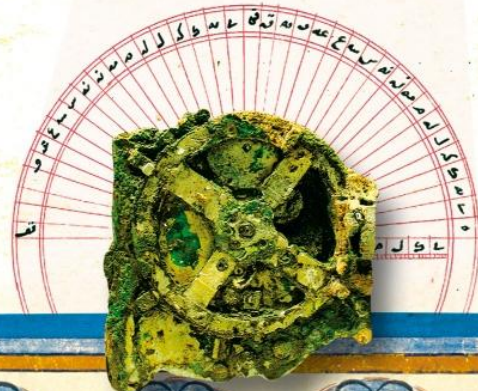
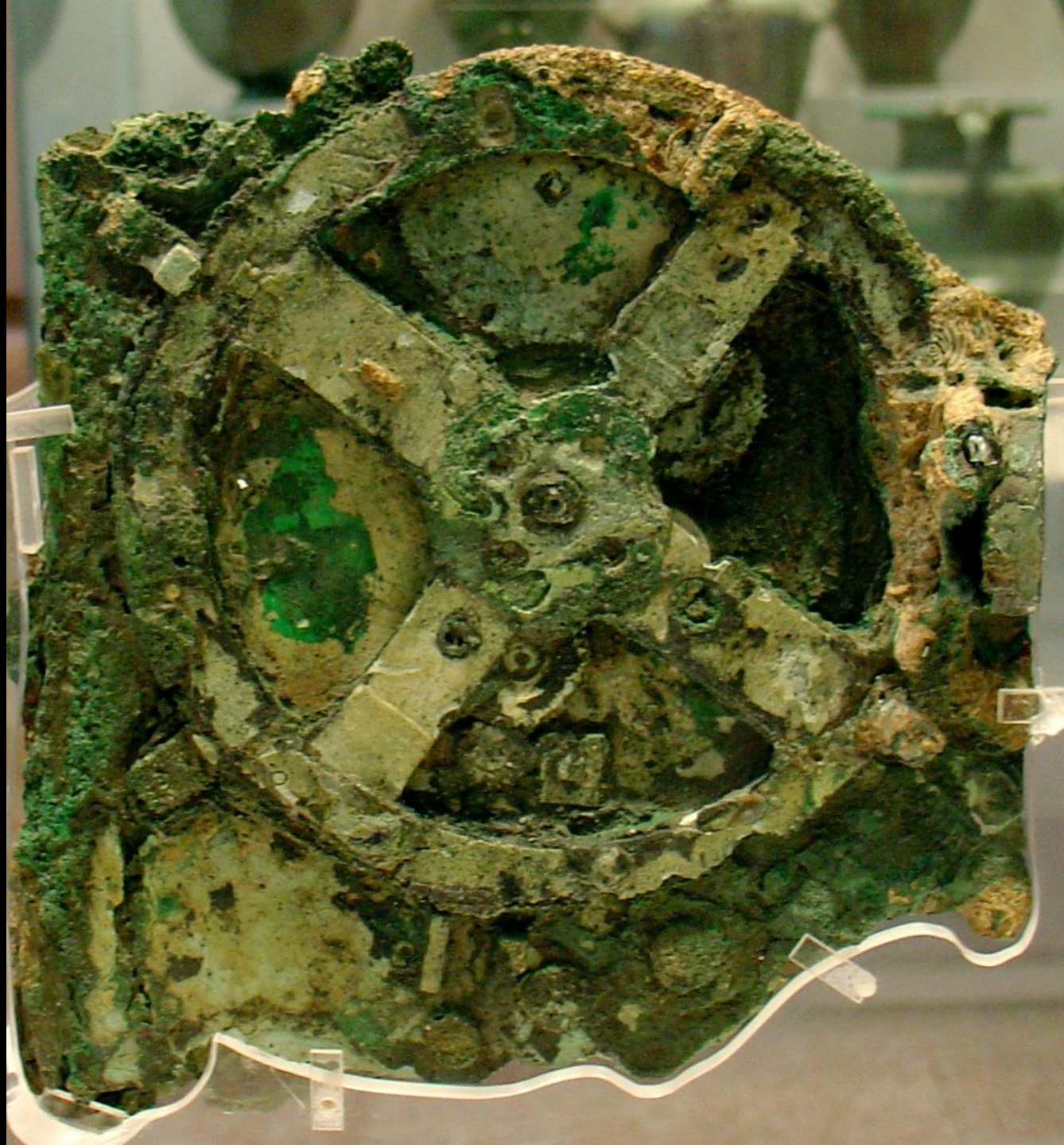


Solving the  
mystery of  
the world's first  
computer

# Decoding the Heavens

Jo Marchant







# The Antikythera mechanism

How was it discovered?

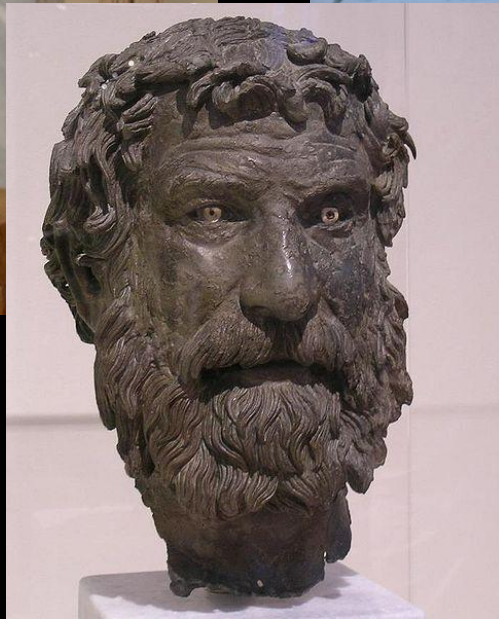
What did it calculate?

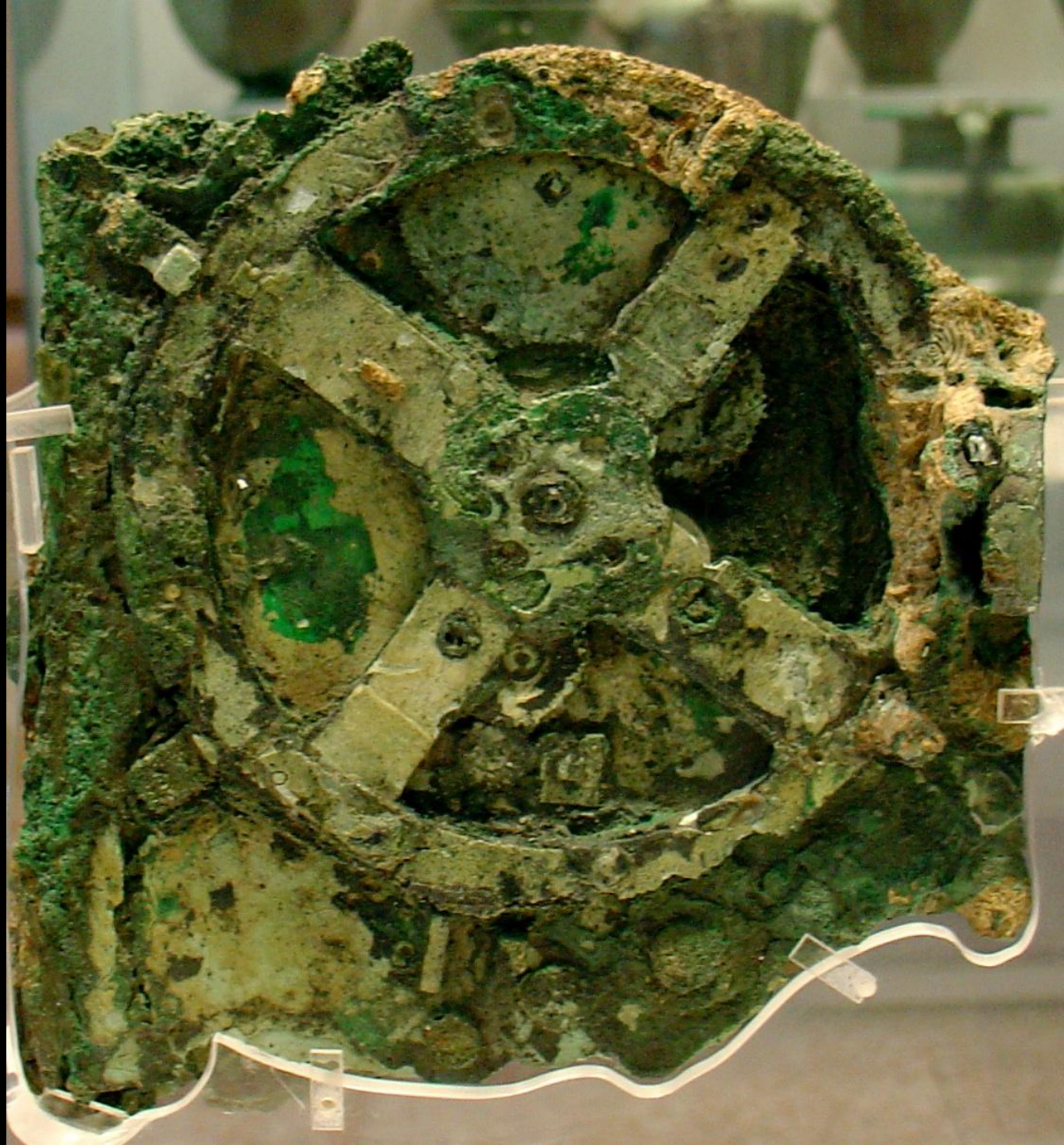
Where did the technology come  
from?

And where did it go?



















“If it is genuine, the Antikythera machine must entail a complete re-estimation of ancient Greek technology. Its discovery 55 years ago...was as spectacular as if the opening of Tutankhamun’s tomb had revealed the decayed but recognisable parts of an internal combustion engine.”

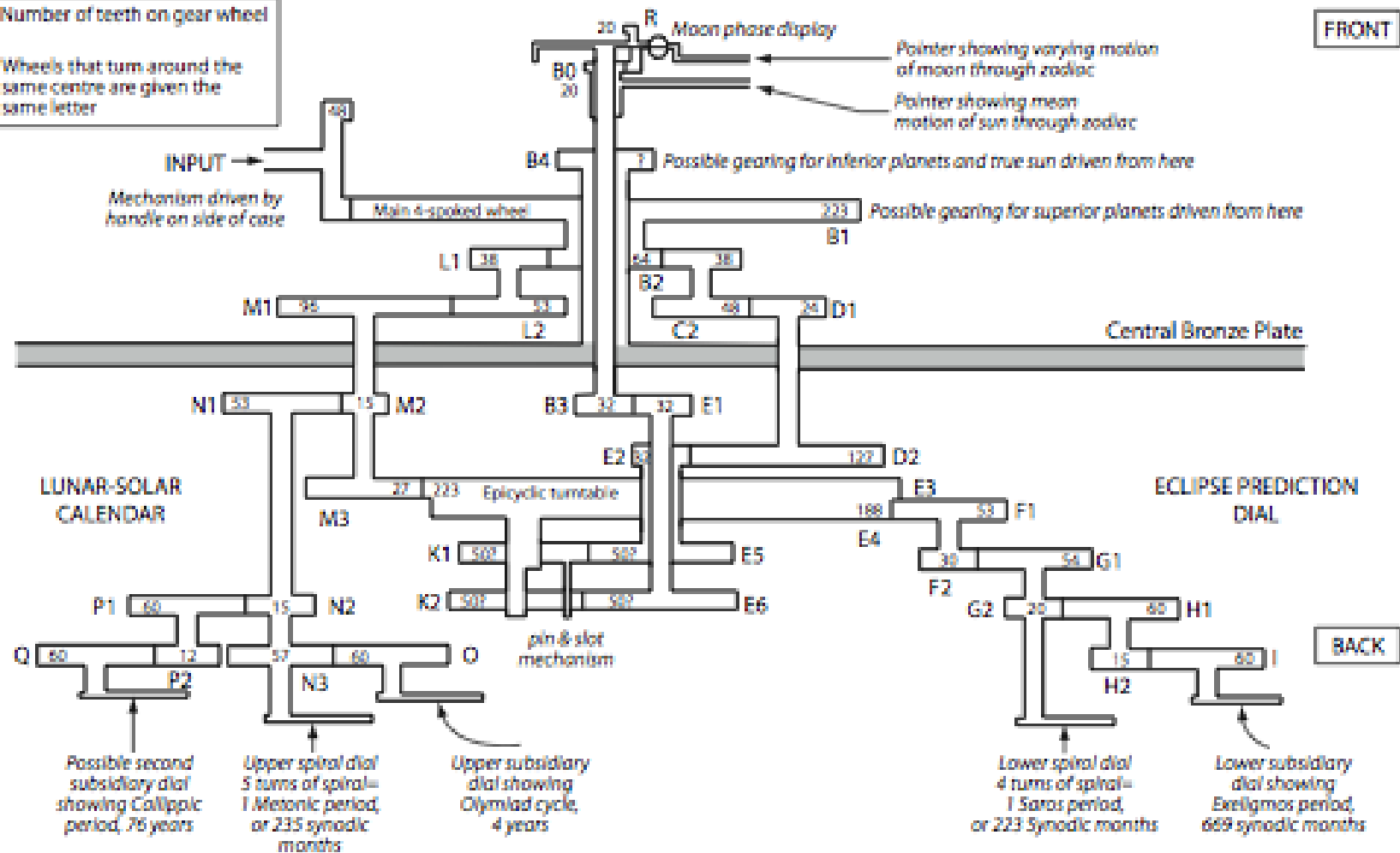
Derek de Solla Price, 1957





48 Number of teeth on gear wheel

M1 Wheels that turn around the same centre are given the same letter

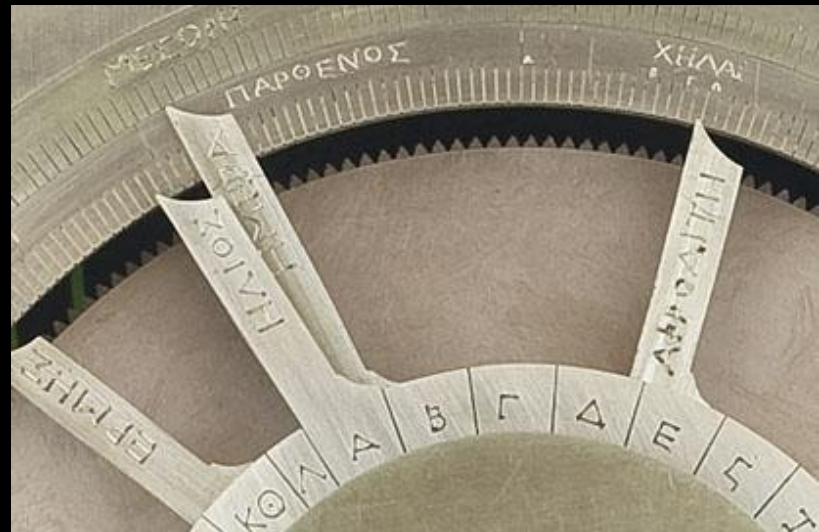
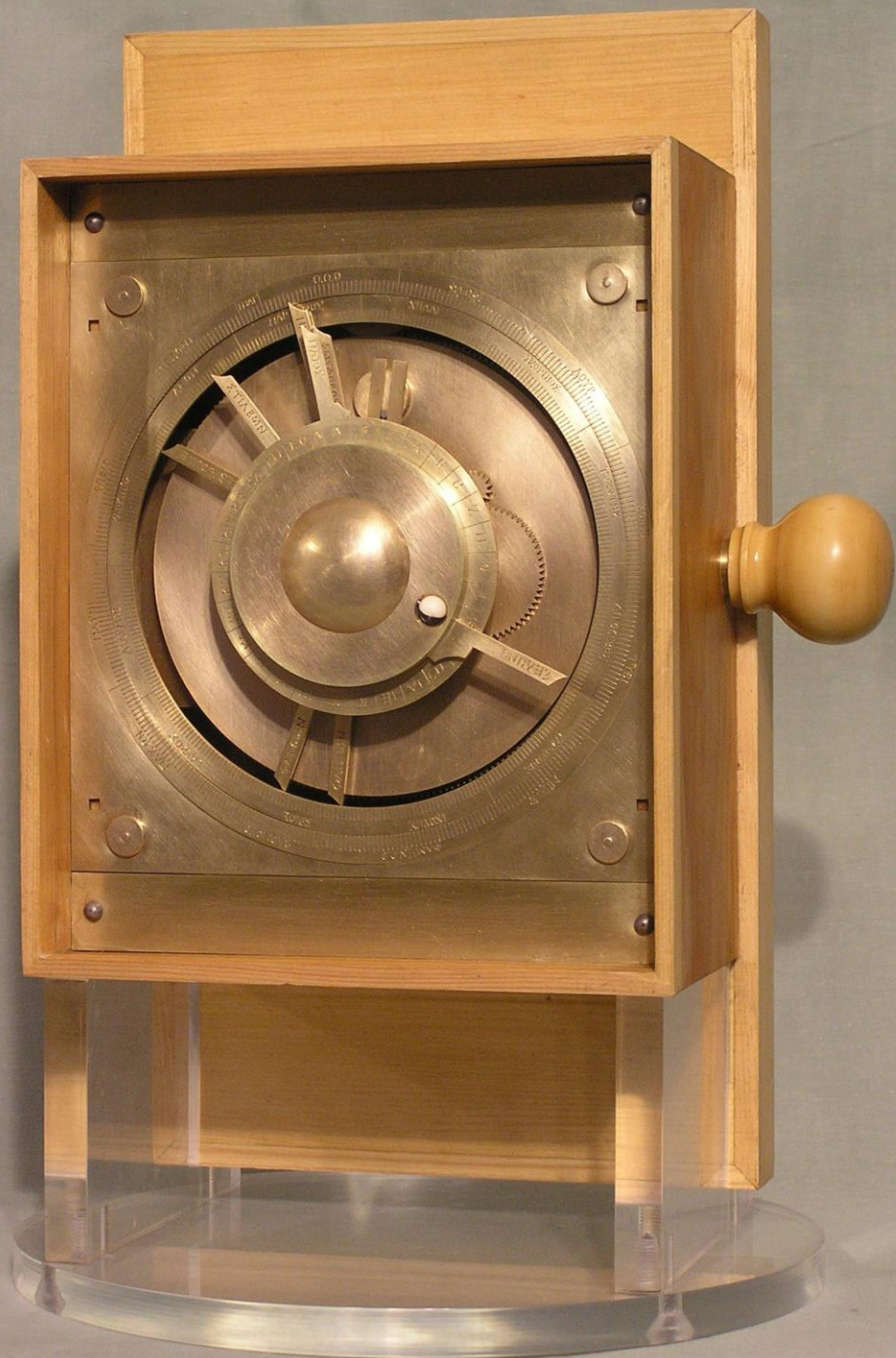


SCHEMATIC DIAGRAM OF THE GEARING INSIDE THE ANTIKYTHERA MECHANISM





So what did it  
calculate?

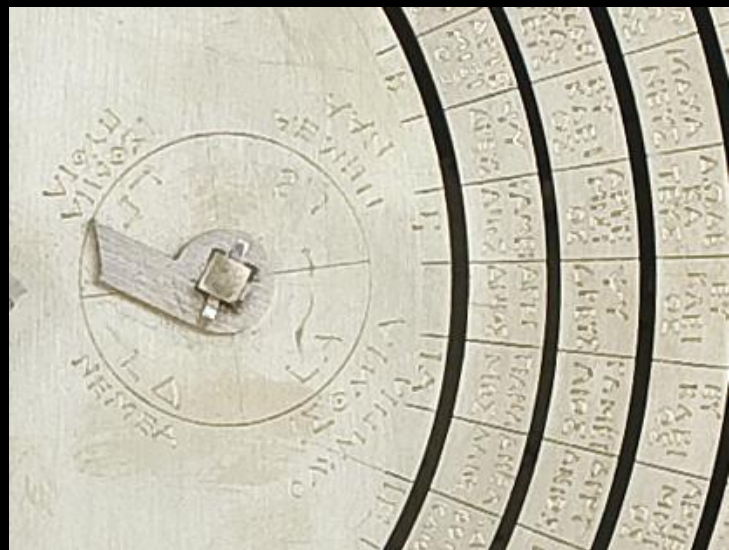
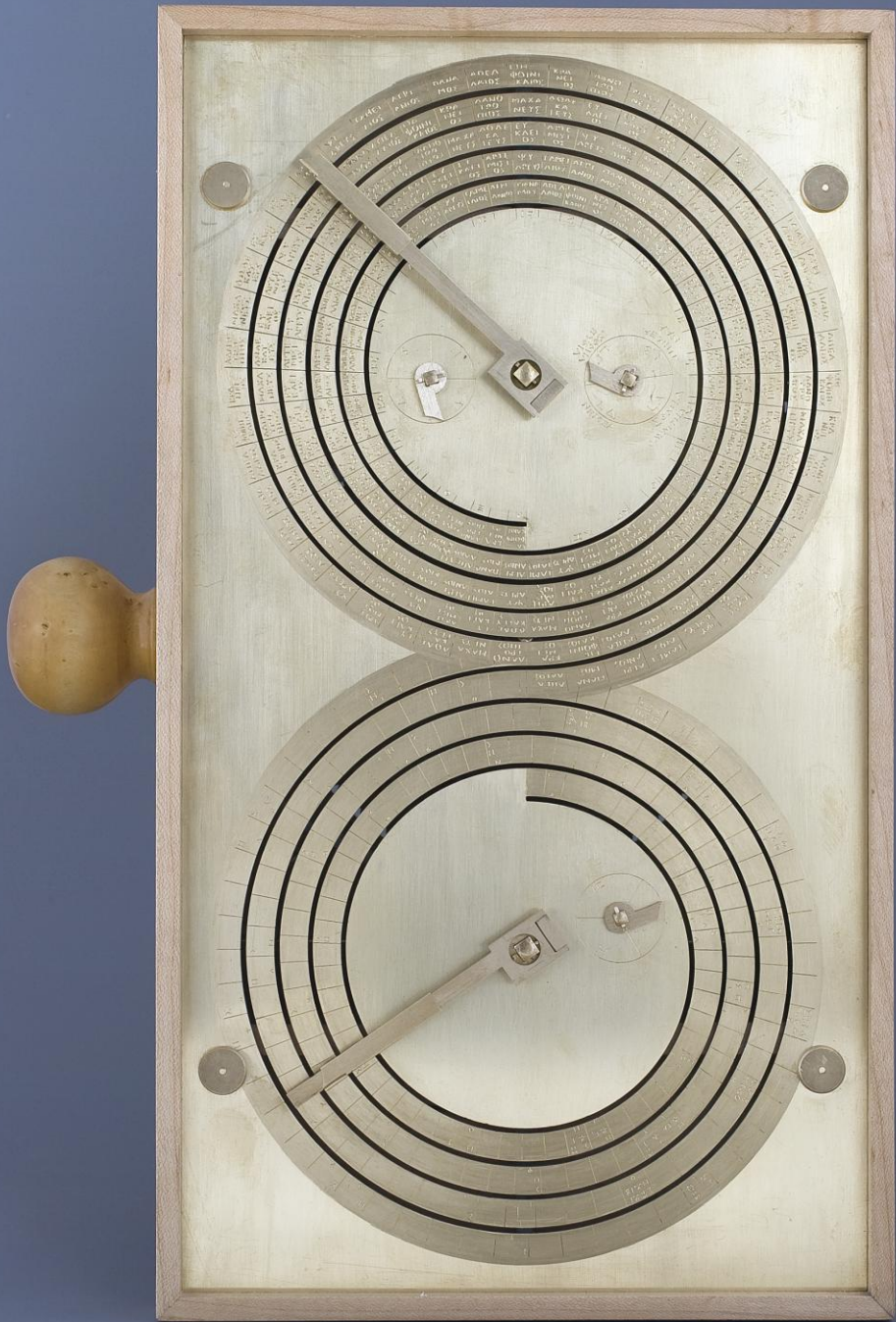


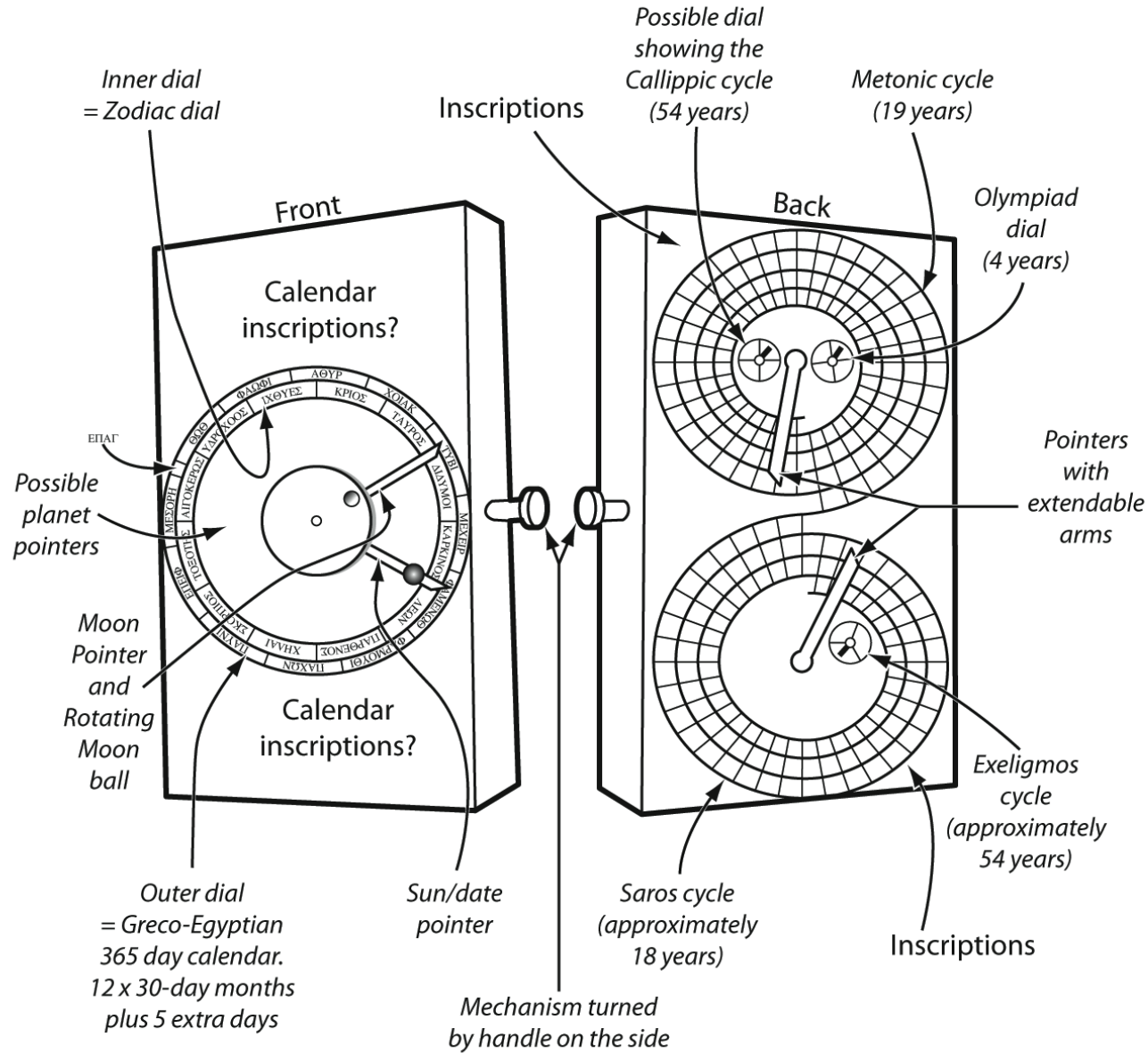




Vega rises in the evening  
The Hyades set in the  
morning  
Gemini begins to rise

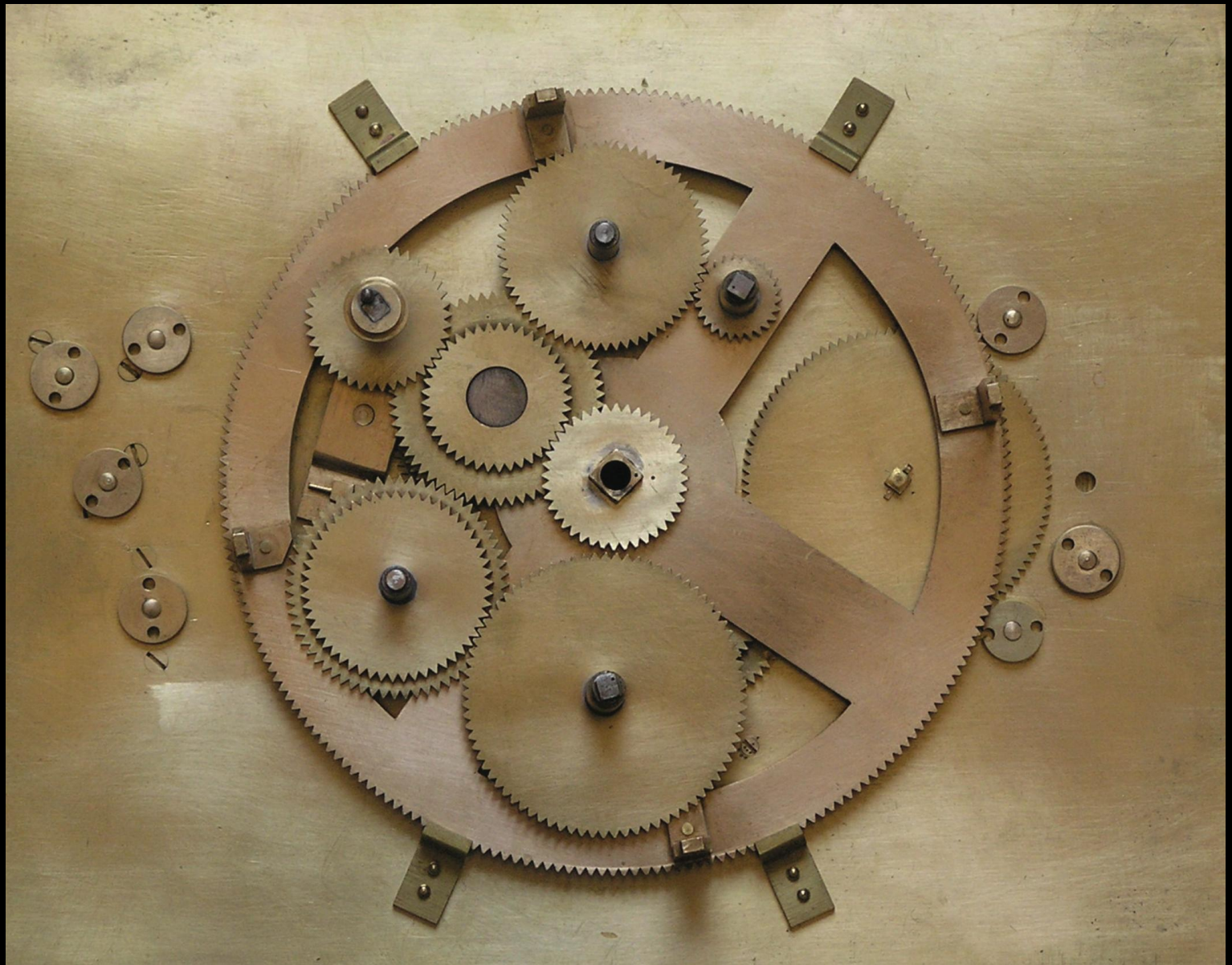
... two pointers, whose ends carry ...  
... the Sun's rays ... ecliptic ...  
... the spiral divided into 235 sections  
...  
... Venus... Mercury...  
... stationary points ...  
... golden little sphere ... little sphere  
...  
... trunnions ... gnomon ... perforations  
...



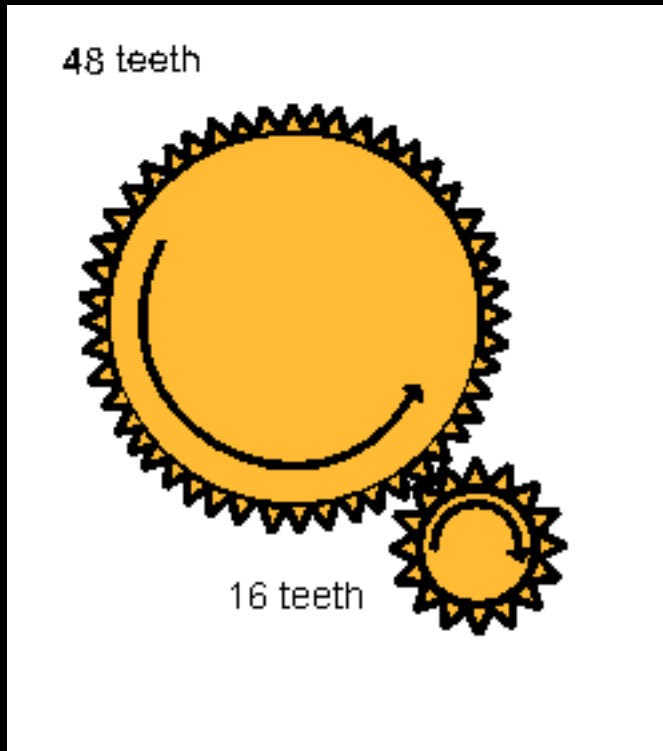




What about the  
maths?



# Turning gears into maths



$$\frac{48}{16} = 3$$

$$\frac{16}{16} = 1$$

$$\frac{16}{48} = \frac{1}{3}$$

$$\frac{48}{16} \times \frac{48}{16} = 9$$

$$\frac{16}{16} = 1$$

$$\frac{48}{16} \times \frac{48}{16} \times \frac{48}{16} = 27$$

$$\frac{16}{16} \times \frac{16}{16} = 1$$



# The Metonic cycle



235 synodic months =  
254 sidereal months = 19  
years

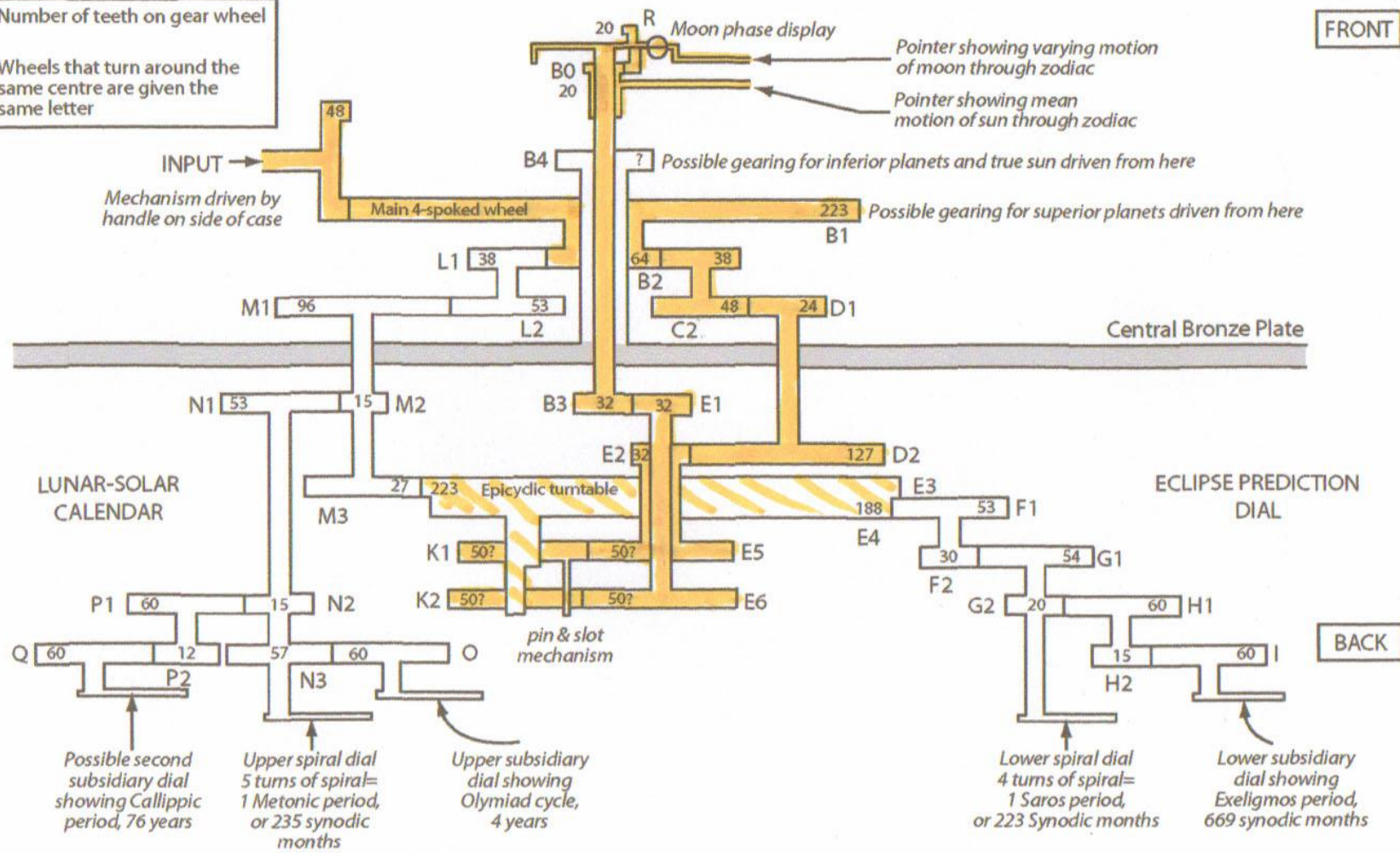
## Antikythera gear train

$$\frac{64}{38} \times \frac{48}{24} \times \frac{127}{32} = \frac{254}{19}$$



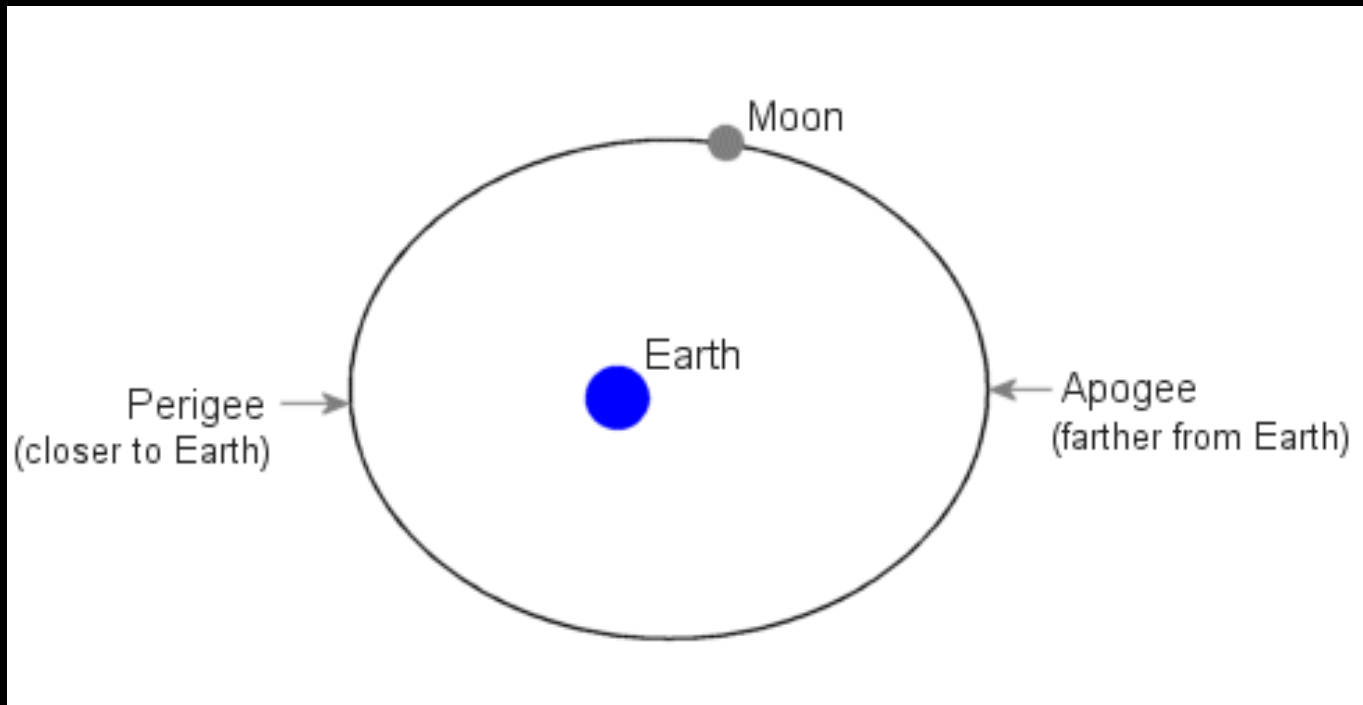
48 Number of teeth on gear wheel  
 M1 Wheels that turn around the same centre are given the same letter

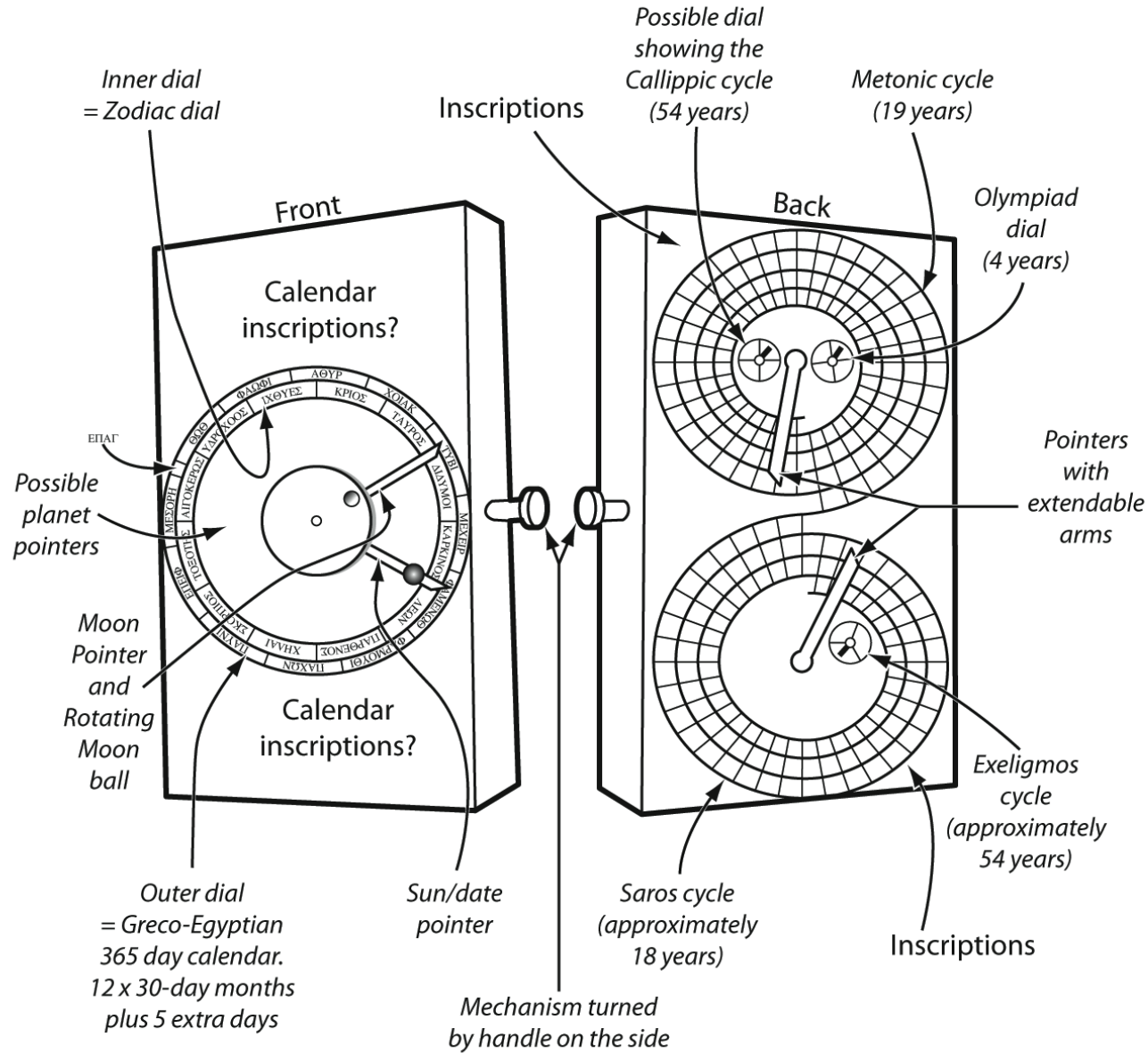
FRONT



SCHMATIC DIAGRAM OF THE GEARING INSIDE THE ANTIKYTHERA MECHANISM

BACK







# SAROS CYCLE

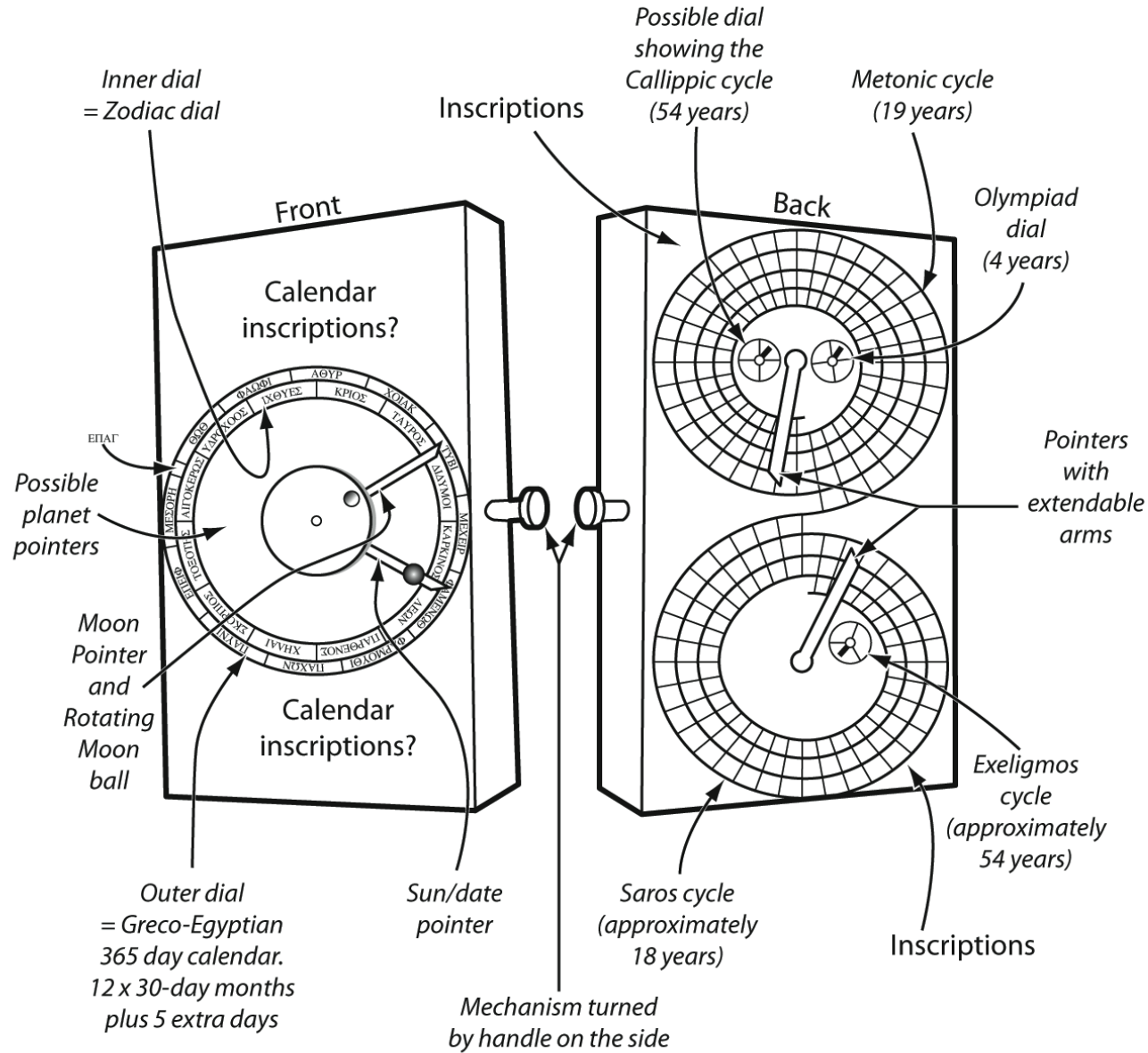


223 synodic months = 18 years 11  
1/3 days

Eclipses repeat after this time, but  
shifted by 8 hrs and 1/3 of way  
around world

So the Greeks used the Exeligmos  
cycle, which is 3 x Saros = 54 years

21 days



Inner dial = Zodiac dial

Inscriptions

Possible dial showing the Callippic cycle (54 years)

Metonic cycle (19 years)

Front

Calendar inscriptions?

Possible planet pointers

Moon Pointer and Rotating Moon ball

Outer dial = Greco-Egyptian 365 day calendar. 12 x 30-day months plus 5 extra days

Sun/date pointer

Calendar inscriptions?

Back

Olympiad dial (4 years)

Pointers with extendable arms

Exeligmos cycle (approximately 54 years)

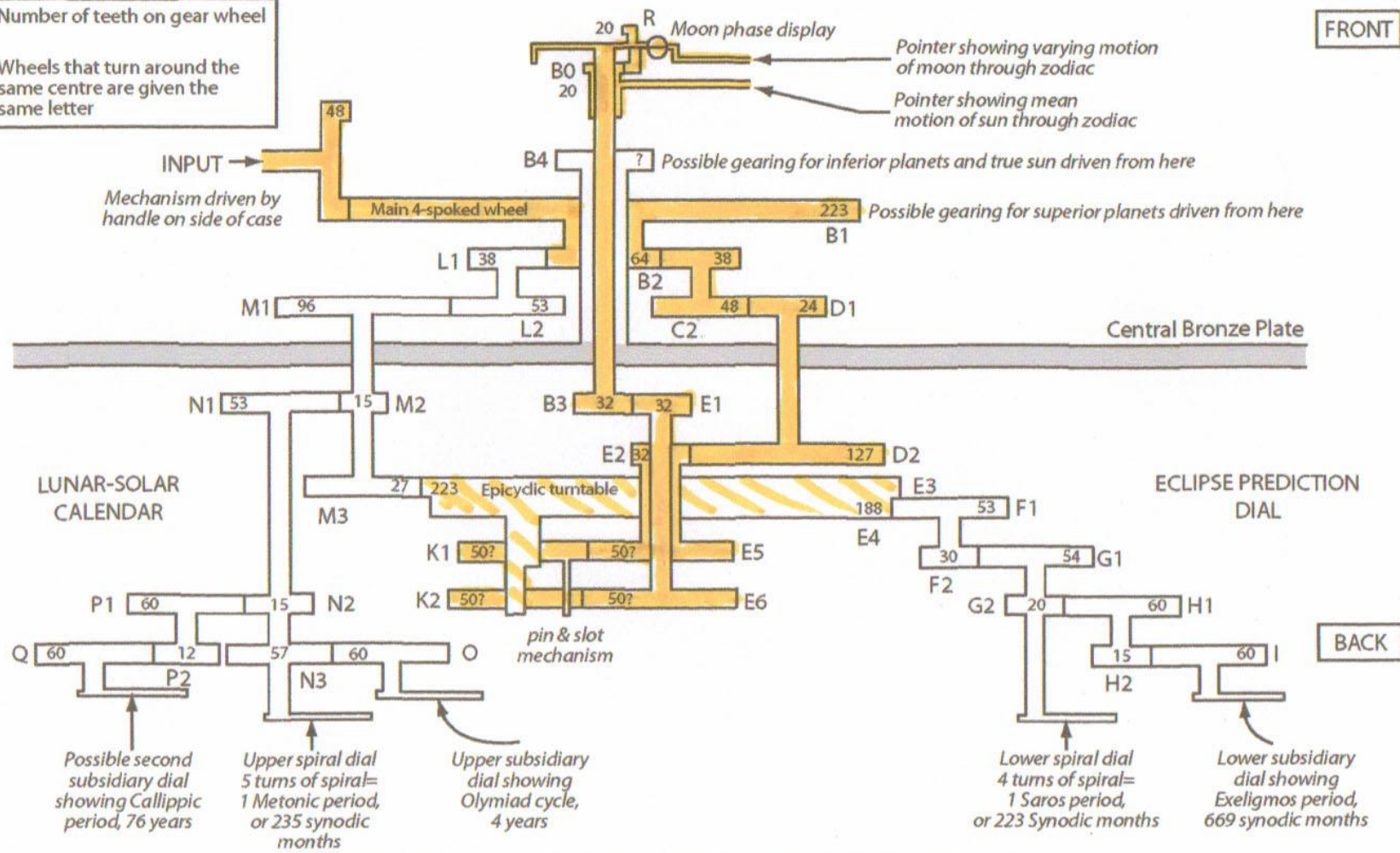
Saros cycle (approximately 18 years)

Inscriptions

Mechanism turned by handle on the side

48 Number of teeth on gear wheel  
 M1 Wheels that turn around the same centre are given the same letter

FRONT



Possible second subsidiary dial showing Callippic period, 76 years

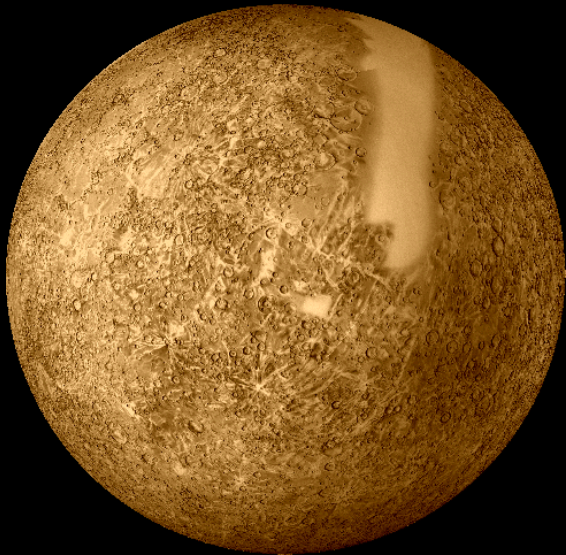
Upper spiral dial 5 turns of spiral = 1 Metonic period, or 235 synodic months

Upper subsidiary dial showing Olympiad cycle, 4 years

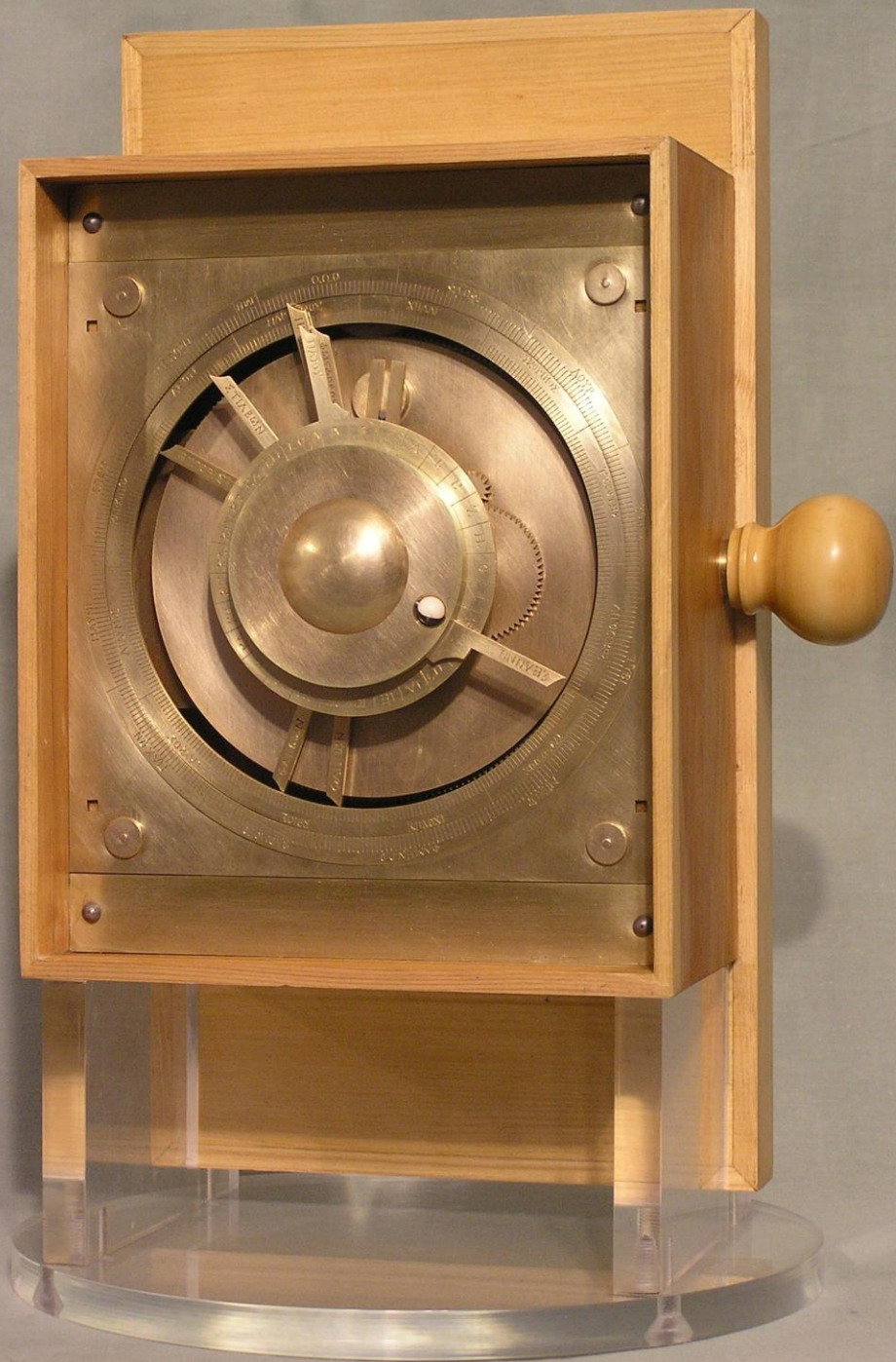
Lower spiral dial 4 turns of spiral = 1 Saros period, or 223 Synodic months

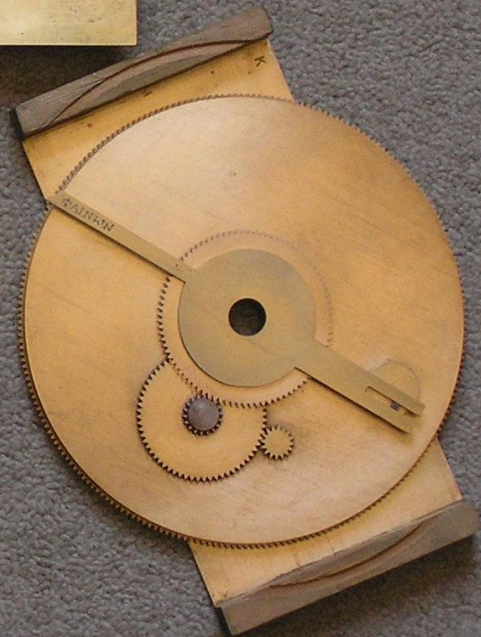
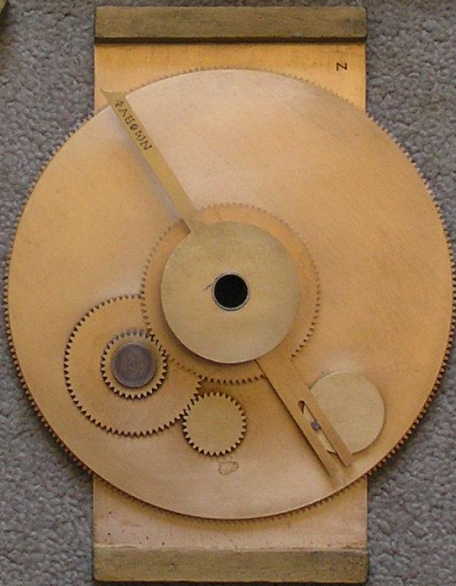
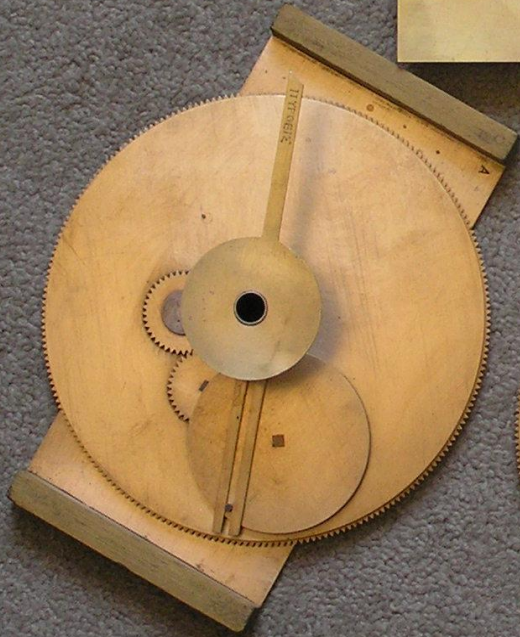
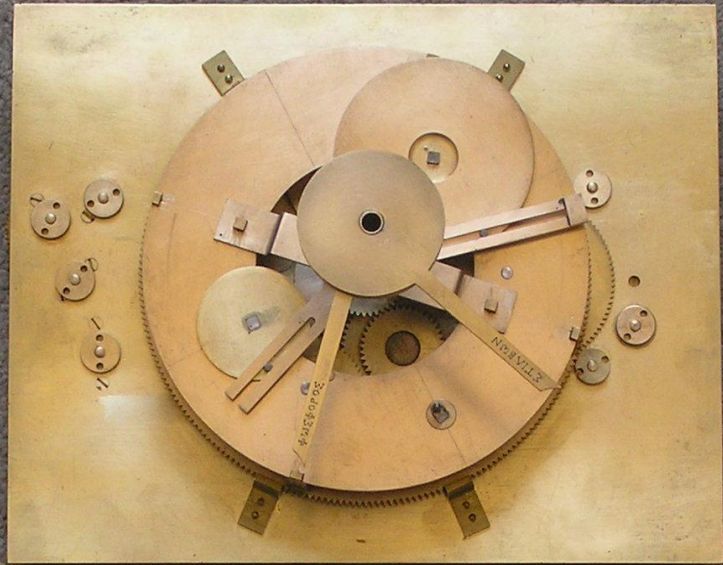
Lower subsidiary dial showing Exeligmos period, 669 synodic months

SCHMATIC DIAGRAM OF THE GEARING INSIDE THE ANTIKYTHERA MECHANISM









## CROSS-CULTURAL COMPUTER

The latest reconstruction of the Antikythera mechanism suggests that its front display relied on Babylonian theories describing the Sun, Moon and planets.

### SUN POINTER

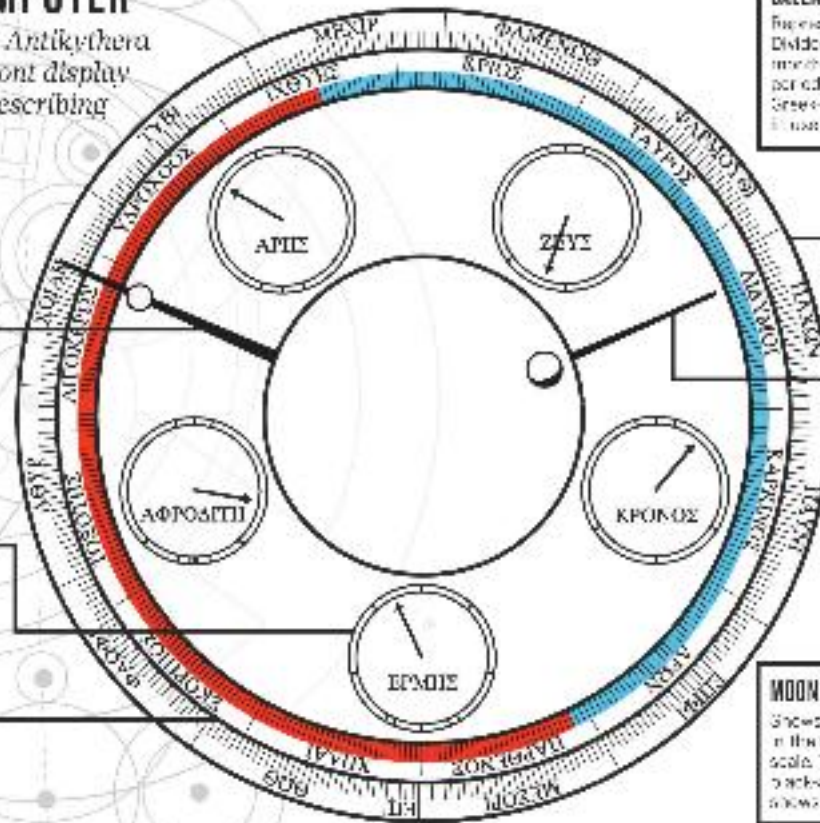
Shows the date on the calendar scale and the Sun's position in the sky on the zodiac scale. Moves one complete turn per year.

### PLANETARY DIALS

The known planets — Mercury, Venus, Mars, Jupiter and Saturn — shown by individual dials. Might have shown the timing or irregularities in each planet's cycle, such as changes in direction.

### ZODIAC SCALE

360-degree dial divided into the twelve signs of the zodiac. Set into a "fast" zone (red) with eight narrower divisions and a "slow" zone (blue) with slightly wider divisions to represent the varying apparent speed of the Sun.



### CALENDAR SCALE

Represents a 365-day year. Divided into twelve 30-day months plus a twenty-seven period, according to Greek-Egyptian calendar in use at the time.

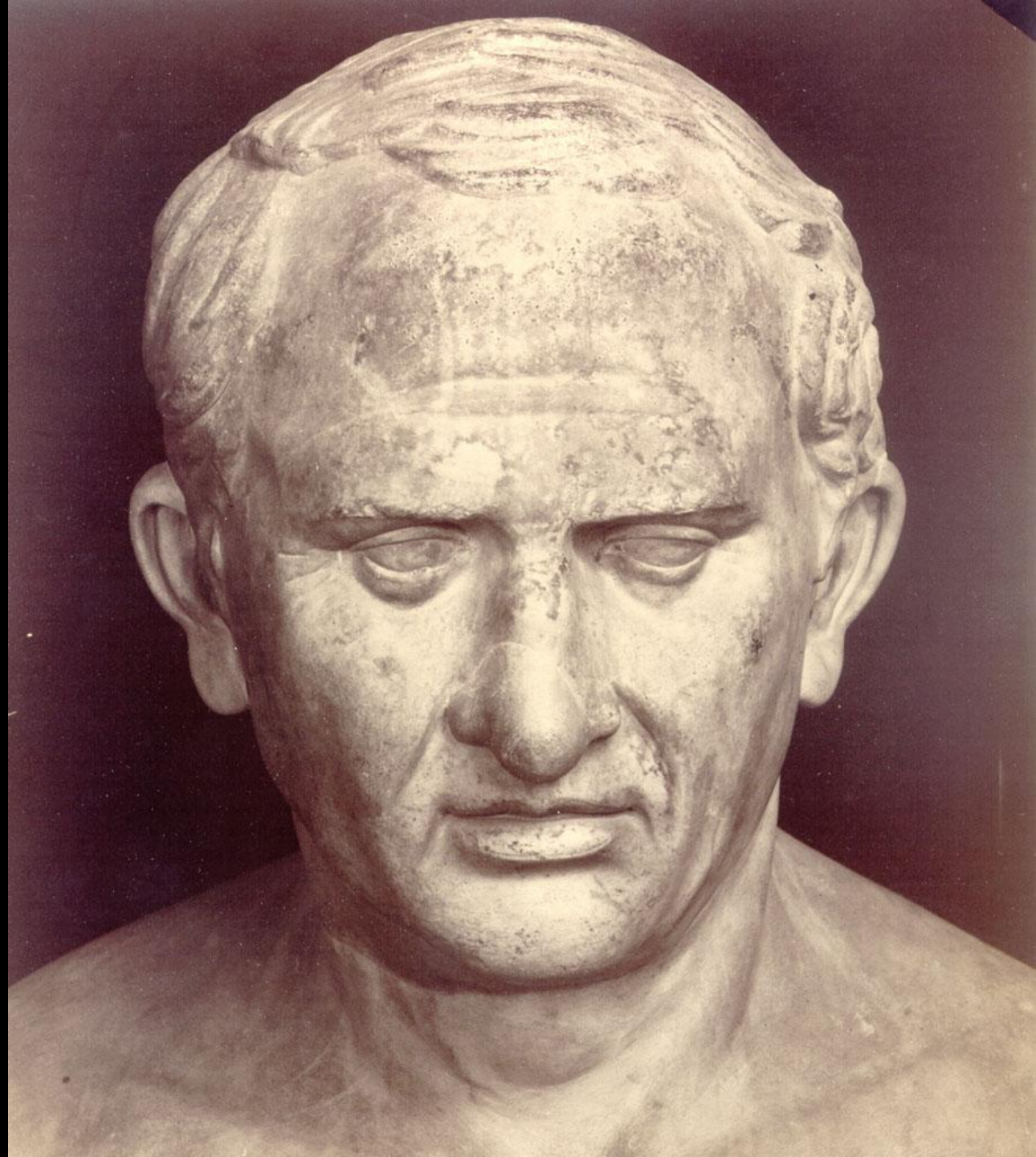
### MOON POINTER

Shows the Moon's position in the sky on the zodiac scale. The revolving back-and-forth will show the phases.



Where did the  
technology come  
from?





# Cicero (1st century BC)



- “[An instrument] recently constructed by our friend Posidonius, which at each revolution reproduces the same motions of the Sun, the Moon and the five planets that take place in the heavens each day and night.”
- “The invention of Archimedes deserved special admiration because he had thought out a way to represent accurately by a single device for turning the globe those various and divergent movements with their different rates of speed.”







# Local month names



ΦΟΙΝΙΚΑΙΟΣ

ΑΡΤΕΜΙΣΙΟΣ

ΚΡΑΝΕΙΟΣ

ΨΥΔΡΕΥΣ

ΛΑΝΟΤΡΟΠΙΟΣ

ΓΑΜΕΙΛΙΟΣ

ΜΑΧΑΝΕΥΣ

ΑΓΡΙΑΝΙΟΣ

ΔΩΔΕΚΑΤΕΥΣ

ΠΑΝΑΜΟΣ

ΕΥΚΛΕΙΟΣ

ΑΠΕΛΛΑΙΟΣ

# 4-year Olympiad Dial



Isthmia

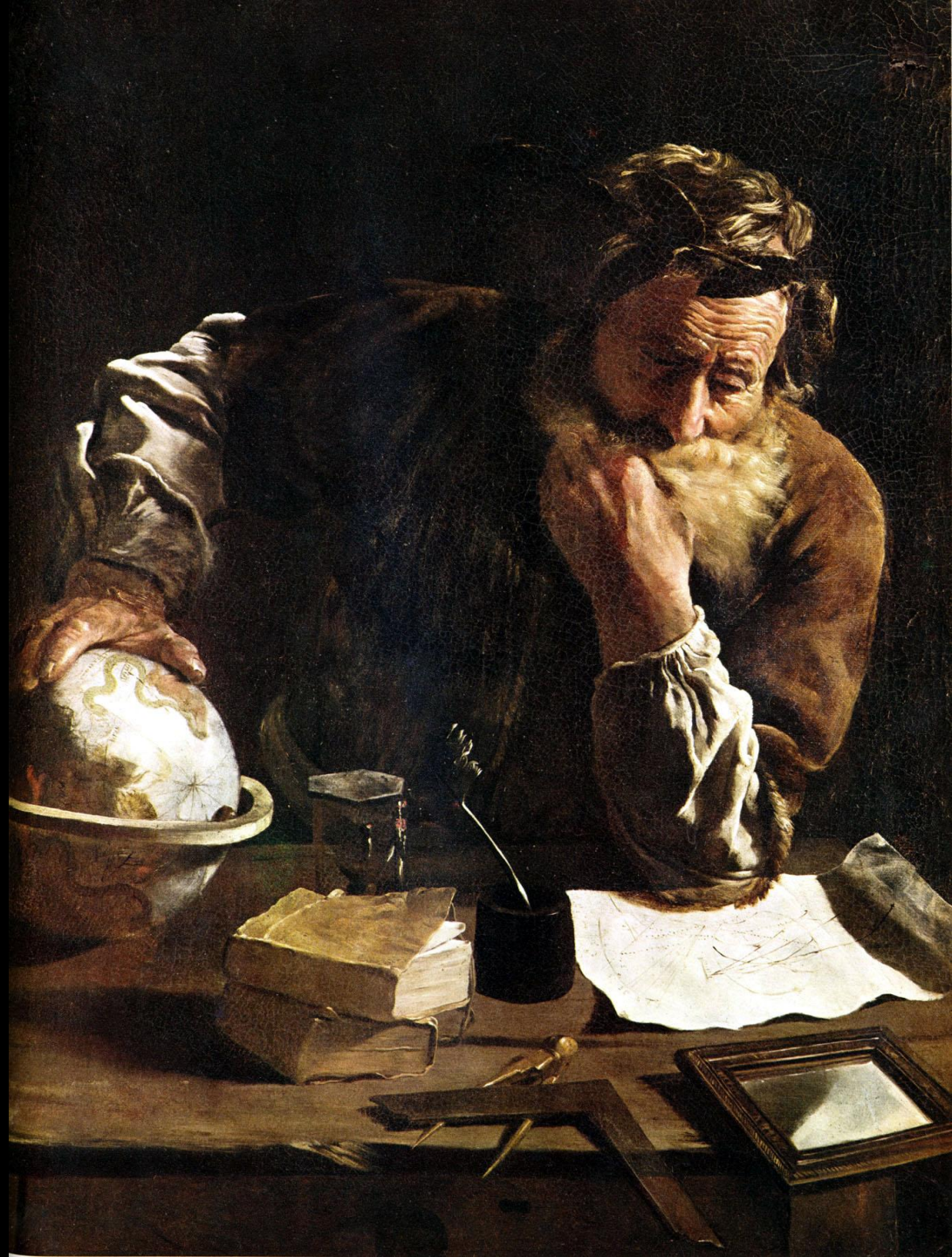
Olympia

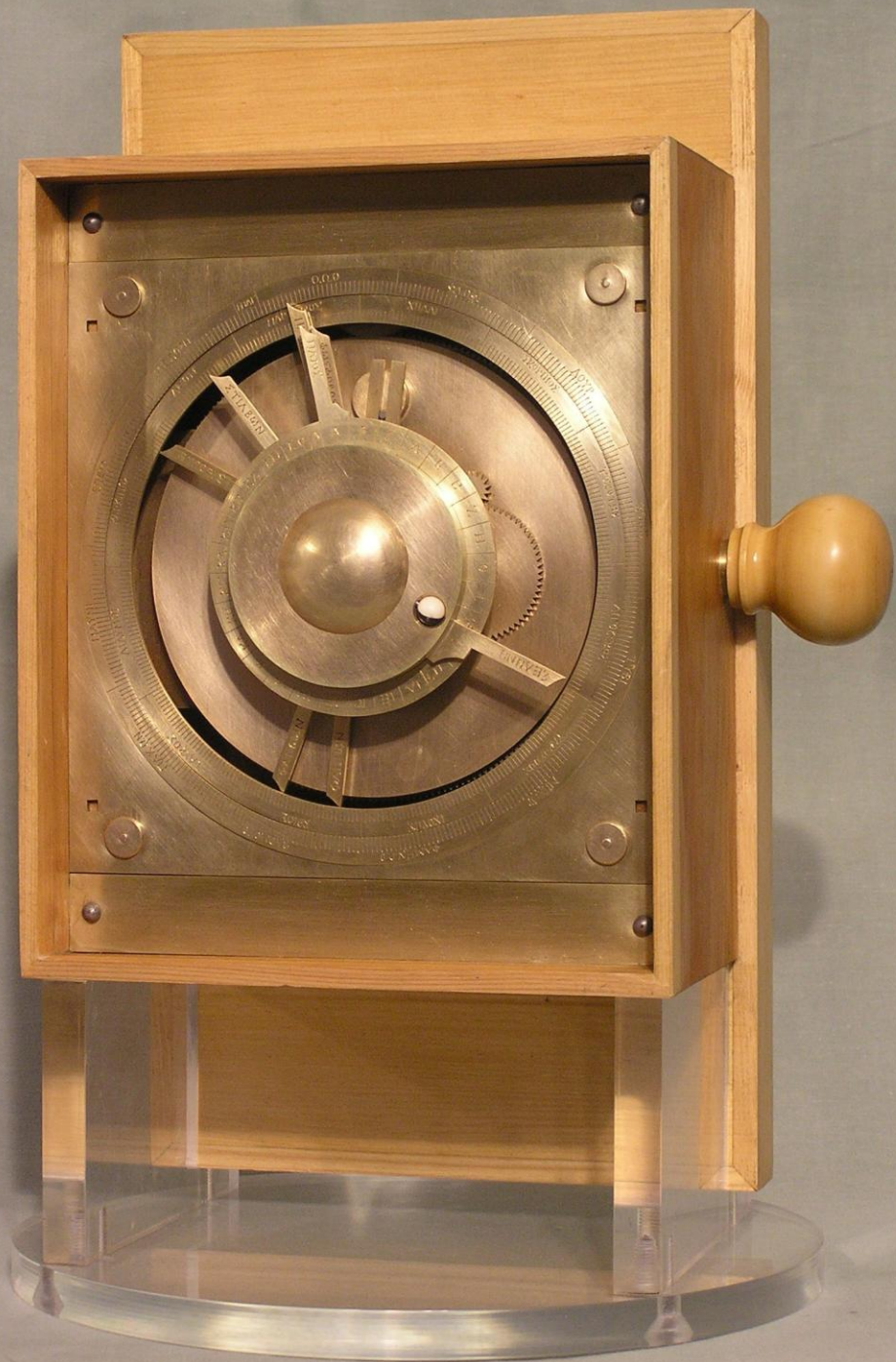
Nemea

Pythia

Naa

??







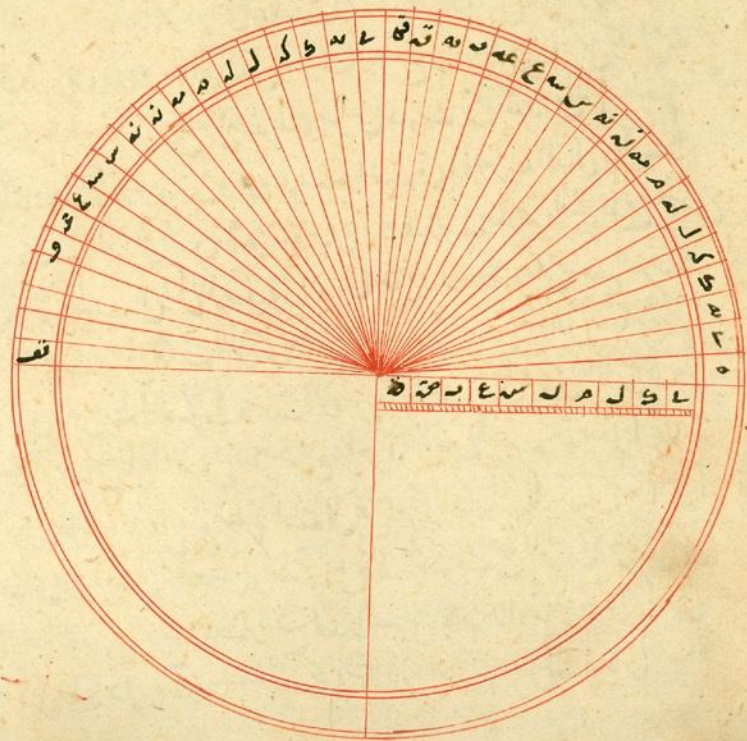
Where did the technology  
go?



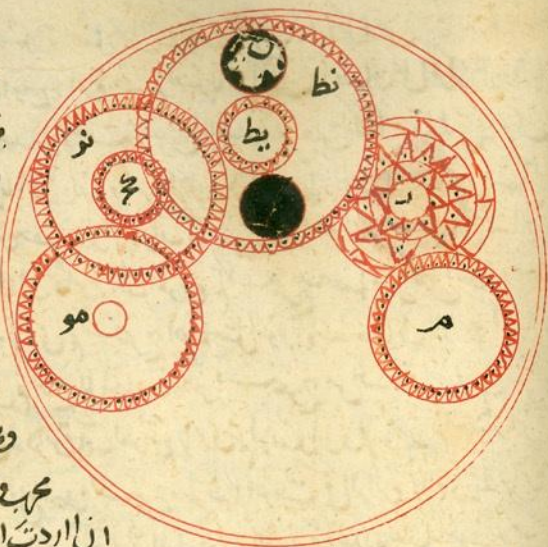




من سبعين فاقصده بالبركار من اجراء التسعين ثم نضع راس البركار على راس  
 الكفة ونظر الراس الاخر ان نطلع من نقطة الدائرة من الخطوط التي هي في ذلك  
 الخط هو خط نصف النهار فان اردت استخراج القبلة فخذ فصل ما بين العينين  
 فضعه في نقطة الراس لئلا يبلغ من الجنوب فندرس قوسا نحو المشرق ثم نصل  
 فصل ما بين الطولين ونضع راس البركار في نقطة والرجل الاخرى تصل ما بين  
 الطولين من اجراء الكفة فوس نقطع القوس الاول ثم نخرج خطا من نقطة  
 الراس على الارض هكذا خط القبلة لهذا الشكل



فقد علم في هذا المبدأ  
 ذلك صفة الاصطراب  
 فيها حجر وضفاح على  
 ارض صبي واحلق وقد  
 صورنا ذلك وكيف  
 يكون الشكل حينئذ  
 وقد صورتهما في شكل  
 لفهم الشكل الاول  
 وهو عمل الاول وشكل  
 حجر وهو الذي فيه الاصطراب



ان اردت ان تجعل في ضفاح  
 علة فاحده في نظر الحق فاعد الاطباق للفق وهو من اجزاء حجر واحد له عندك  
 وان اردت ان يكون في صفيحة واحدة فخط العرض الذي تريد على طبق الكفة في الموضع الذي  
 رسمناه لارابت واحده عليه عندك في الراس وهذه صورة الاصطراب التي هي الكري  
 التي تكون في نظر الكفة التي يكون الاقطاب منها على هذه الصورة وهذه صورة دابر الكري



والشمس في تدرج اداة الامراس التي هي ماتي  
 الاجزاء عليها ليرى الشمس في الشمس كل واحد  
 على ما ترى في عشر درجات وملت على اسمها  
 وسد ما يطلع من كل برج من غير حواجز عليها  
 الحساء يعمل وقد صورتها لك واجرت القطب  
 والزر في كل صفيحة في المبدأ الذي هو









# Web links



[www.decodingtheheavens.com](http://www.decodingtheheavens.com)

[www.antikythera-mechanism.gr](http://www.antikythera-mechanism.gr)

[www.hpl.hp.com/research/ptm/antikythera\\_mechanism/](http://www.hpl.hp.com/research/ptm/antikythera_mechanism/)

[www.mogi-vice.com/transiti/A-t-1280.avi](http://www.mogi-vice.com/transiti/A-t-1280.avi)

[www.shawinspectionssystems.com/library/antikythera/dr/  
dr.htm](http://www.shawinspectionssystems.com/library/antikythera/dr/dr.htm)

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