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STEPHANOS A. PAIPETIS
Professor Emeritus, University of Patras

B4.6 Astronomical Phenomena and the Dating of Odysseus Return

Papamarinopoulos S. ([1]), Preka-Papadema P. ([2]), Antonopoulos P. ([3]), Mitropetrou H. ([1]), Mitropetros P. ([1])
([1])University of Patras, ([2])University of Athens, ([3])InterMedia KT - Interactive Media Knowledge Transfer, Patras, Greece

A solar eclipse, the planet Venus' appearance in the east horizon early in the morning, and the simultaneous occurrence of the '*late setting*' Bootes and Pleiades in the night sky, referred in the Odyssey, helped us to date Odysseus' return to Ithaca. We combined these astronomical phenomena with the excellent Homeric seasonal description of '*long lasting nights*', the agriculture and bucolic scenes etc., which apparently indicate autumn. The time span of 1300-1130 BC, the period associated with the Trojan War's chronology according to the archaeologists and the ancient Greek writers, was taken into account. Based on the NASA's eclipses catalogue and in combination with the software Starry Night's results, we conclude that the solar eclipse of the 30th October 1207 BC, observable during late noon in the Ionian Islands, with a significant solar disc obscuration of 75% is the solar eclipse mentioned by Homer. Odysseus, returned to Ithaca five days before this date, early in the morning. The suitors' killing occurred under the solar eclipse's conditions according to the Homeric text: '*the sun has perished out of heaven and an evil mist covered all*'.

1. Introduction

During prehistoric and historic times many celestial phenomena were attributed to the gods as good or bad omens. It is known that the observation of the sky in ancient times was essential for setting up a calendar, for the determination of seasons, in connection with agricultural, animal breeding and navigation necessities. As Odysseus is sailing toward Ithaca he observes the night sky. The constellations Ursa Major, Orion, Bootes and Pleiades are present (Od. 5.270-277). But when he arrives in Ithaca it is already dawn. The planet Venus is located in the east and it is clearly visible before sunrise (Od.13.93-95).

In this sense, the Odyssey conceals another astronomical phenomenon noted by Heraclitus of Pontus (1st century AD) in his work Allegories (75, 1, 1-9, 3). It concerns the description of the suitors' killing from the seer Theoclymenus, sometime before it happens (Od. 20.356-357). So between blood and lamentations, it is declared that '*and the sun has perished out of heaven and an evil mist covers all*'. The loss of sunlight accompanied with mist is the precise description of a *partial solar eclipse*, because in the case of a total solar eclipse there is deep darkness for a few minutes. Heraclitus points out two pieces of information. The first is the symbolism of the name of the

seer, Theoclymenus, which means '*the one that 'hears' the divine*'. He is the one who recognizes the astronomical phenomenon behind theology. The second is that he recognized a New Moon in the phase of the full moon. The latter is as a prerequisite for a solar eclipse. It is clearly stated in the Homeric text ("*between the waning of this moon and the waxing of the next*", Od.19.306-307). Indeed, a solar eclipse occurs only when the Moon is located in complete alignment between the Sun and Earth, so the apparent diameter of the lunar disk is inserted and covers the apparent diameter of the solar disc, as seen by a ground observer located in the area in which the Moon's shadow falls.

Schoch (1926)[2] and Baikouzis and Magnasco (2008)[3] (based on Schoch's work) suggested that this eclipse was the total solar eclipse of April 16, 1178 BC which was visible on the Ionian Islands. Schoch did not explain the reasons for his choice. Baikouzis and Magnasco based on an *arbitrary assumption of Mercury's retrograde motion*, identifying the Homeric god Hermes with the planet Mercury. They proposed that the journey of god Hermes to Ogygia indicates the planet's Mercury retrograde motion that lasts only for one day. In reality it is known that this phenomenon, in connection with planet Mercury, lasts for several days and happens about three times per, year. It is not an extraordinary astronomical phenomenon. Following the Homeric text the reader can recognize that the god Hermes arrived to Ogygia by *sea*, making an arduous journey of several days (Od.5.43-55, Od.5.97-102).

After all these observations, we decided to look for the right solar eclipse using the Starry Night software and the NASA's catalogs of eclipses (Espenac and Meeus, 2006) [4], which covers the period from 4500 BC to 10000 AD.

2. Odysseus' autumnal return and the suitors' 'afternoon' killing

By reading the Homeric text very carefully, it becomes quite clear that Odysseus returned in the autumn and not in the spring. Therefore, the date proposed, by others of April 16, 1178 BC does not make any sense. The text describes cold, rain, strong wind, lighting fires to produce heat for people's warming and the use of thick blankets (e.g. Od.14.467-479, Od.14.518-522, Od.14.529-533, Od.17.23-25, Od. 1 7.190-191). The fruit which are mentioned are all autumn fruit (pears, pomegranates, figs, apples, grape vines full of grapes (e.g. Od. 5.68-68, Od.5.72-73, Od.7.114-116, Od.24.340-344) and many fallen leaves (Od.5.480-487). Detailed description of all of these details is given by Papamarinopoulos et al (2012) [5]. Also Odysseus' father, Laertes, winters in the palace but in the summer and in the autumn remains in his estate, where he meets Odysseus (Od. 24). Consequently summer is a season not consistent with the previous descriptions. Therefore, the meeting between Odysseus and Laertis took place in the autumn. Winter is excluded too as herds are still outdoors (Od. 24.407-408, Od. 15.397, Od. 17.170-171).

In addition to all these, the nights marked as "*athesfatoi*" (*αθέσφατοι*) meaning that they have long duration (Od. 15.391-394). This clearly indicates that Odysseus' return occurred after the autumnal equinox, because then the nights become longer. Due to the phenomenon of the precession of the equinoxes, the autumnal equinox of the 12th -13th century BC was shifted to 4th of October.

Finally, the Pleiades and Bootes, whose stars are observed overnight in the sky by Odysseus during his return journey (Od. 5.270-277) are simultaneously appearing in the night sky, at latitudes of the Mediterranean Sea (inside or outside it) only in Spring and Autumn. Spring is rejected, by us, for all of the above. Specifically, Odysseus travels exactly as described in the verses:

> *"He never closed his eyes, but kept them fixed on the Pleiades, on late-setting Bootes, and on the Bear - which men also call the Wain, and which turns round and round where it is, facing Orion, and alone never dipping into the stream of Oceanus- for Calypso had told him to keep this to his left."*

Obviously the Bear (also called Wain) is the Ursa Major/Big Bear, according to Aratos ("Phaenomena and Diosemeia", 6.26-44) which was utilized in order North to be defined. Thus, Odysseus was traveling from west to east. Homer gives the information of the circumpolar star stating that the Bear *does not bathe in the Ocean waters*, meaning 'Celestial Ocean' as it was perceived by ancient peoples round the globe. Orion, the celestial hunter, is a well distinct constellation beneath the constellation of Taurus.

The constellation of Bootes contains one of the brightest and most famous stars in the sky, Arcturus, which is behind the Bear-Wain. Arcturus is the 'guardian' of the Bear and Bootes (oxes' driver) is the guide of the seven stars-oxen of wain (oxcart). The Pleiades, a striking open star cluster in the constellation of Taurus, is visible *throughout the night*, in *the autumn* sky, moving from east to west. Instead, in springtime, they set a few hours after the sunset.

Accordingly, the nights of the characterized "*οψέ δύοντα*" Bootes are autumnal according to Aratos ('Phenomena and Diosimeia' 6.579-585). Also Papamarinopoulos et al. (2012)[5] pointed out that in the autumn, the constellation of Bootes is located west, moving from northwest to northeast, while two of its stars (β Bootis and γ Bootis), *at that time in remote antiquity*, remained marginally over the horizon. In this way, Odysseus observes throughout *the night*, the *Pleiades* and *Bootes on the autumn*.

The prophecy of the seer Theoclymenus is done during the lunch of the suitors, while Odysseus battle against the suitors starts a little bit later and finishes before the evening meal, called 'δόρπον:dorpon' (Od. 20.248-259, Od. 20.345-394, Od. 21.68-79, Od. 21.428-429). That means during *late* noon, "*as there is light yet*" as highlighted. Therefore, the solar eclipse should have occurred at midday since the sunlight's loss was visible. The latter is connected (by the prophecy) with the suitors' killing.

3. Search and identification of the eclipse

According to the archaeologists, the Homeric Troy match layers VI and/or VII and their substrates, dating from various excavators, based on the study of ceramics, from 1300 to 1180 BC. The excavators of Troy do not agree on a common date and suggest VIh or VIIa substrates as the Homeric Troy without necessarily accepting the historicity of the Trojan War.

The ancient Greek writers (see Table 1, Papamarinopoulos et al, 2012[5]) also place the fall of Troy in about the same time frame. Therefore the search for the solar eclipse must be done in the time frame from 1300 BC to 1130 BC when the Mycenaean centers no longer exist.

The eclipse cycle called Saros is well known (18 years and 11 days), i.e. the repetition of the same series of eclipses with the same geometry. This means that we can predict the future eclipses. NASA provides all this information (http://eclipse.gsfc.nasa.gov) with algorithms developed by Espenak and Meeus (2006) [4].

Author	layer	Years BC
W. Dörpfeld	Troy VI	ca. 1250 but after Kadesh's battle
C. Blegen	Troy VIIa	1270-1240
G. Mylonas	Troy VIIa	ca 1200
V.R.d'Desborough	Troy VIIa	1230-1250
C. Nylander	Troy VI	No historic Trojan War
M. Finley	-	No historic Trojan War
M. Wood	Troy VI	1250-1260
S. Hiller	Troy VIh Troy VIIa	Middle 13th century End 13th /beginning 12th century
S. Hood	Troy VII b2	10th century
P. Mountjoy	- -	ca. 1210 for VIIa ca 1300 for VIh
M. Korfmann	Troy VI/VIIa	1200- 1180

Table 1: *Archaeologists' and historians' dating on the Homeric Troy* (*Papamarinopoulos et al* (2012)[5])

According to the catalog, 64 solar eclipses (total, partial and annular) visible in the Ionian Islands took place within this time frame. But if we limit ourselves to the autumn, the eclipses are reduced to 14. Taking into account in addition the information that Venus was visible in the east *before* sunrise, five days before the eclipse, during the arrival of Odysseus, we reviewed these 14 dates using the appropriate software (Starry Night) in order to ensure this requirement. Eventually the candidate eclipses were limited to 5 (Papamarinopoulos et al, 2012[5]). Three of them were not detectable as the coverage of the solar disk was minimal (<2%) or the phenomenon occurred after sunset and the fourth happened during early morning hours (~8 am), which is inconsistent with the lunch hour of the suitors killing. Therefore, only one solar eclipse remains that meets all Homeric standards and this is the partial solar eclipse of October 30, 1207 BC having maximum disk coverage of 75%. The phenomenon is progressing through the afternoon (14.31-17.23 LT) and peaks at 16.03 LT (Fig.1). Right after the end of the phenomenon (and the suitors' killing), the Sun set (17.58 LT) and the maids brought

the light, as stated in the Homeric text (Od. 22.497). The "*evil mist*" of the Homeric text and not the total darkness, is the natural consequence of the partial solar eclipse with 75% coverage.

Moreover, a few days earlier, in the previous *full moon* on October 15 at dawn, a partial lunar eclipse took place (52% disc coverage at 5.30 LT), visible across the Mediterranean Sea, based in NASA's catalog and Starry Night's software (Fig. 2). The moon was close to Pleiades and was setting *under the eclipse* as the Sun rose (6.08 LT). For a person familiar with astronomy, as seer Theoclymenus was, this phenomenon (*lunar eclipse*) was the forerunner of the *solar eclipse* that occurred after a few days. We remind the reader that the *lunar eclipse* occurs always in the *full moon phase*. *Then* the Sun, the Earth and the Moon are in a complete alignment with the Earth standing between. The shadow of the Earth falls on the Moon giving it reddish darkening ("*blood moon*").

Fig. 1. The celestial dome over Ithaca on October 30, 1207 BC, at 4 pm. The Solar Eclipse (Sun and Moon) takes place close to the constellation Scorpius, next to the red star Antares. Almost all planets within an angular aperture of 75 degrees are presented.

Fig. 2. A partial lunar eclipse with its disk with 52% coverage is shown. It occurred in October 15, 1207 BC and was visible in the Ionian Islands. The eclipse started at 4.16 LT, when the moon was 21 degrees above the western horizon. Maximum coverage of the lunar disc was on 5.30LT, when the Moon was at just 7.6 degrees above the western horizon, while the sun rose in 6.08LT. The 'blood moon', which was visible near the Pleiades star cluster (Taurus) was in fact in its full moon phase (Od.19.306-307). This absolute astronomical necessity preceded of the partial solar eclipse, shown in Fig.1, was described clearly by Homer in its correct sequence.

4. Attributing astronomical phenomena to divinity

According to the beliefs of that era, astronomical phenomena should be attributed to a deity, in this case to goddess Athena. She appears as Mentor (Od. 22.205-206) and then she is 'transformed' into a flying swallow toward the palace's roof (Od. 22.239-240), while the suitors did not realize this transformation (Od. 22.249). The swallow that sat on the roof is the portent of imminent death (Stageiritis, Ogygia, a, 191) [1]. Simultaneously however, one could link the forked tail of the swallow and the black-white color, with the partial solar eclipse (Fig. 3). It is a Homeric mimesis of the phenomenon. The suitors did not realize it as they were located in the loft and the vestibule of the palace, with closed doors and windows.

As the battle progresses, the suitors are trying to push back Odysseus from the brink of the palace (Od. 22.250) and go out in the yard. As the suitors attempt to push back Odysseus, being in the yard, then they see the sky, perceive Athena as she shows her aegis "*on the roof*" (Od. 22.297-298) and get panicked (Od. 22.299, Od. 22.307). In fact what they might have seen is the 75% dark solar disk and the glare from the remaining part. It is the solar eclipse that is progressing between 20 to 30 degrees altitude above the western horizon. The divination of the natural phenomenon via the presence of Athena is on. Upon returning back to the loft, the "mnistirofonia" (suitors' killing) is committed (Od. 22.299-309).

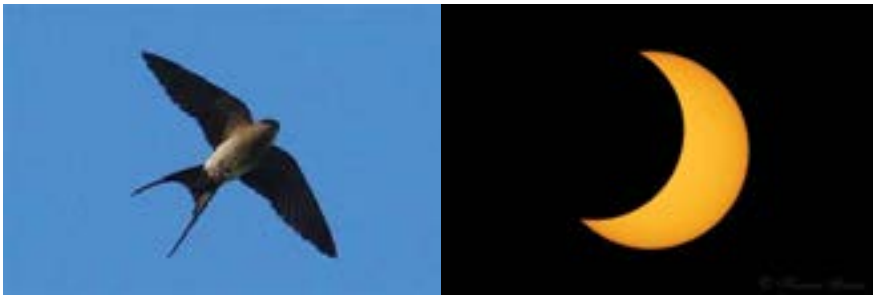

Fig. 3. A solar eclipse with 57% obscuration displayed in parallel with the forked tail of a swallow. (*From the archive of Dr. K. Gazeas, University of Athens*).

So actually in the words of seer Theoclymenus underlies the "physical science" i.e. the solar eclipse expressed by "myth and theology" via the presence of the goddess Athena. We remind the reader what the Delphic priest Plutarch said once: «*The old physical science for both Greeks and Barbarians is natural logos* (*logos in antiquity, in Plato's time, meant fact*) *hidden deeply within myths and occult and mystical theology, expressed mostly with enigmatic words and innuendo*", Plutarch (Fragmenta 157). Athanasios Stageiritis in his work "Ogygia or archaeology" [1] writes that historical myths are the stories about gods, heroes and other ancient symbols connected with myth. He notes that if we remove all the mythical data, true history remains such as the Trojan War for instance. Persons and places are mentioned in these myths that continue to have the same name as also other facts that confirm the validity of the story. What is lacking is the precision of time before the Trojan events. "And if it were possible for that to be found also, then mythology will receive the shape of regular history by the kingdom of Heaven."*And urges "these rules need to be guarded and observed if we want to clean ancient history or mythology as we call it*".

5. Conclusions

In antiquity, people believed that eclipses had a "negative impact" as recorded later on by another poet, Pindar (9th Paean, *Thivaiois in Ismenion* excerpt 52 k, 1-23). "*Civil war*" included as in the case of "mnistirofonia" (suitors' killing).

As it was natural at remote that time, the return of the King of Ithaca, Odysseus, and the extermination of all the pretenders to his throne was associated with the simultaneous occurrence of a solar eclipse, visible from the Ionian Islands. Moreover, this eclipse occurred on the day of the great celebration of Apollo, who was a solar deity (Od. 20.144-159, Od. 20.276-278). Also, a few days earlier, at sunrise, a lunar eclipse was preceded as "blood moon".

Such a serious event ("mnistirofonia", suitors' killing) framed by a "*divine intervention*" observed as a solar eclipse, surely spread throughout the country and the folk muse afterwards transformed it into a song.

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