



HAL
open science

Context and Mathematical Uses of the Plane Astrolabe in the 7th Century

Émilie Villey

► **To cite this version:**

Émilie Villey. Context and Mathematical Uses of the Plane Astrolabe in the 7th Century. 3rd International Prof. Dr. Fuat Sezgin Symposium on the History of Science in Islam, Gürsel Aksoy, Mürteza Bedir, Emine Canlı, Ahmet Hamdi Furat, Ayşe Zişan Furat, Ahmet Göksu, M. Cüneyt Kaya, Mustafa Sabri Küçükbaşçı, Nihal Özdemir, Hasan Umut, May 2023, Istanbul, Turkey. pp.13. <hal-04836478v1>

HAL Id: hal-04836478

<https://cnrs.hal.science/hal-04836478v1>

Submitted on 13 Dec 2024 (v1), last revised 12 May 2025 (v2)

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

[à paraître dans les Actes du 3rd International Prof. Dr. Fuat Sezgin Symposium on
the History of Science in Islam (25-26 May 2023), Istanbul U. ; version
communiquée à l'équipe éditoriale le 8 avril 2024]

Context and Mathematical Uses of the Plane Astrolabe in the 7th Century

Émilie VILLEY

Researcher, CNRS, Orient & Méditerranée (UMR 8167), Paris, France

E-mail : emilie.villey@cnrs.fr

Abstract

The earliest archaeological evidences for the plane astrolabe are Arabic and date from the 9th century. However, as noted by Fuat Sezgin, two treatises on the uses of the astrolabe predate them: the oldest is a Greek treatise by John Philopon (6th c.) known in the Arab tradition under the name of al-Bīṭrīq; the other is a Syriac treatise attributed to the Syrian Orthodox bishop Severus Sebokht (d. after 665) which Fuat Sezgin presents as "der älteste namentlich bekannte Astronom auf islamischem Gebiet" (Sezgin, 1978, p. 111).

In the light of a still unpublished critical edition of Severus Sebokht's *Treatise on the Astrolabe* and a very recently published 7th c. Syriac *Letter on klimata* (Defaux & Villey, 2023), this contribution will show that the Greek and Syriac astrolabes of the 6th and 7th centuries were quite different from those found later in a Syrian-Arab context; that the astrolabe was probably the only means of performing complex astronomical calculations for the Syriac scholars of Cyprus and Syria; and finally that the Umayyads were undoubtedly familiar with the astrolabe from the middle of the 7th century, even before the start of their caliphate.

Keywords : astrolabe, Syriac, Severus Sebokht, Cyprus, *Handy Tables*.

The earliest known surviving plane astrolabe dates back from the 9th century. This is Khafif's astrolabe made in Syria and currently housed in the Museum of History of science in Oxford [47632; 57-84/155] (Briex & Maddisson 2022, vol. 1, pp. 44-45; King, 2005, XIIIc, p. 458 sq). With its rete, featuring 17 stars, a simple back and double-sided plates, it is a valuable piece of Syrian craftsmanship. Archaeologically, we cannot go back beyond the 9th century (although King, 2005, XIIIb mentions the existence of a now lost 8th c. Baghdad astrolabe). However, several literary sources attest to the use of this instrument as early as the beginning of the 6th century: a detailed description from a Greek source and several Syriac sources which will be discussed later in this article. Recent research on these texts renews what we know about the constituent parts of the ancient astrolabe and the uses made of it by the Greeks and Syrians; this research challenges the long-held view that Neugebauer work was the reference regarding the textual transmission of the most ancient Greek testimonies (Neugebauer, 1949 and 1975, pp. 868-879 quoted many times as in King, 2005, XIIIa, p. 364; XIIIb, p. 411, n. 2 and Rezvani, 2020, p. 22). Moreover, having recently observed that early Greek and Syriac sources have been neglected in recent publications and museum exhibits, I thought it was important to present them again. It's worth noting, that the esteemed Scholar Fuat Sezgin was aware of the testimonies given in John Philoponus's and Severokht Sebokht's works and referenced them in the sixth volume of his *Geschichte des Arabischen Schrifttums* (Sezgin, 1978, p. 111). He even considered Severus Sebokht as the most ancient

named known Astronom in Islam ("der älteste namentlich bekannte Astronom auf islamischem Gebiet" in Sezgin, 1978, p. 111). The present contribution will confirm Sezgin's point of view by showing that the Umayyads were undoubtedly familiar with the astrolabe from the middle of the 7th century, even before the start of their caliphate; but first, this contribution will show that the Greek and Syriac astrolabes of the 6th and 7th centuries were quite different from those found later in a Syrian-Arab context and that the astrolabe was probably the only means of performing complex astronomical calculations for the Syriac scholars of Cyprus and Syria of that time.

1. Literary Evidences for the Use of the Astrolabe Prior to the 8th Century.

Four ancient Greek and Syriac texts written before the 8th c. discuss the uses of the plane astrolabe. Three of these texts have been known since the early 20th century through French and German translations: a *Treatise on the astrolabe* by John Philoponus, a *Treatise on the astrolabe* by Severus Sebokht and two chapters within a *Treatise on the constellations* by Severus Sebokht; a recent publication (Defaux & Villey, 2023) brings to light a fourth testimony: the *Letter on klimata* written by Severus Sebokht.

Here is a presentation of each of these sources:

1.1. John Philoponus, *Treatise on the Astrolabe*

The earliest literary witness concerning the uses of the astrolabe is a Greek treatise written in around 540 AD by John Philoponus, also known as al-Bīṭrīq in the Arab tradition (Gannagé-Segonds, 2012). At the beginning of his *Treatise on the astrolabe* (ed./tr. Jarry, 2015, p. 3), John Philoponus explains that his friends encouraged him to write it, because they found the previous Ammonius' writing too mathematical. It should be noted that John Philoponus was a pupil of Ammonius of Alexandria, who provided him with a comprehensive training in philosophy in Alexandria. While Ammonius' writing is lost, Philoponus's is still well known and has been published three times: the first edition by Hase (1839) was heavily criticised in Tannery (1888) and revised by Segonds (1981) who provided a French translation; Jarry (2015) and Stueckelberger (2015) published separate French and German translations based on a new critical edition of the text.

1.2. Severus Sebokht, *Treatise on the Astrolabe*

Syriac Orthodox bishop and scholar Severus Sebokht, also known as the 'Nisibean', served as abbot of the monastery of Qenneshre in the late 7th century. This monastery's school, a vibrant intellectual center of Miaphysitism in the 6th and 7th centuries, was renowned for the teaching it provided in Greek (Fiori, 2012), theology, rhetoric (Farina, 2017), philosophy (Hugonnard-Roche, 2001) and astronomy (Villey, 2014). Its members were fluent in Syriac and Greek, with several of them becoming patriarchs

and bishops. Severus Sebokht's extensive astronomical work and scientific correspondence suggest he had several students and was active in a network of scholars in Syria and Cyprus, connected to the Alexandrian scientific tradition.

His *Treatise on the astrolabe* composed before 660 AD is in two parts (ed./tr. in Nau, 1899 based on a single ms. preserved in Berlin; Gunther, 1932, pp. 61-81 is an English translation of French Nau's translation; I am currently preparing a critical edition of the text on the base of three mss preserved in Berlin, Paris and Mardin). The first part is an original Syriac text. It describes the various components that make up the astrolabe. The second part, which discusses the uses of the astrolabe, is a translation from Greek. The first part mentions a *philosophos* several times, that Severus Sebokht doesn't explicitly identify. This philosopher must be considered as the author of the Greek original treatise translated in the second part. Theon of Alexandria was long believed to be this philosopher, based on comparisons of the evidence of Al-Yakubi (Segonds, 1981, pp. 29-32), the *Souda* and Ibn Al-Nadim (Neugebauer, 1949; King, 2005, XIIIa, p. 364 and King, 2018, p. 12 and 25). Recently, a previously unknown supplement of text was discovered in a manuscript from Mardin (Villey, 2015). This new information prompted me to re-evaluate the identity of the philosopher mentioned in the original text. The most crucial piece of evidence was a date within the newly discovered supplement of text: 523 AD presented as the time the author observed the star Regulus in Leo constellation. Since the text claims to be written at the time of this observation, both Severus Sebokht (who died after 665 AD) and Theon of Alexandria (who died in 405 AD) can be ruled out as authors. This new information strongly suggests that Ammonius of Alexandria is much more likely candidate. Ammonius' treatise is unavailable to verify this. However, John Philoponus' reference supports this hypothesis.

1.3. Severus Sebokht, *Treatise on the Constellations* (chap. 15 and 16)

Severus also deals with the astrolabe in his *Treatise on the Constellations* (Nau, 1929-1932; reprint [Nau] 2014, pp. 200-282). This treatise composed in 18 chapters was written in the year 659-660 AD. It is fully preserved in the only ms. Paris BnF syr. 346, f. 78r-121v. In the chapter 15 of this treatise, Severus explicitly refers to his previous *Treatise on the astrolabe* and explains how to use the astrolabe to find : 1) the different circles of the celestial sphere (equator, tropics, artical circle, antarctical circle); 2) the latitude of a *klima* or a city. In the chapter 16, Severus Sebokht proposes to look again at the latitude of the *klimata*, not only thanks to the astrolabe, but also with the help of Ptolemy's *Handy Tables*. He then moves on to the topic of the *anaphora* (heliacal rising of the zodiacal signs), which he describes as being carried out using the astrolabe, in particular the part known as the rete (*arakne*, i.e. « spider », in Greek and in Syriac). But, as he admits in the next chapter (ch. 16, 2), all the data he gives for each *klima* are taken from Ptolemy's *Handy Tables*, and, to be more precise, from the *Table of the right ascensions* (Villey, 2014, pp. 164-165; pp. 170-172 and the annexes pp. 181-185; a new edition of these astronomical tables has been published in Tihon, 2011; see also Mercier, 2011).

particularly those in the middle of the great inhabited earth. This is why astronomers and geometers make more mention of them in all their works. It is from these < *klimata* > that those who were the inventors of astronomical science provide examples relating to this knowledge. That is all <what I had to say> on the subject. »

At the very beginning of this passage, Severus Sebokht calls his correspondent « your Brotherhood », as in other unpublished letters of the same manuscript (*Letter on the conjunctions*, fol. 121v; *Letter on the lunar nodes*, fol. 124v). The full name of this correspondent is only given at the beginning of the correspondence in the ms. Paris BnF syr. 346, f. 121v, where he is presented as "the priest and visitor Basil of Cyprus". In the first part of the *Letter on klimata* (Defaux, 2023, p. 221), Severus Sebokht mentions Cyprus as an example of island for the 4th klima and he precises that his correspondent is living there with other scholars interested in astronomy. Therefore we have a clear evidence on the fact that the Syrian abbot is corresponding with a community based in Cyprus.

It is interesting to note that the discussion between Cypriots and Syrians in the 660s concerns 1) the question of the number of *klimata* represented on the plates of the astrolabes and 2) the variation observed between the instruments used in Cyprus and what is said in the books. These exchanges prove that in 660 plane astrolabes were manufactured and already circulated in the Arab-Muslim world of Cyprus and Syria. Furthermore, these exchanges demonstrate that Ptolemy's works, in particular the book of *Geography* and the *Handy Tables*, circulated in Syria and Cyprus. However, it seems the scientific content wasn't fully grasped in Cyprus, at least by Severus Sebokht's Syriac correspondents. Indeed, if the Cypriot correspondents had studied these works, they would not have speculated that the absence of certain plates on their instruments was due to the fact that they correspond to *klimata* – or region of the inhabited world – for which no cities were recorded. However, the fact that Severus Sebokht refers to these works indicates that his correspondents had access to them in some form. These Alexandrian works, including the *Almagest* and Theon's *Commentary on the Handy Tables*, were likely read directly in Greek rather than translated (Villey, 2014, p. 172sq).

2. What did a 7th c. Syriac-Greek astrolabe look like ?

Thanks to John Philoponus' (now JP; the following references will be given according to Jarry 2015) and Severus Sebokht's (now SS; references given according to Nau 1899 or the ms. Mardin with a personal translation) treatises, and the letters between Severus and Basil of Cyprus, we can have a clearer picture of the astrolabe in the 6th and 7th centuries. The back of the mater did not bear any kind of shadow square as is customary on later Arabic astrolabes. In fact, this side bore very few engravings: the back of the mater of the oldest Greek and Syriac astrolabes had a cross engraved from the top to the bottom, symbolising the meridian, and from the right to the left, symbolising the horizon. The upper part of

this cross contained one or two quadrants graduated from 0 to 90° to measure the angular height of a star (JP 4-5; SS 90). It had no other inscriptions. In the middle of the back of the mater, fixed by the centre, an alidade – called *dioptra* in Greek and Syriac – was rotating. It was one inch wide and its extremities, pointed and centred, were used to make the ray emanating from the star coincide with a graduation in one of the upper quadrants. The extremities of this alidade were fitted with two small strips, the center of which was pierced. To measure the height of a celestial body, it was necessary to ensure that the ray of light coming from the celestial body passed simultaneously through these two small strips of the alidade (JP 13-15; SS 91).

The upper part of the mater was topped by a hanging system with a ring. The observer could slide a finger through the ring to suspend the whole instrument (JP 5; SS ms. Mardin, f. 16v : "there is also above a little ring skillfully encircled. When someone makes an observation, the ring holds the whole astrolabe, i.e., the former instrument, all together suspended by his finger or a nail").

The plates: each instrument was in theory provided with 3 or 4 plates engraved on both sides as well as the mater. So that theoretically it was possible to obtain plates adapted for each of the 7 *klimata* of the inhabited earth. However, as we have seen in the *Letter on klimata*, the Cypriots claim to find practically only 4 *klimata* engraved in their instruments, i.e. 2 double-sided plates. Interestingly, while all astrolabes include a *klima* engraved on the mater, Severus Sebokht explicitly states that this engraving is unusable (Villey, 2023, p. 244). Each face of these plates is therefore adapted for a different *klima*. It shows the inscription of the name of the *klima* (e.g. $\delta\iota\acute{\alpha}$ $\rho\acute{o}\delta\omicron\upsilon$), the degrees of latitude of that *klima* (36°) and the indication of the longest day in it (JP 11; SS 92); the upper portion of the plates displayed lines parallel to the horizon (from 1-90 degrees). The lower portion feature the seasonal hours marked from 1 to 12. Between each parallel, degrees are inserted. There are 3 types of plates: those on which all 90 circles are engraved, which must have represented instruments with a large diameter (at least 50 cm), those on which only 45 circles are engraved and those on which only 30 circles were engraved (JP 7-8; SS 89). Contrary to what may have been written (King, 2005, XIIIa, p. 364), ancient Syriac and Greek sources don't describe the instrument we typically see in museums, which features only 15 engraved almicanarat circles parallel to the horizon. So, as we can see, the earliest instruments should therefore be thought of as being much bulkier in comparison with the smaller and lighter instruments produced in the mediterranean world and in the Middle East during the Middle Age (Madisson & Brieux, 2022; King, 2005, XIIIc).

Regarding the rete : John Philoponus describes on it seventeen stars (as on Khafif's astrolabe) or more (JJ 22).

3. On some uses of the plane astrolabes in the 6th and 7th c.

It is speculated that the astrolab's most primitive form – possibly dating back to the time of Eudoxus of Cnidus (409-356) or Apollonius of Perge (III-II BC) according to Vitruve, *De Arch.* IX, 9 – was used

solely to calculate equatorial time (Nau, 1899, Introduction, p. 64, note 1). This theory seems to be supported by the writings of John Philoponus and Severus Sebokht, who dedicate a significant portions of their treatises to determining times and the length of the day (JJ 13-23; SS 274-292). Determining the time of day or night presents a significant challenge, because the stars appear to circulate across the night sky on a plane different to earth's 24 hours rotation on its axis. The earth rotates on the equatorial plane, but the stars on the ecliptic plane. In order to know the time, it is necessary to transfer the movement of the stars — including the sun — on the equatorial plane in order to associate them with the 24 hours of terrestrial time. This requires a complex geometric projection. Today such calculation would require to project an ecliptic point onto the equator as follows:

$$\begin{aligned} \tan(\lambda) &= \frac{\sin(\alpha) \cos(\varepsilon) + \tan(\delta) \sin(\varepsilon)}{\cos(\alpha)}; & \begin{cases} \cos(\beta) \sin(\lambda) = \cos(\delta) \sin(\alpha) \cos(\varepsilon) + \sin(\delta) \sin(\varepsilon); \\ \cos(\beta) \cos(\lambda) = \cos(\delta) \cos(\alpha). \end{cases} \\ \sin(\beta) &= \sin(\delta) \cos(\varepsilon) - \cos(\delta) \sin(\varepsilon) \sin(\alpha) \\ \begin{bmatrix} \cos(\beta) \cos(\lambda) \\ \cos(\beta) \sin(\lambda) \\ \sin(\beta) \end{bmatrix} &= \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\varepsilon) & \sin(\varepsilon) \\ 0 & -\sin(\varepsilon) & \cos(\varepsilon) \end{bmatrix} \begin{bmatrix} \cos(\delta) \cos(\alpha) \\ \cos(\delta) \sin(\alpha) \\ \sin(\delta) \end{bmatrix} \\ \tan(\alpha) &= \frac{\sin(\lambda) \cos(\varepsilon) - \tan(\beta) \sin(\varepsilon)}{\cos(\lambda)}; & \begin{cases} \cos(\delta) \sin(\alpha) = \cos(\beta) \sin(\lambda) \cos(\varepsilon) - \sin(\beta) \sin(\varepsilon); \\ \cos(\delta) \cos(\alpha) = \cos(\beta) \cos(\lambda). \end{cases} \\ \sin(\delta) &= \sin(\beta) \cos(\varepsilon) + \cos(\beta) \sin(\varepsilon) \sin(\lambda). \\ \begin{bmatrix} \cos(\delta) \cos(\alpha) \\ \cos(\delta) \sin(\alpha) \\ \sin(\delta) \end{bmatrix} &= \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\varepsilon) & -\sin(\varepsilon) \\ 0 & \sin(\varepsilon) & \cos(\varepsilon) \end{bmatrix} \begin{bmatrix} \cos(\beta) \cos(\lambda) \\ \cos(\beta) \sin(\lambda) \\ \sin(\beta) \end{bmatrix}. \end{aligned}$$

This calculation necessitates the application of trigonometry, a mathematical technique unavailable to John Philoponus and Severus Sebokht. The earliest evidence of Indian trigonometry in the Mediterranean world dates only to Arabic astronomical texts of the 8th century, but the earliest mention of Indian numbers has been found in a Syriac text (Reich, 2000; Takahashi, 2010, pp. 21-23). However, thanks to the planispheric astrolabe, these ancient astronomers were able to solve this kind of equation without difficulty: in *canona* 1-3 of the Syriac *Treatise on the Astrolabe* and paragraphs 4-10 of the Greek *Treatise on the Astrolabe*, John Philoponus and Severus Sebokht explain how, thanks to the astrolabe – without the help of Indian mathematics –, they were already able to calculate equatorial time. How did it work? The ancient astrolabe is a stereographic projection of the celestial circles (equator, summer tropic, winter tropic and lines parallel to the horizon) on a flat surface called a tympanum or plate. If we know, thanks to an ephemeris, in which degree of which zodiacal sign the sun is located, for example, and if we measure its height thanks to the back of the astrolabe which is equipped with an angle measurer, it will then suffice to turn the astrolabe upside down, and to rotate the spider which carries the zodiacal circle until the point of the zodiac in question is found on the right altitude circle. There, an index finger starting from the centre of the earth [which coincides with the centre of the astrolabe] and aligned on the point of intersection between the parallel of the horizon [indicating the instantaneous altitude of the sun] and the point of the zodiac [corresponding to the current position of the sun], ends its course on the graduated perimeter of the astrolabe, which symbolises nothing other than the 24 hours of earth time [of the equatorial time in clockwise direction].

So, by simply measuring the angle of the sun, ancient scholars were able to determine the time of the day. Not the seasonal time, but the equatorial time. This is an essential step towards more complex calculations such as the prediction of lunar eclipses.

In canon 7 of his *Treatise on the Astrolabe*, Severus Sebokht says more: he affirms that the astrolabe is the tool by which data presented in Ptolemy's *Handy Tables* have been calculated, in particular the tables of right ascension:

“[10] [...] we can know if the astrolabe is wrong or right thanks to <the ascensions of> the right sphere that are in Ptolemy's tables. [...] when again we compare the table with the astrolabe to one another, <if> we don't find that their numbers are equal to one another, we must know that there is an error either in the table or in the astrolabe. [16] Then we must investigate both of them since **Ptolemy's table has been made thanks to the astrolabe.**” (pers. transl. according to ms. Mardin, f. 32r; see also Nau, 1899, p. 283)

In his *Treatise on the Constellations*, chap. 16, Sévère Sebokht takes up this same idea which he applies to the tables of oblique ascensions:

“The determination of the ascensions (*anaphorai*) will also take place with the help of the astrolabe, as has been shown by us in his treatise, (namely) that if we look for how many are the ascensions of the rising sign, we see by the rete (*arakne*) of the astrolabe, by how many degrees does the beginning of Capricorn advance, that is to say the index of the degrees; for example, as long as the sign that interests us rises, the number obtained will be said to be that of the ascensions of this sign. Here are the <oblique> ascensions of the signs of the zodiac in all *klimata*, according to the *Handy Tables*, so that this too may not be missed by anyone who wants it [...]” (pers. tr.; see also Nau, 1899, p. 90)

A clarification given above in the *Treatise on the constellations*, chap. 15, however, allows us to nuance this judgment, since Severus declares that the numerical data in the *Handy Tables* are provided with a precision to the nearest 60th degree (e.i. minute), which, as Severus admits it, the astrolabe is incapable of providing:

“So far, oh friend of science, we have given the circles and the latitudes of which we have just spoken according to the astrolabe and according to the airon sphere and according to the rest of the other instruments, on which **it was not possible to mark these small divisions (minutes) which we call *exekostos***, that is to say sixtieths of degrees. In Ptolemy's *Handy Tables*, circles and latitudes are given with minutes [...]”

Moreover, Severus Sebokht attributes geographical virtues to the astrolabe, since according to him, the distribution of the inhabited world into seven climates and the determination of the latitude of their cities were made possible only thanks to this instrument:

“23. About the seven *klimata*, how they are named, how we will know them, and how we will also carry out the calculation thanks to them and, if we want, about each city which is located in these climates, I wrote to you this that you asked but also what you did not ask and which had absolutely not occurred to you, just as I think that you perhaps do not ask yourself where the first discovery and understanding of all these things come from. The discovery and first understanding of these things took place through the astrolabe, on which a long discourse is now presented, and there is also another treatise which we have written on this subject“ (see Defaux, 2023, p. 222)

The comparison of these sources suggests some confusion about the origin of the data in the ascensions tables. Indeed if the astrolabe can produce the data of the *Handy Tables*, one key question is how the tables achieve minute-level precision? And if Severus Sebokht recognize that the astrolabe's limitations prevent it from generating data as precise as the *Handy Tables*, then how can he also claim that the astrolabe was involved in creating those very tables? Severus Sebokht's comments about the astrolabe's limitations seem contradictory. This inconsistency suggests that perhaps he considered the astrolabe as the sole instrument – setting aside the *Handy Tables* – for timekeeping, day length measurement, and latitude determination. Did this instrument compensate for his inability to carry out the necessary complex calculations to obtain these same results more precisely? Did he depend on Claudius Ptolemy's *Handy Tables* and his *Almagest* to obtain precise astronomical data? At least that is what reading these sources suggests. The writings of 7th-century Syriac abbot Severus Sebokht and his Cypriot correspondent divulge an appreciation for the astrolabe. They considered it an indispensable tool for their astronomical calculations.

Conclusions

In the middle of the 7th century, a Syriac abbot established in Syria and a Cypriot community represented by the priest Basil attributed great significance to the plane astrolabe. Their ability to update the data provided in the *Handy Tables* of Claudius Ptolemy and to determine the Equatorial time and terrestrial latitudes depended on this instrument. The widespread adoption of the astrolabe in 7th-century Syrian and Cypriot science strongly suggests a significant increase on its production. We must therefore remain vigilant and open to the possibility of one day identifying a Syrian or Cypriot astrolabe engraved in Greek or Syriac from this period, because we have proof that they were used and were part of the arsenal of astronomers and geographers of that time.

Because of the testimony of Al-Nadim, it has been thought that the first contact of Arabs with the astrolabe was in Harran in the 8th century (King, 2005, p. 411). The texts presented in this contribution

clearly show that they were in contact with this instrument much earlier. Records indicate that Severus Sebokht participated in a debate held in Damascus in 659 AD (Nau, 1899b, p. 6; Nau, 1899, p. 56; Nau, 1929-1930, pp. 331-332). The debate was organised by Mu‘awiya, then governor of Syria. Given Severus Sebokht’s extensive scholarly, ecclesiastical, and political network, it is likely that Mu‘awiya, who had already conquered Cyprus and who was the verge of becoming the first omeyyade calife (in 661), was not aware of the powerfull utility of this instrument.

References

- Brioux, A., Maddisson, F. (2022), *Répertoire des facteurs d’astrolabes et de leurs oeuvres en terre d’Islam.*, 2 vol. Turnhout, Brepols.
- Defaux, O. (2023). Sévère Sebokht, *Lettre sur les climats* : édition et traduction de la première partie ». *Semitica & Classica*, 16, 213-228.
- Defaux, O., Villey, E. (2023). *La Lettre sur les climats* de Sévère Sebokht, édition, traduction et commentaire. *Semitica & Classica*, 16, 207-252.
- Farina, M. (2017). Rhétorique en syriaque. In Touati, H. (Ed.), *Encyclopédie de l’humanisme méditerranéen*. <http://encyclopedie-humanisme.com/?Rhetorique-en-syriaque>
- Fiori, E. (2012). La cultura filosofica e scientifica greca nella Chiesa siro-occidentale (VI-VIII secolo) : un tentativo di interpretazione e uno sguardo d’insieme. In Vergani, E., Chialà S. (Eds), *L’eredità religiosa e culturale dei Sirioccidentali tra VI e IX secolo : atti del 6o Incontro sull’Oriente Cristiano di tradizione siriana*, Milano, Biblioteca Ambrosiana, 25 maggio 2007 Milano (pp. 117-144). Milano.
- Gunther, R. T. (1932). *The Astrolabes of the World. 1, The Eastern astrolabes*. Oxford, University Press (reprint in 1976, London, The Holland press), 61-81.
- Gannagé, E., Segonds, A. Ph. (2012). Philopon. In Goulet, R. (Dir.), *Dictionnaire des philosophes antiques. 5, De Pacius à Rutilius Rufus* 455-563. Paris, CNRS (on the Arab reception of Jean Philopon's work, see in particular p. 503-563).
- Hase, K.B. (1839). Joannis Alexandrini, cognomine Piloponi, de usu astrolabii ejusque constructione libellus. *Rheinisches Museum für Philologie*, 6. Bonn, 129-156.
- Hugonnard-Roche, H. (2001). La tradizione della logica aristotelica. In S. Petruccioli (Ed.), *Storia della scienza. 4, Medioevo, Rinascimento* (pp. 16-26). Roma.
- Jarry, C. (2015). *Jean Philopon, Traité de l’astrolabe*. Paris, Les Belles Lettres.
- King, D. (2018). *The Astrolabe : What it is & what it is not (A supplement to the standard literature)*. Frankfurt, Johann Wolfgang Goethe University.
- King, D. (2005). XIIIa : The neglected astrolabe. A supplement to the standard literature on the favourite astronomical instrument of the Middle Ages. In King, D., *Synchrony with the Heavens, Vol. 2 Instruments of Mass Calculation* (pp. 339-402). Leiden-Boston, Brill.
- King, D. (2005). XIIIb : The oldest known astrolabe, from 8th-century Baghdad or What nobody knew was in the Archaeological Museum in Baghdad: The oldest astrolabe in the world. In King, D., *Synchrony with the Heavens, Vol. 2 Instruments of Mass Calculation* (pp. 403-437). Leiden-Boston, Brill.
- King, D. (2005). XIIIc : The earliest astrolabes from Iraq and Iran (ca. 850 to ca. 1100). In *Synchrony with the Heavens, Vol. 2 Instruments of Mass Calculation*. Leiden-Boston, Brill, 447-543.
- Mercier, R. (2011), *Πτολεμαίων Πρόχειροι Κανόνες: Ptolemy’s Handy Tables. 1b, (Tables A1-A2)*. Louvain – Paris, Publications de l’Institut orientaliste de Louvain 59b.
- Nau, F. (1899). Le traité sur l’astrolabe plan de Sévère Sabokht, écrit au VII^e siècle d’après des sources grecques, et publié pour la première fois d’après un ms. de Berlin. *Journal asiatique* 9,13, p. 56-101 and 238-303.
- Nau, F. (1899b). *Opuscules maronites: texte syriaque autographe et traduction française. 1*. Paris, E. Leroux.
- Nau, F. (1929-32). Le traité sur les constellations écrit en 660, par Sévère Sébokht, évêque de Qennesrin. *Revue de l’Orient Chrétien* 27 (1929-1930), p. 343-410 and 28 (1931-1932), p. 85-100 (introduction, full translation of the 18 chapters ; only chap. 4, 5 and 6 have been edited); reprint in [Nau] 2014, p. 183-280.
- [Nau, F.] (2014): reprint of Nau’s Studies in History of astronomy in *Astronomie et cosmographie syriaques : recueil d’articles de François Nau*, introduits et annotés par É. Villey et H. Hugonnard-Roche. Piscataway NJ.
- Neugebauer, O. (1949). The Early History of the Astrolabe. *Isis* 40, 240-56.
- Neugebauer, O. (1975). *A History of Ancient Mathematical Astronomy*, II, Berlin-Heidelberg-New York, Springer Verlag.
- Reich, E. (2000). Ein Brief des Severus Sebōkt. In Folkerts, M. & Lorch R. (Eds), *Sic itur ad astra: Studien zur Geschichte der Mathematik und Naturwissenschaften: Festschrift für den Arabisten Paul Kunitzsch zum 70. Geburtstag* (pp. 478-489). Wiesbaden.
- Rezvani, P. (2020). *Two treatises on the astrolabe by Abū Rayḥān Bīrūnī (D. CA. 1050). Editions, translations and Commentary*. Franckfurt-am-Main, Institute for the History of Arabic-Islamic Science at the Johann Wolfgang Goethe University [Islamic mathematic and Astronomy vol. 115, 2].
- Segonds, A. P. (1981), Jean Philopon, *Traité de l’Astrolabe*. Paris (Astrolabica 2) [French translation of the Greek text provided with a revision of Hase edition and an extensive study of the text and its transmission].
- Sezgin, F. (1978). *Geschichte des arabischen Schriftums, Band VI: Astronomie. Bis ca. 430 H*. Frankfurt-am-Main, Brill.
- Stueckelberger, A. (2015). *Ioannes Philoponus. De usu astrolabii eiusque constructione*. Berlin-München-Boston, De Gruyter.

- Takahashi, H. (2010). Between Greek and Arabic: The Sciences in Syriac from Severus Sebokht to Barhebraeus. *Transmission of Sciences: Greek, Syriac, Arabic and Latin*, Tokyo: Organization for Islamic Area Studies, Waseda University (WIAS), 16-39.
- Tannery, P. (1888). Notes critiques sur le traité de l'Astrolabe de Philopon. *Revue de philologie, de littérature et d'histoire anciennes* 12, 60-73.
- Tihon, A. (2011). *Πτολεμαίου Πρόχειροι Κανόνες : Les « Tables faciles » de Ptolémée. 1a, (Tables A1-A2)*. Louvain – Paris, Peeters.
- Villey, É. (2023). Chypre, l'astrolabe et la *Lettre sur les climats* : du nouveau au sujet de la correspondance scientifique de Sévère Sebokht (VII^e s.). *Semitica & Classica* 16, 229-252.
- Villey, É. (2015). Ammonius d'Alexandrie et le *Traité sur l'astrolabe* de Sévère Sebokht. *Studia graeco-arabica* 5, 105-128.
- Villey, É. (2014). Qennešre et l'astronomie aux VI^e et VII^e siècle. *Les sciences en syriaque*. Paris, Geuthner, 149-190.
- Villey, É. (2012). *Les textes astronomiques syriaques produits aux 6^e et 7^e s. AD : établissement d'un corpus et de critères de datation. Édition, traduction et lexique* [doctoral dissertation, Université de Caen-Normandie) available on microfiches and to be published in the collection Late Antique History and Religion, Leuven, Peeters.