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The Antikythera Shipwreck

# The technology of the ship the cargo the Mechanism

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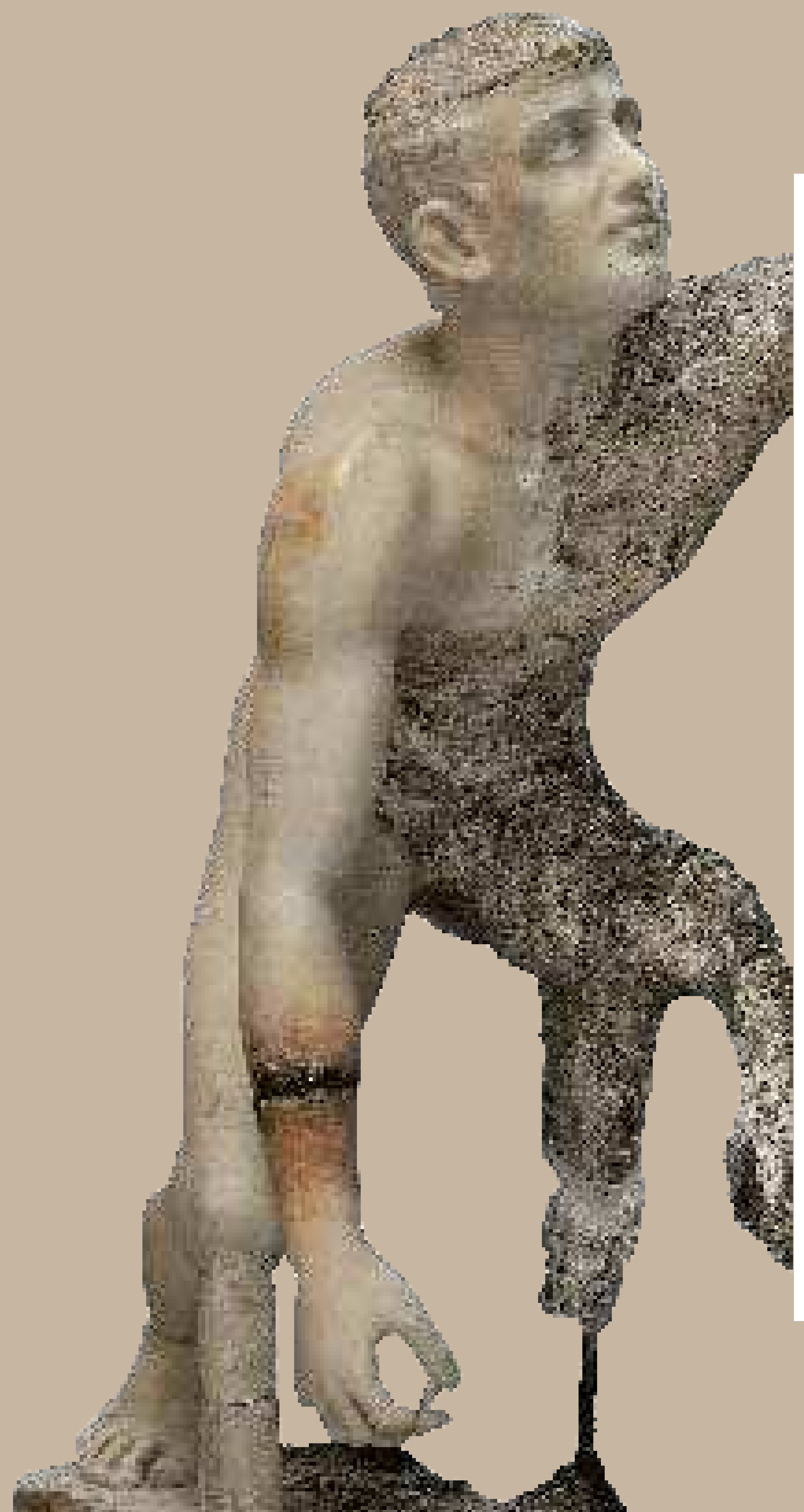

Περιεχόμενα

# Sculpture

The marble statues raised from the Antikythera Shipwreck exhibit many interesting technical details of their manufacture.

Several of these statues were not made, as usual, from a mass of marble, but from two pieces that were joined together with flat, smooth contact surfaces and with dowels in between. In addition, the projecting parts of the figures – such as heads, hands, as well as smaller parts like elements of dress, the top of the head, etc. – also consist of separate pieces of marble. This technique is fully justified, if one considers that all sculpture from the wreck is of Parian marble, a material not always easily extractable in large volumes.

Representative of the aforementioned construction method is the splendid seated statue of Zeus (fig. 2), made of two pieces joined at the abdomen, as well as larger than life-size statues of Odysseus (NAM 5745) and of Achilles (?) (NAM 5746), which belong to statue groups with 'Homeric themes', also constructed from two marble pieces of roughly commensurate size. The former statue is pieced together at the small of the back and the latter at the buttocks.

The technique of constructing parts from separate pieces of marble was already a widespread sculptural practice by the Archaic period. Heads, inserted in cavities at the base of the neck (fig. 1), and forearm attachments, which were fitted to the arms, are the most frequent cases. The fitting of pieces was achieved with quadrilateral sockets that received wooden tenons or metal dowels, which survive in no case. In the sculptures from Antikythera, no grooves with molten lead have been detected, a fact that compels us to think that only strong mortars and adhesives were utilized for the assembly. External metal joints are seldom, and it seems that they are associated with fractures in the marble that resulted during the carving. The Π-shaped iron clamp, situated vertically on the backside of the torso of a statue of Hermes (NAM 2774), over the left buttock (fig. 3), must be due to such a cause. Its bed, colored red from rust, retains the remains of lead that covered the join.

The three horse statues from the Antikythera Shipwreck (cf. NAM 15536) had separately worked and attached heads (fig. 1). For fitting them to the body, an oval reception cavity, coarsely hewn with a point, was opened at the neck. On the upper part of the cavity an anathyrosis (i.e. a smooth band around the edges) was configured for the best fit of the two pieces. The presence of a socket on the bottom of the cavity indicates the craftsman's intention to make the join even sounder. The relief bridle encircling the neck conceals from the outside the junction of the two pieces (fig. 1). In the case of the hand (NAM 15562), the attachable forearm was fitted into a square socket, while incisions around it created the necessary rough contact surface. Mortars and adhesives would have ensured a strong bond. Shortage of material necessitated the similar attachment of a small part of the top of the head in a statue of a young wrestler (NAM 2773), as well as of the helmet in the statue of a warrior (NAM 15534).

In certain instances, the fitting of the attachable parts is achieved with circular holes that would have received round wooden dowels. The forearm attached to the now welded right hand (NAM 15555) was fit into the upper arm in the same manner. The now mended ball of the sandaled left foot in a seated statue of Zeus (fig. 2) was also joined in the same way. The small circular hole, as on the curved fragment of a garment (NAM 15561), is for the metal dowel that fit the piece to the statue's shoulder or thigh.

Fig. 1. Detail of attachment of the horse's head in the neck of the statue. NAM 5747. 1st c. BC.

Fig. 2. Seated statue of Zeus constructed from two pieces. NAM 5743. 1st c. BC.

Another characteristic construction detail are the large props that guaranteed secure support for statues on their bases, as well as smaller struts that joined the hands with the torso and legs. Bronze statues, of course, did not employ struts in order to stand on their bases, except internally, under the feet. However, in copying – that is, the transference of bronze works to marble – the use of struts was required. Supports, placed at appropriate points, generally

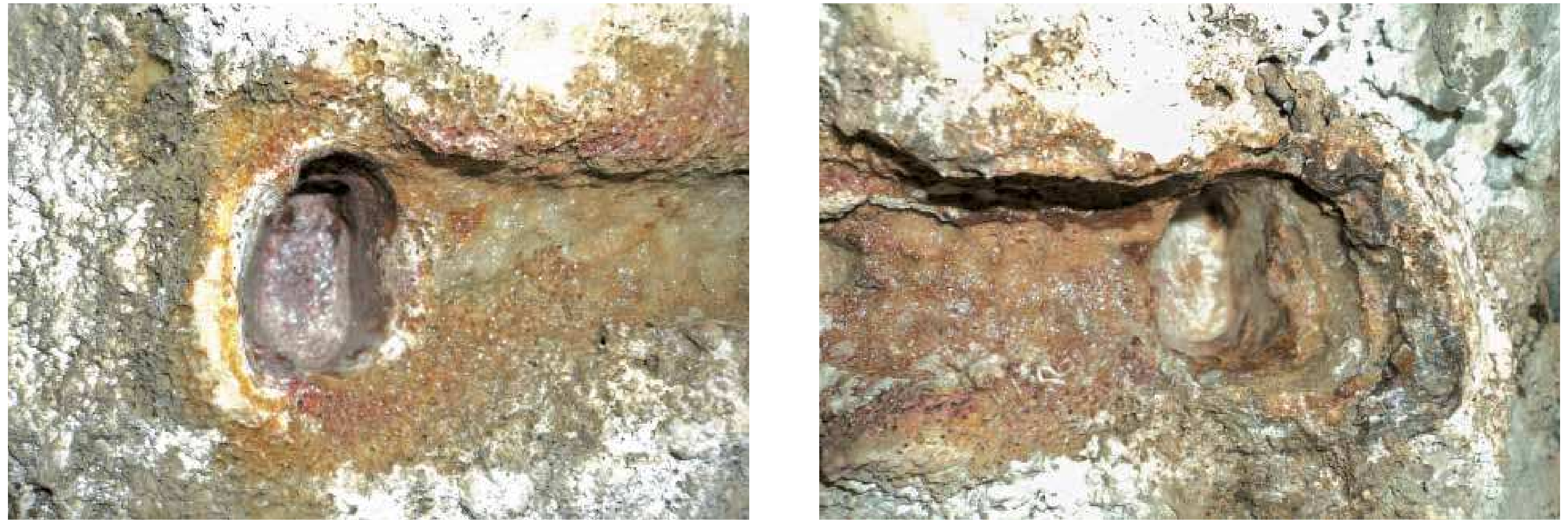

Fig. 3. The bed of vertical Π-shaped metal clamp preserved on the back of the torso of the statue of Hermes. NAM 2774.

next to the lower leg of standing statues, had various simple forms, such as columns or tree trunks, like the prop in the statue of Heracles of the Farnese type (fig. 4), or had more complex ones, such as the tripod that buttresses the statue of Apollo (fig. 5). In the statue of Hermes of the Richelieu type (NAM 2774), the god's mantle, which extends down to the plinth, was innovatively employed as a support.

Also necessary in marble sculptures were struts supporting projecting parts, for example, hands, which were not in danger of breaking off in bronzes. The elements that prevented breakage, relatively short in length and quadrilateral or circular in cross-section, are called by the foreign term 'puntelli' (struts). From very early on, however, research found that the puntelli in sculptures from the Antikythera Shipwreck did not indicate that they were copied from bronze prototypes. Struts ensured, first of all, safe loading and transport of the statues aboard the ship. Today, we know that the marble sculptures contained in the cargo of the ill-fated vessel constituted a bulk order to some Greek sculptural workshop in the beginning of the 1st c. BC, and were bound for Italy. It is likely that some of the puntelli would have been carved away when the works arrived at their final destination.

Nevertheless, puntelli were not 'bothersome' additions to marble statues and copies of the Roman period. The Romans certainly had become so accustomed to them that they left them intact, perhaps fearing that their removal would cause irreparable damage to the sculptures.

Particularly striking among the sculptures from the wreck are the thick, cylindrical puntelli that supported the underbellies of the horse statues (cf. NAM 15536) with the plinth of the quadriga, as with the prop that is still preserved today on the large section of the plinth of a horse statue (NAM 5749). The puntello that connects the lifted hoof (NAM 15554) of a horse's foreleg to the plinth is elongated and quadrilateral in cross-section. Similarly quadrilateral are the puntelli that join the right knee and the left hip of a statue of a wrestler (NAM 2773) with the plinth, the hands of Homeric heroes (NAM 5745 and NAM 5746) with the statues' torsos, as well as that which connects the lower legs of a statue of Hermes (NAM 2774). Finally, the fine puntelli that bridged the distance between the fingers of the hands of some statues, such as the fragment (NAM 15550) and the statue (NAM 2773), could be characterized as tiny 'masterpieces'.

The low orthogonal bases with depressions on the upper side for the inset of the statues' plinths are also included in the technical aspects of marble statues from the Antikythera Shipwreck. These bases enable us to conclude that the statues were loaded upright in the ship's hold. This made the transport more secure. One of the six bases retrieved from the deep has been assigned to the statue of Hermes (NAM 2774).

We observe another technical characteristic in the statue of a young wrestler from the wreck (NAM 2773), particularly on his excellently preserved right side: an intense polishing of the torso, which is a typical feature of the Late Hellenistic and, chiefly, the Roman pe-

Fig. 4. Statue of Heracles of the Farnese type with prop in the form of a tree trunk.
NAM 5742. 1st c. BC.

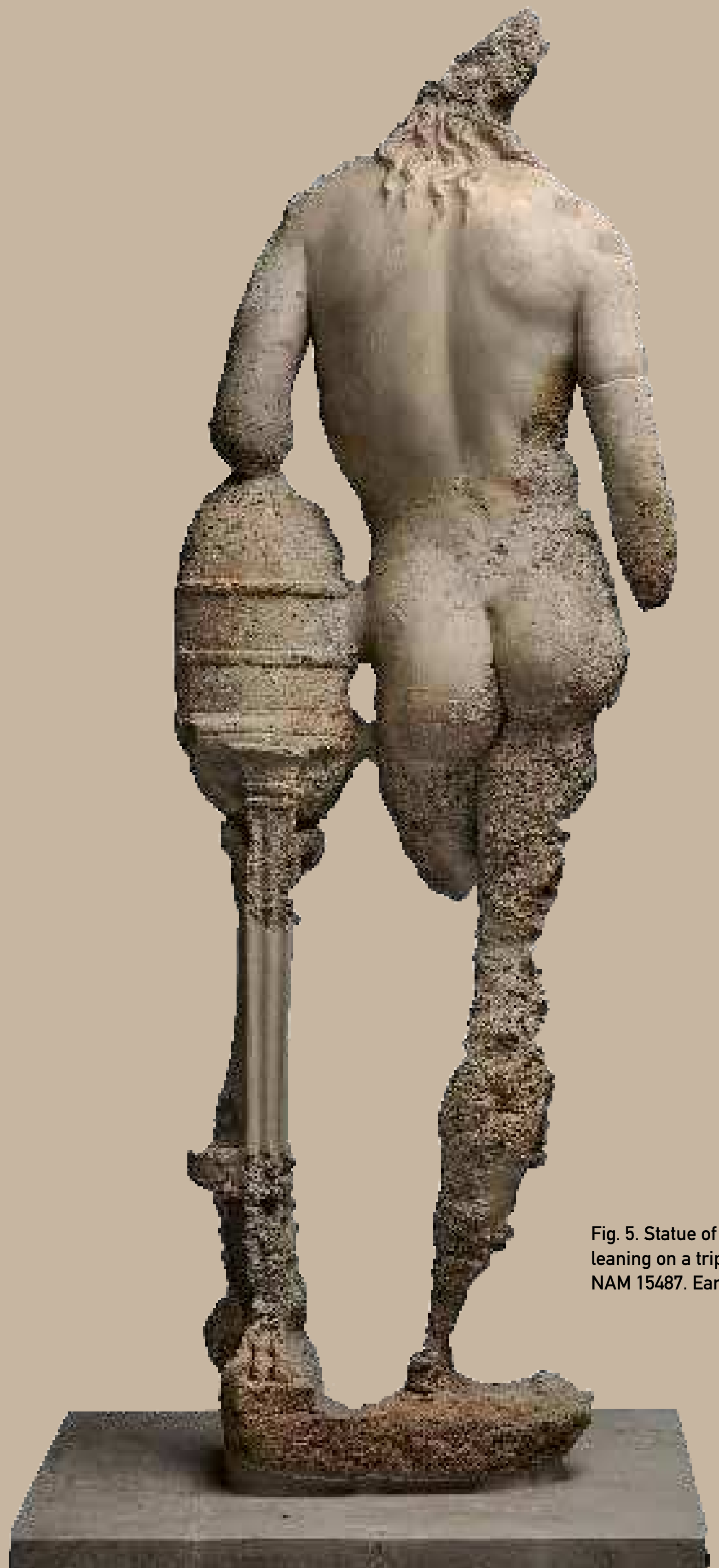

Fig. 5. Statue of Apollo leaning on a tripod. NAM 15487. Early 1st c. BC.

riod. The polished marble surface, achieved with wax, was an artistic means that served to render the texture of human flesh; at the same time, it was indicative of the taste of Roman buyers. It was also a common feature of Renaissance and later glyptic of the 18th and 19th c., which knew Greek works of Classical antiquity almost entirely through polished Roman copies.

## STONE UTENSILS AND ARTIFACTS

The idea of two contiguous millstones moving in a palindromic fashion with the help of a metal handle to grind cereals for the production of flour dates back to the 5th c. BC. The representative example was the quern of the 'Olynthus type', which was in use until the Late Hellenistic period.

Around the beginning of the 1st c. BC or a little thereafter, the manual rotary mill, which comprised two tangent, then cylindrical millstones seem to have been introduced in agricultural technology; the mill consisted of two stones: a) the *onos* (*catillus*), the upper stone, and b) the *myle* (*meta*). The hand mill, essentially the *onos* – insofar as it was the only stone that rotated, moved around a vertical iron axle that passed through the middle of the *onos* and was mounted on the center of the convex *myle* (*meta*), which remained fixed. The grain for grinding was passed through a perforation, the 'eye', born through the center of the *onos*. In order to prevent the seeds from scattering outside the mill, a shallow funnel was formed with walls that were slightly inclined toward the hole on the upper surface of the *onos*. Abrasive stones were always utilized for the construction of millstones, in order that the coarse surface of the material increased friction, thereby facilitating the grinding. The ability to adjust the distance between the

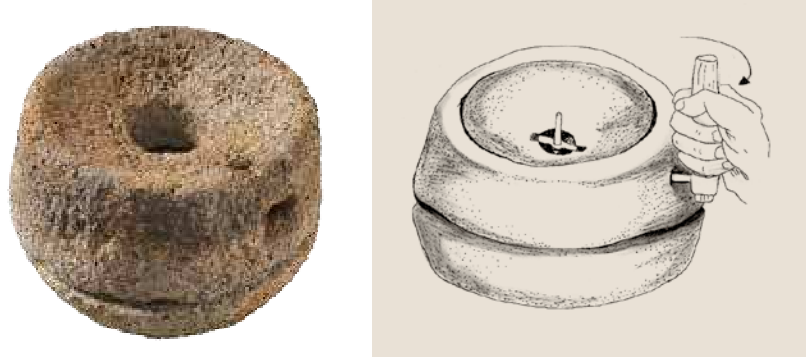

Fig. 6a-b. Manually operated quern, consisting of a pair of millstones. NAM 15556, 15563. Early 1st c. BC.

concave *onos* and the convex *myle* allowed, moreover, total control of the milled product, which could thus vary more coarsely to more finely ground.

In the hand-powered mill (fig. 6a-b) from the Antikythera shipwreck, the *onos* is slightly concave on its lower surface – that is, on the grinding surface – so that it would set perfectly on the convex *myle*. Rotary movement was enabled by wooden or metallic handle, which was situated vertically on the special slot-socket on the outside of the *onos*' narrow side. Molten lead for securing the handle to the hand mill from the Antikythera Shipwreck was poured into a small hole on the upper surface of the *onos*.

### Grinder – Basin Vessel

*Doidykes* or *aletrivanoi*, as grinders of small dimension were called, were intended for mashing vegetables and pulverizing pigments and minerals in a mortar. *Doidykes* in the shape of a human finger, found from the 5th c. BC until the Roman period, are not connected with agricultural activities.

The traces of the red color detected on the grinding surface of the grinder (fig. 7) from the Antikythera shipwreck, together with the chemical analysis, which was conducted on the red coloring matter found in an amorphous stone from the wreck and which indicates that it is cinnabar (mercuric sulfide), strongly suggests that the Antikythera grinder was used to pulverize this pigment. They were usually used in combination with shallow basin-formed vessels, like the one retrieved from the shipwreck (fig. 8). This common household vessel, unchanged in shape from the Archaic to the Roman imperial period, was known as a mortar (*mortarium*/*θυεία*, *θυία*).

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Fig. 7. Grindstone on the shape of a figure. NAM 31055. 2nd-1st c. BC.
Fig. 8. Shallow basin-formed vessel. NAM 15557. 2nd-1st c. BC.

## ABBREVIATIONS

NAM National Archaeological Museum

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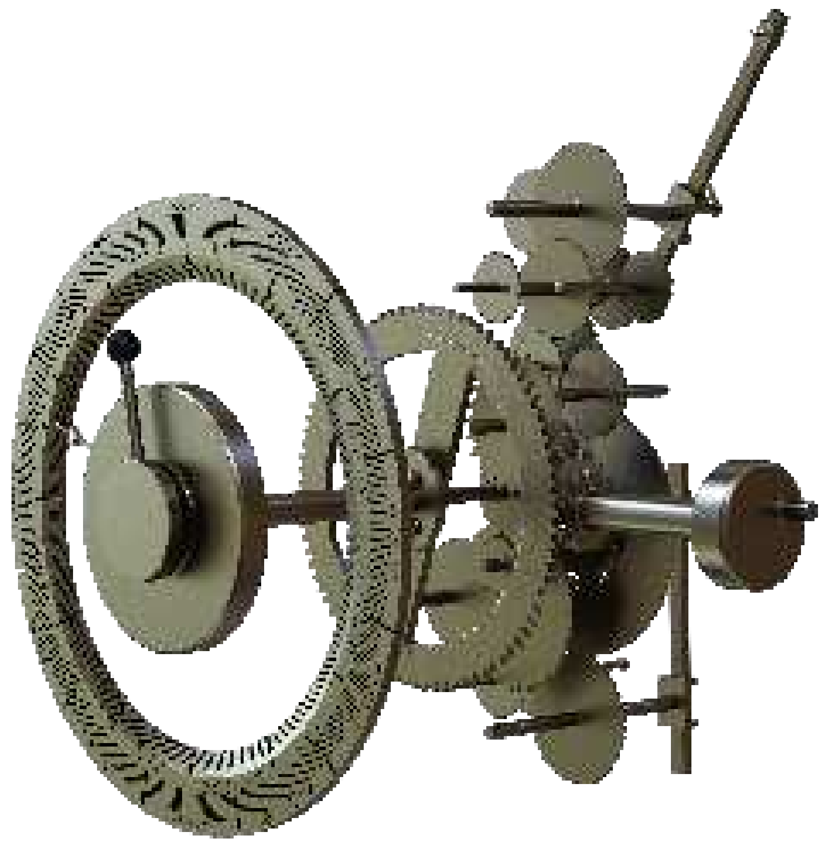

3D representation of the gearing inside the Antikythera Mechanism
(Graphics by M. Buttet, Hublot).