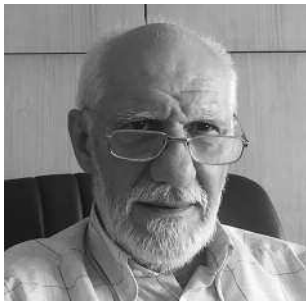


The Antikythera Mechanism

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Generally

The Antikythera mechanism was a technologically amazing analogue computer. It was constructed 2.000 years ago and was used to calculate the exact position of the Sun, the Moon and possibly the planets in the sky. It calculated the phases of the Moon, predicted eclipses and indicated the date of the Panhellenic games. It had front and back doors, with astronomical, geographical and technological inscriptions covering much of the exterior of the Mechanism. Thanks to the innovative research techniques used, were read texts lost for over 2.000 years! All inscriptions are written in Greek. Its dimensions were approximately $30 \times 20 \times 10$ cm –slightly larger than a current Laptop– and contained over 30 gears. It had three main dials, one on the front with two concentric scales, and two on the back in the form of spirals. It is as important for the evolution of technology as the Acropolis for the evolution of architecture. Similar ancient mechanism has not so far been found. This raises the reasonable question of what was the technical infrastructure the time when the Antikythera Mechanism was built and what happened to the knowledge and the art that it reveals.



The underwater excavation

In 1900 a party of sponge-fishers from the island of Syme discovered accidentally an ancient shipwreck off the coast of the island of Antikythera. The excavation began at the end of November 1900 and a few months later were recovered important findings, such as the famous Antikythera Ephebe, many of which are nowadays exhibited at the National Archaeological Museum of Athens. Among the findings, was the Antikythera Mechanism, which –broken, corroded and petrified after 2.000 years on the seabed– was going to



change the knowledge that we had so far on the technological skills of our ancestors. From Pergamon coins that were retrieved, the wreck is dated between 85 and 67 BC. The detailed form of the lettering of the Antikythera Mechanism can be dated to the second half of the 2nd Century BC, implying that the Mechanism was constructed during the period 150-100 BC.



An ancient calendar

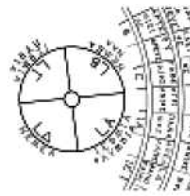
On the back side of the Antikythera Mechanism, there were two main dials in the form of spirals. The lower back dial is a Saros eclipse-prediction dial, arranged as a four-turn spiral of 223 lunar months, with glyphs indicating eclipse predictions. The upper back dial is a 19-year calendar, arranged as a five-turn spiral of 235 lunar months. This calendar is known as the Metonic cycle by the Greek astronomer Meton of Athens who lived in the 5th century BC and had observed that at this period of 19 solar years the Moon returned to the same point in the sky with the same phase. At the subdivisions of the spiral are carved with fine art the ancient names of 12 months, repeated for the formation of the period of the 19 years. The names of the months are of Corinthian origin with the Corinthian colonies of northwestern Greece and Tauromenium in Sicily to



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be the leading contenders. A new font (True type fonts) has been constructed at the Aristotle University of Thessaloniki, reproducing the fine art letters.

The Panhellenic Crown Games



The subsidiary dial within the upper back spiral of the Antikythera Mechanism displayed the celebration year of the ancient Panhellenic crown games. Circumferentially to the dial have been read the words Olympia, Pythia, Isthmia, Nemea and Naa, while internally, in each quadrant, are indicated the four years of the Olympic cycle. All these games were crown games, with winners being rewarded with crowns (stephanoi).



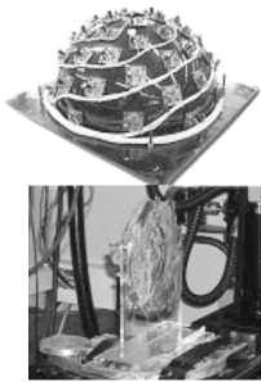
The gears

The Antikythera Mechanism contained at least 30 cooperating gears and several pointers. On the front side, there were two concentric circular scales. The outer scale had 365 subdivisions and the names of the 12 Egyptian months in Greek. The inner scale had 360 subdivisions and the names of the 12 zodiac constellations. The operator, by turning a crank handle, moved the gears that in their turn rotated on the front side two pointers that indicated the position of the Sun and the Moon. Beneath the outer scale, which was removable, there were 365 holes. Every four years the operator could detach it and shift it by one hole, thus taking into account leap years. A rotating sphere, adapted with a crown to the pointer of the Moon, displayed the phases of the Moon. The movement of the Moon is not circular



but elliptical. The display of this movement, taking into account the anomaly caused by its eccentric orbit around the Earth, was achieved by the use of two eccentric gears, the axes of which are distanced by 1.1 mm. The lower gear has a pin that engages with a slot on the upper gear, forcing it thus to rotate by the pin-and-slot arrangement. The epicyclical movement of the upper gear tracked the motion of the Moon in the sky with great accuracy.

Innovative research techniques



During September 2005, the research division of Hewlett-Packard (HP Labs, California) sent to Athens three specialized scientists who recorded, using the innovative digital imaging mechanism PTM Dome, even faded and worn inscriptions and other details of the surface of the fragments of the Antikythera Mechanism.

The Dome surrounded the fragment under examination and took a series of still photos from 50 different directions in order to analyze the three-dimensional structure of the surface. Thus it became possible to study details of the surface of the fragments even when they were not visible with the best systems of conventional and digital photography.

During October 2005, another team of specialists worked at the National Archaeological Museum. This group, from the cutting-edge company, X-

Tek Systems, brought with them the prototype of the very powerful new x-ray machine "Bladerunner", weighing 8 tons, maximum voltage 450 kVolt and resolution of one twentieth of a millimetre (50 nm). The three-dimensional images that were obtained when the fragments of the ancient mechanism were examined revealed internal details of gearing and inscriptions that remained hidden on the seabed of the Antikythera more than two thousand years.



Construction of the most representative model of Antikythera Mechanism

Over the last ten years, a research team of the Aristotle University of Thessaloniki, is studying the Antikythera Mechanism. The team consists of Prof. Seiradakis J. (School of Physics), Prof. Efstathiou K. (School of Mechanical Engineering), Dr. Anastasiou M. (School of Physics), Dr. Efstathiou M. (School of Mechanical Engineering). In this research program, the most representative up to today, models of the Antikythera Mechanism were constructed, in real dimensions and also in scale 3:1.

