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Research Article

Antikythera Mechanism and the Ancient World

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In this historical review, the opinions of Ancient Greece philosophers, astronomers, and poets such as *Thales Milesian, Pythagoras, Plato, Eudoxus, Aristotle, Archimedes, Cicero, Diogenes Laertius, Iamblichus, Plutarch, Homer*, and *Aratus* about the planet position calculations and about the possibility of predictions of natural phenomena are analyzed. The planet positions were predicted before *Eudoxus* (probably before *Philolaus*) by a spindle of Ananke and after Eudoxus by Antikythera mechanism. Following *Pythagoras* and *Plato*, it is established that the regular seismoacoustic observations were performed. In the Ancient World in the Mediterranean area, there was an extensive network of acoustic stations (~10 pcs), which were located in close proximity to the geologic faults. Also, it is shown that the ship that was carrying Antikythera mechanism (A-Ship) was built in 244 BC in Syracuse with direct participation of Archimedes and Archias from Corinthian. Later, the A-Ship was a part of the Roman Republic safety system. The grain volumes, which were delivered to Rome city by large grain vessels, and the population of Rome city in the period 74–71 BC were estimated. Planetary calculator might be used for the chronology of the historical events as a backward prediction in addition to present Radiocarbon dating and Dendrochronology methods.

1. Introduction

The oscillations with the planetary frequencies are especially noticeable in the temperature trend and also in concentrations of a number of impurity gases (see Discussion in [1, 2]). Currently, it is possible to say that there is no physical mechanism that could explain these midfrequency oscillations in atmospheric processes. This compels us to turn to Pythagorean-Plato cosmology.

The main goal of this part of the paper is to answer the questions: for what purposes the Antikythera mechanism has been created and whether the ancient philosophers claimed that there is a relationship between the position of the planets in the solar system and volcanic eruptions, earthquakes, and climate extremes.

2. Aim of the Research

2.1. The Task of the Olives. First of all, our goal is to test possibilities of whether the predictions of local climate changes on seasonal climatological scale can be made. Note that, in the ancient world, the importance of such predictions was high. On the one hand, the underdeveloped transport system and trade (compared to the current state) did not provide the export of agricultural products during good seasons. On the other hand, underdeveloped agricultural methods such as cultivation of the land, including a natural restriction on the fast growth of draft animal quantity, are not allowed to rapidly increase the agricultural production.

In fact, in this paper, we made an attempt to bring the task of the heatwave in Russia at the summer of 2010 to Thales (h3) (see (h3) in the Appendix) task of "olives" [3] 1259_a and [4] p. 14–23.

That is what Aristotle (h4) has written in [3], on this problem:

> *He (Thales Milesian) was reproached for his poverty, which was supposed to show that philosophy was of no use. According to the story, he knew by His skill in the stars while it was yet winter that there would be a great harvest of olives in the coming year; so, having a little capital, he gave earnest-money for the use of all the olive-presses in Chios and Miletus, which he hired at a low*

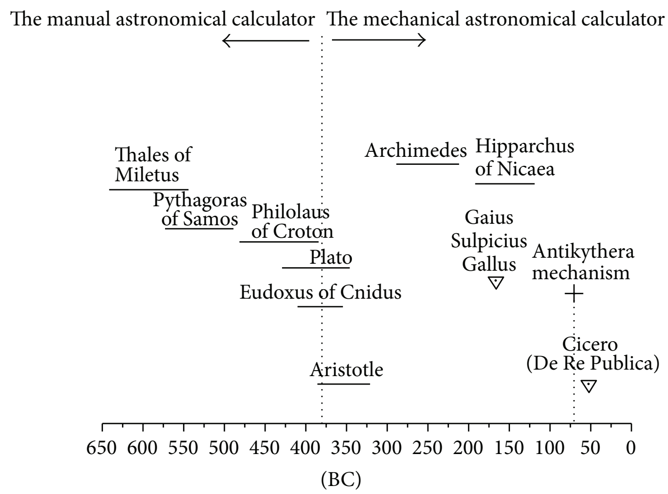


Figure 1: Some ancient philosophers, poets, and astronomers chronology timeline. The proposed date of wreck of the ship, carrying an Antikythera mechanism, marked as cross additionally. The time in which Cicero wrote "De Re Public" and the time of the episode from "De Re Public" in which it was described how Gallulus demonstrated *celestial globe* have been shown as triangles.

> *price because no one bid against him. When the harvest-time came, and many wanted them all at once and of a sudden, he let them out at any rate which he pleased, and made a quantity of money. Thus he showed the world that philosophers can easily be rich if they like, but that their ambition is of another sort.*

Assays of Thales did not survive. However, taking into account that Pythagoras was a contemporary and disciple of Thales, the Thales methodology could be easily recovered from the later work of the Pythagoreans and Plato school philosophers (and in fact by using the works of Pythagoras to Plato). Common information about life and knowledge of Pythagoras could be found in the writings of a Neoplatonic philosopher Iamblichus (h5) [5].

To those for whom Thales's "olives" task seems boring and uninteresting, we can offer the consideration of this problem as Plato's task of "Muse's predictions of destroyed empires" (see [6], VIII, 546).

Thus, the first question, to which answer should be found, is the following: how did ancient scientists calculate the positions of planets and stars in the future, which then were used to make a prediction?

The most complete information on astronomy of Pythagoreans, including the calculations of planet positions, is represented in the work of Burkert [7]. Original work of Burkert [7] was written in German in 1962 and was translated into English, in 1972. In recent years, new data on ancient astronomy (in particular, the works of Antikythera mechanism) are available, and so not all what is written in [7] we can accept (see below).

2.2. Antikythera Mechanism. An ancient mechanical device, which later was called the Antikythera mechanism, was discovered in the Aegean Sea between the Greek island of Crete and the Peloponnese peninsula near the Greek island of Antikythera (Greek Αντικύθηρα) in 1902 on the sunken ship. Currently, the mechanism is in the National Archaeological Museum collection in Athens.

Rados [8], Rehm [9], Theophanides [10], and Price (1959) [11] discovered and determined that the mechanism is unique antique mechanical computing device (for more detail, see historical perspective in [12]). In 1971, Price asked the Greek nuclear physicist Charalambos Karakalos to make the X-rays analysis of the mechanism and build its scheme. Complete scheme was published in 1971 and it contained 32 bronze gears.

Wright offered his reconstruction of mechanism with high-resolution X-ray tomography [13, 14]. This new approach gave a possibility to show that the mechanism was able to take into account the ellipticity of the orbit of the moon, using a sinusoidal correction (the first anomaly of Hipparchus (see (h6) in the Appendix) lunar theory), gear used for this off-center rotation. The number of bronze gears in a reconstructed model is increased to 37. According to experts, the approximated date of mechanism creation is 100–150 BC. The high-resolution X-ray tomography provided evidence that the mechanism could calculate at least the positions of Mars, Jupiter, and Saturn. See also [15, 16] for details.

Within the scope of this work, we are not interested in the mechanism itself, but for us it was interesting to find the answer for the following question: whether there were similar mechanisms in ancient world.

The detailed answer could be found in Cicero (h7) in "Treatise on the Republic" (also called "Treatise on the Commonwealth") [17], p. 72 (XIV, 21) (see Supplementary S1 in Supplementary Material available online at http://dx.doi.org/10.1155/2016/8760513). The lives chronology of some ancient politicians and philosophers has been shown in Figure 1 to improve the text readability. It is significant that there was no information found about the described above mechanism in surviving Archimedes works [18]. Also, note in particular that, according to [17], the Archimedes mechanism demonstration was not in a cave and not in the temple, but at Mark Marcellus villa. This is an important argument for further consideration.

Thus, as Cicero reported, not only were there a couple of mechanisms (one in the temple in Rome and the other at the Mark Marcellus villa), but it turns out that all ancient history is devoted to discussing the details of construction of the Antikythera's type mechanisms. We can count from the time after Eudoxus at least 4 different schemes of the Antikythera mechanism (see notes below (h16) in the Appendix).

The description of ancient mechanism, which was used before Eudoxus and was called "Ananke spindle," could be found in Plato treatise "The Republic of Plato" [6] (X, 617, 621). It is important for us that the spindle Ananke as well as the Antikythera mechanism was able to calculate the planet's positions in past, present, and future ("Lachesis of what has been, Clotho of what is, and Atropos of what is going to be." [6], X, 617).

In addition, note that "Above, on each of its circles, is perched a Siren, accompanying its revolution, uttering a single sound, one note; from all eight is produced the accord of a single harmony," so we kept tradition and called the present work as the same article in the past, "Phenomena in Nature and the Harmony of the Spheres."

At the end of this section, we will try to reconstruct the history of the Antikythera mechanism itself. The coins, found on the sea bottom nearby sunken ship, allowed establishing the approximate date of the shipwreck, about 85 BC.

As well known, between 88 BC and 84 BC, Sulla (h17) fought with Mithridates VI (h28) (First Mithridatic War). In the spring of 87 BC, Sulla entered Greece, where he won a victory over the forces of Mithridates VI and besieged Athens. Plutarch wrote in detail about these events in [19] (p. 363, XII, 2–6) (see *Supplementary S2*).

It would be possible to assume that the Antikythera mechanism was stolen from the Temple of Apollo at Delphi, where the Pythia prophesied. Indirectly Plutarch evidenced about it, see text in *Supplementary S2*. Additionally, Sulla completely destroyed the Academy and the Lyceum in Athens (see Plutarch in [19], "*he (Sulla) laid hands upon the sacred groves, and ravaged the Academy, which was the most wooded of the city's suburbs, as well as the Lyceum.*"), in which there could be a copy of Antikythera mechanism (see Cicero's lines above). Taking into account the civil war, which began in 88 BC, in Rome (between parties of Marius and Sulla), the accident with the ship, carrying Antikythera mechanism, does not seem to be completely occasional.

It is impossible to exclude completely the version that Sulla has tried to grasp such important object as Antikythera mechanism in Academy at Athens or in Temple of Apollo at Delphi and come to Rome with triumph just as what Martsellus made before. However, the detailed analysis has shown that, most likely, the discovered Antikythera mechanism was connected with later events.

2.3. Caves, Temples, and Pyramids. The task of this section is to find an answer to the following question: Where were the Antikythera mechanisms used, and why?

It is well known that the caves can be divided into volcanic, tectonic, erosion, ice, and karst caves. The erosional and karst caves are the most common in the Mediterranean. Often, the erosional caves were formed in insoluble rocks by mechanical erosion. These caves, formed by the action of tidal bore and sea pebbles, are placed along the Mediterranean Sea coast. The size of sea caves is small; they have a wide entrance such as grotto. Since these caves are located at the edge of the sea, the sea sounds are loud inside of these caves. Due to these characteristics, such caves were excluded from further consideration.

The karst caves in the Mediterranean are located inside of hills; they have the greatest length and depth. Karst caves are formed due to the dissolution of rocks with water, so they are found only where there are the soluble rocks present: limestone, marble, dolomite, chalk, gypsum, and salt. In karst caves, minerals dissolve rocks by streams of water and eventually deposit on the walls and arches of caves, forming stalactites, stalagmites, draperies, columns, and so forth.

Iamblichus [5] (34) wrote in detail about Pythagoras and the cave of Pythagoras (see *Supplementary S3*). Pythagoras cave remains. It is located on the Samos Island, Greece, at the bottom of Mount Kerkis, 2 km from Marathykambos/Marathokampos (*Μαραθόκαμπος*), 37.728°N, 26.661°E, 300 m a.s.l. The speleological description of the cave in the literature is absent.

As mentioned above, in the passage, "Minos, son of Zeus," there is a reference to the Cretan myths associated with the cave of Zeus. It has been investigated by archaeologists (one of them is Evans [20]); it was called Diktaean cave (Greek *Δικταίο Άντρο*) or the cave of Zeus. The cave is located in the Diktaean mounts on Lasithi Plateau in Crete with location: 35.163°N, 25.445°E, at an altitude of 1024 m a.s.l. The cave consists of an entrance hall (42 × 19 × 6.5 meters) and a main hall (85 × 38 × 5–14 m).

Aratus (h15) also mentioned the cave of Mount Ida in Crete [21], (30, p. 31); see also Notes in [21], p. 85, where there were hidden "two nymphs Helice and Cynosura."

According to Diogenes (h19) [4] (VIII, p. 323), "Then while in Crete he (Pythagoras) went down into the cave of Ida with Epimenides; he also entered the Egyptian sanctuaries, and was told their secret lore concerning the gods."

Some caves of the ancient world are marked in Figure 2. In Figure 2, the squares with numbers marked the following: (1) cave of the Nymphs at Ithaca, (2) Diktaean cave in Crete, (3) Pythagoras cave in Samos, and (4) cave of Darkness, Malta (cave *Għar Dalam*, located on 35.828°N, 14.526°E). Separately, a green triangle marked underwater volcanoes *Campi Flegrei del Mar* (Phlegraean Fields of the Sicily Sea), with coordinates 37.10°N, 12.70°E, at 8 m below sea level as a possible Sirens Island (see (h26) in the Appendix).

Note that 700 years before Pythagoras, Homer (see (h20) in the Appendix) mentioned the cave of the Nymphs at Ithaca [22] (Od., XIII, 110–130) Porphyry (h21) "The Cave of the Nymphs" [23]. The cave was also found, located on the Ithaca Island, Greece, with coordinates 38.366°N, 20.697°E, 160 m a.s.l. The general description of the cave, which is present in the Homeric poem, corresponds to geographic location. The Music Temple in Crotone is also marked in Figure 2 at

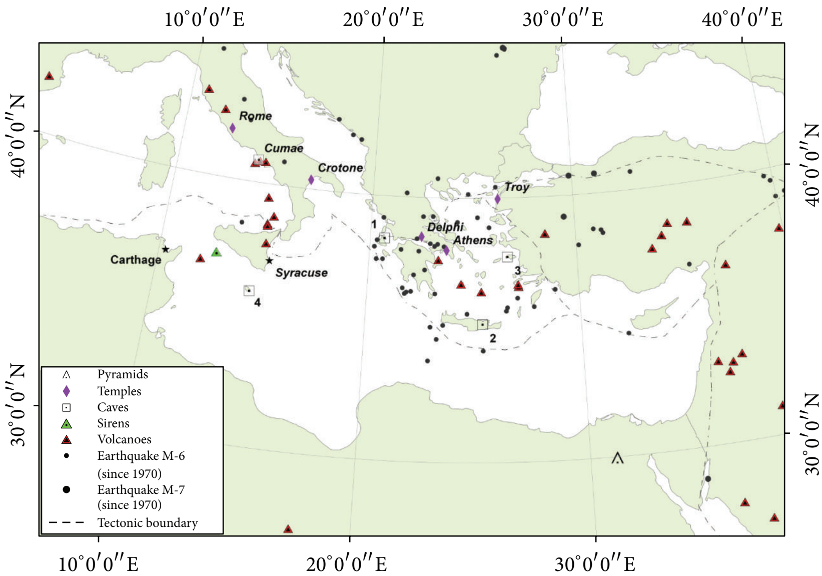


Figure 2: The seismic activity map in the Mediterranean. The tectonic faults were marked in dotted lines. The earthquake with 6 and 7 magnitudes has been plotted as points (from 1970). The volcanic activities were marked as triangles. The Valor Temple in Rome, the Temple of the Muses in Crotone in southern Italy (the school of Pythagoras), the Parthenon in Athens, and the Pyramid of Cheops were shown additionally. As squares with numbers marked: Cave of the Nymphs in Ithaca (1), Diktaean Cave in Crete (2), Cave of Pythagoras in Samos (3), and Cave of Darkness in Malta (4).

southern part of Italy. Pythagoras created his school at this temple after he left Samos.

2.4. Caves and Cosmos. Why caves were useful for space study? Is the space more visible from the caves?

The historian Losev wrote in [24] (book I, p. 125) about the cave: "The cave is located near the olive tree in Ithaca, interpreted Porphyry (see (h21) in the Appendix) as space and center of the hidden, invisible cosmic forces. . .." That comprehension of the cave as a space was typical for Greeks and started probably from Pythagorean Philolaus (see (h22) in the Appendix) [25] (493, p. 286).

Let us go back to Plato. Plato in [6] (VII, p. 193, "Symbol of Cave") encouraged studying science in such order: arithmetic (525), geometry (526-527), mechanic and, the rotation of solids (528), astronomy (527, 530), and music (530-531). After studying these branches of science, Plato called pupils to come down into the cave.

So, the answer of the question, placed early, is obvious. In Mediterranean, in the karst caves, the ancient philosophers investigated the seismic activity on the tectonic breaks by using acoustic methods. Furthermore, they showed relationship between natural phenomenon and the planet positions.

Note that Plato placed high emphasis in his treatise on the matter of how to rise up from the cavern. After a long stay in the dark enclosed space of caves, which is described in [6], the warning about preservation of vision could indicate the regularity and long duration of observations in caves.

Also, note that in cave the acoustic effects are more superior to the acoustic effects in the ancient temples (if the temple has a built-in underground acoustic camera) and in the Egyptian pyramids. Additionally, in the caves nearby tectonic faults, the acoustic effects will be stronger than those in remote caves.

The shortest distance from the cave to the tectonic fault for the Nymphs cave on Ithaca is equal to 75 km, for Pythagoras cave on Samos, 110 km, and for Diktaean cave in Crete, 90 km, respectively. The distance to the tectonic fault from Apollo Temple in Delphi is less than 20 km, from Syracuse, 40 km, and from Muse Temple in Croton, 180 km. But the distance from the Temple of Virtue at Rome to the tectonic fault in bottom of Mediterranean Sea is equal to 314 km and the distance from the Great Pyramid of Cheops/Khufu (29.979°N, 31.134°E) to the fault in the Red Sea bottom is equal to 400 km (see (h27) in the Appendix) (Figure 2).

As it is difficult to separate the myths from the reality, not all the caves and temples were listed in this study. For example, the information about Cumaean Sibyl cave (see Figure 2) is not used in this study. The Cumae is located not far from the Mount Vesuvius (40.849°N, 14.054°E), so it gives the possibility to use this cave for monitoring of seismic activity.

Over the time, in the ancient world, the importance of using the caves was reevaluated. The center of civilization shifted from ancient Greece to Rome, where seismic activity was much lower. So, opinion about the caves and predictions has been changed.

Cicero in [17] (XXV, 39, p. 21) described the cave as a place where the wild animals live. Nothing was mentioned about the caves in Geminus (see (h23) in the Appendix) work [26]. On the other side, Theon (see (h24) in the Appendix) in [27] (546), following Plato, admitted the possibility of predicting events, but he wrote about it uncertainly. The cave, as an instrument of observation, did not occur in [27]. None of the caves and none of the islands of Sirens (in this case, as a synonym of Ananke spindle) were mentioned in Cleomede (see (h25) in the Appendix) [28]. And the most curious thing is that Aristotle in his treatises "De Caelo" [29] (268^a–311^b), "De Generations et Corruptione" [30] (314^a–338^b), and "Meteorologica" [31] (338^a–390^b) told nothing about the Sirens and the caves in Platonic understanding of this matter.

2.5. Statement of the Problem. So, there is no doubt that a whole system of caves existed in Ancient Greece (600–350 BC). These caves were located not far from the tectonic faults and these caves were used for acoustic observations which were carried out for a long period of time. Probably, Phoenicians built earlier (~1000 BC) a similar system. Some mention of this can be found in "The Odyssey" [22] (see (h26) in the Appendix), in which Circe's prophecy (Od. XII, 150–160) and a description of a hydroexplosive volcanic eruption and a tsunami (Od. XII, 215–218) are present.

However, the main goal of the paper is to answer the question: whether the ancient philosophers claimed that there is a relationship between the position of the planets in the solar system and volcanic eruptions, earthquakes, and climate extremes.

The Pythagorean-Plato cosmology was studied in [32]. It was shown that there is a correlation between linear configuration of planets and the natural phenomena. In [32], it was offered to make some changes in the Third Newton's law (addition in text is allocated below):

> *When one body exerts a force on a second body, the second body exerts a force equal in magnitude and opposite in direction to that of the first body [in the absence of obstacles in the path between these bodies].*

Below in this study, the features and constructions of the Antikythera ship will be investigated in detail, and the relation between features of this ship and the Antikythera mechanism also will be established.

2.6. Interlude: The Antique Sea Navigation by Stars. In this study, the history of the Antikythera mechanism and its role in Ancient Greece was considered. It was shown that the major goal in Ancient Greece was the study of seismic activity in the Mediterranean. Each historical epoch poses its own problems, so, in the following sections, discussing the future fate of the Antikythera mechanism, we will focus the attention on climate changes that were very important in the Ancient Rome.

Rather, dear reader, as a minute break, in the following, some ancient world historical curiosities will be presented from the category of historians' astronomy. The question is whether the astronomy was applied in the ancient world for navigation at sea or not. Of course, the lines from Homer [22] (Od. V, 330), telling about a departure Odyssey from Calypso's island, recall from mind:

> *Sleep did not fall upon his eyelids as he watched the constellations—the Pleiades, the late-setting Bootes, and the Great Bear, which men call the Wain, always turning in one place, keeping watch over Orion—the only star that never takes a bath in Ocean. Calypso, the lovely goddess, had told him to keep this star (Wain) on his left as he moved across the sea.*

Table 1: Use of night navigation by the stars in ancient times.

	Destination of navigation by stars	Answer
1	Definition of world sides	Yes
2	Holdings of general direction of vessel movement	Yes
3	Maneuvering between the islands	Probably
4	Movement between the reefs in the coastal zone	No
5	Entrance to the harbor	No

However, we must keep in mind that the problem of the astronomical instruments used for accurate astronomical measurements from a board of the ships remained in the later epoch, including the time of Columbus, Magellan, and Cook. Let us note that in order to make precise measurements of sailing ships coordinates first mate went ashore on the cockboat. The possibility of using astronomy as a tool for sea navigation in Ancient times is shown in Table 1.

An important milestone in the use of merchant fleet at night was the lighthouse construction, in particular the building of the large Lighthouse of Alexandria. I believe that, even after a wide application of the lighthouses, the entrance to the harbor at night was a rare phenomenon, because it was necessary to pay in addition to the port dues the extra beacon dues. Therefore, beacon lights were actively used only in stormy weather, when there was a real threat to the ships, and in case of delivery of the urgent cargo for the public games, festivals, coronations, and so forth.

The above lines represent certain interest, so we will spend some time for the "*The Odyssey*" books 5 and 12.

First, we will consider the following question: who was Odysseus on the ship: helmsman, rower, security guard, or passenger? I believe that Odysseus was a priest or a priest assistant, which was hired on this ship. If the next lines in Homer, Od. V, 330, "*Pleiades, the late-setting Bootes, and the Great Bear, which men call the Wain, always turning in one place,*" were addressed to helmsman Eurylochus, the statement that in ancient time's astronomy was used for the night sea navigation would be obviously true and the further consideration would not be required. However, these lines relating to Odyssey show that priest Odyssey was familiar with astronomy. That fact that the priests knew astronomy is not a surprise.

The next steps are to find the location of Ogygia (Calypso's island) and to confirm the accurateness of the ship course. For this purpose, it is necessary to understand the general situation and the tasks, which have been set up for Odyssey.

In the Mediterranean, in the 12-13 century BC on the horizontal geological fault between the Eurasian and the African continents, there were serious changes of geologic activity. Some geologic activity in the horizontal break remained at least till Pythagoras's times. So it is well known that Pythagoras's student Philolaus was frightened to go down in the dungeon of the Temple of Muses (Croton, Italy), as one of the reasons for activation of the horizontal fracture in the Mediterranean Sea could be an increase of the Earth rotation speed.

Therewith, the Eurasian continent is very massive; the continent under load will be shifted not so much to the East as to turn the European part of the continent to the south, pushing Africa. This phenomenon leads to the following natural disasters.

(a) The numerous and strong volcanic eruptions and earthquakes occurred on the horizontal fault at Gibraltar-Syracuse-Rhodes line (see Figure 2). Let us note that strong eruptions and earthquakes cause only local damage to settlements nearby the epicenter of geological activity. As an example, it is possible to point to the Santorini eruption (~1380 BC). However, the tsunami, which formed after the earthquake, can cause significant damage to coastal villages and port facilities in trading cities at a great distance from the epicenter.

(b) The geological activity at the break between Africa and the Arabian platforms was progressively and significantly reduced. Due to this reason, difficulties were created for registration of seismic activity in the Egyptian pyramids area. In this situation, it should be assumed that Egyptian pyramids were recognized as objects, which are unfit for further use, and new temple complexes were started to be built.

(c) As known, the Mediterranean Sea is a closed reservoir, so the sea level is determined by the amount of precipitation over the sea area and over the catchment's area. From the south, the Mediterranean Sea is bordered with the desert or semidesert areas. Only the Nile water fills the Mediterranean Sea from the south side. From the north, the Alps Mountains obstruct the passing of the wet air mass from the Atlantic Ocean to the Mediterranean Sea region.

As a result, the water balance in the sea and its level strongly depend on the receipt of passing water mass through the Strait of Gibraltar and Bosporus and Dardanelles passages. Even at insignificant displacement of Africa in the south, the inflow of Atlantic water was sharply increased, causing the sea level to rise up to a new balance level between evaporation and water inflow. The speed of the flooding and the essential size of the level lifting unequivocally specifies to a violation of water balance, instead of immersing the African plate due to pressure from the Eurasian platform. Thus, in the 12-13 centuries BC, due to expansion of the Straits of Gibraltar, a water level in Mediterranean Sea rose up more than 5–10 m which led to changes of coastlines and flooding of port facilities and part of the urban quarters. Note that changing of the coastline contours had led to the degradation of some Mediterranean cities which lost their harbor and the fast prosperity of the other cities which have acquired possibilities to perform the trading operations.

(d) The local climate was changed. It is known that at modern speed of the Earth rotation the warm Gulf Stream passes above the north of Scandinavia and locks the passage between Iceland and Europe for the cold Arctic water stream. Conversely, when Earth rotation is accelerating, the Gulf Stream will drop to the West, to Europe, and then stream will turn along the west coast of Africa. If the rotation is very fast, the Gulf Stream will turn towards Spain and Europe will be in the area of a glaciations start. It should be noted that the climate of Mediterranean in 12-13 BC started to change and began to become more humid and less hot.

Thus, the increase of the Earth's rotation is the reason of the raising activity in horizontal Mediterranean break and of changing climate in Europe and in the Mediterranean. For understanding the text of a poem, it is necessary to specify the following concepts.

(i) "Golden Apple" is a large gold nugget. Apparently, Carthage was a main source of nugget native gold in Mediterranean. Gold deposits are located in the desert in 1500–1800 km to the south of Carthage: Ahaggar (23°17′0″N, 5°32′0″E), Tirek (21°30′7″N, 2°30′10″E), and Amesmessa (20°58′41″N, 2°29′2″E). Gold mineralizations in these deposits were in the form of quartz veins and vein lets. The gold content in situ rock is equal to 15–25 g/ton.

Let us note that Carthage (Phoenician, *Qart-ḥadašt*) means the "New City" (~814 BC), so the Old Punic City (exact title is not known) was in the region of modern Libya and Algeria and it probably existed in the Odyssey times. It is assumed that, due to changes in the coastal line, the trade with native Berbers was conducted by barter method directly on the sea beach or in temporary tent campus. For simplicity, the specified trade site will be named in the following also as Carthage.

(ii) As a result of the fact that Amenhotep III sent a large quantity of gold as gifts to the kings of Mitanni and Babylon, in Asia, there was a strong opinion "that the gold in Egypt is as much as the sand in the desert." Actually, the phrase means that, in Nubia, the province of Egypt, there is a lot of gold, but this gold is presented in the form of placer (gold dust), unlike the gold nuggets from Carthage. Thus, to extract the product from gold placer, the medium melting temperatures ~1000°C are required but it was expensive at antique time. As it is known, the melting point of gold is 1063°C and of copper is 1084.5°C, while the melting point of such metals as tin is 231.9°C and as lead is 327.4°C, as the parts of bronze, so they are much lower.

(iii) "Sirens" is a sound, which was generated by water vapor in geysers. The number of underwater volcanoes in the Mediterranean is insignificant. Such volcanoes are located between Sicily and the northern coast of Africa. Now, these volcanoes are not active and are located at shallow depths under a sea surface. Modern GPS systems show the location of the "Sirens" with high accuracy. Odysseus sailed to Carthage and passed the Sirens. According to Homer, when Odysseus passed the island with Sirens, one of the volcanoes exploded due to ingress of water in the caldera with the subsequent formation of a wave tsunami.

(iv) "Golden Fleece" is a golden thread or string (fleece of gold hair). Thus, gold is a very soft metal: Brinell hardness is equal to 220–250 MPa. Gold could be stretched into wire having a linear density up to 2 mg/m. Note that gold is inert metal, and it does not react with volcanic gases. It is possible that a ball of Ariadne (sister of the Minotaur) thread was also made of gold.

Let us note that the strings were not completely from gold. Gold is soft but is not elastic material. Strings were made usually from the intestines of young lambs, which were cleaned, specially treated, and twisted. For improvement of the sound quality and for safety, the strings were braided with gold thread (Colchis fleece). The strings could serve for certain period of time, so from time to time it was necessary to go in Carthage for gold nugget.

(v) "Divine Music" is a sound emitted by strings stretched in specially equipped premises under the temple or in the caves nearby geological faults. The human ear cannot perceive seismic vibrations, so it is necessary to convert the seismic vibrations into acoustic waves. The seismic activity was estimated by the height of the sounds.

So let us return back to the poem text. According to the poem, Odysseus ignored the negative seismic forecast (in Malta) and went to the Carthage. Near the island of Sirens, which located at the south of Sicily, he barely survived during the tsunami. From the Carthage, the ship, which Odysseus sailed, did not go past the Sirens Island but floated, skirting around the north of Sicily. It allows identifying a wreck ship place and a location of Calypso's island.

According to legend, the Helios god sent his flock to the fertile pastures of the Trinacria Island, entrusting it to two lovely daughters, the young shepherdesses Fauetusa and Lampatia, born of his pairing with Neerea. So the names of the Aegadian Islands perhaps take origin from the two shepherdess names and their mother: Auegusa-Favignana (Foetusa), Pharbantia-Levanzo (Lampatia), and Hiera-Marettimo (Neerea).

From one side, the Aegadian islands connected with Helios legends; from the other side, the Aegadian Islands were named in Greek, Aegatae Nisoi, *Αιγάται* Νήσ*οι*, meaning the islands of goats.

Therefore, the reference to Helios' cattle by Homer in Od. XII, 450, gives a unique binding to district. The port on the Favignana Island was a hub port in traveling to Corsica, Sardinia, and the eastern coast of Spain (Figure 3). The port was actively used at first by Phoenician and then by Carthaginian. Note that the long sea journeys required the food supplies, so it is possible that the inhabitants of the islands specialized in preparations of the goat smoked hams, which are well preserved for a long time.

So, let us reconstruct a picture of events. According to the text of the poem, within a month blew only south wind (Homer, Od. XII, 420). Odysseus sailed from Marsala towards Favignana, but due to the team fatigue and due to strong south wind, 12-oar sloop could not enter the harbor (Figure 4). At the harbor entrance, the sloop turned a board to a wave and tilted. As a result, the wave throws overboard the six best rowers. The sloop was able to straighten out, set sail, and went to north to the harbor of the Levanzo Island (Figure 4). However, on the island of Levanzo, the harbor is too small and during a strong storm with the western and southern winds is unsafe. Odysseus was hoping that the wind will change to the west breeze and the sloop will be able to reach a large port (Trapani), where it is possible to complement the team. However, after a few days, instead of the west light breeze, the strong storm front came and Odysseus was trapped (Homer, Od. XII, 370–380, 510, 530). He either would lose the boat or, in a thunderstorm, at night, should go to the sea, (Homer, Od. XII, 460).

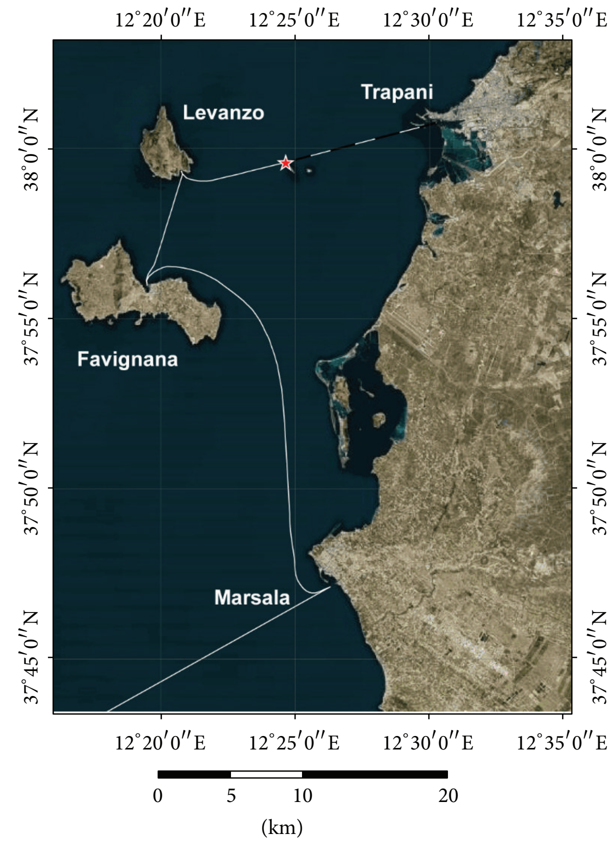
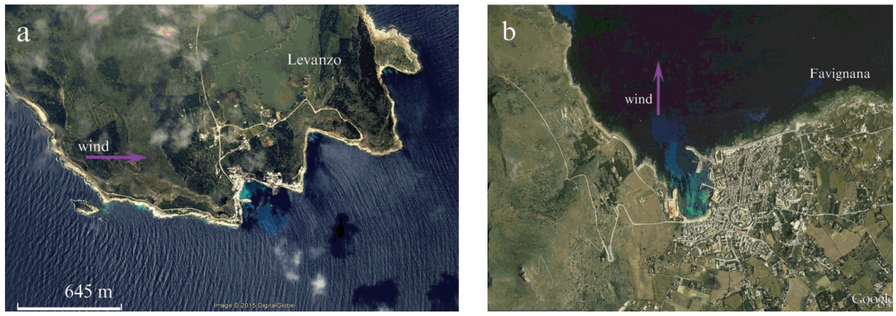


Figure 3: Reconstruction of the Odysseus' backward path to Itaka. The asterisk denotes a place of the wreck sloop on the reef.

On the Odysseus way was a small island reef (Figure 5(a)). The break, leading to the Maraone island formation, is well visible on satellite imagery (Figure 5(b)). The height of the island is insignificant and is equal to ~3-4 m. Note that it is difficult to see the low island and the reef surf over high waves in a thunder storm. Often in the atmosphere near the reef, there are a lot of sea aerosols, so the mast of the ship and the island itself will work as lightning rods. At the moment when the sloop was close to the reef, the lightning could hit repeatedly, as well as in the reef and in the ship, about what was narrated by Homer, in Od. XII, 530. It is very difficult to make a maneuver near reef with incomplete rover team (with 3 oars on each sloop board) and with a broken mast.

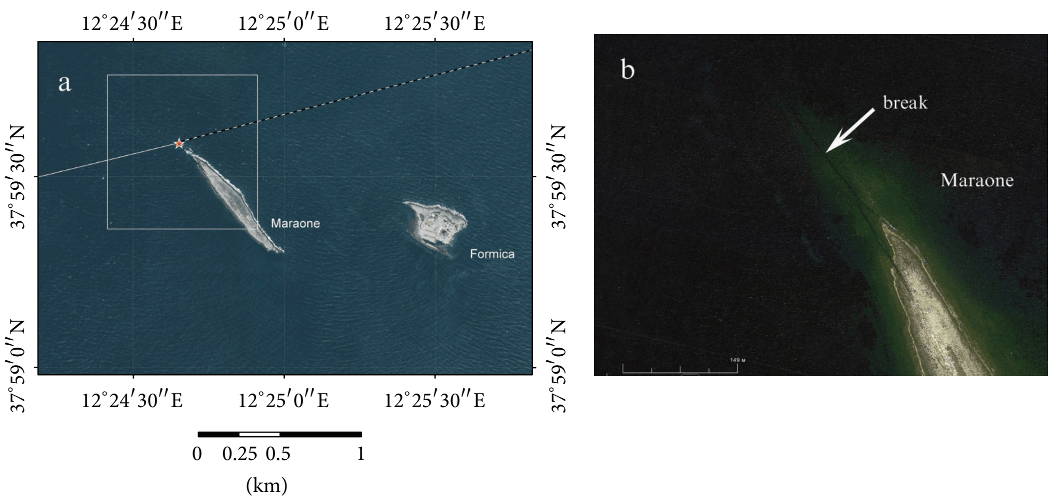
Reader, have you ever seen a Norwegian who does not know what snow is or who is not able to stand on skis? It is hard. Have you ever seen an insular Greek (from Itaka) who could not swim and does not know sea commands? Yes, it was Odysseus.

What should Eurylochus do, if he sees that the sloop carries on the reeves? He should give the command to abandon ship and be the first to jump into the raging sea, showing an example of courage. The corresponding lines are present in the poem: Eurylochus rushed overboard as a good diver (Homer, Od. XII, 540). The team followed him (see ibid). The beach of Maraone is flat, so the crew had a chance to be rescued.



(a) (b)

Figure 4: The detailed Google Earth satellite image of the Favignana (b) and Levanzo (a) harbors. The wind direction at the moment when the Odyssey sloop was entering into the harbors is specified in addition. On picture (a), the rough sea is visible for the northern-western breeze. The waves partially come into the bay.



(a) (b)

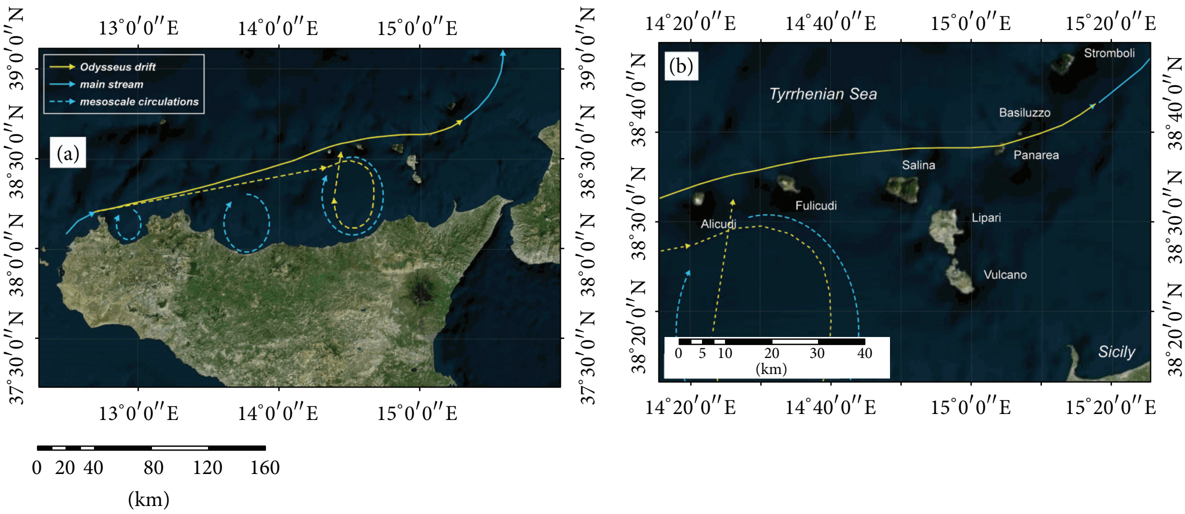
Figure 5: The last site of the Odyssey sloop route on the line Levanzo-Trapani was shown. Odyssey tried to sail away from the storm front of which was approaching from the West. The sloop wreck location on reefs of the Maraone Island is marked as an asterisk (see (a)). On space satellite image (see (b)) the geological break (fault) is shown.

Further, Homer wrote that after shipwreck Odysseus has reached Island Calypso by attaching a piece of a mast to the keel. Most likely, on the reef, the boat collapsed on a part and the hold of the sloop with a cargo (amphoras) sank. Currently, the fragments of the old boat and several amphoras are exhibited in a small museum on the neighboring island Formica. The museum is so small that the official catalog of the museum is absent in press. Perhaps that is the sinking part of the Odysseus sloop. Let us note that at volcanic activity of break the "*sulphurous smoke*" (sulphureous) can be released, which is indicated in the poem *Homer* (Homer, Od. XII, 540). In the water, supersaturated with sulfur compounds, the wood is preserved, so the ship could be in not so bad state.

According to the poem text (Homer, Od. V, 160) after this wreck, Odysseus drifted for several days. As known from [33–36], the stream of a surface water nearby shipwreck is directed to the north-west coast of Sicily, and then it is pressed to the coastline near Cape. So episode in the poem about a tree corresponded to a place near Cape in north-west of Sicily. Further stream follows along northern coast of Sicily to east coast of Italy (see Figure 6).

In addition to the basic stream, it is possible to generate wind induced mesoscale clockwise circulations. The speed in basic stream on sea surface is equal to ~1.0 km/h, so after 9.5 days the sloop fragments could be drifted 220–230 km from the western Cap of the Sicily (see (Homer, Od. XII, 590)).

The Odysseus sloop fragments drifted due to the sea flow and the wind power. Without west wind, Odyssey could drift in main flow (see solid yellow line in Figure 6). The hypothetical path of Odyssey drift with wind component was shown in Figure 6 as dash yellow line. This line corresponded to situation described in poem, when a strong west storm changed to the calm one and then it changed to the south wind. Without knowledge of a relation between the wind and



(a) (b)

Figure 6: The yellow path shows the Odysseus drift along the north bank of Sicily. The blue arrows indicate the main surface sea streams. The blue dash line shows the mesoscale circulation of sea water. The yellow paths show the Odysseus drift taking into account the wind drift (dash line). One of the Aeolian Islands could be the Calypso Island (see (b)).

the sea drift components, it is possible to propose that the sloop debris could be thrown on any of the Aeolian Islands: Lipari, Vulcano, Salina, Stromboli, Filicudi, Alicudi, Panarea, or Basiluzzo.

Let us note on the Alicudi Island that there is the Timpone delle Femmine, a kind of natural shelter of caves where women were hidden when pirates staged raids.

Apparently, from Figure 6, the distance from Sicily to the nearest coast, Vulcano island, is about 30 km. Let us note that the distance from Linari Island to Italy is ~85 km and from sea path to the nearest major port (Messina) is ~120 km. All these distances exceed the limit of visibility on the sea, which in clear weather is equal to approximately 20–25 km. Thus, Odysseus did not see the Sicily coast and had to sail on a raft from the Calypso Island, guided by the stars in space. According to lines (Homer, Od. V, 330), "keep this star (Great Bear) on his left as he moved across the sea," Odysseus chose the right direction to the West.

The next question is of interest: in what language during 7 years did Odysseus and Calypso speak? The territory of Sicily at that time inhabited *Elymi* (western Sicily), *Sicani* (central part of Sicily), and the *Siculi* (eastern Sicily). The Calypso Island is near the coast, which is inhabited by Sicels that arrived to Sicily between the second and first millennium BC. Thus, Calypso's language is Sicilian language. The Siculian language belongs to the Indo-European language group and has a great similarity to the Latin language. *M. Terenti Varronis* in his treatise *De Lingua Latina 1, 101*, [37] noted many similarities between Siculian and Latin, wrongly assuming that Sicels came from Rome. In addition, it should be noted that *Apollodorus*, in *Epitome 7.24* [38], wrote the following: "There Calypso, daughter of Atlas, received him, and bedding with him bore a son Latinus."

Let us summarize our brief discussion. First, the text of poem by *Homer*, in *Od. books 5 and 12*, is autobiographical, as no one could have known such details. Hence, undoubtedly, the original author of the poem "The Odysseus" is Egyptian, Ugaritic, and Phoenician priest ([Od]ysseus, [Ul]ysses). The original text of the poem was written long before the advent of the Greek alphabet. From the other side, the Odysseus journey dates from ~1177 to 1178 BC [39–41]. The oral version of the poem could be excluded, as the details, what we find in the text, would be lost at repeated retelling of the poem during 8 centuries.

Who is the outstanding scientist, writer, and priest who lived in the Middle East in the XII century BC? The answer is obvious. The original author of the poem "The Odyssey" is Tesithen [42], (Tesithen, natural name, Usirhotep, priestly name, Mōÿsēs, writer's pseudonym). Also, we will confirm that Mōÿsēs means taken (rescued) from the water. Thus, both the Odyssey and Mōÿsēs are writers' pseudonyms of Tesithen.

Usually, at ancient time, the ruler deeds, the victories over the enemy, or the major natural disasters were written on the papyruses. However, papyruses did not often include poems about the adventures of a junior priest or a priest assistant. How to keep the text of the manuscript from the washout? On this question, Odyssey found an extremely simple solution. It is necessary to write a treatise on language, which is not understood neither by the Supreme priests nor the rulers. For these purposes, Calypso's language is quite suitable. Therefore, it is possible to state a careful hypothesis that the original text could be written in the Siculian dialect of the Latin language using the Phoenician alphabet and no one reads these poems for a long time.

You might ask who has managed to solve a secret of these rolls and how? Prodicus of Ceos could do it, so at some time the poem was dating from IV century BC. It is known that Plato and Euripides during a visit to Egypt got antiquity papyrus for the academy. It is authentically unknown whether or not Prodicus visited Egypt. However, it is known that she was engaged in history of the religion and interpreted religion through the framework of naturalism. Therefore, most likely, Prodicus received from Egypt all Odysseus papyruses. On the question of how to read these papyruses, an ingenious Prodicus found a natural decision. Prodicus went to the nearest port and began to look for merchants and sailors familiar with Calypso's language. The knowledge of the Siculian dialect of the Latin language for Greeks from Ithaca was not something unusual, as Ithaca located near Sicily and for long time Greeks from Ithaca maintained close trade relations with Messina and Syracuse.

Prodicus masterfully translated the text of the poem and adapted it for the Greek readers and spectators. In those places where the original text of "*The Odysseus*" due to the decrepitude of the papyrus was not preserved, we see written Prodicus inserts. It should be assumed that all the Odysseus/Mōÿsēs works were translated by Prodicus. The statement that Prodicus has amassed a great amount of money (Plato, Hipp. Maj. 282d) (Xenophon, Symp. Iv. 62, i. 5) probably is true. Also, probably, it is not casually that Homer represented Odysseus (Mōÿsēs) as Greek from Itaka. There is nothing known about other manuscripts of Odysseus (Mōÿsēs), in particular about the astronomical works. Most likely, these treatises have been recognized insufficiently due to being not well described by the guidance and the leadership of the Supreme priests. Now, the Homer poems are the only thing that proves that Odysseus (Mōÿsēs) was an astronomer.

The absence of archaeological proofs and written manuscripts does not allow us to date a principle of an astronomical prediction of the natural cataclysms earlier than Pythagoras time. Thus, the principle, on which the Antikythera mechanism prediction is based, was called Pythagoras-Plato cosmology, not an Egyptian cosmology.

I hope that "Interlude" makes you smile a few times. However, we need to continue our investigation.

3. The Antikythera Ship Descriptions

3.1. The Ship Descriptions. The history has kept the description of unusual ship called Syracusan, which later was called Alexandrian [43] (see details in Supplementary S4 in Supplementary Material). In this study, this ship was referred to as S-Ship. This ship is very similar to a ship that sank near Antikythera (referred to below as A-ship). These two vessels were compared on the basis of comparison between A-ship archeological findings, presented in the National Archaeological Museum, Athens [44], and S-ship description in [43]. We will show that it is probably the same ship.

(1) According to [43], "*a drawing-room which having a book-case in it, and along the roof a clock, imitated from the sun-dial at Achradina*" was presented on S-ship. Due to pitching during movement of the vessel, any accurate astronomical observations on cargo ships board could be extremely difficult. However, both vessels had astronomical instruments or have been somehow related to astronomy. Additionally, let us note that due to the short distances between the destination ports in ancient times in the Mediterranean Sea the use of navigation by the stars has not been in common practice.

(2) Both A-ship and S-ship had on board numerous sculptures that are very unusual for a freighter ship (holkas, in ancient Greek). According to description, a temple devoted to Aphrodite with statues and vases on board was on the S-ship, and this is logical, since it was a ritual vessel, which was built by a special project. On the other hand, the heterogeneity of cargo shipping by A-ship and the presence of Antikythera mechanism and excellent sculptures along with a large number of fairly simple household ceramics immediately attracted attention. It specifies singularity of A-ship vessel.

(3) The S-ship was comfortable passenger-and-freight vessel, which had convenient individual cabins for passengers. In place of wreck of A-ship, the women's jewelry was found, specifying in presence passengers on board. In addition, on board A-ship the pieces of the richly decorated lodges that are not an attribute of the cargo ship staff cabins were found.

(4) Radiocarbon dating of A-ship wood residues was in the range of 220 ± 43 BC, corresponding to the confidence interval of years 245-244 BC when the S-ship could be built.

(5) The most ancient coin lifted from the place of A-ship wreck was from Knidos and this coin issued in 250–210 BC. This fact coincides with the dating of the S-ship construction. Taking into account its safety, it is possible to assume that this coin was hidden or was lost in the crevices of the hull. Probably, this coin was the coin, which has testified in the sections (43G-44G) of the [43]: "*And there was a tribunal instituted to judge of all offences which might be committed on board the ship, consisting of the captain and the pilot, and the officer of the watch; and they decided in every case according to the laws of the Syracusans.*"

(6) Note that both vessels were the grain-cargo vessels. In particular, the parts of pipes to pump water out of the hold were found; such pumps are typical of the grain-cargo vessels (or salt-cargo vessels).

(7) The tiles on a floor of the cabins inside the S-ship were mentioned in [43]: "... *And the supper-room for the sailors was capable of holding fifteen couches, and it had within it three chambers, each containing three couches; and the kitchen was towards the stern of the ship. And all these rooms had floors composed of mosaic work, of all kinds of stones tesselated.*"

On the other hand, in place of wreck of A-ship, the Corinthian tiles were found. We also note that the principal architect of S-ship was Archias from Corinthian. The lines below are ones in which it was written about the tiles in [44]: "*The Corinthian roof tiles (Lat. imbrices and tegulae) suggest the existence of a roofed area on the deck, which very probably served for the preparation of food or/and to protect, by means of the tiles, the retractable wooden doors of the loading hatches.*"

(8) Let us notice that the lead sheets were used in covering of the A-ship for board protection; such lead sheets were not applied later in I century BC: "*The Kyreneia ship was already old when the sheets were applied. Lead hull sheathing was common in the Hellenistic period and the Early Roman period on newly built ships, but ceased at the end of the first century*

Table 2: The presence of the attributes on board of the ship.

No	The attribute	Ship: S-ship	Ship: A-ship
1	Astronomical instruments	+	+
2	Statues and beautiful vases	+	+
3	Cabins for passengers with richly ornamented lodges	+	+
4	Historical description dating for S-ship versus radiocarbon dating for A-ship	245–243 BC	220 ± 43 BC
5	The oldest dating by coin from Knidos	–	250–210 BC
6	Type of ship is grain ship	+	+
7	Ceramic tiles on the floor/root	+	+
8	Lead hull sheathing	+	+
9	One of the ports of arrival/departure Syracuse, Sicily, Italy	+	+
10	Something has to do with Archimedes	+	+

AD." In the S-ship description, a vessel covered by lead sheets and case tarring also is mentioned.

(9) From the six identified coins, raised up from the crash site of A-ship, three are from Sicily. On the other hand, according to the S-ship description, the S-ship was built in Syracuse.

(10) Some objects from both vessels related directly to Archimedes. On the A-ship, the Antikythera mechanism was similar to the other two astronomical mechanisms, which were created by Archimedes (see [17]). On the S-ship, the pumps, battle-catapults, and scorpions were designed by Archimedes. Also, an original way of large vessel descent on water was invented by Archimedes.

Summarizing what is mentioned above (see also Table 2), it is possible to conclude that the A-ship and S-ship are the same ship. Chronological ruler for A-ship and S-ship is shown in Figure 7.

Were there during Antique Times other similar large vessels or not?

Yes, as is well known, Pliny Eld. in Natural History, (XVI, 201) talked about absolute achievement of shipbuilding technology. He talked about the ship, which has delivered on board an obelisk from Egypt to Rome in Caligula reign time (37–41 AD). The weight of the Egyptian obelisk, which stands in front of the Lateran Basilica in Rome, is about 230 tons and its height is of 32 meters. For transportation of the obelisk, the ship with carrying capacity of 2500-ton displacement was used [45].

Besides Lucian [46] in the dialogue sections 5 and 14 described the Alexandria vessel "*Isis*" transporting grain. The length of this ship was equal to 54-55 m and the relation of ship length to width was 4 : 1; that is, the ship's width was equal to ~13-14 m; depth of a hold was –13 m. The *Isis* parameters were very similar to S-ship sizes. This confirms that these large ships were built in ancient times and, apparently, in one same pattern.

Surely readers also remember Noah and his ark. However, in this paper, we consider only the events that occurred in the Mediterranean area during the period from 500 BC to 43 BC. Therefore, questions on how to estimate activity of the savior Noah and whether Noah is a hero or a rascal are far beyond the scope of this study.

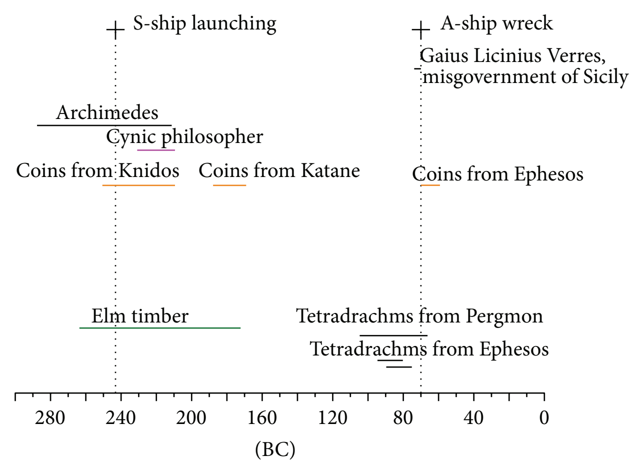


Figure 7: The lifetime of Archimedes and Verres as misgovernment of Sicily, A-ship dendrology scale, and A-ship coins chronology were shown. The S-ship launching date and A-ship wreck date were marked as a cross.

3.2. The Historical Events of S-Ship Construction Time and the Purpose of Its Construction. In the ancient philosophy, the link between climate change and the position of the planets was called a "Thales Milesian problem about olives," which was later renamed by Aristotle in the problem of the benefits of the philosophy. This conception, which is known as the Pythagorean-Plato cosmology, dominated almost until the end of 1 BC. The link between climate change, volcanic eruptions, earthquakes, and the position of the planets was shown in [32].

Following Thales Milesian and Pythagoras, Archimedes created and used the astronomical calculator (Antikythera mechanism) to calculate the date of the onset of climate change and convinced Hieron (see (h28) in the Appendix), the tyrant of Syracuse, to build a large ritual grain-cargo ship.

In this study, it was found that local climatic changes were caused by a linear configuration of the planets at the multiply linear planetary Saturn-Jupiter-Earth-Venus-Mercury alignments. A change in the atmospheric masses circulation in the Mediterranean area in August has led to the situation when the usual flood of the Nile did not occur while the crops in Sicily in June-July were successfully harvested.

As known from Canopus Decree (6 March 238 BC) at the beginning of the reign of Ptolemy III Euergetes (see (h29) in the Appendix), it was necessary to transport the large quantities of grain [47] (see *S5 in Supplementary Material*). As also we know from the cuneiform tablet (BM 34428, British Museum), the king Ptolemy III Euergetes invaded Mesopotamia and laid siege to Babylon in January 245 BC (243 BC?); however, he had to return soon to Egypt because of sedition at home. Presumably, the revolts of the hungry occurred due to an insufficient flood of Nile in August 244 BC. Thus, vessel building should be dated ~244 BC, or more accurately 245–243 BC.

3.3. Sculpture of the Unknown Philosopher. Another interesting point to which it would be interesting to pay attention is the sculpture of the philosopher found in the place of the A-ship wreck. A number of researchers describe the sculpture as Cynic philosopher. Thus, S. Karouzou believed that the philosopher's head is a work of the Rhodian school of the bronze sculpture. She noted that, due to the presence of elements of the early baroque, a probable date of sculpture creation was approximately 230 BC.

Let us return back to description of S-ship [43]. In it, there is information about three masts of the vessel, one of which was incredibly high: "*And of the masts, the second and third were easily found; but the first was procured with difficulty among the mountains of the Bruttii, and was discovered by a swineherd. And Phileas, an engineer of Tauromenium, brought it down to the seaside.*"

As known in Sicily, the basic building material for the masts was the *Pinus pinea*, which grew in *Bruttii* (Southern Italy). The height of a mature tree is insignificant and reaches a value which is equal to approximately 20–30 m; therefore, to find in Sicily or/and in southern Italy a slender tree for a mast height of 18–20 m (1/2–2/3 from tree height) seems really difficult. The history kept not only the memory of this unique mast, but the name of the mechanic *Phileas of Tauromenium* who lowered this tree from mountains.

It is authentically known that only one of the ports in the Mediterranean had restrictions on the mast height and this port was Rhodes, one of the largest ports in Asia Minor. The sculptor Chares of Lindos constructed the Colossus of Rhodes in 282 BC. The Colossus of Rhodes statue stayed at the entrance to the port and was over 30 m (36 m) in height. Thus, S-ship could not enter Rhodes port.

It must be assumed that in such unusual and cynical way the Syracuse gave preference to the Cnidus port instead of the Rhodes port. The presence of the temple devoted to Aphrodite S-ship on board also confirms this hypothesis about Cnidus in which the cult of Aphrodite was much respected. Note that Cnidus is homeland of *Eudoxus*, which is one of the first developers of the Antikythera mechanism. It should also be noted that the remains of other grand sculptures on Rhodes are possibly a result of unsuccessful attempts to develop methods of lifting up the Colossus of Rhodes, to make Syracuse pay for entrance to the harbor.

Availability of a discharge sloop (small boat) also points to the reluctance of Syracuse to pay for entrance to some ports: "*And it had some small launches attached to it (S-ship), the first of which was one of the light galleys called cercurus, able to hold a weight of three thousand talents; and it was wholly moved by oars. And after that came many galleys and skiffs of about fifteen hundred talents burthen.*"

In this way, there is no wonder that the unknown Rhodes sculptor has created Archimedes in the form of the cynical philosopher. The sculpture of Archimedes probably was created after the well-known Rhodes earthquake 227/226 BC (16 February 226 BC?), which destroyed the Colossus of Rhodes. So in this manner, nature itself solved the problem of confrontation between Archimedes and sculptor Chares of Lindos.

Also, note the next historical curiosity about Archimedes bust. The bust of Archidamos III, a fourth-century BC king of Sparta, presented in the National Archaeological Museum of Naples (Naples, Italy) from the Villa of the Papyri in Herculaneum, widely claimed to represent Archimedes. However, the reason for placement of Archidamos III bust of little known, military chief of Sparta (nonphilosopher) in the library of the Villa of the Papyri in Herculaneum is not clear. Let us note that there is some similarity between the bust of Archidamos III and the bust of Cynic philosopher. Taking into account defect in an inscription on the reverse side of the bust, it is possible to suggest that it was the ancient historical adulteration.

4. Manufacture of Grain and Its Transportation

4.1. Geography of the Grain Cultivation in the Mediterranean. As it was shown above, the A-ship and S-ship were used for grain transportation. Therefore, it is interesting to consider some features of grain transportation in the Mediterranean region at 80–70 BC, that is, shortly before A-ship wreck.

Undoubtedly, during the last two thousand years, the serious changes in agricultural technique of the plough-land processing took place; moreover, the changes in climate could happen. However, the changes in the soil structure and in topography could occur much more slowly. It is better to say that as two thousand years ago wheat could not be grown on rocks, as well, it is difficult to grow wheat in this area now. The analysis of crop cultivation was illustrated by the croplands from the satellite images, which were obtained from the spectrometer MERIS of the satellite Envisat (see [48]). On the basis of these satellite images, the GlobCover-2009 vegetation map has been created. In Figure 8, the rain-fed and irrigated croplands according to GlobCover-2009 vegetation map were shown. Apparently, from Figure 8, today as well as two thousand years ago, the rain-fed croplands practically are absent nearby Alexandria.

Let us note that there is an obviously expressed north-south gradient in croplands between north territory including fertile areas of Ponto, Thracia, Sarmatia, and Bosforo at Pontus Euxinus (Black Sea), which were controlled by Mithridates, and cropland areas located in Asia Minor (modern

Table 3: Approximate quantity of the grain delivered from Sicily to Rome during the period (74–71 BC) and its cost.

Index	Descriptions of purchase	Price of wheat for modius, in sesterce	Quantity in modius	An approximate sum, in sesterce
1	Corn from first tenths	As tax[1]	3,000,000	9,000,000
2	Corn from second tenths	3	3,000,000	9,000,000
3	Corn levied	3.5 (4)	800,000	2,800,000 (3,200,000)
		Total		
2 + 3	Rome paid through Verres		3,800,00	11,800,00 (12,200,000)
1 + 2 + 3	Total for one year		6,800,000	20,800,000
Info	S-ship grain cargo	3	360,000[2]	1,080,000

[1]Tax corn sold at $1\frac{7}{12}$ sesterces as social price (by "Lex Sempronia Agraria" law) for poor persons or sold at 3 sesterces as regular price; [2]S-ship capacity is equal to 2,500 tons; capacity of usual vessel ~50–70 tons.

territory of Turkey). During Mithridates's wars, that is, at 89–85 BC, 83–81 BC, and 74–63 BC, the traditional way of the grain deliveries through the straits, from the north to the south in the coastal cities of Asia Minor through passages, was closed. However, due to changes in the war theater, it is possible that grain transportation from the north was restored as early as 70-69 BC.

As can be seen from Figure 8, also there is a strong gradient in cropland area between the central part of Mediterranean and Asia Minor. In particular, the fertile areas are located along the coast of Italy, in the territory nearby Carthage oon the African coast, in Sicily, and in Sardinia. As it is known, the Italian coast of the Adriatic Sea was in revolt by Spartacus at 74–71 BC, so regular grain supplies from this area have been hampered. Grain supplies from a southern direction, from Alexandria, practically were never carried due to lack of grain surpluses and their high cost price which was connected with maintenance of irrigational systems.

Based on the principle of traffic optimization, the external supply of crop to Rome could grow up in Sardinia, Sicily, and Africa. Note that the villas gardens and fields nearby Roma city produced mainly fruits, vegetables, and other perishable goods. However, during the period from 74 to 71 BC, a unique opportunity to grain smuggle was provided in the directions: Sicily, Asia Minor, and east coast of the Adriatic Sea (from Pola and Acruvium ports) (this possibility is not shown in Figure 8). Asia Minor was paying for grain silver tetradrachms. As it will be shown in the following, that fact was important for our investigation.

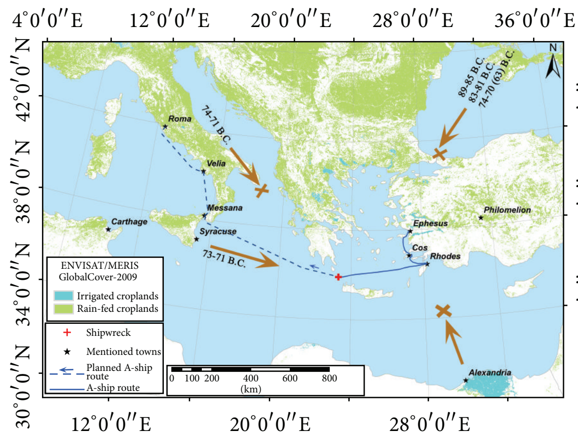


Figure 8: The rain-fed and irrigated croplands in Mediterranean area (GlobCover-2009 maps) obtained by MERIS spectrometer based on ENVISAT satellite were shown. The line corresponded to the last route of A-ship. The brown arrows with date showed a possibility of the grain transportations during Mithridates's wars.

4.2. Volumes of the Grain Deliveries. From the description [43] page 44 it is known that load-carrying capacity of grain bunker on S-ship was equal to sixty thousand medimni which corresponds to 360,000 modii. It is necessary to find the answer to a question: is it a lot of or a little? For this purpose, we will compare load-carrying capacity of grain bunker of S-ship with total grain volume of deliveries in one year to Rome. The process of grain supplies from Sicily to Rome is described in detail in Cicero [49] (III, 163) convenience of reading, quoted pieces are placed in Supplementary Material; for Cicero, see *S6–S10 in Supplementary Material.*

For clarity, we bring together all information about grain supply in Table 3. In a simplified scheme, each farmer sends 1/10 of the yield as a tax (first tenths), moreover, he had to sell to Rome more than 1/10 of the yield (second tenths) at the fixed price (3 sesterces), and at last it must be ensured that he sells to Rome demand (at the request of Rome) a grain at higher price. For Sicily province, this contracted price usually was equal to 3.5–4 sesterces (see Table 3). Thus, totally, Rome gave to Verres as a propraetor of Sicily about thirty-six million six hundred thousand sesterces for this purchase of corn in Sicily (12,200,000 sesterces per year; see Table 3).

As can be seen from Table 3, in the period described by Cicero (74–71 BC), Sicily sends to Rome approximately 6,800,000 modii in a year. The A-ship could transport all this volume of grain for 18–20 trips.

It is of interest to estimate how much grain per year was necessary for the city of Rome to have. For this estimation, we use the statement of Cicero about Apronius [49] (III, 72). According to Cicero, one district in the city of Rome consumed 2,376,000 modii/year (198,000 modii/month or 6,510 modii/day) of wheat grain. As known, at the Cicero time, city of Rome was divided into four districts or "quarters" and only in 7 BC Augustus divided the city of Rome into fourteen administrative regions (Latin regions). This gives a possibility to roughly estimate that the amount of grain that was needed for Rome city grain is equal to 9,504,000 modii/year.

Thus, deliveries of grain from Sicily (6,800,000 modii/year) covered about 70% of the demands of the city of Rome.

On the other hand, the value that represented how much the grain needs are in the city of Rome in one day provides us with a possibility to estimate the number of residents in the city of Rome. Thus, city of Rome consumed 26,040 modii/day; 1 modius is equal to 8.74 litres; the bulk density of wheat is equal to 780–800 kg/m^3, so we will calculate weight of grain consumption of the city of Rome which is equal to about 180,000 kg/day of grain. Since a standard norm of grain consumption is about 0.5–0.65 kg/(person·day), so number of residents in the city of Rome should be estimated in a range of 275,000–360,000 inhabitants for 74–71 BC. However, other researches gave a little more ~450,000 inhabitants in city of Rome in 70s BC [50].

4.3. Verres's Ship. The descriptions of A-ship and S-ship have been considered above in detail. However, a question remains whether there were cargo ships at Verres or not and why they were required. Indeed, at a time, when Verres was *legate* in Minor Asia at consul Gnaeus Cornelius Dolabella 81 BC, under his possession, there was a cargo ship on which he tried to steal from Temple in Delos an Apollo's statue. However, the ship was insufficiently large, and during a storm it was cast ashore and crashed see Cicero [49] (I, 46).

Later at time, when Verres was as *propraetor* of Sicily in 73–71 BC, he had a large cargo ship, which was built especially for him in Messana (Sicily). This ship Cirero was repeatedly mentioned in his speech against Verres (h31): [49], (III, 10 and 12), (IV, 23 and 150), (V, 43, 47 and 59). So in Book 5 [43] Cicero described the ship as "merchant vessel of the largest size, like a trireme, very beautiful, and highly ornamented" (kibea or holkas, in ancient Greek). The purpose of building this ship was discussed by Cicero also (see [49], (V,45)).

From speeches of Cicero, it is possible to estimate a load-carrying capacity of this vessel. Thus, in [49] (III, 107) Cicero indicates that at once Apronius, staff of Verres, has taken out the three hundred thousand modii of wheat from Aetna and Leontini, which were fertile plains in the east of Sicily. Thus, load-carrying capacity of Verres's ship is almost the same as the load-carrying capacity of the S-ship.

In [49] (V, 47) Cicero raises up a question about a material of which Verres's ship was built. Cicero wrote that the Mamertines, residents of Messana, had no wood to build this ship. Thus, we can conclude that Verres's ship was not built in Messana. Most likely, in port of Messana, the oldest ship has been repaired, which was used in this port as a landing-stage (fr. débarcadère) and harbor crane. Let us note that, according to description of the S-ship, the S-ship had a tall mast shifted to a rostrum and also had loading mechanisms created by Archimedes, which located in the stern of the vessel. Thus, it is impossible to exclude that A-ship, Verres's ship, and S-ship were the same vessel because these ships shared a community of the scene and the time interval. The simultaneous presence of three large-capacity unusual vessels in the same area of the Mediterranean Sea raises the doubts.

Note that such a large ship could be used as a military-landing vessel, while carrying up to three thousand soldiers. As it was known from Cicero, when Spartacus had disappeared from the political arena, the arch-pirate came into Verres's house in Syracuse. However, a question of relations between Verres, Spartacus, Crassus, and Pompey is beyond the scope of this paper.

4.4. Angry Greek Goddess Hera Ruined the Legendary Ship. According to Cicero, Verres was not the ship owner; so the number of captains and the ships in their arrangement were limited. The history kept a name of one captain who constantly accompanied Verres and was devoted in all Verres's smuggler secrets. The captain name was *Charidemus of Chios*. He has been accused of stealing two statues in Samos, one of which was *Hera of Samos* Cicero [49], (I, 51, 52 and 60). Charge against him was put forward by Chians on the accusation of the Samians, but the captain was acquitted. Probably, he was also involved as the witness on trial against Dolabella. Note that, in August, 5th 70 BC, captain *Charidemus of Chios* was present as a witness at the first session of the other trial, the Sicilians against Verres, whose hearing was in city of Rome. Therefore, Verres's ship in July-August 70 BC was conducted by first assistant of captain.

As follows from the analysis of archeological find of A-ship wreck, the main freight was not wine, as many believe; amphorae were filled by Kos and Rhodes balms and lagynos (*lagynoi*) were filled with Phoenician ointments used in the preparation of athletes to games. Thus, goods should be delivered to Rome till 16 August, when the games began. The load was urgent and on the captain's bridge there was no enough experienced sailor.

As can be seen from Figure 8, the A-ship was 1300 km away from Rome, so, moving at a speed of 2-3 knots, the ship could overcome distance from Antikythera to Rome in 2-3 weeks, depending on weather conditions. Taking into account that games began on August 16, the ship probably sank at late July-early August, 70 BC.

Again, we will address the description of archeological findings in places of A-ship wreck. The spindles were greatly curtailed. That means that the mast and/or a ship ceiling have been pulled out from original places. Such destruction occurs, when the ship runs on the reefs at full speed. The trajectory of a ship analysis shows that ship cracked when turning left during entering harbor (see Figure 9). The captain assistant has mistakenly accepted smuggler fires in a grotto for the lights of Antikythera port.

Perhaps, if the captain in this voyage was *Charidemus of Chios*, the ship could have not suffered a crash. Note that the same statue of goddess (*Hera of Samos*) was destroyed in 43 BC by both Verres and Cicero, but it is a different story, which is beyond the scope of this study.

4.5. The Treasure Island or "Aerarium Sanctum". Above-mentioned in this study, the mechanisms of sharp climatic changes predictions were considered, as well as the features of the large specially constructed grain vessels analyzed in detail; their traffic volumes were estimated also. However, the picture of a rescue remains incomplete; there is no one essential detail. Cicero in [49], (II, 5) mentioned in passing

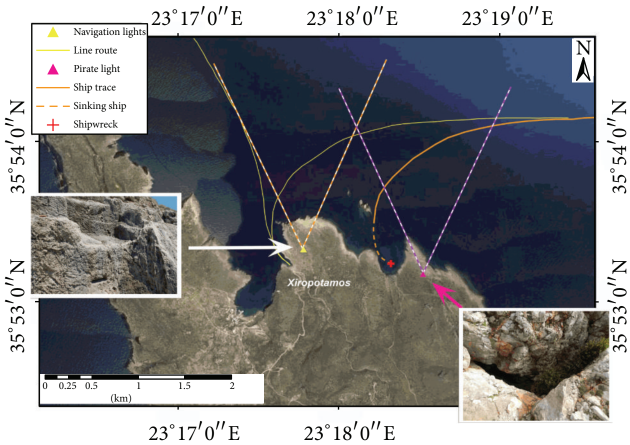


Figure 9: The bay and port of the Xiropotamos on Antikythera Island in Google Earth satellite images. The current ship routes are marked as yellow color lines. The orange line is the assumed to be track of A-ship. The range light of antique lighthouse and the range light of smuggler wildfire at the entrance of cave were shown. On plates, the antique lighthouse ruins and cave were shown (Google Earth photos). The A-ship entered harbor at night by following smuggler navigation lights and sank after breaking left board on the reefs.

about sacred fund "*aerarium sanctum*" as "well-filled treasury left us by our ancestors." It could be opened only in case of emergency.

Let us note that aerarium (Greek, τὸ δημόσιον) is the Treasury Department, which was at Temple of Saturn. Aerarium was ruled by two *urban quaestors* under the control of Senate. In the republic era of Rome, the aerarium was divided into two parts: the state treasury ("*aerarium saturni*"), where regular taxes were stored and from what the sums, required for routine government spending, were taken, and sacred treasury ("*aerarium sanctum*"), which was opened only in the cases of an extreme danger "ad ultimos casus servabatur" [51] (XXVII, 10 and 11). Money in the sacred treasury was saved for storage and, therefore, it was necessary to have some space to keep it, so the fee, at least in later times, was to be paid in silver or gold coins or to be stored treasury in silver and gold bowls and jewelry.

Earlier, it was considered that both parts of the aerarium were in Temple of Saturn, but in different parts of the temple. However, the sacred treasury place in the Temple of Saturn has obviously not enough space for huge amount of *t* treasures that were taken along by the Romans in the eastern provinces.

Where was the sacred treasury ("aerarium sanctum") hidden? Let us return again to Cicero. So, Cicero wrote that Sicily rescued Rome in the hardest for him a minute, and replaced with itself this fund. Moreover, Cicero wrote about it in the expressions guiding us to the idea that in Verres's propraetor time (i.e., at 73–71 BC) this sacred treasury has not existed.

Thus, it is possible to assume that climate changes at *Gaius Marius*, in 87 BC or a little later at *Sulla* time, in 86 BC, created conditions for opening of the "aerarium sanctum." However, fund began to recover soon after the first victories over Mithridates. Cicero suggested that Dolabella and Verres in 81 BC started to replenish the fund, trying to steal sculptures in Delos and Samos. The elementary schemes of Ancient World rescue were illustrated in Figures 10(a) and 10(b).

Is it enough for you "to cross Rubicon" (see (h35) in the Appendix) to declare yourself a Savior of Rome and for you "aerarium sanctum" doors will be widely open? Was the famine at 49 BC so great that it was required to open an "aerarium sanctum"? These questions are not simple. After destruction of Academy in Athens, the period of the Pythagorean-Plato cosmology has actually ended; therefore, the climatic changes forecasting became inaccessible to Rome.

Where was the sacred treasury ("aerarium sanctum") hidden? The answer of this question could be in the following. At the time when Verres was a propraetor of Sicily, sacred treasury has been hidden in *Messana*; however, at the beginning of 70 BC, it was taken out from Sicily on the board of Verres's Ship. As known, the smugglers usually hide treasure on uninhabited islands, and then they keep them a secret. Nearby Italy coast nearby Rome, there were no many islands. Their names are Gorgona, Capraia, Elba, Pianosa, Montecristo, Giglio, and Giannutri (Tuscan archipelago) in Tyrrhenian Sea. One of them, Montecristo island, so it is possible to assume that adventure novel of Alexandre Dumas was based on the real events, which have occurred at the time of Cicero. Probably, that cave on Montecristo stores till now memory of captain Charidemus of Chios, Dolabella, Verres, Cicero, Julius Caesar, and Marcus Antonius and his wife Fulvia.

5. Conclusions

As it was written above, the main goal of this part of the paper is to answer the question: for what purpose has the Antikythera mechanism been created?

In this study, it is shown that the Antikythera mechanism was an integral part of a complex safety system of the Roman Republic (Empire). The Antikythera mechanisms were created to predict natural disasters, primarily the short-term climatic changes, which strongly decreased the yield of grain crops. The theoretical basis for Antikythera mechanism as the tool for the prediction of natural disasters was Pythagorean-Platonic cosmology. Previously, it was shown that the influence of the solar system planets is a short-term influence and it manifested itself at the alignment of planets.

The safety system evolution, which was used in Mediterranean in the settled agricultural empires, also was studied. In particular, it is shown that, in Ancient Greece (600–200 BC), more attention was paid to seismic safety. Therefore, the Greek safety system consisted of a forecasting system and the system of the seismic-acoustic stations located in immediate proximity from geological faults in caves or specially equipped premises under temples. The measurements on seismic-acoustic stations were carried out by specially trained *acousmatic* students (the term Pythagoras) and naiads/water nymphs (the term on Homer). The forecasting system was carried out using a hand astronomical calculator called Ananke spindle. The main center of these studies was at Pythagoras school in the Music Temple in Crotone, Southern

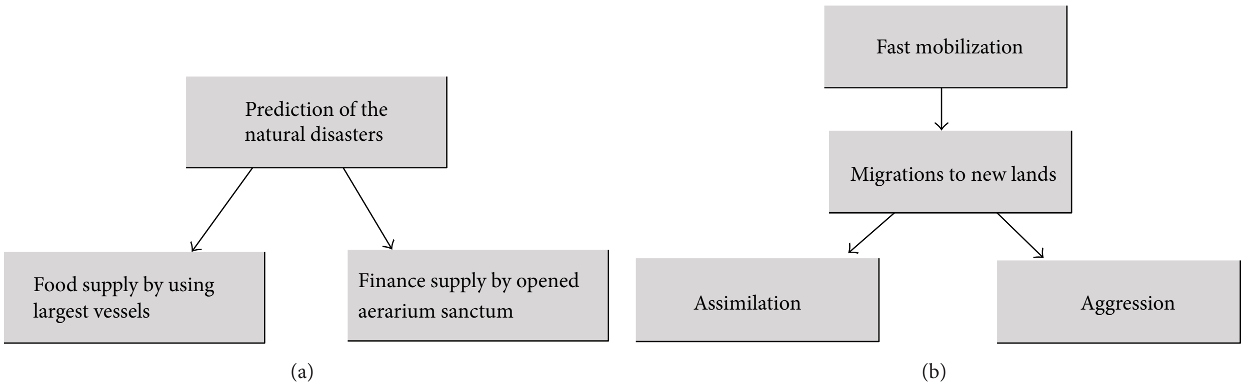


Figure 10: The two different major schemes of rescue in ancient world for settled empires (a) and nomadic (b) empires were given for comparison.

Italy. Later Philolaus and Eudoxus made an attempt to improve the hand astronomical calculators.

The version of the mechanical astronomical calculator, known as the Antikythera mechanism, was developed by Archimedes from Syracuse, Sicily. From Cicero, it is authentically known about existence of two more samples of these mechanisms. It is possible to assume that all the natural disaster forecasting centers in Mediterranean were using similar devices. Due to the decrease of seismic activity in the Mediterranean region and due to moving the center of political activity to Rome, the safety system was changed also.

In this study, it is shown that the Roman safety system consisted of Antikythera mechanism, large tonnage grain A-ship, and special financial fund. The grain ship provided a food safety, and the financial fund ("aerarium sanctum") helped to overcome consequences of natural disasters. Great Rome, having such rescue system, could dictate its rules to neighboring countries, also suffering from climatic disasters. As known, the aerarium sanctum could be opened only in case of emergency; however, after *Marcus Antonius* time, the principle of management of fund was changed and Rome was doomed. Destruction of Plato's Academy in Athens by Sulla, loss of skills of large vessel building, corruption, and misappropriation of sacred funds had led to safety system degradation. After each climatic cataclysm, Rome was not so strong as before. Thus, the question of Rome falling was only a question of repeatability of the climatic disasters.

Let us pay attention to a number of the minor results.

As shown above, the planetary calculator might be used for the chronology of the historical events as a backward prediction. This method can improve the accuracy of the radiocarbon dating and dendrochronology methods. In particular, a more precise dating of the most powerful Santorini volcanic eruption on Thera Island has been proposed. Also, in this study, it was shown that Ptolemy III Euergetes invaded Mesopotamia and laid siege to Babylon in 245 BC, not in 243 BC as what was assumed early.

On the basis of the hydroexplosive volcanic eruption and a tsunami description, given by Homer, the coordinates of the Sirens Island were also found. In the example of Sirens Island eruption, it was shown that the accuracy of the predictions that were made by Circe prophecy (Malta, approx. 1000 BC) exceeds the accuracy of current seismic methods.

Appendix

Here are brief historical information about personalities and comments

(h1) Pythagoras of Samos (ancient Greek: *Πυθαγόρας ὁ Σάμιος*, 570–490 BC): Ionian (Greek) philosopher, mathematician, mystic, and founder of the religious and philosophical schools called Pythagoreanism.

(h2) Plato (ancient Greek: *Πλάτων*, 428/427–348/347 BC, Athens): Greek philosopher, a student of Socrates, teacher of Aristotle, writer of philosophical dialogues, and founder of the Academy in Athens.

(h3) Thales of Miletus (ancient Greek: Θαλῆς ὁ Μιλήσιος, 640/624–548/545 BC): Greek philosopher and mathematician of Miletus (Asia Minor), the representative of the Ionic natural philosophy, and the founder of the Milesian (Ionian) school.

(h4) Aristotle (ancient Greek: *Ἀριστοτέλης*, 384–322 BC): ancient Greek philosopher, a student of Plato, from 343 BC, tutor of Alexander the Great, and the naturalist of the classical period.

(h5) Iamblichus (ancient Greek: *Ἰάμβλιχος*, 245/280–325/330 AD): Syrian neoplatonic philosopher, a student of Porphyry, and the head of the Syrian school of neoplatonism in Apamea.

(h6) Hipparchus/Hipparchos of Nicaea (ancient Greek: *Ἵππαρχος*, approx. 190–120 BC): Greek astronomer, geographer, and mathematician who compiled the first star catalog in Europe, including the absolute values of a thousand stars' coordinates (only one of his works (Commentary on Phenomenon, written by Aratus and Eudoxus) has reached us).

(h7) Marcus Tullius Cicero (106–43 BC): Roman politician and philosopher, consul, and orator.

(h8) Furies Phil Lucius (consul 136 BC): orator.

(h9) Gaius Sulpicius Gallus: astronomer, politician, and orator and consul of the Roman Republic with Mark Claudius Marcellus (see (h11) in the Appendix) in 166 BC.

(h10) Marcus Claudius Marcellus (grandson (see (h11) in the Appendix)) (about 209–148 BC): a well-known Roman military and political leader and three-time consul of the Roman Republic (166, 155, and 152 BC).

(h11) Marcus Claudius Marcellus (grandfather (see (h10) in the Appendix)) (270–208 BC): a famous Roman military and political leader and five-time consul of the Roman Republic (222, 215, 214, 210, and 208 BC). He led the siege of Syracuse that ended by taking the city. Afterwards he was charged for theft in Syracuse before the Senate and was acquitted by the Senate.

(h12) Archimedes (Ἀρχιμήδης; 287–212 BC): Greek mathematician, physicist, and engineer from Syracuse who laid the foundations of mechanics and hydrostatics, the author of a number of important inventions, and the creator of Antikythera mechanism, located in the *Temple of Virtue at Rome*. Archimedes was killed during assault of Syracuse.

(h13) *Temple of Honos and Virtus*, built by son Mark Claudius Marcellus (see (h11) in the Appendix), located behind the *Porta Capena* gates in the Servian Wall of Rome. Temple had two branches, the deity of Honor and Valor deity. Up to now, it has not survived.

(h14) Eudoxus of Cnidus (ancient Greek: Εὔδοξος, approx. 408/410–approx. 355/347 BC): Greek mathematician and astronomer. Student of Archytas of Tarentum and Plato. Planetary Eudoxus model consisted of 27 interconnected spheres (gears), revolving around the Earth (the theory of homocentric spheres). Knowledge of him is obtained from secondary sources, such as Aratus's (see (h16) in the Appendix) poem on astronomy.

(h15) Aratus of Soli (ancient Greek: Ἄρατος ὁ Σολεύς, about 315/310–240 BC): Greek poet. Aratus wrote the astronomical poem "Phenomena" (Φαινόμενα) and the poem "Diosemeia" (Διοσημεῖα). Aratus's "Phenomena" was based on the lost works of Eudoxus of Cnidus (see (h14) in the Appendix).

(h16) Four schemes of Antikythera mechanism:

(1) "The order of the planets, from the earth at the center, is Moon, Sun, Venus, Mercury, Mars, Jupiter, Saturn – an order retained by Eudoxus, Callippus, Aristotle, and even Eratosthenes." [7], p. 300.

(2) "Democritus was well informed in both mathematics and astronomy and wrote a whole book *περὶ τῶν πλανήτων*. His series of heavenly bodies, from the earth as a center, was Moon, Venus, Sun, planets, fixed stars; and the planets themselves were put at various distances from the earth." [7], p. 312.

(3) "The 'correct' one was, however, included in the system of Philolaus; for the sequence of the ten 'divine bodies' was, in the unanimous testimony of Aristotle and the doxographers, central fire, counter-earth, Earth, Moon, Sun, five planets, heaven of the fixed stars. If we consider only theportion between earth and heaven, this is the order accepted by Eudoxus, Plato, and Aristotle." [7], p. 313.

(4) "At the same time, the effort continues to attribute to the Pythagoreans before Plato, and even before Philolaus, a different, geocentric planetary system which became dominant in the later Hellenistic period. In this, the sun is in the middle of the seven planets, flanked on each side by three of them—Venus, Mercury, and the moon in the direction of the central earth, and Mars, Jupiter, and Saturn in the direction of the heaven of the fixed stars. This arrangement of the planets attained a canonical position in astrology, and still determines the order of the days of the week. It cannot be documented earlier than Archimedes." [7], p. 318.

(h17) Lucius Cornelius Sulla (Felix) (138–78 BC): Roman statesman and military leader, consul in 88 and 80 BC, dictator in the period of 82–79 BC, and author of bloody proscriptions. Sulla was the first Roman who captured Rome.

(h18) Mithridates/Mithradates VI (ancient Greek: *Μιθραδάτης*, 134 BC–63 BC): king of Pontus and Armenia Minor in northern Anatolia at 121–63 BC.

(h19) Diogenes Laertius (ancient Greek: *Διογένης ὁ Λαέρτιος*): late ancient historian of of the Greek philosophers. Nothing is known about personality. He supposedly lived at the end of II AD, at the beginning of III AD.

(h20) Homer (ancient Greek: Ὅμηρος): a legendary ancient Greek poet. The author of "*Iliad*" and "*Odyssey.*" According to Herodotus, Homer lived 400 years before him, which would place him at around VIII BC.

(h21) Porphyry of Tyre (ancient Greek: Πορφύριος, real name Malchus or Melech) (approx. 232/233–304/306 AD): neoplatonic philosopher, music theorist, astrologer, and mathematician.

(h22) Philolaus of Tarentum (ancient Greek: Φιλόλαος, approx. 470–approx. 385 BC): philosopher, Greek Pythagorean, mathematician, student of Pythagoras, a contemporary of Socrates and Democritus and the author of one of the versions of the spindle Ananke (see also Discussion) (see (h16) in the Appendix). Philolaus essay "On Nature" has survived only in fragments.

(h23) Geminus of Rhodes (ancient Greek: Γεμῖνος ὁ Ῥόδιος, I century BC): Greek mathematician and astronomer. Nothing is known about life of Geminus. An astronomy work of his, the "Introduction to the Phenomena," still survives.

(h24) Theon of Smyrna (ancient Greek: Θέωνος ὁ Σμυρναῖος, 1st half of the II AD): Greek philosopher (neopythagorean), mathematician, music theorist, and the author of "*On Mathematics Useful for the Understanding of Plato*."

(h25) Cleomedes (ancient Greek: Κλεομήδης, sometime between the mid-1st century BC and 400 AD): Greek astronomer and Stoic philosopher. The only one work of Cleomedes known now is "On the Circular Motions of the Celestial Bodies."

(h26) Let us note that only location of a group of Surtseyan eruption volcanoes (hydrovolcanoes in shallow-water) in the Mediterranean has been known. These volcanoes which in the case of eruption lead to massive explosions and bursts of steam and generate tsunamis occur between Sicily and the African continent. Location is indicated in Figure 2 as a green triangle.

(h27) Due to the large distance from Great Pyramid of Cheops to tectonic breaks in Red sea, Great Pyramid could not be used according to the destination (for burial of Pharaohs). For more details about pyramids, Chaldean astronomy and astrology, and Jews coming out of Egypt, one should look into Middle East history publications.

(h28) Hiero II (ancient Greek: Ἱέρων Β′; c. 308 BC–215 BC): the Greek Sicilian king of Syracuse from 270 to 215 BC.

(h29) Ptolemy III Euergetes (ancient Greek: Πτολεμαῖος Εὐεργέτης, Ptolemaĩos Euergétēs): the third king of the Ptolemaic dynasty in Egypt who reigned in 246–222 BC.

(h30) Archidamus III (ancient Greek: Ἀρχίδαμος Γ′): king of Sparta from 360 BC to 338 BC.

(h31) Gaius Licinius Verres (~114 B.C.–43 BC): Roman politician who was a supporter of Gaius Marius but after 83-82 BC became a supporter of Sulla (Lucius Cornelius Sulla Felix); a *quaestor* at consul *Gnaeus Papirius Carbo III* in 82 BC; a *legate* in Asia at consul *Gnaeus Cornelius Dolabella* in 81 BC; a *praetor urbanus in Rome* in 74 BC; and a *propraetor* of Sicily in 73–71 BC. Verres was suspected of numerous abuse and extortion and ultimately he appeared before court. Cicero was a prosecutor at the court. Considering that the cognizance in court was lost, before the end of the process, Verres voluntarily went into exile.

(h32) The ancient unit for dry measures: modius (Roman) = 8.73 litres, medimnos (Greek) = 52.5 litres. Thus, one medimni is equal to 6 modii.

(h33) The ancient Greek and Roman monetary system: The Sestertius (lat. *sestertius*) was a small silver coin valued at one-quarter of a Denarius (lat. *dēnārius*). A silver Denarius was supposed to weigh about 4.5 grams. In practice, the coins were usually underweight. The tetradrachm (ancient Greek: Τετράδραχμον) was an ancient Greek silver coin, with weight of 15.5 grams in Rhodes or Phoenician-monetary system or weight of 17 grams in Attic, Greek monetary system. Because the Roman denarii were usually underweight, in practice Rhodes tetradrachm exchanged for three Roman denarii.

(h34) Velia located at 40.161°N, 15.155°E was a Greeks' ancient city Hyele (Ancient Greek: Ὑέλη) on the coast of the Tyrrhenian Sea, Italy, which was founded around 538–535 BC. The name later was changed to Ele and then Elea (Ancient Greek: Ἐλέα) before it became known as Velia (current Italian name).

(h35) The expression of "Cross Rubicon" is not translated wordplay. From one side, the Rubicon is a river at the boundary between the Cisalpine Gaul province and Italy. From the other side, as known, the sacred treasury ("aerarium sanctum") seems to have been first established soon after the capture of Rome by the Gauls, in order that the state might always have money in the treasury to meet the danger which was ever most dreaded by the Romans—a war with the Gauls (see Appian, The Civil War (II, 41)).

Competing Interests

The author declares that they have no competing interests.

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