**01.**

**Good afternoon Ladies and Gentlemen,**

Eight years ago, I had the pleasure of meeting a Norwegian named Mr. Eivind Luthen in Istanbul. During our conversation, he shared a remarkable dream with me: to see a Viking ship sail from Tønsberg all the way to Istanbul, retracing the journey of their ancestors from a thousand years ago. It was a dream that captivated me, and Eivind made me a partner in this endevır.

Soon after, I had the privilege of meeting Einar Erlingsen, the former president of the Oseberg Heritage Foundation, along with Borge Knutsen, Unni Ottosen, Jan Vogt Knutsen, and Lars Bill, the current president of the foundation.

Finally, the day arrived when the ship was launched. Together with Işıl, we had brought the sea water, in which the ship was baptized, from the Golden Horn, from the quay of the Rahmi Koç Museum, where the ship is anchored today.

The first institution we met in Istanbul to make this dream come true was the Rahmi Koç Museum. I am especially grateful to Museum Director Mine Sofuoğlu and Vice-President Selen İşyar for opening the doors of this wonderful museum and protecting the project.

I would like to thank KUDANFOR Director Admiral Cem Gürdeniz who realize this panel for his enthusiasm and bringing us together.

Today, we will present you the story of the Yenikapı 12 shipwreck, beginning from its discovery towards the full-scale reconstruction.

**02.**

Salvage excavations conducted in the Yenikapı quarter of the historic peninsula of Istanbul by the Istanbul Archaeological Museums 2004–2013 have brought to light the Theodosian Harbour on the Sea of Marmara. The excavations were carried out in a deposit 12 m deep, representing a time span ranging from the late Ottoman period back to the Neolithic period.

The remains of the 37 ships uncovered constitute the largest assemblage of ship finds dating to the Byzantine periods. Istanbul Archaeological Museums delegated the scientific work on the wrecks to Istanbul University Department of Conservation of Marine Archaeological Objects (27 wrecks) and the Institute of Nautical Archaeology (8 wrecks).

**03.**

The harbor is known to have been built in the late fourth century during the reign of Theodosius the first, in response to the demands of the growing economy and population of the capital city of the Byzantine Empire. The presence of granaries on the east side of the Theodosian Harbor, suggests that this harbor was used for unloading the grains and other items brought from Egypt was known to be a large commercial harbor.

**04.**

The galleys have a unique value as the archaeological samples dating to the Byzantine period were found in Yenikapı for the first time. Yenikapı galleys, mentioned as galea in the Byzantine texts, were skaut ships with a single file of oars on each side, up to 30 m in length and 4 m in width.

**05.**

Merchant ships come in various sizes and features, from small boats of 7 m in length to seagoing ships exceeding 20 m in length. The majority of these vessels are flat floor timbers in cross-section amidships. Diagonal and S-scarfs were used to join planks in a strake. There are transverse holes through the keels amidships and towards the stern, presumably used for hauling the vessels eşore. According to the joining feature of the hull planks, they are divided into three groups: planking with mortise-and-tenons (4), edge-dowell (13), and without any edge connection (6).

As you can see on the slide.

**06.**

This slide shows the cargo ship’s locations at the Yenikapı excavation site.

**07.**

Yenikapı 12 shipwreck was discovered in the site in February 2007. You see its location in the slide.

**08.**

The wreck is dated to the 9th century AD according to C14 dating and a coin.

**09.**

YK 12 sitting on its bottom, and was quickly buried, most of the timbers under the amphoras were preserved in their original places.

You see the excavation of the wreck.

**10.**

YK12 was one of four shipwrecks that contained cargo in the excavation area. As well as the amphoras, the personal artifacts and cooking yutensıls were found in a compartment close to the stern.

**11.**

Documentation and lifting studies of the Yenikapı 12 were carried out by the Istanbul University team. The shipwreck was documented *in situ* with 3D measurements and drawings, full-scale hand drawings, photography, and photo-mosaics. Then the hull members were dismantled and in July 2007 they were moved to storage tanks in the IU Yenikapı Shipwrecks Research Laboratory.

**12.**

Five timbers were made up the keel of the vessel.

The scarfs between the five keel timbers were keyed hook scarfs.

It has a pair of transverse holes at the middle and stern post.

**13.**

The planks are edge joined with regularly spaced dowels from the garboard to the first wale.

**14.**

The framing system consists of L-shaped flat floor-timbers

and short and long futtocks. They were placed with the long arms alternating to port and starboard.

**15.**

Towards the stern, a bulkhead was found to store the personal items of the captain and the crew.

**16.**

Among the preserved vessel elements are rarely found, such as a small part of a through-beam. This through-beam was fitted and fastened on the first wale with a treenail.

**17.**

Another unique sample is the caprail which is found together with the last wale under the vessel.

**18.**

Also, the mast-step timber was found in its original place and intact.

The circle mark of the mast based is identified on the inner surface of the mast-step.

**19.**

The ceiling was found *in situ* up to the vessel’s waterline. These planks had been systematically placed and fastened to the floor-timbers with iron nails.

**20.**

Considering the properties of the wood used, it can be seen that the

builder also kanşısly selected different species for specific uses on the vessel.

(Seven different tree species were used in the construction of the YK12 hull:

Chestnut was used for all the planking. The keel members were made from hornbeam and beech wood. Oak was used for wales, floor-timbers and ceiling planks. Also, walnut was used for some floor-timbers.

Ash was preferred for futtocks, mast-step and bulkheads.

Oriental Plane was used for a repair plank.)

**21.**

Reconstruction of YK12 based on the evidence of hull remains, which is seven meters in length and two point three meters in width.

In this animation you see the preserved layers of the YK12's hull remains

**22.**

After the shipwreck was documented *in situ*, its wooden elements were disassembled and carried to the protection tanks at Istanbul University Yenikapı Shipwrecks Project Application and Research Laboratory. In the laboratory, hull elements were documented and cataloged on a one-to-one scale, and construction technology and reconstruction were studied. It was reconstructed to its original proposed size and shape.

**23.**

The hull bottom of YK 12 was well preserved.

The surviving parts of the hull consisted of keel timbers, seventeen planking strakes, two wales on the starboard side, a piece of the starboard caprail, twenty-five frames, the mast-step timber and forty-three ceiling planks.

In contrast, the majority of the futtocks, deck and upper elements, mast, rigging, and steering components were not found.

**24.**

The approach used in reconstructing the missing parts of the shipwreck can be handled in three major methods.

Evidence from archaeological remains, korraboreyted acceptable suggestions and entirely hypothetic suggestions.

**25.**

You see in the slide, the stages of the reconstruction of the YK12 hull.

The original parts are depicted with turquoise collar.

**26.**

First, the clues upon the *in situ* elements were evaluated. A few examples:

The locations of missing floor-timbers are determined according to the room and space of extant frames. (33 adet)

**27.**

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

**28.**

After these works, we akamplişt comparable wreck studies on the missing parts. We are very lucky in this subject. The other Yenikapı shipwrecks belonging to the same period, ship type, dimension, function and similar construction tradition helped us so much. For the upper forms of the posts, preserved parts of the other Yenikapı shipwrecks were evaluated. (YK5, YK18,YK29 ve YK32)

**29.**

Also, the Byzantine ship images referred to the general hull shape of the period.

**30.**

A few different three-dimensional (3D) models were constructed.

Physical 3D research models yielded clues about the shapes and dimensions of the missing floor-timbers and of the missing planking ends.

**31.**

The mast-step timber is the principal indicator of the rigging system. The vessel's small size and lack of any other mortise on the inner surface of the floor timbers suggest that YK12 had a single mast.

In addition, archaeological artifacts from the Yenikapı site provided necessary proof. Also, Byzantine ship depictions portray Lateen sail and pairs of quarter rudders.

**32.**

For the engineering calculations and the line plan consulting for the YK12, we received help from Professor Abdi Kükner, an Academic Member of the Shipbuilding Faculty at the İstanbul Technical University. Hypothetical reconstruction drawings of Yenikapı 12 were realized using both hand and digital drawings. Then, the vessel’s lines were created digitally based on numeric values from offset tables using NAPA software, as were the hydrostatic properties.

The hold was determined to be approximately 3.2m long, and YK12 carried an average of 210 or a maximum of 250 amphoras. (The vessel's cargo capacity is about 3.26 tonnes at the loaded waterline. The loaded waterline (WL3 on the reconstruction) was located at Wale 2).

**33.**

YK 12 was a small merchantman working coastal waters with the sizes of
nine point twenty-four in length and two-point sixty-four in breadth. It was likely propelled by a single-mast, lateen-sail rig and steered by two-quarter rudders, characteristic of the period. It had a storage compartment near the stern.

(The reconstructed length-to-beam ratio of the vessel is 3.5 to 1. Displacement is calculated as c.5.2 tonnes.)

**34.**

Detailed information about YK12 construction and reconstruction can be found in the IJNA’s Two Thousand Eighteenth issue and much more in Yenikapı12 detailed book. By the way, we would like to express our gratitude to our book sponsor Tina Turkish Underwater Archeology Foundation and Oğuz Aydemir for their valuable contributions.

**35.**

We decided to build a reconstruction of the YK 12 shipwreck.

The design of the hull form of the replica is based on the actual remains of the shipwreck. After completing all necessary data, chestnut trunks (4.5 m long and 50 cm in diameter) and other timbers were provided.

The sliced chestnut trunks were washed and then dried in a controlled procedure. (A construction area about 15 m long and 6 m wide has been set up at RMK Marine shipyard.)

You can see the stain of the tannin on the chestnut timbers.

**36.**

The full-scale drawings of the keel and the frames were printed, and their molds were made. These molds guided shipwrights to cut out timbers in desired forms. The construction began with setting up the keel.

The reconstruction was based on the original hull shape, dimensions, and tree species. Frame-plank joint locations, keel, plank forms, and planking patterns were built according to the original vessel.

(According to analyses, turpentine resin had used for waterproofing on the shipwreck. But in this stage, we just applied a modern collared-wood protection wax.)

**37.**

When we finished the hull, we started to work on the rudder system. The haypotisayzt support mechanism and size of the quarter rudders were tested during the first sailing trials of a full-scale reconstruction of the ship launched in 2017.

Also, rigging was tested with temporary equipment. (thirty-five square meter sail surface)

**38.**

It was provided financial support for only building a replica for the museum exhibition under the project context. With this limited finance, we tried to make a vessel that could sail on the sea. Experimental archaeology couldn’t be applied because of time and cost limitations. Therefore, this replica must be considered as a sailing full-scale test model.

After rebuilding, the YK12 replica was launched to the sea from the RMK Marine daak.

**39.**

In the first sailing, there were twenty-two knots of wind. We decided to sail, and sometimes we reached 7 knots.

**40.**

You see images from the sailing

Returning back to the harbor. Quarter rudders were so much facilitated the maneuverability.

We expect to realize the experimental archaeological studies of YK12 in the future.

**41.**

After the sailings were completed, the replica was transported to the Istanbul Archaeological Museums' garden to be exhibited.

Then, the replica was transported to exhibit at the Rahmi Koç Museum.

**42.**

Finally, we would like to offer a brief overview of the main differences between Mediterranean and Scandinavian shipbuilding.

**43.**

Like the Mediterranean ships, the YK12 is also carvel-built.

Nordic ships are clinker-built.

This is the most well-known fundamental difference between the two shipbuilding techniques.

YK12's carvel planking was joined to each other with wooden edge dowels.

Kantırery in the Viking ships overlapping planks were joined with copper or iron rivets at the clinker-built.

**44.**

The outer edges of the frames are also shaped according to the construction characteristics of the coatings. The outer edges of the YK12's frames are straight.

Kantırery to this, in the Viking ships, the outer surface of frames has stepped for the clinker planking structure.

**45.**

The internal structure of the YK12's hull consists of a straight floor, narrow stringers, mast step timber, and ceiling planks.

However, Viking boats have a more gradual structure and construction suitable for square sail rigging.

**46.**

Another difference is in the posts. YK12 stem and stern post have a flat structure. The ends of the hull planks were placed on the sides of posts and fastened to them with treenails.

Viking ships have posts with stepped edges for fitting side timbers.

**47.**

For the construction of YK12, chestnut lags were used with parallel sawing technique.

On Viking ships, there was a triangular cut in oak wood.

Additionally, successive marks on the wooden surfaces of YK12 show that the planks were cut with a frame saw along their length.

Planks were created by splitting the logs and shaping them with hewing axes at the Viking shipbuilding.

**48.**

YK12, a 9th-century boat, has Latin sailing equipment.

Viking ships have square sails.

**49.**

I would like to express my gratitude to Oseberg Heritage Foundation who have established friendships between Tonsberg and Istanbul, Norway and Turkey.

Finally, we would like to thank you for your time and interest.