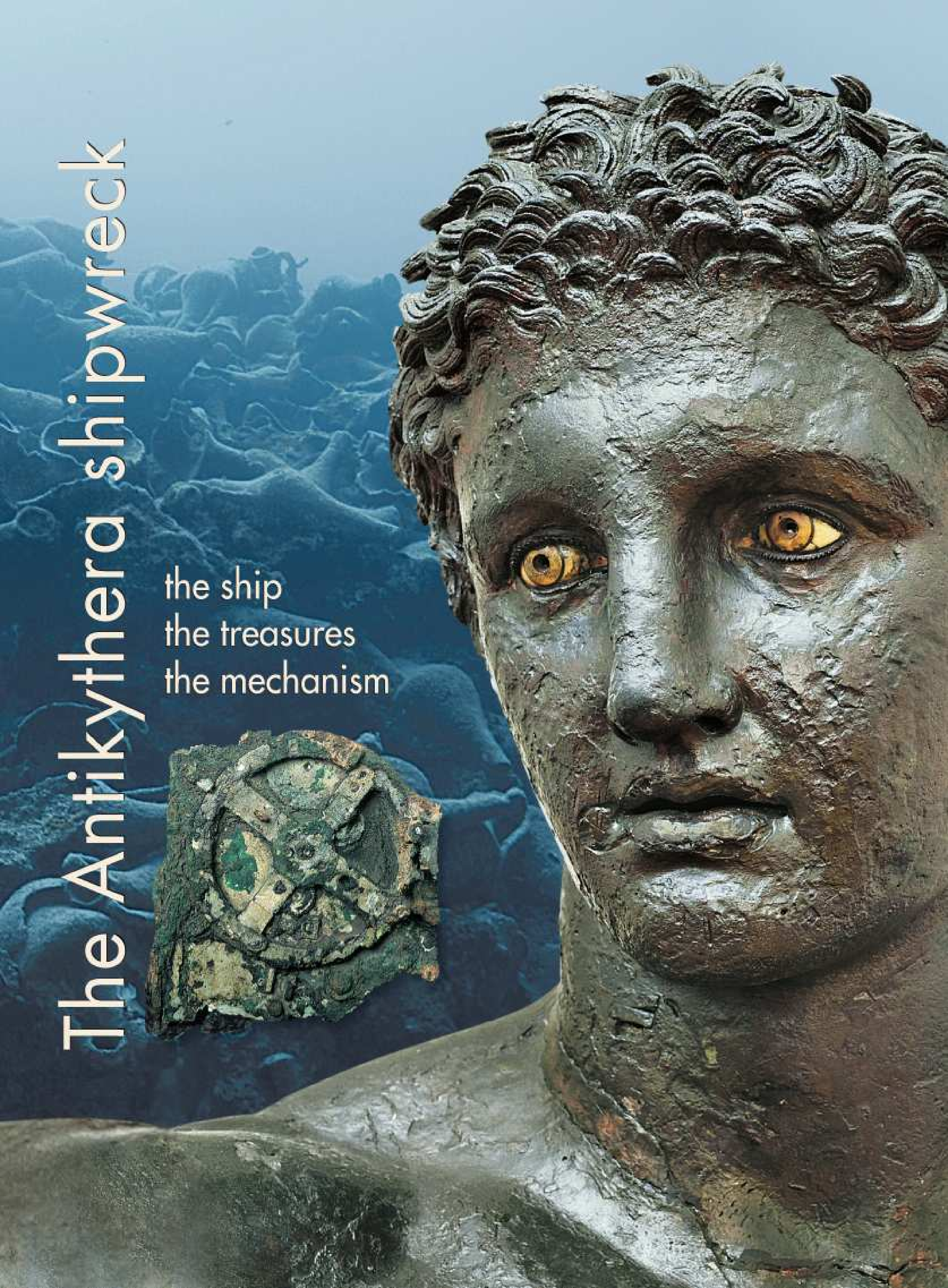
The Antikythera shipwreck

the ship
the treasures
the mechanism



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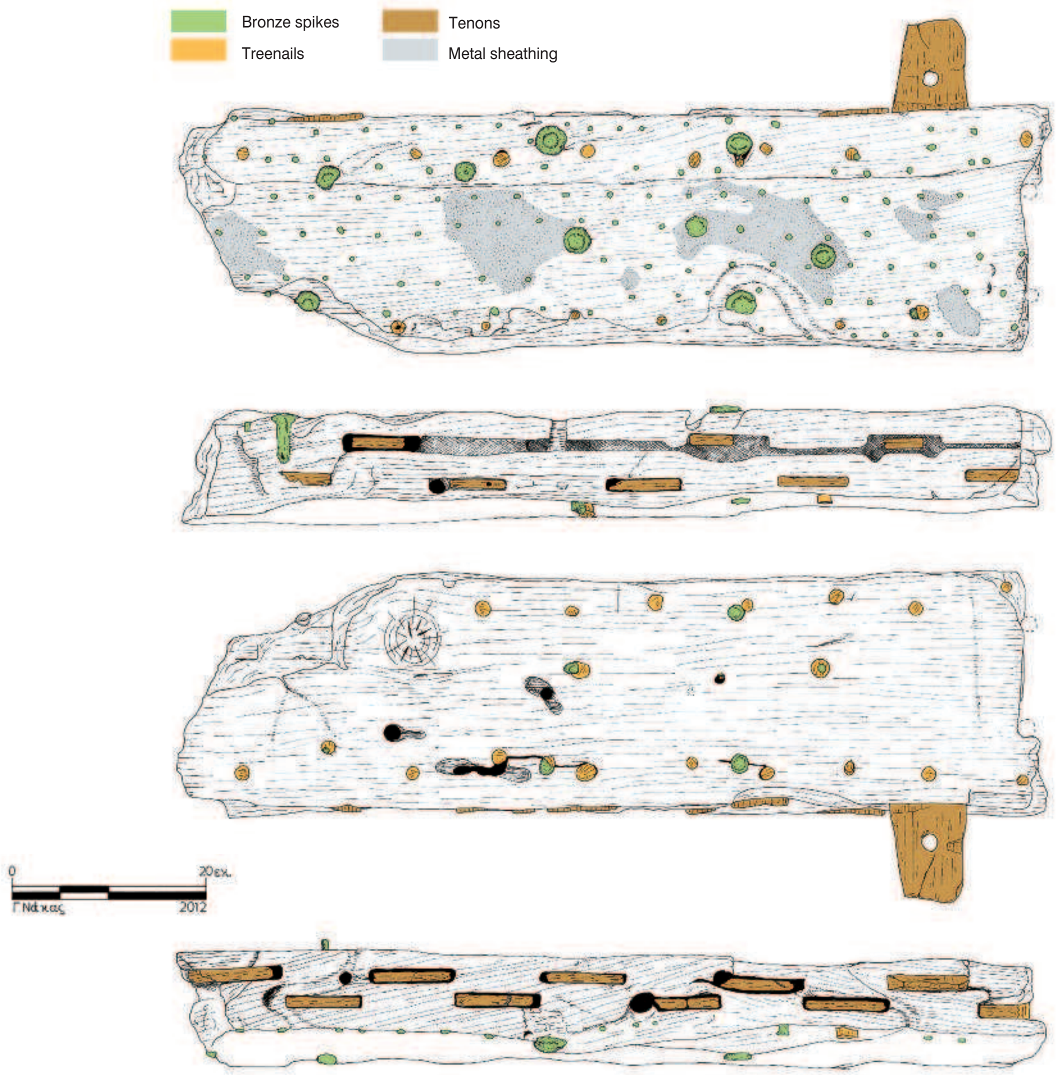

1. FRAGMENT OF A HULL PLANK
220 B.C. (±40)
Elm timber
L. 0.90 m., w. 0.26 m., th. 0.11 m.
From the material retrieved in 1976
Athens, Ephorate of Underwater Antiquities,
BE 2011/11

Piece of a plank. It would have been positioned on the lower part of the ship's hull. The wood has suffered surface deterioration and has lost much of its mechanical strength. Damages caused by marine borers (teredenidae) are visible. Mortises in both edges of the plank with half broken tenons surviving in the interior, one of which remains intact. The plank is made of elm timber (ulmus), known in the Aegean region as karagatsi. In traditional shipbuilding, from the existing five varieties of elm, two are primarily used, namely the ulmus montana and the ulmus pedunculata.
Elm has been classified as a so-called hardwood. Its timber is relatively heavy, of medium hardness and resilient. In comparison to other timbers of the Mediterranean, it has an inferior mechanical strength though it does not split easily, it dries fast and most importantly it has long life duration. On the other hand, however, it is vulnerable to insects and fungi and has a tendency to warp. Although the use of elm timber was frequently preferred in water-logged environments, yet in ancient shipbuilding its employment was rather limited. Evidence which derives from some Roman shipwrecks suggests that elm would have been used primarily in the construction of the frames.
There are traces of caulking on the outer part of the plank. A layer of resin or pitch would have been placed between the planking and a sheath of lead sheets, to protect the ship's hull against marine borers. The lead sheets were held in place by short bronze nails. On the surviving plank six horizontal, parallel lines of short bronze nails are fixed at a regular spacing of

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0.04–0.05 m.: the same distance is kept between each individual line. Particular care is given to the vertical axial alignment of every nail as well: the nails in any one line correlate to the intermediate spacing of those immediately above and below in the quincunx pattern. A consistency in the distribution of the nails is thus achieved most effectively, distributing the stresses evenly and regularly over the area concerned: an essential consideration given that the hull is exposed to heavy vibrations and external pressures. On the outer surface of the plank, seven nails, with round heads of about 0.034 m. in diameter are visible. Their shafts, circular in section, are driven through wooden treenails, hammered into prefabricated holes that were themselves drilled through the planking and the frames. These nails fastened the planking to the frames. They were hammered in from the outside: two, and in some cases three, nails were required for each frame in each plank.
Especial attention was paid to avoid placing two bordering nails on the same vertical axis: this care reduces the risk of splitting the attached frame. The considerable thickness of the plank allowed the cutting of mortises on the edges in two parallel lines. The broken tenons of the joinery are still visible in these cuttings. They have an elongated rectangular shape; their sides narrow towards both ends. Their maximum length was 0.22 m., while their width did not exceeed 0.08 m. After the planks were joined together, holes were drilled through them: the tenons were then held firm in position by being transfixed by wooden pegs. Both tenons and wooden pegs were made of oak (querus). Although working oak is considered to be difficult, its timber possesses a high endurance and longevity and only a medium degree of contraction-expansion. These are perfectly appropriate qualities for functional parts such as tenons and pegs.

BIBLIOGRAPHY: Unpublished.

G.Kou.

2. FRAGMENT OF A HULL PLANK

220 B.C. (±40)
Elm timber
L. 0.61 m., w. 0.23 m., th. 0.10 m.
From the material retrieved in 1976
Athens, Ephorate of Underwater Antiquities,
BE 2011/12

Plank from the hull of the ship, restored from three fragments. The wood has suffered surface deterioration and has lost much of its mechanical strength. Damages caused by marine-borers (teredenidae) are visible.
There are traces of caulking on the outer part of the plank. A layer of resin or pitch would have been placed between the planking and a sheath of lead sheets to protect the ship's hull against marine-borers. The lead sheets were held in place by short bronze nails, which were placed at short intervals.
Heavier bronze spikes with rounded heads, were hammered from the external side through the plank: they fixed the planking to the frames on the inside of the hull. The part of the spike that protruded through the inner face of each frame was double clenched.
Rectangular mortises were cut into both edges of the plank, in parallel lines, and were then joined with tenons. The edge-joined planks were transfixed by wooden pegs driven through holes drilled into the tenons.
This double line of mortises-and-tenon joints set into the edges of every plank would have created an internal skeleton inside the shell and so strengthened the ship's hull.
The extremely hefty width of the planks, enabling the cutting of the mortises in two eccentric and off-centre parallel lines, and the close-set frames all suggest that the ship was heavily timbered, constructed for carrying an enormous load.

BIBLIOGRAPHY: **Unpublished.**

G.Kou.

3. FRAGMENT OF A HULL PLANK

220 BC (±40)
Elm timber
L. 0.48 m., w. 0.25 m., th. 0.095 m.
From the material retrieved in 1976
Athens, Ephorate of Underwater Antiquities,
BE 2011/13

Plank from the hull of the ship.
The wood has suffered surface deterioration and has lost much of its mechanical strength. Damages caused by marine-borers (teredenidae) are visible.
A frame is fastened vertically to the inner part of the plank. The frame has shrunk and deformed, due to the loss of the wood's cellulose; therefore it is not possible to estimate what its original size would have been. As in most ancient Mediterranean wrecked ships, the frame would have been rectangular in section, with plane-worked surfaces. The frames were fastened to the ship's hull, after the planking was assembled. The process of joining those two parts started with

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the drilling of holes through planking and the attached frame, followed by the insertion of long wooden treenails into the holes. Finally the wooden treenails were themselves transfixed by bronze spikes, hammered from the external side of the planking. This order of procedure, well known already to the shipwrights of the classical period, made possible the protection of the planking from metal corrosion and the pressure applied from the nails and facilitated the replacement of nails if necessary.

BIBLIOGRAPHY: Unpublished.

G.Kou.

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4. BRONZE SPIKES

220 B.C. (± 40)
Copper alloy
L. X 19003: 0.34 m., X 19005: 0.295 m.,
X 19007α: 0.448 m., X 19007β: 0.373 m.,
X 19007γ: 0.33 m., X 19007δ: 0.345 m.
From the material retrieved in 1976
Athens, National Archaeological Museum,
X 19003, X 19005, X 19007α–δ

Forged spikes of copper-alloy from the hull of the Antikythera wreck. The metal has suffered extensive corrosion. Their shafts are twisted, probably from violent detachment of the once-joined parts. The spikes have rounded heads and their shafts are square in section, tapering to a more circular section towards their ends. Below the head, the edges (corners) of the shaft are rounded off. The use of the tetrahedral forged spike is already known in the naval architecture of the Classical period. The advantages of its shape include the ease with which it could be driven home, and its firm grasp once there within the wood along the full length of the shaft (from the progressive narrowing of the same), as well as lack of play, resistance against corrosion and great resistance to lateral tensions (pressures).

Their original position within the structure is unknown. Similar spikes are used to fix the frames to the planking. The fact however that the shafts have not been clenched, which would be expected in the case of their use with frames and planking, in correlation with their extended length and again with the way they curve along some two-thirds of their surviving portions, all seem to indicate that they would have been used in the lower part of the hull, plausibly at the keel or the mast-step.

BIBLIOGRAPHY: Unpublished.

G.Kou.

5. FRAGMENTS OF METAL SHEATHING

First half of 1st c. BC or earlier
Lead
Th. (including patina) 0.0015–0.004 m.
From the material retrieved in 1976 (7 July, from a depth of 52 m.)
Athens, National Archaeological Museum, X 19015

Several fragments, including six large twisted sheets covered with calcareous concretions and seashells. One sheet is pierced. One fragment shows a low circular projection, which may correspond to a nail head, 0.049 m. in diameter. Two fragments preserve a thin band with incised vertical lines, possibly traces of the tool used for smoothing and attaching that sheet to another. The sheathing of the hull's exterior with lead sheets up to the water line and occasionally well above it is attested since the late 4th c. BC in the Kyreneia shipwreck. The Kyreneia ship was already old when the sheets were applied. The thin strips with peripheral nails from the Porticello wreck (415–385 BC) were interpreted as material for insulating or repairing the joints (seam patches). Lead hull sheathing was common in the Hellenistic period and the Early Roman period on newly built ships, but ceased at the

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