

The Antikythera Mechanism: Human Ingenuity or Alien Technology?

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“How can the capacity to build a machine so magnificent have passed through history with no obvious effects?”
– Jo Marchant.

“It’s a popular notion that technological development is a simple progression. But history is full of surprises.”
– François Charette

“[The Antikythera Mechanism] stands as a strange exception, stripped of context, of ancestry, of descendants.”
– Jo Marchant.

Introduction: The Antikythera Mechanism is an ancient Greek astronomical clock able to calculate and display celestial information, particularly cycles such as the phases of the moon and a lunar-solar calendar. For our group's debate topic, we're focusing on the mystery surrounding the origins of the Antikythera Mechanism. Specifically, whether the technology was of early Greek design or a gift from ancient aliens.

Context: The Antikythera Mechanism dates to around 150 – 100 BC, indicated by the analysis of textual data and lettering. It is the earliest known mechanical analog computer (a computer that uses moving parts to show changing information; e.g. slide rule); no earlier geared mechanism of any sort has ever been found. Nothing close to its technological sophistication appears again for well over a millennium; astronomical clocks aren't seen again until the fourteenth century.

The device was recovered in 1902 from the wreckage of a Roman merchant ship off the island of Antikythera (Image 1) by archaeologist Valerios Stais. Coins found at the site by Jacques Cousteau in the 1970s date the shipwreck sometime shortly after 85 BC. Among the many objects recovered from the wreck, including bronze and marble statues, pottery, glassware, and gold jewelry, were several bronze fragments (Image 2). At first overlooked, these were later associated with some sort of astronomical machinery. But the realization that this was the earliest known device involving an arrangement of gear-



Image 1: The Island of Antikythera, Greece.



Image 2: Fragments of the Antikythera Mechanism.

wheels came only slowly.

From the late 1950s to the early 1970s, historian of science and technology Derek De Solla Price studied the badly corroded and fragmented mechanism extensively. Price proposed that the mechanism had been an astronomical calendar with display dials on the front and back indicating the positions of the Sun and the Moon. This gearing, comprising of some 30 wheels, was a clever mechanical simulation of a basic period relation that linked the length of the solar year with the phases of the Moon. Great advances in deciphering the Antikythera Mechanism have been made in recent years by Michael Wright, who has relied on digitized X-rays and linear tomography to achieve better imaging of the mechanism and some remarkable insights into its functions.

Reconstruction – How it Worked: The

device was originally contained in a square wooden case a bit smaller than a shoebox. On the front were two metal dials, one inside the other, that showed the zodiac and the days of the year. Metal pointers displayed the positions of the Sun, the Moon and five planets visible to the naked eye.

As the wooden knob on the side of the box was turned, the Moon made a full revolution and the



Image 3: Model of the Antikythera Mechanism.

Sun inched a twelfth of the way around the dial. Through a window near the center of the dial perched a ball painted half black and half white, which spun to show the Moon's changing phases. On the back of the box were two spiral dials, one above the other (Image 3 and Image 5). A pointer at the center of each traces its way slowly around the spiral groove. The top dial shows the Metonic cycle – 235 months fitting quite precisely into 19 years. The lower spiral was divided into 223, reflecting the 223-month period of the Saros cycle, which is used to predict eclipses. There are 30 known gear-wheels in the

Antikythera Mechanism, the biggest taking up nearly the entire width of the box, the smallest less than a centimeter across (Image 4). They all have triangular teeth, anything from 15 to 223 of them, and each would have been hand cut from a single sheet of bronze. Turning the side knob engaged the big gear-wheel, which went around once for every year, carrying the date hand. The other gears drive the Moon, Sun and planets and the pointers on the Metonic and Saros spirals.

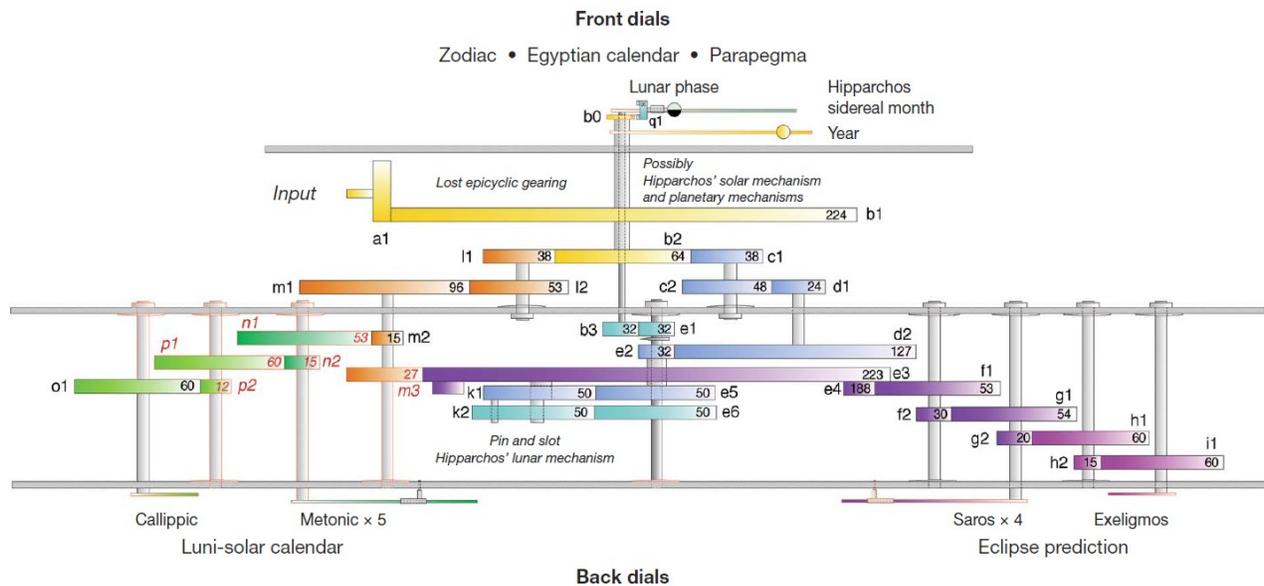


Image 4: Reconstruction of the gear trains.

Perspectives: The two perspectives we are debating are that of human ingenuity and alien technology. **Alien Technology** – the device is far too advanced for humans; the technology was given, by aliens, to the Greeks more than a millennium before it's human conception. **Human Ingenuity** – at the peak of the Hellenistic era, Greek astronomers, namely Hipparchus, Archimedes, and Posidonius from the island of Rhodes, constructed the device based on known laws and observations of the night sky and mathematical prowess.

Arguments: Alien Technology – No physical evidence of an earlier device has ever been found. There is no precursor; the Antikythera Mechanism is one of a kind. Additionally, devices of similar complexity aren't seen again for another fourteen hundred years. Based on these facts, the

argument can be made that aliens bestowed the technological know-how upon the Greeks, and when the device was lost, so was the technology.

Human Ingenuity – The Roman merchant ship was carrying a rich cargo of luxury goods, including vases in the style of Rhodes, a rich trading port at the time. The ship sank in the middle of a busy shipping route from the eastern to western Aegean, and it seems a fair bet that it was heading west for Rome, which had by that time become the dominant power in the Mediterranean and had a ruling class that loved Greek art, philosophy, and technology. The Rhodian vases are telling clues, because Rhodes was the place to be for astronomy in the first and second centuries BC. Hipparchus, arguably the greatest Greek astronomer, is thought to have worked on the island from around 140 BC until his death around 120 BC. Later the philosopher Posidonius set up an astronomy school there that continued Hipparchus' tradition; it is within this tradition that the mechanism is believed to have originated. Circumstantial evidence is provided by Cicero, the first-century BC Roman lawyer and consul. Cicero studied on Rhodes and wrote later that Posidonius had made an instrument “which at each revolution reproduces the same motions of the Sun, the Moon and the five planets that take place in the heavens every day and night”. The discovery of the Antikythera Mechanism makes it tempting to believe the story is true. The researchers realized that the ratios of the gear-wheels involved produce a motion that closely mimics the varying motion of the Moon around Earth, as described by Hipparchus. When the Moon is close to us it seems to move faster. And the closest part of the Moon's orbit itself makes a full rotation around the Earth about every nine years. Hipparchus was the first to describe this motion mathematically, working on the idea that the Moon's orbit, although circular, was centered on a point offset from the center of Earth. In the Antikythera Mechanism, this theory is translated into mechanical form. Almost everyone who has studied the mechanism agrees it couldn't have been their first try – it would have taken practice, perhaps over several generations, to achieve such expertise. Indeed, Cicero wrote of a similar mechanism that was said to have been built by Archimedes. That one was

purportedly stolen in 212 BC by the Roman general Marcellus when Archimedes was killed in the sacking of the Sicilian city of Syracuse. The device was kept as an heirloom in Marcellus' family: as a friend of the family, Cicero may indeed have seen it. So where are the other examples? A working model of the heavens may have had value to a cultivated mind – bronze had value to everyone. Most bronze artifacts were eventually melted down: the Athens museum has just ten major bronze statues from ancient Greece, of which nine are from shipwrecks. So in terms of the mechanism, we're lucky that it survived.



Image 5: Antikythera Mechanism with underlying X-ray image.

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