The Early Hellenic Sky Map reconstructed from Archæoastronomical and Textual Studies

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Abstract

It has earlier been shown that the walls on the hills of Petsophas and Traostalos in eastern Crete were oriented towards the positions of certain heavenly bodies. That conclusion resulted in a new interpretation of the finds from those hilltops: almost all terracotta finds could be explained as having an astronomical significance. However, some constellations, which are important for the modern sky map, are not represented amongst the finds from the hilltops. Ursa Major, in particular, is missing. The early Hellenic texts and popular traditions regarding the northern constellations have therefore been studied. This study is presented here and it is shown that the early Hellēnes saw the constellations around the northern celestial pole in the same way as other European cultures. An archæological evaluation of orientations has thus resulted in a new understanding of some terracotta figurines and also of the early Hellenic constellations.

KEY WORDS: Ancient Hellenic Ouranography, Sky Maps, Northern Constellations, Ursa Major, Ursa Minor, Bootes, Arcturus, Bronze Age, Aegean Sea, Crete, Petsophas, Traostalos, Terracotta Figurines, Literary Sources, Sanctuaries.

I. Introduction: Background

For some years now a team from Uppsala University has studied some Minoan buildings and their orientations. This team has shown that many peak sanctuaries, palaces, and villas were orientated towards major celestial events, e.g.: Sunrise/ Sunset at the Equinoxes and Solstices. At the peak sanctuaries on the hilltops of Petsophas and Traostalos it has also been shown that two walls are directed towards the heliacal rising and setting of the bright star Arcturus, a very useful star for keeping a calendar and for navigation [HENRIKSSON & BLOMBERG, 1996; HENRIKSSON & BLOMBERG, 1997-98; BLOMBERG & HENRIKSSON, 1999; BLOMBERG & HENRIKSSON, 2000].

The previous authors have also analysed the text by Aratos and have shown that part of the astronomical information given in his *Phainomena* pertains more correctly to the Middle Minoan Period (c. 2000-1650 BCE) than for his own time (c. 275 BCE). Aratos' text follows closely that of the astronomer Eudoxos [c. 395-342/1 BCE; LASSERRE, 1966: 139] and several independent studies of these texts show that both Eudoxos and Aratos based their information on older positions that seem to have been transmitted from c. 2000 BCE to their time. See the Appendix for a summary of these studies.

As part of the work of the Uppsala team, a study of the small terracotta finds from the two peak sanctuaries and an attempt for reconstructing the early Hellenic sky map based on textual evidence have been attempted.

II. Terracotta Figurines from Petsophas & Traostalos

Petsophas was first excavated early during the previous century [MYRES, 1902-03]; Traostalos was excavated on two occasions in the 1970s and then recently in the 1990's [RUTKOWSKI, 1991; DAVARAS, 1972a; DAVARAS, 1972b; DAVARAS, 1978; DAVARAS, 1981; DAVARAS, 1984]. The identification of both sites as Minoan peak sanctuaries and the dating of them to the periods MM I–LM I (c. 2000-1600 BCE) is generally accepted. That was the time when the Minoan culture was at its peak. There is no evidence for any activity at the two sites during LM II–III.

Both places lie close to the Mediterranean shore and there is clear evidence in the archæological record that the Minoans in the area had contact with other people to the East and Southeast, e.g.: the Egyptians. There is an unobstructed view of the horizon from the Northwest over the East to about Southeast from both sites. Mary Blomberg and Göran Henriksson [see previous references] have already presented the orientations of the two sites and proposed that they were used for observing celestial events in order to keep a calendar and to be able to navigate with the help of various stars.

On these hilltops a large number of small terracotta figurines have been found. More than 2000 between them have been recorded: mostly animals, small human figurines and human anatomical members. There were also two small structures.

The prevailing interpretation of these finds is that they are votive offerings used in at least three cults: (i) a healing cult, motivated by the anatomical parts; (ii) a farmers' fertility cult, represented by the animals; and (iii) some kind of cult to one or more celestial bodies, such as the Moon and Orion [MACGILLIVRAY, 2000] represented by the human figurines. It has earlier been shown that these ideas cannot explain all of the finds, nor does it seem logical that the small structures on these peaks should have housed several rather different cults [BLOMBERG, P., 1999; BLOMBERG, P., 2002].

In order to understand these sites we must also take into consideration that some of the walls of the peak sanctuaries do not meet in right angles, but in rather specific angles, correct for pointing out the direction for e.g.: the rising and setting of the important star Arcturus, the brightest star in the constellation Boötes [HENRIKSSON & BLOMBERG, 1996].

It has already been argued that the figurines represent the heavenly bodies, especially constellations or parts thereof as described by Aratos and also in Egyptian texts on coffin lids [BLOMBERG, P., 2002; NEUGEBAUER & PARKER, 1960: 1-32]. But we also find figurines that seem to represent comets, & c. [RUTKOWSKI, 1991, e.g.: HM 4855].

The fact that almost all (~ 99%) of the figurines can be explained as representing heavenly bodies, that the walls are directed towards celestial events and that there existed a tradition in the Hellenic area regarding the positions of the stars from Minoan times down to Hellenistic times, indicate that the Minoans had a competent knowledge of

what we call Astronomy, and that we can conclude that the figurines found on Petsophas and Traostalos represent constellations and other heavenly bodies. This Minoan «sky map» is (*mutatis mutandis*) very like our modern map of the sky. They had already defined most constellations. There seems to have been an exchange of ideas around the Eastern Mediterranean, although not a regular transfer of knowledge, as the Minoan asterisms differ partly from those in the East. However, there are some areas in the sky that are not clearly understood; so-me important modern constellations are missing and some figurines seem to represent constellations that we do not use today. As an example we can take the sheep. We have no constellation *Sheep*, but it was a constellation in areas around the eastern Mediterranean in the Bronze Age [LOCHER, 1981; LOCHER, 1993]. Unexplained in the first analysis of the figurines are the bulls. There are quite a number of bulls, mostly complete animals, in a standard size of 5-6 cm, but there are some large ones as well. There is no front part of a bull, like our constellation Taurus and no figurine that can be identified as a cow.

III. An Unexplained Problem in Hellenic Astronomy

A major problem in understanding early Hellenic Astronomy concerns the circumpolar stars, i.e. those stars that never set below the horizon and are close to the North Celestial Pole. The main modern constellation in this area is *Ursa Major*, in Hellenic *ἡ Ἄρκτος*, the Bear. The oldest text that contains this name is met in Homēros' *Odyssey*. Odysseus was instructed by Calypsō to keep *Ἄρκτος* on his left when he sailed to the land of the Phæacians [*Odyssea*, **V**: 281]. While sailing he also watched the *Pleiades*, the late–setting *Boōtes* and *Ōriōn*. Homēros notes that the *Bear* was also called the *Wagon*, *Ἅμαξα* in Hellenic. The *Bear* is said to circle or rotate where it is. Homēros also mentions some other constellations with the comment that the *Bear* is the only one that does not go down below the horizon, thus it is circumpolar [*Od.*, **V**: 270-76]. Consequently, from the Hellenic name we obtained our Latin translation *Ursa*[1], which we use for two constellations, *Ursa Major* and *Ursa Minor*. However, Homēros does not mention *Ursa Minor*, he uses *ἡ Ἄρκτος* in the singular.

The alternative name, the *Wagon* or *ἡ Ἅμαξα*, designates a four–wheeled vehicle usually drawn by oxen. It is clear from these early texts that it would be the correct word for a wagon pulled by one or several oxen. Both names for the constellation, *Ἅμαξα* and *Ἄρκτος*, are feminine and only used in the singular by the early authors such as Homēros. However later on, by e.g.: Aratos and Nonnos [see ***XLVII***: 251], they are also used in the plural and thus designate two distinct constellations, namely *Ursa Major* and *Ursa Minor* [see ARATOS, 27]. Close to these two constellations we have *Boötes*, the *Ox Driver*, some times translated as the *Ploughman*. On our modern star map, however, he has no oxen to drive. *Boötes* is used from the beginning of Hellenic literature, but later on, e.g.: by Eudoxos and Aratos, he is also called *Ἀρκτοφύλαξ*, translated as the *Bear Watcher/Guard* [ARATOS, 92]. Close to the pole, between *Ursa Major* and *Ursa Minor*, we have *Draco*, a constellation that appears under the name *Δράκων*, but it is not mentioned in the Hellenic texts until after 500 BCE so it is left out of the present discussion.

The major problem we face is: understanding what Homēros meant with *Ἄρκτος*, and —if it is the same as our *Big Dipper*— why he did not recognize *Ursa Minor* as a separate constellation? The second problem is why should the constellation be named the *Bear*? As many scholars have pointed out, it does not look like a bear [ALLEN, 1963: 423]. The name of the nearby constellation, *Boötes* the *Ox–Driver*, is also strange as it is close to the *Bear* but far away from *Taurus*.

We do not find any bear amongst the figurines from Petsophas neither from Traostalos, and bears seem not to have lived in Crete. The early constellations were normally given names after well–known animals and/or objects of the daily life such as bull, raven, marten, crater, & c. There are several such constellations and this explanation regarding their names is presented in most publications on early constellations. Thus, it is difficult to understand why the early Hellenic people would name a constellation *Bear*.

We meet two names for the same northern constellation in the early texts: the *Bear* (*ἡ Ἄρκτος*) and the *Wagon* (*ἡ Ἅμαξα*). The oldest texts do not mention *Ursa Minor*, and there seems to have been only one constellation *Bear*. Many scholars have commented upon this and have said that Homēros did not know the constellation called *Ursa Minor*, as he did not mention it [MARTIN, 1998: comment to l. 27]. The background is that Homēros mentions several constellations including *Ἄρκτος*, and then says that she is the only constellation that does not go down below the horizon and that she rotates. This can of course mean that *Ἄρκτος* was the only one amongst the constellations mentioned that does not go down into the ocean, but it may also mean that it was the only then identified constellation that was circumpolar. The idea prevailing during the 20th century was that *Ursa Major* was the only identified circumpolar constellation of the Hellēnes at the time of Homēros. The constellation *Ursa Minor* is not mentioned in astronomical texts before Thalēs (6th century BCE) who is said to have introduced it to facilitate navigation [SCHERER, 1953: 176]. Aratos said that the ancient Hellēnes sailed using *Ursa Major*, while the Phœnicians navigated using *Ursa Minor* [ARATOS, 37-39]. It is not known when the Minoans and the Phœnicians began sailing, but they sailed in the Mediterranean well before Mycenæan times. However, as both the early Hellēnes and the Phœnicians are said to have used different constellations for navigation, the ancient Hellēnes seem not to have learned about the heavenly bodies from neither Phœnicians nor Babylonians —the general opinion in the literature [ALLEN, 1963: 16-20]— as *Ursa Minor* is a better constellation for determining North [KIDD, 1997: 180ff].

Kidd, in his comments to Aratos, says that *Κυνόσουρα* (< *κυνὸς οὐρά* = *dog's tail*) must have been the original Hellenic name for *Ursa Minor*, but does not discuss its age nor why he says so [KIDD, 1997: 188]. This name is not

[1] **Editors Note:** For the history of Ursa Major, see also LE BOEUFLE, A..: «Histoire de la Grande Ourse, ou les métamorphoses d'une constellation», *Vita Latina*, **100**, Avignon (Aubanel) 1985, 15-20; KRUPP, E.C.: «The Dipper in Disguise», *Griffith Observer*, **51**[12], 1987, 3-18.

mentioned in the texts before Aratos. Eudoxos and Thalēs used the term *Ἄρκτος Μικρά*, which indicates that *Κυνόσουρα* could not have been the old name [EUDOXOS, fragm. 1: 13].

IV. The Enigma *Ἄρκτος*

The name *Bear* bears a problem. It comes from the Hellenic texts on Astronomy and navigation [cf. *Od.*, **V**, 270-76]. It is in them that we for the first time meet this name referring to a constellation.

There are no constellations called *Bear* anywhere in Europe, nor in the Near East. Many scholars have suggested several backgrounds for the name. The Latin *Ursa* can be explained simply as the translation from the Hellenic, but why the Hellēnes chose *Ἄρκτος* remains a mystery. No European popular tradition has a word meaning bear for a constellation. In Sweden the popular name is *Karlavagnen*, i.e. Charles' Wagon, and almost all European people have a celestial Wagon or some specific wagon. Many cultures have also oxen that pull the wagon. There are cultures that consider the seven stars of the *Big Dipper* just as seven stars or even seven oxen, like the Romans [ROSCHER, 1909-15, sp. 873]. In Babylonia there seems to have been a wagon and oxen [ROSCHER, 1909-15, s.v. *Sterne*, sp. 1489]. Our old childhood friend, Jakob Grimm, who was also a great scholar in folklore, clearly states that *Bear* as name for a constellation was not used in any old German texts and it is not found in Slavic, Lithuanian nor in Finnish [GRIMM, 1854: 687ff]. The same opinion is found in the many articles by René Basset, who during the years 1886-1905 published a number of notes in the *Revue des traditions Populaires* on popular names for different constellations, almost one note in each volume. Even in Basque, where the myth of the sky bear is strong, he finds that *Ursa Major* is represented as two oxen, led by a boy, pulling a wagon [BASSET, 1902: 342]. It is clear that there was no asterism *Bear* amongst the European people, not even where the animal bear had a sacred position.

The most common suggestion during the 20th century has been that the name is a misunderstanding of an eastern name for *Ursa Major*. Two possibilities have been given. According to the first, it comes from the old Indian name meaning *radiant*. That word was then corrupted via *árcati*, *arká–*, *arcíş–*, into *arktos* (see e.g.: SCHERER, 1953: 134). The second suggestion is that *Ἄρκτος* is derived from the Akkadian word *ereqqu* (= *wagon*) [HEUBECK *et al.*, 1988: i-viii; SZEMERÉNYI, 1962]. This suggestion is based on sound linguistic principles. The Hellēnes, according to this explanation, confused the sound of the Akkadian name for wagon with their own word for bear. This is not entirely logical, as they seem already to have conceived the constellation as a wagon, just as the Akkadians did. It seems also clear that the eastern influence on the early Hellenic Astronomy is very limited [DICKS, 1970].

The word *Ἄρκτος* also means North and is used in combinations that mean *being strong*, & c. It seems that the background for the use of *Ἄρκτος*, as a misinterpretation of an eastern name, is partly based on the popular belief that Hellenic Astronomy is derived from Babylonian Astronomy. In a talk on Linguistics in London it was emphasised that one of the main aims of the speaker was to show the Semitic influence on Hellenic language and culture [SZEMERÉNYI, 1962b: 19]. Such a tendency could very well have influenced the explanation offered on the origin of the constellation of the *Bear*.

A much earlier suggestion derives from Classical and Hellenistic authors who discussed Homēros' use of *Ἄρκτος* in their commentaries. Today we still have Strabōn's *Geography*, where he comments on the navigation instructions that Odysseus received and explains *Ἄρκτος* as being the circumpolar stars or the Arctic Circle as defined by the early Hellēnes, i.e. the circle that encloses the circumpolar stars [see ***I***, 1, 6]. Their Arctic Circle changed locally as its position on the sky changes with latitude. Other early authors sharing this view were, according to Strabōn, Hērakleitos (6-5 century BCE.), and Kratēs (1st century BCE) [Strabōn, ***I***, 1, 6]. These three authors are especially interesting as they lived in the Hellenic tradition and used the language. In the case of Hērakleitos, this was close to the time when the *Odyssey* was written down in the form that has reached us. The word during their own time for the Arctic Circle was *ἡ ἀρκτικός*, which can mean *near/of the bear*, *arctic*, *northern*, & c. This interpretation was totally accepted by the English scholar Robert Brown who translated Aratos in the 19th century and faced difficulties with the constellation *Ἄρκτος* [BROWN, 1899 -1900: 250ff]. *Ἄρκτος* as originally referring to all the circumpolar stars seems to be the most logical explanation as there are several cases in the literature where *ἄρκτος* is used for *North*; for instance, Hērodotos says that a place is said to face *North*, *ἄρκτον* [HĒRODOTOS, ***I***: 148]. This very early understanding of *Arktos* as the circumpolar stars makes it very easy to understand why two names were used by several early authors, one for the circumpolar stars amongst which the main constellation is *Ursa Major*, and another for *Wagon*, which today is called the *Big Dipper* in English.

Interesting in this context is also the other name for *Boötes*, *Ἀρκτοφύλαξ*, which means the bear watcher. The name can very well also refer to a constellation that indicates the Arctic Circle, as it is partly circumpolar and partly not. According to Aratos, *Boötes'* left hand never sets and it would make the circumpolar stars fairly easy to be identified by a navigator. During Middle Minoan times the bright star *Arcturus*, positioned in the southern extremity of *Boötes*, rose and set at about 38° off true North as seen from Petsophas. Earlier and in the more northerly part of Hellas, where Homēros is said to have originated, the star *Arcturus* was itself circumpolar during the early Minoan times, i.e. the constellation *Boötes* and its brightest star *Arcturus* could be used for identifying the limits of the circumpolar stars.

Let us turn again to the *Big Dipper*. As already stated, it was understood as a wagon in most cultures around Hellas, and in most of them as a wagon drawn by one or several oxen. The Latin name for the *Big Dipper* means seven oxen and the old *Thesaurus Græcæ Linguæ* from the first half of the 19th century gives the Latin word *Septentriones* as translation for *Ἅμαξα*. It is clear that the Romans took their Astronomy from the Hellēnes, thus we can say —as many scholars already did— that it is clear that the Hellēnes saw the *Big Dipper* as one or several oxen with a

wagon. Another fairly early author is Germanicus Cæsar who translated Aratos' poem and says about *Boötes*: «the *Ploughman*, who slowly follows his setting wagon» [GAIN, 1976: 138ff][2]. Aratos could also have meant the same, when he wrote about Boötes' setting: «No more will Boötes bulk large above and below horizon, the lesser part being above and greater already in darkness. It takes four signs of the Zodiac together for the Ocean to receive Boötes' setting. When he is sated with daylight, he occupies more than half the passing night in the loosing of his oxen, in the season when he begins setting as the Sun goes down. These nights are named after his late setting.» [ARATOS, 581-85]. The Hellenic word used for loosing his oxen is *βουλυτός*, a noun formed by *βοῦς* (= *ox*) and *λύω* (= to loose, unyoke, & c.), it is normally understood as indicating the time of the day when it is time to unyoke one's oxen, i.e.: the late afternoon or evening. However the original meaning must be *to loosen the oxen from their wagon or plough*. There are also several Scholia [e.g.: *Scholia Vetera*, **27**: 77ff] that comment and indicate a wagon with oxen

V. Conclusions

The northern stars —after the present study— can be understood in the following ways: The group that was circumpolar was called Ἄρκτος *and this word had also the meaning* North. *The main constellation, our* Big Dipper, *was called* Ἅμαξα *and was understood as a wagon pulled by one or several oxen.* Boötes *was leading the wagon driven by one or several oxen (a wagon and oxen are found at or near Petsophas).* Ἀρκτοφύλαξ *was the star* Arcturus *(*Ἀρκτοῦρος*) and was used to aid in the recognition of the circumpolar stars.*

What started as an analysis of the orientation of walls of a peak sanctuary on eastern Crete ended with a study of the finds from those peak sanctuaries, and also as an explanation of how a northern constellation was named Ursa.

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[2] Gain comments that these lines are not a translation, but the author's picture is taken from Aratos' ll. 581-85. I understand that Germanicus Cæsar meant that Boötes was leading a wagon and was unyoking his oxen, which were pulling the wagon.

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APPENDIX

STUDIES REGARDING THE AGE OF THE INFORMATION IN ARATOS' *PHAINOMENA*

Year	Scholar	Result in Years BCE	Method
1885	Robert Brown	c. 2085	Analysis of the Great Circles
1908	Maunder	c. 2700	Analysis of the Southern Sky
1923	Crommelin	c. 2500?	Analysis of the Southern Sky
1966	Ovenden	2600 ± 800	Analysis of Simultaneous Risings
1984	Roy	c. 2000	Analysis of the Great Circles
1999	Zhitomirskij	Early 2nd Millennium	Analysis of the Great Circles
2000	Henriksson/Blomberg	c. 2250	Analysis of the Great Circles

A Comment of the Author on Bradley Schaefer's Recent Paper in *JHA*, 33, 2002, 313-350.

Bradley Schaefer seems not to have read a modern publication on Aratos with comments [e.g.: KIDD, 1997]. In the very beginning he says that both Hēsiodos and Homēros mention *the Big Bear*; something that neither of them do, a fact discussed in all modern comments on their texts. They mention only *Arktos*, in the singular, no «Big». As a matter of fact, he does not mention which edition of Aratos he uses, neither does he mention where in the Hellenic texts he found what he cites. I got the impression that he did not read the complete texts. He continues in a similar way when he says that there was a constellation *Bear* in many European cultures. It is, however, clear that there was no such constellation anywhere in European folk culture, not even in cultures where the animal bear had a sacred position such as the Saami people or in the Basque culture. The Basque culture has a Sky Bear, as he says, but it is not a constellation. In Northern Europe the folk understanding of the constellation Ursa Major is an elk. So far as I know he is correct that the North American Indians have a constellation Bear, but I have not seen any base for that understanding before the Europeans came to North America and had Ursa Major and Ursa Minor with them as navigation constellations. These mistakes in his paper make me uneasy in reading it.

If we look at his analysis of the «voidists» he is more on his own ground. In note 30 he cites the La Laguna Conference publication, which means that he is aware of the paper by Mary Blomberg and Göran Henriksson, where they discuss the age of Aratos' information, as well as my presentation of the finds from the peak sanctuaries on Crete. However, he states that there is no archæological evidence for understanding the constellations in Hellas before Homēros and Hēsiodos. He does not comment on mine and Mary Blomberg's papers from La Laguna. He sees only what he wants to see. When reading his paper it is interesting to find for instance that the constellation *the Altar* was seen from Crete during Minoan times, but not much later. An altar belongs to the finds from those peaks and Schaefer's analysis thus confirms that seemingly the Minoans could have had a constellation named *Altar*, which the later Hellēnes did not see. Some constellations not seen during the Minoan times, according to Schaefer's analysis, are missing from those peaks. The finds from those peaks are very interesting as a matter of fact. However, we must not draw the conclusion that the western constellations were formed and identified by the Minoans. This process is most likely much older, but it seems that the names we use today for many constellations were already established during the Minoan times. Crete seems to have been an important point of contact in the Eastern Mediterranean during the Early Bronze Age. The knowledge and formation of the constellations must be much older and most likely took place over a large geographical area. The more one looks into the history of Astronomy, the older it seems to be; and the information coming down to us seems to have been compiled probably by several cultures. It seems to me, however, that Aratos used information from around 2000 BCE for much, but not all, of his text. At least some of the information important for navigation & c. may be later than Minoan times.

His analysis of the «voidists» as such is of interest and adds further understanding to the early study of the constellations, but he has no real reason behind some of his conclusions on the history of the constellations. He may be right about mistakes made by the «voidists», but to date the western constellations to the time just before Homēros and Hēsiodos seems to be incorrect to me. Schaefer's paper, which is interesting, contains some serious faults casting doubts on the whole of it. His lack of knowledge of the Hellenic texts and what they really tell and mean is a drawback. Otherwise, I have no doubts about his mathematical calculations, & c.