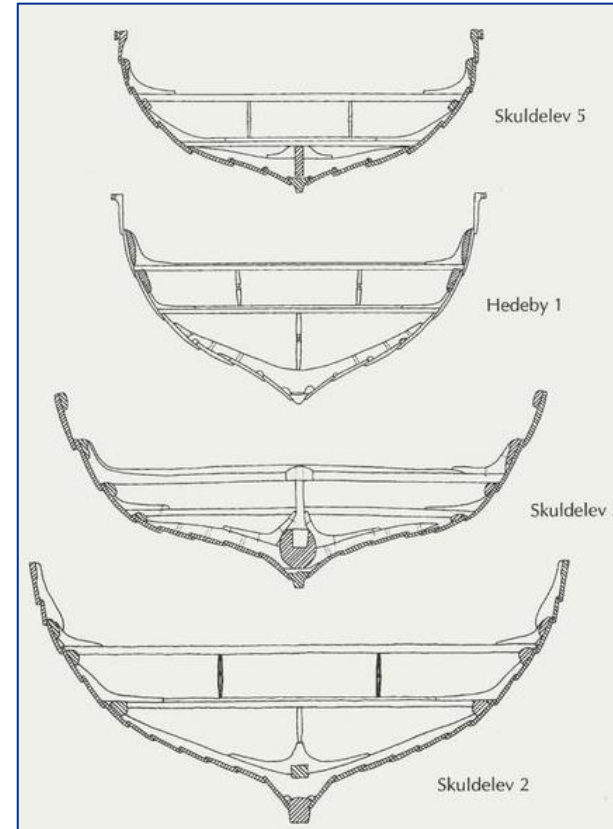
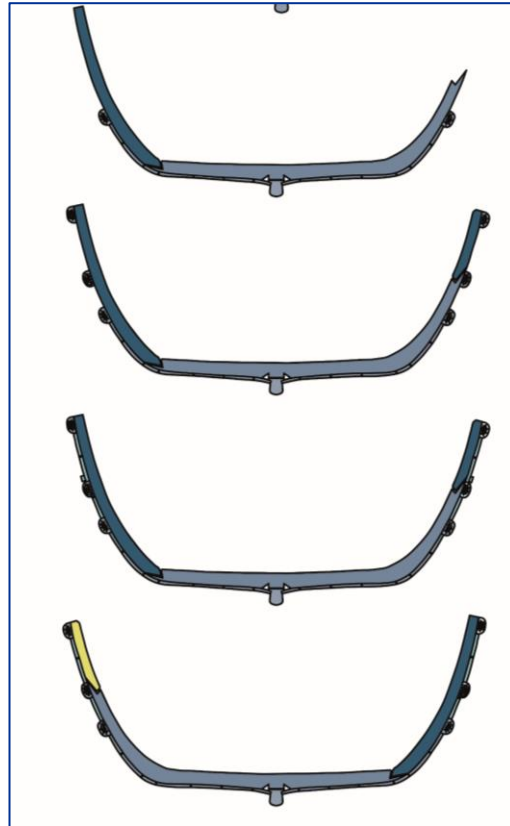


Yenikapi 12 & Viking Ships

Frame shapes

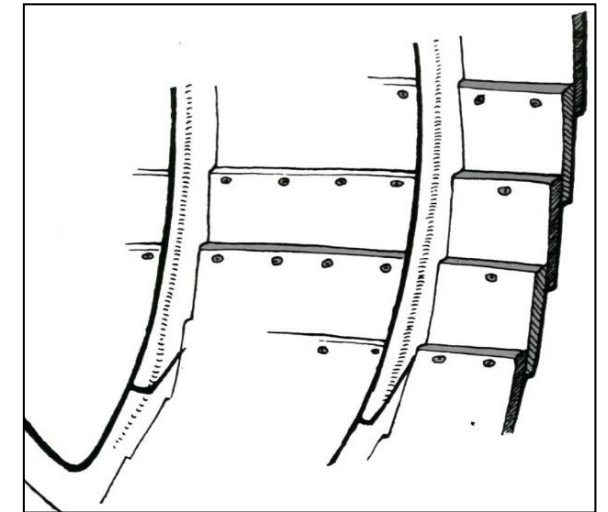
Yenikapi 12 Vessel

Flat outer sides



Viking Ships

Stepped outer sides



Yenikapi 12 & Skuldelev Ships, 9th century AD

Internal structures of hulls

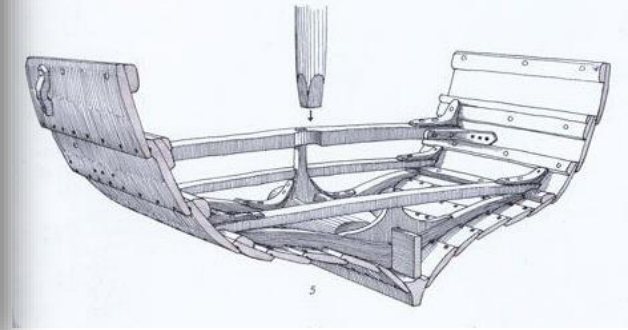
Yenikapi 12 Vessel

The straight floor, narrow stringers, mast-step timber and ceiling planks



Viking Ships

The gradual structure, construction suitable for square sail rigging

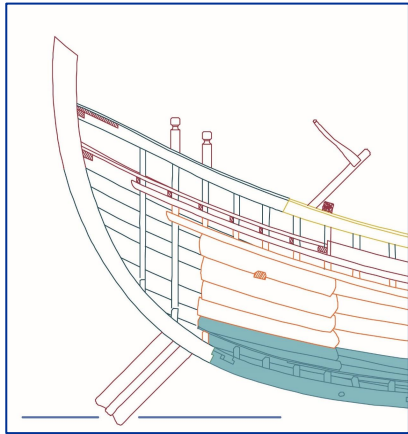


Yenikapi 12 & Skuldelev Ships, 9th century AD

The stem and stern post shapes

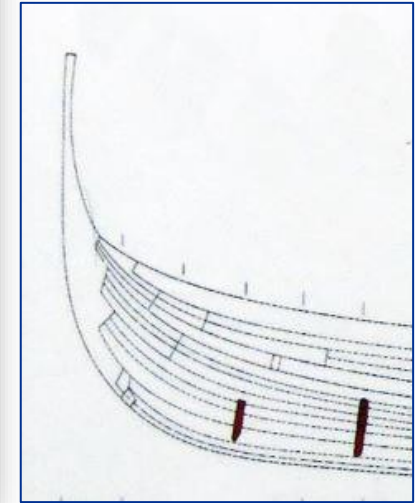
Yenikapi 12 Vessel

Rectangular section posts



Viking Ships

Posts with step edge

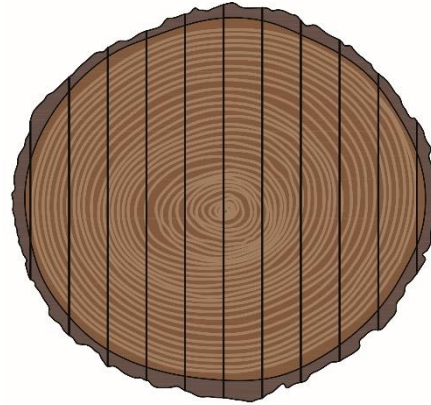


Yenikapi 12 & Skuldelev Ships, 9th century AD

Slicing a log

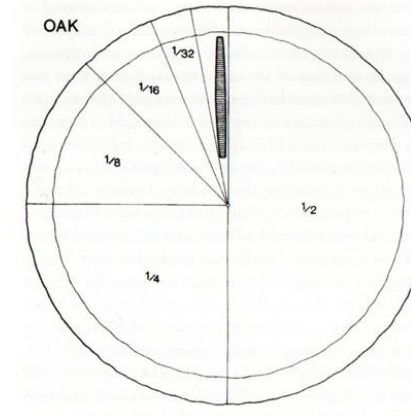
Yenikapi 12 Vessel

Parallel sawing by frame saws



Viking Ships

Triangular slicing by hewing axes



Yenikapi 12 & Skuldelev Ships, 9th century AD

Sail and rigging types

Yenikapi 12 Vessel

Lateen sail



Viking Ships

Square sail



YENİKAPI SHIPWRECKS PROJECT

Istanbul Archaeological Museum
Istanbul University
Yenikapı Shipwrecks Project Team

ISTANBUL UNIVERSITY
Department of Conservation of
Marine Archaeological Objects
ufuk.kocabas@istanbul.edu.tr
isilozsait@gmail.com

2023©

***Thanks
for your time
and interest...***

