The Antikythera mechanism

—by Shankar Vedantam

Pulled from a shipwreck about 18 miles north of Crete in the Mediterranean Sea in 1900, the artifact is so sophisticated that its complexity would not be matched for a thousand years—it was also the world's first known analog computer.

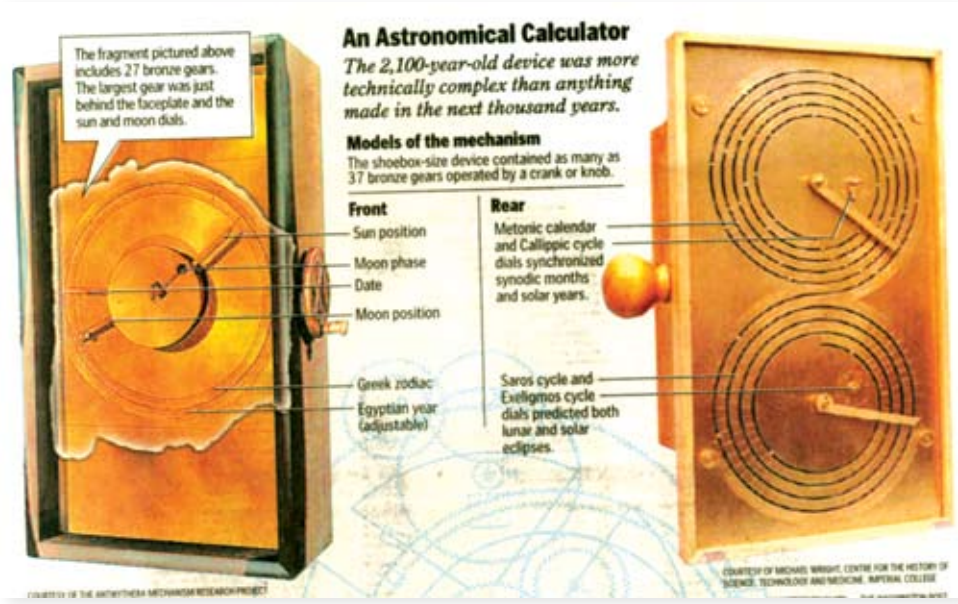
The device owes its discovery to an enterprising archaeologist who cleared off a layer of organic material from one of the pieces of "junk" stored from the shipwreck in a cupboard and found what looked like a gearwheel staring him in the face.

That "bit of rusty old metal" is now displayed in the national Archaeological Museum in Athens, and in late November 2006, it was the sole subject of an international conference convened to revisit results of decades of research into its origins and application, in light of a recent examination of the mechanism using high-resolution X-ray tomography.

Every discovery about the device has raised new questions. Who built the device, and for what purpose? Why did the technology behind it disappear for the next thousand years? What does the device tell us about ancient Greek culture? And does the marvelous construction, and the precise knowledge of the movement of the sun and moon and Earth that it implies, tell us how the ancients grappled with ideas about determinism and human destiny?

"We have gear trains from the 9th century in Baghdad used for simpler displays of the solar and lunar motions relative to one another—they use eight gears," wrote François Charette, a historian of science in Germany, in an editorial accompanying a new study on the Antikytheran mechanism in *Nature*. "This mechanism has more than thirty gears. To see it on a computer animation makes this mind boggling. There is no doubt it was a technological masterpiece."

"The device was probably built between 100 and 140 BC, and the understanding of astronomy it displays seems to have been based on knowledge developed by the Babylonians around 300-700 BC," said Mike Edmunds, a professor of astrophysics at Cardiff University in Britain.



A reconstruction of the gear mechanism to its original state using advanced three-dimensional imaging technology yielded some surprises. The mechanism was built to show the relationship between lunar months (i.e., the time it takes for the moon to cycle through, say, full moon to full moon) and calendar years. The gears had to be cut so precisely as to be able to reflect the complexity of 19 calendar years equaling 235 lunar months.

By turning the gear mechanism, a person could check what the sky would have looked like on a date in the past, or how it would appear in the future. The device was encased in a box with doors in front and back covered with inscriptions—a kind of instruction manual. Inside the front door were pointers indicating the date and the position of the sun, moon, and zodiac, while opening the back door revealed the relationship between calendar years and lunar months, and a mechanism to predict eclipses.

"If they needed to know when eclipses would occur (and the rising and setting of stars) and then relate them to dates and religious experiences, they only needed to turn a handle, and up popped out a date on the front," said Yanis Bitsakis, a physicist at the University of Athens who co-wrote the *Nature* paper. "It's a mechanical computer the likes of which people had not conceived until recently."

Building it would have been expensive and required the interaction of astronomers, engineers, intellectuals, and crafspeople.

Charette said the device overturned conventional ideas that the ancient Greeks were primarily ivory tower thinkers who did not deign muddy their hands with technical stuff. He also thinks that it was unlikely that the device was used by practitioners of astrology, then still in infancy. More likely, he said, it was bound for a mantelpiece in some rich Roman's home.

Given that astronomers of the time already knew how to calculate the positions of the sun and the moon and to predict eclipses without the device, it would have been equivalent of a device built for a planetarium today—something to spur popular interest.

Why was the technology that went into the device lost? "The time this was built," said Edmunds, "the jackboot of Rome was coming through. The Romans were good at town planning and sanitation but were not known for their interest in science."

The fact that the device was so complex, and that it was being shipped with a quantity of other luxury items, tells Edmunds that it is very unlikely to have been the only one ever made. "There must have been a tradition of making them. We're always hopeful a better one will surface."

Analog computer used in the late 1950s. [Source: www.computermuseum.li].