

# Ancient Greek Eclipse Calculator Marked Olympics

Antikythera mechanism linked to Archimedes' home of Syracuse

An ancient Greek astronomical calculator that showed the positions of the sun, Earth and the moon, and outshined any known device for 1,000 years after it, also kept track of something more mundane: when the next Olympics would take place.

And its design just might have sprung from the skull of the brilliant scientist Archimedes.

Researchers have pried these and a few other fresh secrets from the corroded bronze fragments of the Antikythera mechanism, a clockwork-like assemblage discovered in 1901 by Greek sponge divers off the Greek island of Antikythera, between Kythera and Crete.

Members of the Antikythera Mechanism Research Project (AMRP) and their colleagues used data from high-resolution, 360-degree x-ray scans to decipher markings as small as 0.06 inch (1.7 millimeters) tall on a spiral dial on the rear of the instrument. The five-twist spiral is inscribed with 235 sets of markings believed to indicate the months in a 19-year calendar.

Known as the Metonic calendar, people have used it since Babylonian times to account for the fact that 12 lunar months add up to only 354 days—11 days shy of a solar year. (Gears located behind the dial face would have moved a pointer like the minute hand on a clock to refer a user to particular markings on the dial.)

Writing in *Nature*, the team was able for the first time to read the names of the months on the dial, which match those of calendars once used in the Corinthian colonies of northwestern Greece, suggesting that the mechanism was built in the area.

Seven of the month names match a calendar used in a part of Sicily believed founded by settlers from Syracuse in the fourth century B.C. Syracuse was home to Archimedes, the polymath who in one apocryphal story leaped from a bath shouting, "Eureka!" (I have it) after figuring out how to tell if a royal crown was made of solid gold by submerging it in water and measuring the water it displaced.

Researchers assume that the Antikythera mechanism, built in approximately 150 to 100 B.C., sank on its way



**OLYMPICS ON DIAL:** The ancient Greek clockwork device known as the Antikythera Mechanism (shown here in a computer-generated reconstruction) kept track of the Olympics and other ancient tournaments along with eclipses of the sun and moon.

from the Greek island of Rhodes to Rome, then a major trading route. Although Archimedes died in 212 B.C., too early to have built the Antikythera mechanism, the Roman philosopher Cicero attributes a device to Archimedes that was similar to it.

"There's a chance that it's a kind of descendent of his invention," study author Alexander Jones, a historian of ancient science at the Institute for the Study of the Ancient World at New York University, says.

Whatever purpose Archimedes may have had in mind for his instrument, Jones says the use of the Corinthian calendar indicates that the Antikythera mechanism was not built for scientists. Instead it may have been for teaching nonspecialists about astronomy.

Bolstering that interpretation, the researchers discovered that the markings on a smaller dial inside the Metonic one spelled out the locations of the names of Panhellenic games, the highly popular sporting events of which the most famous is the Olympics.

The games were on a four-year cycle, and each quar-

ter turn of the dial indicated which games took place that year in the cycle. "That's something of no scientific interest. That's of human, social interest," Jones says.

One of the things the mechanism was well-suited to teach was the predictability of eclipses—the apparent task of a second, four-twist spiral dial on the instrument's back.

Its 223 divisions correspond to months in the Saros cycle, another ancient calendar system—this one an 18-year cycle—for tracking eclipses. Of these divisions, researchers had previously identified 16 that were marked with glyphs, or sets of characters, indicating solar and lunar eclipses. The team increased that number by two to 18.

The pattern of glyphs was highly accurate: it matched the start dates of 100 eclipses that occurred during the final four centuries BC, as determined by NASA. "We could start the dial at any of these dates and all the known glyphs would exactly match actual eclipses," says study author Tony Freeth of Cardiff, Wales, a former mathematician and member of the AMRP.

The device seems to have fallen short, however, in predicting the exact hour of an eclipse. An inner dial is divided into three sections that may have specified the number of hours to add to the eclipse time marked on the glyph.

But the authors were unable to figure out a way to make the times match those of the eclipses calculated by NASA. They suspect that the device's maker used an imprecise method for calculating those times.

The shortcoming does not diminish the brilliance of the Antikythera mechanism, which "has at its heart a real genius about it," Freeth says. Of particular ingenuity, he says, is a pin and slot mechanism involved in the front side of the instrument, which shows the positions of sun, Earth and moon.

Freeth and his colleagues reported two years ago that the pin and slot were used to account for variations in the speed of the moon in the sky. One can almost hear the inventor of that little trick shouting, "Eureka!"

## Heart problems rare for remote Greek monks: doctors

**ATHENS-** Monks from medieval male-only communities on Greece's Mount Athos have far lower levels of heart and lung disease than average Europeans despite only rudimentary healthcare, *Medecins du Monde* said on Wednesday.

Doctors from the French medical charity who visited the 1,000-year-old, reclusive religious community at the weekend to provide medical attention found its monks to be in exceptionally good health.

"Cardiological problems faced by the monks are very few and have no relation, in

terms of frequency, with the general population," said MDM Greece's spokeswoman Sophia Ioannou, adding that lung problems were also practically unknown.

The seven-man team of specialists treated around 200 monks from four of the most remote monasteries on Mount Athos, which lies some 270 km (170 miles) north of Athens on the Halkidiki peninsula. Eye problems were the most common complaint.

"Mainly due to two reasons, living conditions and good nutrition, the diseases frequently faced by Western societies, coronary disease and lung disease are not confronted by this population," she said.

Given to the monks by Byzantine imperial decree in the 9th century, Mount Athos forms a self-governing region within Greece. Women -- and even female livestock -- are not allowed on the mountain, which has only one clinic for its 3,000 monks, some of whom live as hermits in caves.

Life is lived as closely as possible to Byzantine times: the monasteries celebrate Christmas 14 days behind the rest of Greece as they still use the Julian calendar. The monks also observe a high number of fast days each year, seldom eat meat, and cultivate their own wines, fruit and vegetables.

Britain's Prince Charles is a



frequent visitor to the UNESCO world heritage site, whose monasteries house priceless ancient manuscripts, icons and art works which are only gradually being catalogued.

A report published by the U.N. Food and Agriculture

Organisation on Tuesday said the Mediterranean region was fast abandoning its traditionally healthy diet and modern Greeks had become the plump nation in Europe, with three-quarters of the population obese or overweight.