Syriac astronomical texts (500-700 ce): christian Voices Defending Ptolemaic astronomy*

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SYRIAC ASTRONOMICAL TEXTS (500-700 CE): CHRISTIAN VOICES DEFENDING PTOLEMAIC ASTRONOMY*

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Part of the 'obscurity' of the period from the 6th to the 8th century can be attributed to the fact that an insufficient number of Greek and Syriac sources of that time were made accessible to historians, though those sources could have borne a very valuable testimony not only to the circulation of 'classical books', but also to the religious institutions in which they circulated and the reason they were conserved.[1] This is especially the case for astronomical texts. [2]

The Μαθηματικὴ Σύνταξις ('*The Great Mathematical Treatise*' or *Almagest)* of Claudius Ptolemy was generally considered the Bible for astronomical studies from 200 CE onwards;[3] it was usually transmitted

* I would like to thank Henri Hugonnard-Roche for his reading and valuable suggestions. The remaining problems are of course my own responsibility.

1. See the call for study by Averil Cameron in her article 'New Themes and Styles in Greek Literature. A title revisited', in Scott F. Johnson (ed.), *Greek Literature in Late Antiquity. Dynamism, Didacticism, Classicism* (Aldershot, 2006), pp. 15-17.

2. The lack of edition and translation of Syriac astronomical sources has been deplored in Hidemi Takahashi, 'The Mathematical Sciences in Syriac: from Sergios of Resh-'Aina and Severos Sebokht to Barhebraeus and Patriarch Ni'matallah', *Annals of Science* 68.4 (2011), pp. 477-91. A brief survey of that corpus had also been published in Henri Hugonnard-Roche, 'Textes philosophiques et scientifiques', in Ray J. Mouawad (ed.), *Nos sources : arts et littératures syriaques* (Antélias, 2005), pp. 475-504 et *idem*, 'Matematica e astronomia', in Sandro Petruccioli (dir.), *Storia della scienza 4 Medioevo, Rinascimento* (Roma, 2001), pp. 36-41. For a long time, the only Syriac astronomical works known were those published by François Nau († 1931). Nau's studies on Syriac astronomical texts were recently reprinted in [Nau], *Astronomie et cosmographie syriaques. Recueil d'articles de François Nau*, Introduits et annotés par É. Villey et H. Hugonnard-Roche (L'œuvre des grands savants syriacisants / Scholars of Syriac: Collected Works 1; Piscataway NJ, 2013).

3. Until Kepler (15th c.), the *Almagest* was often the subject of commentary, discussion, polemic, but its geocentric system seems not to have ever been surpassed from the point of view of the mathematical calculations. On the Arabic astronomers and their attempt to develop Ptolemaic theories, see Regis Morelon, 'Panorama général de l'histoire de l'astronomie arabe', in Roshdi Rashed (ed.), *Histoire des sciences arabes 1* (Paris, 1997), pp. 17-33 and 'L'astronomie arabe orientale entre le VIIIe et le XIe siècle', in *ibidem*, pp. 35-69. Before Kepler, Copernicus had already revolutionized the astronomical works but the heliocentric system he proposed (with Mercury and Venus around the sun) was not complete.

in manuscripts with the so-called *Handy Tables* (Πρόχειροι κανόνες) and also with later commentaries (user manuals for both the *Almagest* and *Handy Tables*) written by Pappus of Alexandria († 350 AD) and Theon of Alexandria († 405 AD). During Late Antiquity those books and their contents were usually addressed at the end of philosophical treatises.[4] In the Greek context of Alexandria, that tradition of studying seems to have been preserved without any break until the death of Eutocius of Askalon in 525 CE.[5] From then until the Arabic Golden Age, little is known about the way that astronomical knowledge and books were transmitted. After Alexandria ceased to be the intellectual centre of the Mediterranean, and until the glorious time of Bayt al-Hikma in Baghdad, it is not known who was able to study astronomy and where it was possible.

Indeed, the late antique astronomical texts written in Greek and Latin that testify to the transmission of Alexandrian astronomical knowledge, between the beginning of the 6th and the 8th c., are sparse: the *Preceptum canonis Ptolomei*, translated into Latin from a Greek Byzantine piece during the year 535 CE, [6] is the last Latin treatise known to have dealt with Ptolemaic astronomy until the year 1100 CE;[7] after c. 550 CE and before the 8th century, only two astronomical Greek works using Ptolemaic astronomy have been studied up till now: the *Treatise on the astrolabe* of John Philoponus (490-570 AD)[8] and the *Astronomical Commentary on Handy Tables* attributed to Stephanos of Alexandria (7th c.).[9]

4. See Iseltraut Hadot, 'Scienza e istituzioni', in Sandro Petruccioli (dir.), *Storia della scienza 1 La Scienza antica* (Roma, 2001), p. 999 and Daniel Pingree, 'The teaching of the Almagest', *Apeiron* 27 (1994), p. 78.

5. On religious confusions that led the Alexandrian School to christianize teaching after Eutocius, see Edward J. Watts, *City and school in late antique Athens and Alexandria* (The transformation of classical heritage 41; Berkeley, 2006), pp. 233-36.

6. See David Pingree,'The Praeceptum canonis Ptolomei', in Jacqueline Hamesse and Marta Fattori (eds), *Rencontres de cultures dans la philosophie médiévale, Traductions et Traducteurs de l'antiquité tardive au XIVe siècle* (Louvain-la-Neuve, 1990), p. 365.

7. See Bruce S. Eastwood, 'Astronomia, computo e astrologia', in Sandro Petruccioli (dir.), *Storia della scienza 4 Medioevo, Rinascimento* (Roma, 2001), pp. 149-68.

8. Two critical editions of this Greek treatise have been recently published: Jean Philopon, *Traité de l'astrolabe*, texte établi et traduit par Claude Jarry (Paris, 2015) and Joannes Philoponus. *De Usu Astrolabii eiusque constructione* (Über die Anwendung des Astrolabs und seine Anfertigung) herausgegeben, übersetzt und erlaütert von Alfred Stückelberger (Bibliotheca scriptorum graecorum et romanorum teubneriana 2016; Berlin, 2015)

9. The whole commentary has recently been edited and translated in Jean Lempire, *Le commentaire astronomique aux Tables Faciles de Ptolémée attribué à Stéphanos d'Alexandrie, tome I, histoire du texte, édition critique, traduction et commentaire, chapitres 1-16* (Publications de l'Institut Orientaliste de Louvain 68, Corpus des Astronomes Byzantins 11; Louvain, 2015); I am very grateful to Jean Lempire who showed me the proofs of his

In this context, Syriac astronomical texts written between 500 and 700 CE are very precious, and since new texts have recently been edited and translated,[10] it is relevant here to present briefly the material now accessible to historians and to give some advice on using it.

Earlier Syriac Sources Dealing with Ptolemaic Astronomy

First of all, Syriac astronomical texts may be considered, along with Greek astronomical texts, the most reliable sources for helping historians to understand the real contribution of Christian scholars in the transmission of astronomical knowledge to the Arabs and within the Byzantine Empire. Since most of these texts remain unpublished, they have to be read directly in the manuscripts. After an investigation covering Syriac collections of four European libraries[11], I took an inventory of ten manuscripts containing astronomical texts written before the 8th c.[12] If we want to compare this with the Latin corpus, this result is far from being ridiculous.[13]

Before we make an inventory of those sources and present their characteristics, we have to introduce the scholars who have written them and their intellectual context. It is noteworthy, that all of the Syriac authors of preserved astronomical texts were based in Western Syria and intellectually connected to the traditional scientific and teaching activities of Alexandria. Most of them also belonged to the Syriac-Orthodox Church.[14] The

book before publication; see also Jean Lempire, 'D'Alexandrie à Constantinople : le Commentaire astronomique de Stéphanos', *Byzantion* 81 [2011], pp. 241-66.

10. See Émilie Claude-Villey, *Les textes astronomiques syriaques produits aux 6e et 7e s. AD : établissement d'un corpus et de critères de datation. Édition, traduction et lexique,* thèse de doctorat de l'Université de Caen, 2012.

11. Bibliothèque nationale de France, British Library, Biblioteca apostolica Vaticana and Staatsbibliothek zu Berlin.

12. Ms. London BL Add. 12154 (8 or 9th c.); ms. London, BL Add. 14538 (10th c.), ms. Mardin, Syriac orthodox Church of the 40 martyrs, syr. 553/13 (14-15th c.); ms. Paris BnF syr. 346 (1309 AD); ms. Vatican, BAV, sir. 68 (1465 AD); ms. Vatican, BAV, sir. 555 (1501 AD); ms. Berlin, Petermann 26 (1556 AD); ms. Vatican, BAV, sir. 217 (16th c.) and ms. Vatican, BAV, sir. 516 (19th c.). Among manuscripts containing texts not fully dedicated to astronomy but in which the authors integrate astronomical developments, see ms. London, BL Add. 14658 (7th c.) and ms. Lyon BM syr. 002 (837 AD).

13. No Latin manuscript containing an astronomical work of that time is known. We just know that eight Latin manuscripts (all from the 11th-13th c.) contain a copy of the *Preceptum canonis Ptolomei*, but, as explained by David Pingree, this translation was always transmitted for an astrological purpose (see Pingree, '*Preceptum canonis Ptolomei*', pp. 355-75).

14. It was actually the case for Severos Sebokht, Athanasios of Balad, Ya'kub of Edessa and Giwargi bishop of the Arab tribes (for a biography of these authors see Sebastian

astronomical treatises they wrote during the 6th and 7th centuries, give us a valuable and unquestionable testimony to the facts that: 1) they were clearly involved in the transmission of the astronomical and geographical works of Ptolemy; 2) the logical and rhetorical works of Aristotle were the basis for their higher education.

Syriac scholars who dealt with Ptolemaic astronomy during that time are: Sergios of Rešʿayna († 536 AD),[15] Severos Sebokht († c. 665 AD)[16] and his students of Qenneshre: Athanasios of Balad († 687),[17] Yaʿqub of Edessa († 708 AD)[18] and Giwargi of the Arabs († 724 AD).[19] These authors were

P. Brock *et al.* (eds.), *The Gorgias Encyclopedic Dictionary of Syriac Heritage*, [Piscataway NJ, 2011]). Besides these authors, the anonymous author of the *Handbook of Astronomy* (section 22), who worked at the beginning of the 6th c. AD, seems to have belonged to the *Philoponoi* movement (see Claude-Villey, *Textes astronomiques syriaques*, p. 185). According to Edward J. Watts, the *Philoponoi* were an association of lay Christian students very active in Alexandria during the 5th and 6th c. and directly linked to the anti-Chalcedonian movement of Severos of Antioch (see Watts, *City and School*, pp. 214-260).

15. The *Treatise on the Action of the Moon* by Sergios of Rešʿayna is not properly an astronomical treatise, but rather dedicated to an astrological matter (the purpose of that treatise, which Sergios addressed to a certain Theodoros, is, as the author says himself in the *proemium*, to clarify the astrological theory used by Galen in the third book of his medical treatise *On the critical days*). However, this treatise encompasses astronomical passages, in which Sergios of Rešʿayna refers to the astronomical work of Ptolemy (see an edition of that text in Eduard Sachau (ed.), *Inedita Syriaca. Eine Sammlung syrischer Übersetzungen von Schriften griechischer Profanliteratur. Mit einem Anhang. Aus den Handschriften des brittischen Museum* (Wien, 1870), pp. 101-124; a correction of that edition with a French translation has been proposed in Claude-Villey, *Textes astronomiques syriaques*, pp. 190-242.

16. Many astronomical texts are in circulation under the name of Severos Sebokht. He is certainly the author of the *Treatise on the Astrolabe*, the *Treatise on the Constellations*, the *Letter on Ascending and Descending Lunar Nodes*, the *Treatise on Klimata*, the *Letter on Pasqua Date Computation for the year 665* and of a *Letter on the Conjunction of Planets* (for a complete list see Claude-Villey, *Textes astronomiques syriaques*, pp. 107-138).

17. Thanks to the *Letter on Ascending and Descending Lunar Nodes* of Severos Sebokht, we know that Athanasios of Balad could have been involved in astronomical studies: in this letter, Severos explains that, since he feels too tired to travel, he preferred to send 'Athanasios' instead of himself to explain the use of the *Handy Tables* (for calculating eclipses) to an important official of Mesopotamia (see Severos Sebokht, *Letter on Ascending and Descending Lunar Nodes* in ms. Paris BnF syr. 346, f. 127v. This passage has been edited and translated in French in François Nau, 'Le traité sur les constellations écrit en 660, par Sévère Sébokt, évêque de Qennesrin', *ROC* 27 (1929-1930), Introduction, pp. 335-36 [= (Nau), *Astronomie et cosmographie*, pp. 191-92]). Although we guess that this 'Athanasios' is Athanasios of Balad, we cannot however be sure.

18. Yaʿqub of Edessa included some very interesting astronomical passages in his *Hexaemeron* (see Jean-Baptiste Chabot, *Iacobi Edesseni Hexaemeron seu in opus creationis libri septem* (2nd ed.; Louvain, 1953). According to the ms. BL Add. 14538, f. 155r, Yaʿqub of Edessa also wrote a text on 'how heathen came to think that the sun, moon, and stars, were living and rational beings, endowed with free-will' (see William Wright, *Catalogue of the Syriac Manuscripts of the British Museum acquired since the year 1838 vol. 2* [London, 1871], p. 1008).

19. Two astronomical letters from Giwargi of the Arabs are preserved (see Victor Ryssel [ed.], *Georgs des Araberbischofs Gedichte und Briefe: aus dem Syrischen*, übersetzt

also all involved in studying, commenting, teaching and, for some of them, translating the *Organon* books of Aristotle.[20] Their academic activities were consequently very close to those of their Greek contemporary colleagues who also seriously dealt with astronomy: John Philoponus († 570) and Stephanos of Alexandria (c. 610) whose astronomical works we still have access to,[21] and also commentaries on Aristotelian books on Logic. [22]

und erläutert von V. Ryssel [Leipzig, 1891] and Victor Ryssel [ed.], 'Die astronomischen Briefe Georgs des Araberbischofs', *ZA* 8 [1893], pp. 1-55) and also maybe astronomical tables to calculate the movement of the moon (in ms. Vat. sir. 68, f. 265v according to the manuscript description put online by the Center for the Preservation of Ancient Religious Texts – Brigham Young University-, see http://cpart.byu.edu/?page=59).

20. From Sergios of Reš'ayna, two commentaries on Aristotle's *Categories* are preserved (see Henri Hugonnard-Roche, *La logique d'Aristote du grec au syriaque* [Textes et traditions 9; Paris, 2004]); two of the Severos Sebokht's letters can confirm the interest of the Bishop of Qenneshre in Aristotelian philosophy, in which (they are as yet unpublished) he explains difficult passages of Aristotle's *De Interpretatione* and *Prior Analytics* (see Henri Hugonnard-Roche, 'Questions de logique au VII^{e} siècle. Les épîtres syriaques de Sévère Sebokht et leurs sources grecques', *Studia graeco-arabica*, 5, 2015, pp. 53-104); from Athanasius of Balad, we know his *Introduction to Aristotle's Logic*, one translation of Porphyry's *Isagoge* and Henri Hugonnard-Roche showed that he also produced a translation of Aristotle's *Posterior Analytics*, *Topics* and *On Sophistical Refutations*, because we can find some fragments in the Arabic manuscript Paris BnF ar. 2346 (see Hugonnard-Roche, 'La tradizione della logica', p. 22); Ya'qub of Edessa undertook a new translation of Aristotle's *Categories* which is preserved (see Hugonnard-Roche, 'La tradizione della logica', p. 21); finally, commentaries and translations of the Logic *corpus* produced by George of the Arabs need to be studied: his translations (with commentaries) of Aristotle's *Categories*, *De Interpretatione* and *Prior Analytica* have been preserved (see Hugonnard-Roche, 'La tradizione della logica', p. 22).

21. See footnotes 8 and 9.

22. Philosophical works of John Philoponus were preserved as his *Commentary on Aristotle's Categories* and two commentaries on *Prior* and *Posterior Analytics* (see the contribution of Giovanna R. Giardina to the collective article "Jean Philopon" in Richard Goulet (dir.), *Dictionnaire des philosophes antiques*, 5a [Paris, 2012], pp. 467-68). Regarding Stephanos of Alexandria, its identity is currently a subject of controversy: according to the editors (Jean Lempire, C*ommentaire astronomique*, Introduction, pp. 5-6 and Hermann Usener, 'De Stephano Alexandrino', in *Kleine Schriften von Hermann Usener* III (Leipzig-Berlin, 1914), p. 290) and to Wanda Wolska-Conus ('Stephanos d'Athènes [d'Alexandrie] et Théophile le Prôtospathaire, commentateurs des *Aphorismes* d'Hippocrate, sont-ils indépendants l'un de l'autre ?', REB 52 (1994), pp. 12-13) the same Stephanos of Alexandria would have written, at the beginning of the 7th century, philosophical and astronomical works; however, Mossman Roueché tried to show that the most reliable source (*Chronographeion Syntomon*), on which that fusion was based, would have been wrongly interpreted (see Roueché Mossman, 'Stephanus the Alexandrian philosopher, the Kanon and a seventh-century Millennium', *Journal of the Warburg and Courtauld Institutes* 74 [2011], pp. 1-30). But Jean Lempire refuted his main argument (the fact that the plural 'kanona' in Greek could not refer to the *Handy Tables*) in Lempire, *Commentaire astronomique,* Introduction, p. 6, note 13, so that no evident element seems now to prevent an attribution of the *Astronomical Commentary on Handy Tables* to the *philosophos* Stephanos. Among his philosophical works, a *Commentary On Aristotle's De Interpretatione* has been conserved (see Richard Goulet [Dir.], *Dictionnaire des philosophes antiques*,

Among the astronomical works by the above-mentioned Syriac scholars, several pieces, completely dedicated to astronomy, without any mention of the Bible or any religious or astrological matter, can be considered as 'scientific' texts. Excluded from the following list are texts that fall into the category of astrology, such as Sergios of Reš'ayna's *Treatise on the Action of the Moon*.[23] We must also exclude Sergios of Reš'ayna's translation of the Greek, pseudo-Aristotelian treatise *De Mundo*[24], because it is a brief summary of the doctrines expounded in Aristotle's *De Meteorologica* and *De Caelo*; and finally we have to exclude the *Hexaemeron*[25] of Ya'qub of Edessa because, belonging to the encyclopedic and exegetical genre, it is not entirely devoted to astronomy.

Here is the list of Syriac astronomical texts now accessible to historians:

– Anonymous, *Handbook of Astronomy* (beginning of the 6th c.)

The anonymous *Handbook of Astronomy*, the oldest known astronomical manual in Syriac, is in a unique manuscript written in 1309 AD in Mardin (ms. Paris BnF syr. 346).[26] I have recently edited and translated the 22nd section (*sedrā*) of this handbook (f. 51r-60v).[27] This section focuses on lunar eclipses. Other fragments of that astronomical manual (section 11 [f. 172r-177v] and a fragment of the section 21 [f. 54v-55r])[28] are preserved in the same manuscript but also in the ms. BL Add. 14538 of the 10th century. The text was wrongly attributed to Severos Sebokht by the copyist since the astronomical language used in those three sections is completely different from the vocabulary usually observed in the astronomical works of the Bishop of Qenneshre.[29] This '22nd section' is

Supplément (Paris, 2003), p. 115) and a *Commentary on Aristotle's Posterior Analytics* has been attributed to him (according to the online CNRS database PINAKES) but has not yet been studied.

23. See above footnote 14.

24. Edited in Paul de Lagarde (ed.), *Analecta syriaca* (2nd ed. Osnabrück, 1967), pp. 134-58.

25. See above footnote 17.

26. A detailed notice of that manuscript has been published in François Nau, 'La cosmographie du VIIe s. chez les Syriens', *ROC* 15 [1910], pp. 228-54 (= [Nau], *Astronomie et cosmographie*, pp. 165-78); for an updated description of that manuscript, consult the CNRS online database *E-ktobe manuscrits syriaques*.

27. See Claude-Villey, *Textes astronomiques syriaques*, pp. 155-86.

28. A detailed description of this *Handbook of Astronomy* can be found in Émilie Villey, 'Qennešre et l'astronomie aux VIe et VIIe siècles', in É. Villey (ed.), *Les sciences en syriaque* (Paris, 2014), pp. 161-63 and 174-78.

29. This attribution was already suspected by François Nau ('La cosmographie', p. 229 [= (Nau), Astronomie et cosmographie, p. 119) and Hidemi Takahashi ('Mathematical Sciences in Syriac', p. 480).

entirely dedicated to explaining the cause of the lunar eclipse: after a *proemium* referring to other sections (section 11 and section 21) and presenting the purpose of the present one, the author gives a theoretical explanation of the astronomical phenomenon (How is the shadow of the earth projected on the moon? What are the ascending and descending nodes? Why is the full moon necessary to a lunar eclipse? Why must the moon always be situated inside 'ecliptical limits' to be eclipsed?); then he presents four cases of observation of the side on which the eclipse begins; in a subsequent long debate on the cause of lunar eclipses the author opposes the 'Chaldean' theory of 'Atalya'[30]; there is then an attempt to provide a geometrical representation of the 'real' phenomenon; the last development deals with the calculation of the position of lunar nodes: according to the Syriac author, Chaldeans could have made precise calculations and have foreseen lunar eclipses, but since they did not know the reason for that phenomenon, their writings should not be taken into consideration; if anyone really wished to predict a lunar eclipse he should preferably use the astronomical books of Ptolemy:

> Indeed, the fact is that, when they <(the Chaldeans)> write on Atalya, they are partially accurate because it occurs as they said. It is not because something happens that would not be different from what they said (i.e. that because of Atalya there may be an eclipse), but because when they calculate the day and the hour of an eclipse, what they calculated occurs, even though there is no Atalya, as has been demonstrated above. Indeed the fact that they are accurate in what they say relating to the calculation that concerns the eclipse and that they foresee it, before it happens, is not due to the fact that they are accurate in their belief that Atalya exists, but because of the accuracy and exactness of their calculations. But they just calculate and do not know the reason. Indeed there is no mention <of it>. Every time they calculated, it would have been necessary that they would speak of the nodes of the circles. For lack of this knowledge, they speak of Atalya that their calculations have formed. It is evident that where we say, in our calculations: 'here are the ascending and descending node', they say: 'here stand the head and the tail of Atalya'. Indeed they calculate without knowing the reason for the calculation and why they did so. That's why they were misled.
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> The calculations thanks to which the nodes can be precisely found, also with their causes, are in the book entitled *Table of the calculations* (*Qānonā d-ḥušbānē*), written by the astronomer Ptolemy. It is about the course and movement of all of the luminaries. Even though many preceeded him and came after him, only he became more famous in the art of astronomy than

30. According to this Syriac text, Atalya is a mythological figure that looks like a giant snake, whose head and tail could come between the stars and the earth, causing eclipses. This mythological explanation of the astronomical phenomenon is attributed to Chaldeans, whose identity has not been confirmed.

all of <his> predecessors and successors, because we can define the precise and true causes of the eclipse by following his demonstration. Indeed, from the great sea of precious knowledge that is in his books, we could just collect a small drop and cast an exhortation or encouragement to the friends of work, so that they successfully accomplish, without turning away from <their> love of science, even if the mouths of the adversaries are wide open and their tongues drawn.[31]

– Severos Sebokht, *Treatise on the Astrolabe* (before 660 AD)[32]

The *Treatise on the Astrolabe* was edited and translated by F. Nau in 1899.[33] It is comprised of two parts: the first part (called '*proemium*' by Severos Sebokht) contains a description of the pieces of the astronomical instrument; the second part (called '*skolyon d-asṭrolabon*') presents 25 technical astronomical and geographical applications. F. Nau thinks that Severos Sebokht wrote here an original work, but that is not the

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[31] Personal translation of *Handbook of Astronomy*, section 22 in ms. Paris BnF syr. 346, f. 59r-59v (ܗܿܝ ܓܝܪ ܕܟܕ ܡܚܘܬܝܢ ܠܗ ܟܠ ܐܬܠܝܐ ܂ ܡܫܪܝܢ ܒܡܕܡ ܕܐܡܪܝܢ ܂ ܒܗܿܝ ܕܢܦܩ ܠܚܒܪܐ ܐܝܟ ܕܐܡܪܝܢ ܂ ܠܐ ܓܝܪ ܢܦܩ ܂ ܠܐ ܦܘܫܐ ܡܢ ܗܿܝ ܕܐܡܪܝܢ ܂ ܕܒܠܝܬ ܐܬܠܝܐ ܗܘܝܐ ܐܩܠܝܦܣܝܣ ܂ ܘܒܕ ܫܡܫܝܢ ܘܡܗܪܐ ܡܥܠܬܐ ܕܐܩܠܝܦܣܝܣ ܢܦܩ ܠܚܒܪܐ ܗܘ ܡܕܡ ܕܣܒܟܘ ܂ ܒܕ ܝܗܒ ܠܬܘܗܝ ܐܬܠܝܐ ܂ ܐܝܟ ܕܐܬܢܒܝܘܬ ܡܢ ܠܟܠ ܂ ܗܿܝ ܓܝܪ ܕܡܫܪܝܢ ܒܡܕܡ ܕܐܡܪܝܢ ܒܣܘܥܪܢܐ ܕܟܠ ܐܩܠܝܦܣܝܣ ܂ ܘܡܕܡܝܢ ܢܕܥܝܢ ܠܗ ܡܕܡ ܕܬܗܘܐ ܂ ܠܘ ܡܟܝܠ ܕܡܗܘܕܝܢ ܕܐܝܬ ܐܬܠܝܐ ܡܫܪܝܢ ܂ ܐܠܐ ܡܟܝܠ ܥܕܪܐ ܘܬܘܪܨܐ ܕܫܘܡܠܝܗܘܢ ܂ ܗܿܠܝܢ ܕܒܕ ܫܡܫܝܢ ܠܗܘܢ ܒܠܚܘܕ ܂ ܫܠܡܗܘܢ ܠܐ ܢܕܥܝܢ ܂ ܠܐ ܓܝܪ ܐܝܬܘ̄ ܗܟܢ ܂ ܗܿܘ ܡܢܐ ܓܝܪ ܕܒܕ ܫܡܫܝܢ ܂ ܙܕܩ ܗܘܐ ܠܗܘܢ ܕܢܡܪܘܢܝܗܘܢ ܟܠ ܢܩ̈ܘܕܬܐ ܗܠܝܢ ܕܒܣܘܕܪ̈ܐ ܂ ܗܿܘܢ {ܟܠܗ} ܢܕܟܬܒܘܢ ܐܡܪܘܗܝ ܟܠ ܐܬܠܝܐ ܗܿܘ ܕܟܠܗ ܫܩ̈ܝܠܢܘܗܝ ܂ ܟܠܝܗܐ ܗܘ ܓܝܪ ܕܐܝܟܢܐ ܕܐܡܪܝܢ ܒܕ ܫܡܫܝܢ ܕܬܠܡ ܐܬܠܝܗ ܐܢܐܟܒܢܘܢ ܘܡܠܐܟܒܢܘܢ ܂ ܬܠܡ ܐܡܪܝܢ ܐܦ ܗܿܘܢ ܂ ܕܦܐܡ ܪܫܗ ܕܐܬܠܝܐ ܘܕܘܟܬܗ ܂ ܫܡܫܝܢ ܓܝܪ ܂ ܒܕ ܠܐ ܢܕܥܝܢ ܣܠܩܗ ܕܣܘܥܪܢܐ ܂ ܘܕܡܟܝܠ ܡܢܐ ܗܘܐ ܡܢܐ ܫ̈ܡܫܝܢ ܂ ܘܒܕܓܠܗܘܢ ܒܟܝܘܬܐ ܕܐܝܟ ܗܕܐ ܘܐܬܐܬܒܝܘ ܂ ܫ̈ܡܥܢܐ ܕܝܢ ܕܡܢܗܘܢ ܡܬܐ̈ܬܝܢ ܢܩ̈ܘܕܬܐ ܗܠܝܢ ܫܬܐܬܝܬ ܡܢ ܟܠ̈ܠܬܝܗܝ ܂ ܐܬܬܝܗܝ ܒܡܬܠܬܐ ܗܿܘ ܕܡܬܐܡܪܐ ܦܘܢܐ ܕܫ̈ܡܥܢܐ ܂ ܕܒܫܕܕ ܠܦܛܠܡܐܘܣ ܐܣܛܪܘܢܘܡܘܣ ܂ ܟܠ ܪܗܛܐ ܘܡܘܟܐ ܕܟܠܗܘܢ ܢܗܝܪܐ ܂ ܗܿܘ ܕܒܕ ܩ̈ܢܝܢܐ ܗܘܘ ܕܦ̈ܝܠܝܢ ܘܐܣ̈ܝܢ ܡܢܗ ܂ ܗܿܘ ܟܠܣܘܕܘܗܝ ܚܠܦ ܡܢ ܟܠܗܘܢ ܡ̈ܢܕܥܐ ܘܐܣ̈ܝܪܐ ܂ ܐܬܢܝܚ ܒܐܘܡܢܘܬܐ ܗܕܐ ܕܐܣܛܪܘܢܘܡܝܐ ܂ ܐܦ ܓܝܪ ܥ̈ܠܠܬܐ ܚ̈ܬܝܬܬܐ ܘܫ̈ܪܝܪܬܐ ܗܠܝܢ ܕܐܩܠܝܦܣܝܣ ܂ ܠܦܘܬ ܬܚܘܝܬܗ ܗܢܐ ܫܟܚܢ ܂ ܡܢ ܝܡܐ ܓܝܪ ܪܒܐ ܕܝܕܥܬܐ ܡܝܬܪܬܐ ܕܒܟܬܒܘ̈ܗܝ ܂ ܢܛܦܬܐ ܡܕܡ ܙܥܘܪܬܐ ܐܡܨܝܢ ܠܡܓܒܐ ܂ ܒܕ ܡܬܡܪܢܘܬܐ ܡܕܡ ܐܒܥܝܢ ܠܓܒܝܐ ܐܘܪܚܢ ܠܪ̈ܚܡܝ ܥܡܠܐ ܕܬܘܒ ܢܬܟܫܪܘܢ ܘܠܐ ܢܬܗܦܟܘܢ ܡܢ ܪܚܡܬܗ ܕܝܕܥܬܐ ܂ ܐܦ ܟܕ ܦܬܝܚ ܦܘܡܐ ܕܣ̈ܢܝܐ ܦܘܡܗܘܢ ܘܡܥܒܛ ܠܫܢܗܘܢ ܕܗܿܢܘܢ ܕܠܘܩܒܠܐ ❖). For the second paragraph, see also Nau, 'Le traité sur les constellations', Introduction, p. 330 (= [Nau], *Astronomie et cosmographie*, p. 186).

[32] As we know, this treatise is preserved in three Syriac manuscripts: ms. Mardin, Syriac Orthodox Church of the 40 martyrs, syr. 553/13 (14-15th c.), ff. 3r-53r; ms. Paris BnF syr. 346 (1309 AD), ff. 36v-51v and ms. Berlin, Petermann 26 (1556 AD), ff. 82v-98r.

[33] The edition is based on the only ms. Berlin, Petermann 26. See François Nau, *Le Traité sur l'astrolabe plan de Sévère Sabokht écrit au 7^{e} s. d'après des sources grecques et publié pour la première fois avec traduction française* (Tiré à part du Journal asiatique; Paris, 1899); see also an accurate English translation of the Nau's translation in Robert T. Gunther, *The Astrolabes of the World 1. The Eastern astrolabes* (Oxford, 1932), 1, pp. 82-102.

opinion of Edgar Reich[34] who observes that one word (*epašeq* ; 1st pers. Sg. Pa'el inacc.) used by the author in the *proemium*, could be translated 'I will translate' and not only 'I will explain' as F. Nau maintained. After a thorough investigation of this question, I have shown that the whole treatise is most probably a reworking of a Greek treatise entitled *Scholion on the Astrolabe*.[35] The second part (and also most probably the central part of the first one) is likely a compilation of texts excerpted and literally translated from that lost Greek treatise. The original author may have been Ammonios of Alexandria († after 517 AD).[36] So then the Syriac translation provides the most ancient evidence of the use of the plane astrolabe in the Late Antiquity, even before the *Treatise on the Astrolabe* of John Philoponus. Furthermore, it contains technical developments that are not in the treatise of John Philoponus and among which one is of particular interest, showing how far a sixth century scholar could both use the *Handy Tables* (*qānonā*) of Ptolemy and the astrolabe instrument: in the seventh chapter of the second part, the Greek author explains that the user of the astrolabe should always pay particular attention to the construction of the instrument and check its accuracy by comparing the result with the number resulting from the calculation based on the Ptolemy's *Handy Tables*. But then, what is most interesting is that it is clearly stated that the *Handy Tables* might also be wrong, so an observation made with the astrolabe should be an opportunity to check whether the number given by the *Handy Tables* is right or not:

> If this number, resulting from the table, is equal to the number that results from the indicator of degrees that is included in the *arachne*, then it is obvious that the astrolabe is correct. But if the results are out by two or three degrees, it is known that it is not correct.[37]
>
> By <using the table of> the right sphere which is in the *Handy Tables* of Ptolemy, we can know if both numbers are the same: the number given by the <angular> distance separating the indicator of degrees of the *arachne* from the degree (and the zodiacal sign), which is in the middle of the sky, and the number of the ascensions of the degree of the middle of the sky given in the <table of> the right sphere. We can know <if both numbers are the same> in each of the zodiacal signs and degrees by seeking both the

34. I am very grateful to Edgar Reich, for the discussions we had in Berlin about the *Treatise on the Astrolabe* of Severos Sebokht in December 2013. He is preparing an edition of the treatise, with a German translation and commentary.

35. See Émilie Villey, 'Ammonius d'Alexandrie et le Traité sur l'astrolabe de Sévère Sebokht', *Studia graeco-arabica*, 5, 2015, pp. 105-128.

36. Based on a hypothesis formulated in Villey, 'Ammonius d'Alexandrie'.

37. Severos is using here the 'Tables of the Oblique Ascension' (= A2) of the *Handy Tables* for the fourth climate (cf. text in Tihon, *Πτολεμαίου Πρόχειροι*, pp. 113-16; transl. in Mercier, *Πτολεμαίου Πρόχειροι*, pp. 26-29).

> ascensions of every zodiacal signs and the ascensions of the right sphere. But after having moved the *arachne* until the degree diametrically opposite to the desired degree, seen at the same time how much the indicator of degrees of the *arachne* has shifted from the middle of the sky, and compared the table with the astrolabe one to another, <if> we do not find that their numbers are equal, then we must know that there is an error either in the table or in the astrolabe. Then we must investigate both of them since the table of Ptolemy has been made thanks to the astrolabe.[38]

This evidence shows that during the 6th century astronomy was not necessarily limited to basic teaching[39], but that scholars could also have concerned themselves with the development and the perfection of its instruments (Tables, astrolabe). However, it does not prove that 150 years later Severos Sebokht had the habit of using an astrolabe and computed new astronomical tables. Indeed, in the *qanona* 20 of the *skolyon*, dedicated to the axial precession, Severos Sebokht did not modify the practical exercise applied to the position of the star Regulus for the year 523. Obviously, he translated the Greek treatise without worrying about its practical applications in c. 660. But from a mathematical point of view, neither the position nor the chronological elements given in the exercise were very valuable at that time. Nevertheless, since this translation allows us to see a precious testimony, otherwise lost in Greek, it would be interesting to have a critical edition of it[40] and to compare its technical content with the one of John Philoponus'. [41]

– Severos Sebokht, *Treatise on the Constellations* (before 662 AD)

Translated by F. Nau and published in 1931-1932,[42] this long text (in 18 chapters) has never been entirely edited.[43] It is preserved in two Syriac

38. Personal translation. For the Syriac text and a French translation see Sévère Sebokht, *Traité sur l'astrolabe* [Nau], II.7, p. 48.

39. This is not the point of view of Pingree, 'Teaching of the Almagest', pp. 78 and 88.

40. Edgar Reich is preparing a critical edition with a reordered text and a German translation. I am preparing another critical edition with an English translation.

41. This comparison would now be possible, thanks to two recent publications on the John Philoponus text (see footnote 8). Previously, the only edition of the Greek text, made by Karl-Benedict Hase ('Joannis Alexandrini, cognomina Philoponi, de usu astrolabii ejusque constructione libellus', *Rheinisches Museum für Philologie* 6 (1839), pp. 156-219), which was used by A. Ph. Segonds for his translation (see Jean Philopon, *Traité de l'astrolabe* [Paris, 1981]), was highly criticized in Paul Tannery, 'Notes critiques sur le traité de l'Astrolabe de Philopon', in Paul Tannery *et al.*, *Mémoires scientifiques 4, Sciences exactes chez les byzantins* (Toulouse, 1912), pp. 241-60.

42. See Nau, 'Traité sur les constellations' (= [Nau], *Astronomie et cosmographie*, pp. 183-282).

43. François Nau has just edited part of chapters 4, 5 and 6 in Nau, 'Traité sur les constellations', pp. 355-61, 367-71 and 375-77 (= [Nau], *Astronomie et cosmographie*, pp. 211-17, 223-27 and 231-33).

manuscripts.[44] We know that Severos Sebokht finished it in 659-660 AD. Apart from the first chapters, which are dedicated to defining what 'astronomical art' is and to distinguishing it from 'astrological art', the *Treatise on the Constellations* deals with different astronomical concepts: Severos Sebokht presents the arguments in favour of the sphericity of the earth; he defines mathematically the concept of the 'zodiacal circle' and other theoretical circles that astronomers place on the celestial sphere to get spatial points of reference for their calculations; some further chapters are entirely dedicated to explaining the theory of the *klimata* (system of geographical spatial repartition) and we also find explanations of the length of days and nights according to the particular *klima*; finally he deals with the measurement of the sky and earth and expounds some theoretical considerations on the habitable zones of the earth.

The *Geography* of Claudius Ptolemy, and also his *Handy Tables*, are often quoted:

> […] and it would be the same if someone wanted to put the <angular> distance of the inclination of the poles from the horizon for example on the island called Thule, which is written about in the books *Geography* and *Handy Tables* of Ptolemy – I mean in the *Table of the cities* –, that its latitude is 63°. Indeed, this is here the ἔξαρμα (angle of inclination) of each of the poles.[45]
>
> […] The sun, or the degrees of the sphere, does not rise at the same time above all of the cities that belong to the same climate <according to whether they are> eastern or western, as the *Handy Tables* of Ptolemy and the astrolabe show it.[46]
>
> In the *Handy Tables* of Ptolemy, <the data relating to> the circles and the latitudes are given with the minutes. Who wants to reckon laboriously according to the *Handy Tables*, must know that even thus he will not stray from what is being searched for.[47]

44. Partially in the BL Add. 14538 (f. 153r-155r) and entirely in the ms. Paris BnF syr. 346 (f. 78r-121v).

45. Personal translation of Severos Sebokht, *Treatise on the Constellations*, ch. 14 in ms. Paris BnF syr. 346, f. 110v (ܐܘܟܝܬ ܕܐܝܟܢܐ ܕܢܣܝܡܘܗ̇ ܠܡܫܬܘܠܠܘܬܐ ܕܩ̈ܠܒܐ ܡܢ ܐܘܪܝܙܘܢܛܝܣ ܕܐܟܡܢܐ: ܐܝܟܢܐ ܕܒܓܙܪܬܐ ܗ̇ܝ ܕܡܬܩܪܝܐ ܬܘܠܐ: ܕܟܬܝܒ ܥܠܝܗ̇ ܒܟܬܒܐ ܗ̇ܘ ܕܓܐܘܓܪܦܝܐ ܥܠܬ ܘܩܢܘܢ ܕܦܪܘܟܝܪܘܢ ܕܦܬܠܡܐܘܣ: ܐܡܪܢܐ ܕܝܢ ܒܩܢܘܢܐ ܗ̇ܘ ܕܡ̈ܕܝܢܬܐ: ܦܬܝܗ̇ ܡܢܘܬܐ ܣ̈ܓ: ܡܟܝܠ ܗܢܐ ܗܘ ܗܪܟܐ ܐܝܬܝܗ ܗܘܐ ܐܟܣܪܡܐ ܕܟܠܚܕ ܡܢܗܘܢ ܕܩ̈ܠܒܐ:). For a French translation, see Nau, 'Traité sur les constellations', pp. 406-07 (= [Nau], *Astronomie et cosmographie*, pp. 262-63).

46. Personal translation of Severos Sebokht, *Treatise on the Constellations*, ch. 15 in ms. Paris BnF syr. 346, f. 115r (ܠܐ ܐܡܬܝܢ ܕܝܢ ܫܡܫܐ ܐܘ ܗܘܢ ܡ̈ܢܘܬܗ̇ ܕܐܣܦܝܪܐ ܥܠ ܟܠܗܝܢ ܡ̈ܕܝܢܬܐ ܕܒܗ ܒܩܠܝܡܐ: ܡ̈ܕܢܚܝܐ ܥܡ ܡܥܪ̈ܒܝܬܐ. ܐܝܟܢܐ ܕܡܘܕܥܐ ܦܪܘܟܝܪܘܢ ܕܦܬܠܡܐܘܣ ܥܡ ܗ̇ܘ ܐܣܛܪܠܒܘܢ ܡܚܘܐ). For a French translation, see Nau, 'Traité sur les constellations', p. 88 (= [Nau], *Astronomie et cosmographie*, p. 270).

47. Personal translation of Severos Sebokht, *Treatise on the Constellations*, ch. 16 in ms. Paris BnF syr. 346, f. 116r (ܒܡܘܕܥܐ ܕܝܢ ܦܪܘܟܝܪܘܢ ܕܦܬܠܡܐܘܣ ܥܡ

These quotations illustrate the great reverence felt by Severos Sebokht for Ptolemy's works, which are obviously presented as the basis of the instruction in astronomy given to Syriac students. We note that no other astronomical work is quoted. The *Phaenomen* of Aratos is admittedly quoted in the first six chapters but only in order to demonstrate that the 'astrological' point of view does not deserve to be seriously taken into consideration.

– Severos Sebokht, *Letter on Ascending and Descending Lunar Nodes* (c. 662 AD)

This letter,[48] which contains a calculation on 'what will happen during the year 379 of Diocletianus', was obviously written before 662 AD by Severos Sebokht. It is dedicated to 'Stephanos *illuṣṭriyos*, *karṭulara* (< gr. χαρτουλάριος) of the whole *Gzīrtā*' with the intermediary of a 'brother'. The purpose of the letter is to show different methods of calculation to determine the position of the lunar nodes for a precise date and predict lunar eclipses. The best one, according to Severos, is by far the method set out in the *Little Commentary* of Theon of Alexandria, which required the use of *Handy Tables*:

> Concerning your desire to compute <the position of> the ascending or descending nodes quickly and without any work, I have found it nowhere else and I think that nobody else has made a calculation of <the position of > the ascending and descending nodes quicker, easier and requiring less work than the calculation of the *Handy Tables*, as Theon of Alexandria teaches it in his *Commentary on the Handy Tables*.[49]

There should be one more text added to this list: a letter included in the correspondence of Severos Sebokht. In this letter, written in 661-662 AD,

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48. As we know, this letter is in the only ms. Paris BnF syr. 346, ff. 124v-128v. The Syriac text has been edited with a French translation in Claude-Villey, *Textes astronomiques syriaques*, pp. 248-69. See also two excerpts of this text ed. And transl. in Nau, 'Traité sur les constellations', pp. 335-37 (= [Nau], *Astronomie et cosmographie*, pp. 191-93).

49. Personal translation of Severos Sebokht, *Letter on Ascending and Descending Lunar Nodes* in ms. Paris BnF syr. 346, f. 125r (

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the author, whose identity is not confirmed,[50] deals with the origins of astronomical science and asks a series of questions related to the movement of the sun. This letter, known from the studies of Nau[51] and entirely edited and translated in 1995 by Edgar Reich,[52] is famous because of the oldest mention of the Indian numerals it contains.[53] It presents an interesting reference to the *Almagest*, showing that the author knew of the existence of Ptolemy's treatise. But the questions also show that he had certainly no access to the text.[54]

The first characteristic of those Syriac astronomical texts is that they are original compositions, with the exception of the second part of the *Treatise on the Astrolabe*, which clearly results from a translation of a Greek Alexandrian Text (with however a minor re-organisation). Although their authors write directly in Syriac, they use Greek astronomical concepts and Greek technical words, as a medium for conveying the astronomical concepts, which were developed in Alexandrian Texts. It is also clear that the authors of these texts were seeking to apply that knowledge in a Syrian context (by discussing in Syriac the Greek technical vocabulary; by naming the cities for which Severos Sebokht was searching the longitude and latitude – like Nisibe – which never appeared in the Ptolemaic work; by predicting the position of the lunar nodes in the year 662 AD; and by calculating the date of Easter in the year 665).

Another characteristic of these texts is that their authors recognize the full authority of the Alexandrian astronomers: we have seen in the above-mentioned 22nd section of the *Handbook of Astronomy* the anonymous author insisting on the fact that Ptolemy was the best astronomer that the world had ever had and that if one wanted precisely to foresee an astronomical phenomenon, the work of that master could not be overlooked. He defends the use of the astronomical work of Ptolemy against

50. See a discussion on that point in Villey, 'Qennešre et l'astronomie', pp. 168-70.

51. See Nau, 'La cosmographie', pp. 248-52 (= [Nau], *Astronomie et cosmographie*, pp. 138-42); Nau, 'Notes d'astronomie', pp. 25-27 (= [Nau], *Astronomie et cosmographie*, pp. 225-227); Nau, 'Le traité sur les constellations', Introduction, pp. 332-33 (= [Nau], *Astronomie et cosmographie*, pp. 188-89).

52. Edgar Reich, 'Ein Brief des Severos Sebokt', in Menso Folkerts *et al.* (eds.), *Sic itur ad astra. Studien zur Geschichte der Mathematik und Naturwissenschaften. Festschrift für den Arabisten Paul Kunitzsch zum 70. Geburtstag* (Wiesbaden, 2000), pp. 478-89. See also a partial English translation in Hidemi Takahashi, 'Between Greek and Arabic: The Sciences in Syriac from Severus Sebokht to Barhebraeus', in H. Kobayashi and M. Kato (eds), *Transmission of Sciences: Greek, Syriac, Arabic and Latin* (Tokyo, 2010), pp. 21-23.

53. See Takahashi, 'Mathematical Sciences in Syriac', pp. 480-81.

54. For a discussion on that point see Villey, 'Qennešre et l'astronomie', pp. 149-90.

the methods of calculation of the 'Chaldeans'. And finally, he explains that, 'lovers of work' (*Philoponoi*?), who were most probably his students, must continue their study of Ptolemaic works, 'even if the mouths of the adversaries are wide open and their tongues drawn'.[55] That last sentence leads us to believe that during the 6th century the study of astronomy at this time was not so easy and most probably that the study of Ptolemaic astronomy was like a kind of 'militancy'. But who would those 'adversaries' have been? Were they Syriac scholars who refused to use Ptolemy and his commentators because they belonged to Greek culture (they preferred to use works of 'Chaldeans', whom they considered to be particularly their rightful ancestors)? Were they rather as Christians defending a literal reading of the Bible and refusing to accept teaching about the sky from a pagan? Another example of that insistence on using Ptolemaic works instead of other methods is given by Severos Sebokht in his *Letter on the Ascending and Descending Lunar Nodes*: by reading that letter attentively, we understand that Severos Sebokht had already explained to Stephanos how he could calculate the position of the nodes of the moon. To manage it, Severos had sent to him the whole book of the *Commentary* of Theon of Alexandria *on the Handy Tables*.[56] But as it happens Stephanos wanted from Severos alternative methods of calculation. This was why the bishop of Qenneshre accepted, though unwillingly, the request to present a method 'without the use of the *Handy Tables*' but warned that this other method could not be considered 'satisfactory'.[57] It is one testimony more to the fact that since the beginning of the 6th century and

55. *Handbook of Astronomy*, section 22, f. 59v.

56. See Severos Sebokht, *Letter on Ascending and Descending nodes* in ms. Paris BnF syr. 346, f. 127r (ܡܛܠ ܕܝܢ ܗܿܝ ܐܚܪܝܬܐ ܕܐܦܝܣ ܗܘ ܓܢܝܣܐ ܪܚܡ ܠܡܫܝܚܐ ܕܐܡܬܠ : ܕܦܪܐܕܝܓܡܐ ܢܥܒܕ ܠܗ ܥܠ ܕܐܩܠܝܦܣܝܣ ܫܡܫܢܝܬܐ ܘܕܗܿܝ ܣܗܪܢܝܬܐ : ܘܐܢ ܟܠ ܒܙܒܢܐ ܗܘܐ ܠܦܓܥܬܐ : ܘܡܬܟܬܒܢܢ ܠܗ ܠܬܐܘܢ ܗܿܘ ܕܐܬܟܬܒ ܒܗ ܒܦܘܫܩܗ ܗܿܘ ܕܥܒܕ ܡܛܠ ܦܪܘܟܝܪܘܣ :; 'And about this last thing: the noble friend of Christ has convinced us to give an example related to the eclipses of the sun and moon, even though such <an example> has been given many times by Theon. We have quoted (lit. 'recorded') the commentary he wrote on the *Handy Tables*; above (f. 126v), Severos had already spoken about 'the examples of the author of the commentary, that he (?) made for you, Brother' (ܬܚܘܝܬܗ ܕܒܢܝܐ ܒܡܦܫܩܢܘܬܗܘܢ ܗܿܘ ܕܥܒܕ ܠܟ ܐܚܘܬܟ) showing that the astronomical book of Theon of Alexandria was most probably in the hands of his correspondent.

57. See Severos Sebokht, *Letter on Ascending and Descending nodes*, f. 125v (ܐܢܕܝܢ ܠܐ ܗܘܐ ܫܦܝܪܐ ܠܒܪ ܚܐܪܐ ܕܐܡܝܪ : ܐܠܐ ܕܢܚܘܐ ܚܕܐ ܠܗ ܡܬܬܘܣܦܐ ܡܢܢ ܐܚܪܝܬܐ : ܐܘܡܢܘܬܐ ܕܒܗ ܗܘܐ ܐܦ ܒܗ ܠܐ ܢܦܩܢ ܠܗ ܡܢܝܢܐ ܗܿܘ ܕܦܪܘܟܝܪܘܣ : ܢܗܘܐ ܡܫܟܚ ܠܐܢܒܒܢܘܬܐ ܘܠܡܬܢܚܬܢܘܬܐ :; 'Although it is not convenient for the above-mentioned noble <friend of Christ>, we propose another method, through which we can also calculate <the positions of> the ascending and descending nodes, without using the *Handy Tables*'.

even at the time of Severos Sebokht (second half of the 7th century), some Syriac scholars had set great store by the astronomical theories developed by Claudius Ptolemy and transmitted by his commentators. Those testimonies also plainly demonstrate that the same scholars actively contributed to the transmission of those Greek works.

It is for that matter not difficult to identify which authors and which of their works were used in a Syriac context, since titles of the works and names of authors are frequently quoted; sometimes they even give a literary quotation. The Alexandrian astronomical quoted works are:

- The *Almagest* of Claudius Ptolemy;[58]
- The *Handy Tables* of Claudius Ptolemy;[59]
  - Table of the ascensions of the right sphere[60] (= A1[61]);
  - Table on oblique ascensions[62] (= A2);
  - Table of the movements of the sun and moon[63] (= A3);
  - Table of declinations and lunar latitude (=A5);

58. *Pṭalomaos b-Synṭaksis*. See Reich, 'Ein Brief des Severus Sebokt', p. 479 (texte) and p. 484 (translation).

59. '*Qānonā d-ḥušbānē*' ('Table of calculations') in *Handbook of Astronomy*, section 22, f. 59v; '*Qānonā*' in Sévère Sebokht, *Traité sur l'astrolabe* [Nau], II.7; II.10, p. 53; '*Procheiros*' in Severos Sebokht, *Treatise on the Constellations*, chap. 14 in ms. Paris BnF 346, f. 110v; chap. 15, f. 115r; chap. 16, f. 116r (transl. in Nau, 'Traité sur les constellations', XIV.10, p. 407; XV.8, p. 88 ; XVI.1, p. 89 [= (Nau), *Astronomie et cosmographie*, p. 263, 270 and and 271]) and in Severos Sebokht, *Letter on Ascending and Descending Lunar Nodes* in ms. Paris BnF 346, f. 124v, 125v, 126v and 127r; '*qānonā d-procheiros*' in Severos Sebokht, *Letter on Ascending and Descending nodes*, f. 125r and 125v.

60. '*b-(a)sphērā triṣātā da-b-qānonā d-Pṭolemaos*' (literally: 'in the right sphere which is in the table of Ptolemy') in Sévère Sebokht, *Traité sur l'astrolabe* [Nau], II.7, p. 48; '*b-qānonā d-(a)spherā triṣātā*' (literally: 'in the table of the right sphere') in Sévère Sebokht, *Traité sur l'astrolabe* [Nau], II.10, p. 53.

61. References to the *Handy Tables* are given according to the nomenclature fixed by Anne Tihon in her *Πτολεμαίου Πρόχειροι Κανόνες. Les « Tables Faciles » de Ptolémée vol. 1a (Tables A1-A2)* (Publications de l'Institut Orientaliste de Louvain 59B; Louvain, 2011), pp. 8-9. A transliteration of the Tables A1 and A2 can be found in Raymond Mercier, *Πτολεμαίου Πρόχειροι Κανόνες. Les « Tables Faciles » de Ptolémée vol. 1b (Tables A1-A2)* (Publications de l'Institut Orientaliste de Louvain 59B; Louvain, 2011).

62. See Severos Sebokht, *Treatise on the Constellations* [transl. Nau], XVI.6, pp. 90-91 (= [Nau], *Astronomie et cosmographie*, pp. 272-73); Sévère Sebokht, *Traité sur l'astrolabe* [Nau], II.7, p. 95 (we propose a different translation: 'Then we multiply the number of temporal hours which is written at the opposite of the first degree of Aries in the third column (σελίδιον), in the fourth *klima* of the table (*qānonā*) that Ptolemy made with 12 hours and we add to it the number of *anaphoras* that is placed in front of the degree of the sun in the same fourth *klima* in the second column'); II. 10, p. 53.

63. '*Qānonā d-ptayā d-sahrā*' ('Table of the Latitude of the Moon') in Severos Sebokht, *Letter on Ascending and Descending Nodes*, f. 126v.

  - Table of mean motions, planets[64] (=A14);
  - Table of noteworthy cities[65] (G1);
- The *Geography* of Claudius Ptolemy;[66]
- The *Commentary on the Ptolemaic Handy Tables* of Theon of Alexandria;[67]

But in what language did these texts circulate in Syria at this time? On the occasion of the Symposium Syriacum of Malta (2012), I discussed the linguistic elements raised by the observation of the literary quotation of Theon's work in the *Letter on Ascending and Descending Lunar Nodes*. In view of the incomprehensibility of the syntax of the passages, the great number of words and long expressions transliterated from the Greek, I put forward the hypothesis that Severos Sebokht did in fact use a Greek copy of the Theon's *Commentary on Handy Tables* and not a translation. If this hypothesis is validated, it probably signifies that Syriac scholars of the 6th and 7th centuries had never translated Theon's work but had always read it directly in Greek. Does the same possibility apply to the *Almagest* and the *Handy Tables*? At this point we have to wait for the study of other Syriac testimonies to be able to give a clear answer. But what the already edited and translated Syriac texts are showing, is that Alexandrian astronomical works had undoubtedly circulated in the Syro-occidental milieu directly in Greek, from the beginning of the 6th century and continued into the second part of the 7th century in the time of Severos Sebokht. Outside those astronomical Syriac texts, two other sources can testify that Ptolemy's works may have circulated in Syria at a very early period: the *Treatise on the Action of the Moon*[68] by

64. See Severos Sebokht, *Letter on the Conjunction of Planets* in François Nau, 'Notes d'astronomie syrienne', *Journal asiatique*, 16 (1910), pp. 210-15 (= [Nau], *Astronomie et cosmographie*, pp. 146-51).

65. '*Qānonā d-mdītē*' in Severos Sebokht, *Treatise on the Constellations*, f. 110v, transl. in Nau, 'Traité sur les constellations', XIV.10, p. 407 (= [Nau], *Astronomie et cosmographie*, p. 263).

66. '*Ktābā d-geograwphiqōn*' ('Book of Geography') in Severos Sebokht, *Treatise on the Constellations*, f. 110v, transl. in Nau, 'Traité sur les constellations', XIV.10, p. 407 (= [Nau], *Astronomie et cosmographie*, p. 263).

67. '*Skolyon d-prokeiros*' in Severos Sebokht, *Letter on Ascending and Descending Lunar Nodes*, f. 125r. A literal quotation of Theon's *Commentary on Handy Tables* appears in the same letter (f. 125r); it is however not certain whether that quotation comes from the *Little Commentary* (Chapter 15) or the *Great Commentary on Ptolemy's Handy Tables* (Chapter 21) of Theon of Alexandria. See Claude-Villey, *Textes astronomiques syriaques*, p. 253.

68. See Sergios of Reš'ayna, *Treatise on the Action of the Moon* [Claude-Villey], 2. 3. 1, p. 205 (ܘܐܝܟ ܕܚܫܒ̈ܢ ܗ̇ܘ ܕܡ̈ܢ ܚܫ̈ܒܢ ܥܠ ܣܗ̈ܪ ܕܥܒ̈ܕ ܒܟ̈ܬܒ̈ܐ ܕܐܦ̈ܣ̈ܘ ܕܐ̈ܣ̈ܛ̈ܪ̈ܘ̈ܢ̈ ܘܕ̈ܡ̈ܢ ܕܐ̈ܣ̈ܛ̈ܪ̈ܘ̈ܢ̈ ܐ̈ܦ̈ܣ̈ܘ ܕܐ̈ܣ̈ܛ̈ܪ̈ܘ̈ܢ̈ ܘܐ̈ܦ̈ܣ̈ܘ ܕܐ̈ܣ̈ܛ̈ܪ̈ܘ̈ܢ̈ ܕ̈ܡ̈ܢ ܕ̈ܡ̈ܢ ܕ̈ܡ̈ܢ); 'The calculations by which <the ascending and descending nodes> could always be found are in the *Book*

Sergios of Rešʿayna (early 6th century) and an old scholium of the 5th-6th centuries preserved in the margin of the *Almagest* (in a 9th century Greek manuscript), mentioning an astronomical observation made in Apamea in the year 462 AD.[69]

Space Representation of the Byzantine Elite of the 6-7th c. CE

The second point that may be of great interest for historians is that Syriac astronomical texts can inform us on how the sky and the earth could have been represented among the Byzantine and maybe even the Arabic elite in Late Antiquity.

According to the recent studies of Jean Lempire, the *Astronomical Commentary* attributed to Stephanos of Alexandria was read and annotated by the emperor Heraclius himself.[70] By reading and supporting the astronomical work of that astronomer, we can guess that the emperor Heraclius agreed with the idea of earth sphericity and with the geocentric system of Ptolemy assumed in that book.

The same should be said about the 'illustrious Stephanos, chartulary of all *Gzirtā*',[71] who requested the astronomical knowledge and competences of Severos Sebokht before the year 662 AD: this Stephanos obviously occupied an important place in the Byzantine tax administration and was still active for the same administration under Arabic rule.[72]

of Calculation (/ *Handy Tables*; '*ktābā haw d-hušbānā*') of Ptolemy'). The *Treatise on the Action of the Moon* is however dedicated to astrology, and Sergios had obviously an astrological interest in using *Handy Tables*. The treatise was composed before 536 AD (date of Sergios' death) and is fortunately preserved in a 7th c. Syriac manuscript (BL Add. 14658).

69. See Joseph Mogenet (†) and Anne Tihon, *Le « Grand Commentaire » de Théon d'Alexandrie aux Tables faciles de Claude Ptolémée. Livre I* (Studi e Testi 315; Città del Vaticano, 1985), pp. 73-78.

70. As already said, the attribution of that astronomical handbook to Stephanos of Alexandria is disputed (see Roueché, 'Stephanus the Alexandrian philosopher'). Basing his observations on manuscripts in which the handbook was attributed not to Stephanos of Alexandria, but to Heraclios, Jean Lempire proposes: 'le manuel astronomique a été lu et annoté par Héraclius et […] la tradition manuscrite descend de cet exemplaire impérial' (Lempire, C*ommentaire astronomique*, Introduction, p. 4). See also his article Jean Lempire, 'D'Alexandrie à Constantinople', pp. 241-66.

71. '*Stephanos illuṣṭriyos karṭularā d-kulloh gzīrtā*' in Severos Sebokht, *Letter on Ascending and Descending Lunar Nodes*, f. 124v, transl. in Claude-Villey, *Textes astronomiques syriaques*, p. 251. This *gzīrtā* could have been the Arabic administrative region of Mesopotamia Djazira (see *Encyclopédie de l'Islam*, II, p. 536).

72. Inside the Byzantine administration, the χαρτουλάριος (chartulary), who was subordinate to the *logothète,* was responsible for the making of tax registers (see Jean-Claude Cheynet, 'Chapitre 6 : L'administration impériale' in Jean-Claude Cheynet [dir.], *Le monde byzantin, t. 2 : L'Empire byzantin 641-1204* [Paris, 2006], p. 142).

The fact that those two Byzantine astronomers were supported by powerful men should not be a surprise, since astronomical studies required time and significant financial help. The quality of the preserved astronomical works transmitted should demand our attention. Indeed, one can see how valuable these texts would have been for the elite of the day; by using the astronomical knowledge they could anticipate eclipses and make calendars, and they could become aware of the extent of their territory by mapping it.

The *Letter on Ascending and Descending Lunar Nodes* of Severos Sebokht clearly answers a precise and pragmatic request of the noble Stephanos, who wanted to know how he could foresee an eclipse. As it happens, the explanations could enable him to know – for a precise date – whether a lunar eclipse might happen or not. Regarding the forecast of a solar eclipse, which is more difficult to do, Severos proposed sending him a student (Athanasius).

This evidence clearly shows that during the second half of the seventh century a political man like Stephanos was in search of such people able to predict astronomical phenomena.[73]

It is also very interesting to see, thanks to the unpublished *Letter on the 14th of Nisan* of Severos Sebokht,[74] that the Syriac-Orthodox Church of Syria had already assured his independence from Constantinople and Alexandria by following a proper liturgical calendar. Venance Grumel has found evidence of the fact that the Nestorian Church followed the calendar fixed by Justinian in 562. But that calendar was not adopted either in Constantinople or in Alexandria.[75] Now we can also learn from the *Letter* of Severos that this Justinian calendar had been similarly adopted by the Syriac-Orthodox Church.[76]

Finally those astronomical texts enable us to assess the capability of some Syriac scholars to map the world. Although no map produced in a Syriac milieu and respecting the Ptolemaic conventions has been preserved

73. This could have eventually been of great help in manipulating the popular creeds and superstitions. See the ms. Vat. sir. 217 which contains many old divination texts with astronomical predictions attributed to Daniel the Wise (description of this manuscript online: http://www.mss-syriaques.org/fre/search/results/152468-Recueil-composite-de-textes-astrologiques-de-mantique-sciences-naturelles-m%C3%A9-decine-etc.html). That kind of divination was very popular: see also the ms. Paris BnF syr. 425, f. 108r-275v.

74. In Paris BnF syr. 346, f. 136r-140r.

75. Venance Grumel, *La Chronologie*, *Traité d'études byzantines I La Chronologie* (Bibliothèque byzantine, Études ; Paris, 1958), pp. 98-110.

76. See all details on this evidence and its implications in Claude-Villey, *Textes astronomiques syriaques*, pp. 36-37.

– the only maps we can find simply divide up the world into seven *klimata* (divisions in respect of latitude) –, the Syriac sources would seem to indicate that scholars of the 7th-8th centuries would probably have been able to achieve this. Actually it has been shown, through the study of two treatises of Severos Sebokht and the *Hexaemeron* of Ya'qub of Edessa, that scholars in Qenneshre during the second half of the seventh century had been deeply impressed by the *Geography* of Ptolemy in their spatial representation of the earth: in the *Treatise on the constellations*, Severos Sebokht gives a repartitioning into geographical zones precisely corresponding to the repartitioning found in the Ptolemy's *Geography* (the habitable earth divided into 3 parts: Europe, Libya and Asia; each of these parts is subdivided into countries, cities and eparchies).[77] Furthermore Severos explains that, thanks to the observation of lunar and solar eclipses, the distance in longitude between two cities can be known, and he gave exactly the same approximated (and wrong) numbers as given in the *Geography* to locate in longitude the cities of Alexandria (60°30') and of Ctesiphon (80°);[78] chapters 14 and 15 of his *Treatise on the Astrolabe* are dedicated, thanks to this instrument, to determining the longitude of cities and the time difference between two cities, giving the example of Arbela and Carthage with the same degree of longitude (respectively 35° and 80°)[79] as in the *Geography*.[80] Concerning the *Hexaemeron*, Olivier Defaux convincingly demonstrated the fact that Ya'qub of Edessa reproduced long lists of geographical names (for cities, mountains, rivers) taken directly from the *Geography*. These lists are so close to the Greek preserved copies (in the order in which the names are given and in the vocalization of the names), that it is also possible to determine on which manuscript tradition Ya'qub of Edessa relied.[81]

Studies on those astronomical and geographical Syriac texts must be carried on to understand how far the politicians, for whom these Syriac scholars could have worked, were *theoretically* able to order geographical space (by measuring distances) and to foresee the most important astronomical phenomena.

77. See Severos Sebokht, *Treatise on the Constellations* [transl. Nau], II. 7, p. 351 (see footnote [1] and compare with Ptol., *Geogr.*, VIII).

78. See Severos Sebokht, *Treatise on the Constellations* [transl. Nau], XV. 8, p. 88 and Ptolemy, *Geogr.* 6, 1, 3 (for Ctesiphon) and Ptolemy, *Geogr.* 4.5.9 (for Alexandria). In reality the difference in longitude between Alexandria and Ctesiphon should not exceed 15°, so there is here a big mistake in Ptolemy's *Geography*, blindly accepted by Severos Sebokht.

79. Sévère Sebokht, *Traité sur l'astrolabe* [Nau], II.15, p. 293.

80. Ptolemy, *Geogr.*, I.4 ; IV.3 ; VI.1.

81. See Olivier Defaux, 'Les textes géographiques en langue syriaque', in Émilie Villey (ed.), *Les textes scientifiques en syriaque*, (Études syriaques 11; Paris, 2014).

Now let us put this technical literature into the cultural and religious context of the 6th and 7th centuries, because Ptolemaic astronomy was based on a representation of space (the sphericity of the earth) that was not so popular. Though the already-mentioned Syrian Christians, in the same way as the Alexandrian Greek astronomers, had defended arguments in favour of the sphericity of the earth and had clearly integrated the geocentric system of Ptolemy, those theories were far from being accepted by all scholars of that time. In the face of this scientific literature, many authors offered vigorous resistance: they were those who wrote in Greek such as Cosmas Indicopleustes[82] or in Syriac under pseudonyms such as Rufinos, Berosos[83] or Dionysos Aeropagite.[84] Those authors pretended that the earth was planar or cuboid! The result was that, within a perfectly Christianized empire, there co-existed two kinds of spatial representation during the 6th and until the end of the 7th century: a 'scientific' representation, inherited from Alexandrian astronomers, and a 'biblical' representation.[85] We define as 'scientific'[86] every piece of knowledge

82. Cosmas Indicopleustès, *Topographie chrétienne,* introduction, texte critique, illustration, traduction et notes par W. Wolska-Conus, 3 vols. (Sources chrétiennes 141-159-197; Paris, 1968-1970-1973). According to Bernard Flusin Cosmas Indicopleustes 'propose dans sa *Topographie chrétienne* une géographie proprement chrétienne' (see Bernard Flusin, 'La culture écrite', in Cécile Morrisson [dir.], *Le monde byzantin I L'empire romain d'Orient (330-641)* [Paris, 2004], p. 269). But the ancient Syriac astronomical texts seem to oppose this idea, because their authors were clearly both Christians and believed in the sphericity of the earth.

83. About Ps. Rufinos and Ps. Berosos see Giorgio Levi della Vida, 'La Dottrina e i Dodici Legati di Stomathalassa. Uno scritto di ermetismo popolare in siriaco e in arabo', in *Atti della Accademia dei Lincei, Mem. Scienze morali*, ser. 8, 3. 8 (1951), pp. 477-542 [= *Pitagora, Bardesane e altri studi siriaci,* a cura di R. Contini (Roma, 1989), pp. 125-91] and *idem*, 'Pseudo-Beroso Siriaco', *RSO* 3 (1910), pp. 7-43.

84. See Antoine Kugener, 'Un traité astronomique et météorologique syriaque', in *Actes du XIVe Congrès international des Orientalistes (Alger 1905)* (2nd ed. Kraus, 1968), Part 2, pp. 137-63.

85. Late antique texts presenting a 'biblical' spatial representation never use mathematics, the extent of their astronomical vocabulary is very poor and no more developed than what was found in the biblical lexicon. For a detailed panorama of celestial models in Late Antiquity, see Hervé Inglebert, *Interpretatio christiana : les mutations des savoirs (cosmographie, géographie, ethnographie, histoire) dans l'Antiquité chrétienne, 30-630 après J.-C.* (Collection des études augustiniennes, Série Antiquité 166; Paris, 2001).

86. In *The exact Sciences in Antiquity* (Princeton, 1952), the historian of science O. Neugebauer agreed to describe as 'scientific' some astronomical pieces of Late Antiquity and the Middle Ages. But recently this terminology has been contested by Geoffrey E.R. Lloyd in *Une histoire de la science grecque*, [Paris, 1990], p. 9 and Inglebert in *Interpretatio Christiana*, pp. 199-201. They consider that it would be exaggerated to apply that adjective 'scientific' to scholarly works before the 17th c., because the 'certainties' and 'precise knowledge' of modern science would not yet have emerged at that time. But this point of view is rather disputable, since scientific knowledge and also scientific methods always have to be open to revision (this is a very fundamental characteristic that distinguished them from a dogmatic point of view).

coming from a combination of observations and logical reasoning (following the rules described in the *Posterior Analytica* of Aristotle) and as 'biblical' every piece of knowledge based, either directly or through an intermediary, on one biblical book.

In his very helpful study *Interpretatio Christiana*, Hervé Inglebert has demonstrated that until the end of the fourth century, the Fathers preferred to defend the spherical model of the earth (Origen, Eusebius of Caesarea, Athanasios of Alexandria, the Fathers in Cappadocia and Didymos the Blind); but that then, from the end of the 4th century until the 7th century, Diodoros of Tarse, Severos of Gabala, Theodore of Mopsuestia, John Chrysostomos, Theodoretus of Cyr and obviously Cosmas Indicopleustes returned to the archaic model. We have then to wait for the *Hexaemeron* of Georges of Pisidia (c. 630-650) to find again any agreement between biblical involvement and the spherical model. The same thing can be established among the Syrian Fathers: Aphraate (c. 336-345), Narsaï, Ya'qub of Serugh and the Ps. Denys (c. 550) were also simultaneously defending the archaic model of the earth, whereas Bardesane (2th c. AD) had been open to the spherical model.[87]

Then we have to consider that the Christian champions of the 'scientific' celestial model were most of the time found in a Miaphysite Christian milieu: as far as I know, it is actually only from this context that famous scholars such as John Philoponus[88] and Severos Sebokht emerged, although their relationship with their Church did not always seem to have been peaceful. Furthermore our investigation of the manuscript tradition shows that all astronomical Syriac texts are preserved in manuscripts of the Syriac-Orthodox tradition. Why were those scientific compositions produced predominantly in an Alexandrian and in a West-Syrian Miaphysite context? Is that linked to the Persian (and then Arabic) domination that widely supported the non-Chalcedonian clergy based in Syria?[89]

87. See Inglebert, *Interpretatio Christiana*, pp. 27-72.

88. It is very interesting to see that the seven Miaphysite works of John Philoponus have all been preserved in Syriac (see Goulet (dir.), *Dictionnaire des philosophes*, 5a, pp. 492-95).

89. According to Gilbert Dagron (Gilbert Dagron, 'L'Église et la chrétienté byzantines entre les invasions et l'iconoclasme (VIIe- début VIIIe siècle)', in Jean-Marie Mayeur *et al.* [dir.], *Histoire du christianisme des origines à nos jours* 4 *Évêques, moines et empereurs (610-1054)* [Paris, 1993], pp. 16-28), the Miaphysite clergy was widely supported by the new Persian invader at the time of Stephanos of Alexandria and Severos Sebokht. That support may have provided them with a period of freedom. Moreover the Arab invasion seems not to have changed anything in the predominance of the Miaphysite clergy in the Christian Egyptian and Syrian panorama. But such is not the opinion of Harald Suermann, *Die geschichtstheologische Reaktion auf die einfallenden Muslim in der edessenischen Apokalyptik des 7. Jahrhunderts* (Frankfurt am Main-New York, 1985).

Is this perhaps due to the kind of biblical interpretation they used which was rather allegorical? [90]

The astronomical Syriac texts also provide interesting evidence about the conflicts that arose between the champions of the biblical model and the supporters of the scientific concepts. The author of the 6th century *Handbook of Astronomy* and Severos Sebokht both dedicated a portion of their writing (as introduction or conclusion) to defending themselves against the accusation of denying free will.[91] Indeed, their interest in astronomy could have been confused with astrological activities, which were strictly condemned by ecumenical Councils. Furthermore Christian Ptolemy's followers had to justify their use of Greek books, which were pagan sources.

It is not so easy to know the exact diffusion of that scientific representation of space in the Mediterranean region during that time. When considering the preserved Greek manuscript containing astronomical works by Ptolemy, and also works by John Philoponus and Stephanos of Alexandria, it would be wrong to think that the Ptolemaic literature would have been censured in a radical manner: indeed, the Alexandrian astronomical works were abundantly copied during the Middle Ages.[92] Furthermore it would also be wrong to think that their authors would have been widely persecuted, especially if we take into account the powerful sponsors of our astronomers. The reason for the small size of the astronomical Syriac corpus is more likely due to the fact that until now few

90. Maybe schools open to allegorical biblical interpretation were more inclined to let their members complete their astronomical knowledge by reading pagan technical literature. This was not the case in Antioch, where a rigorous literal hermeneutical method was applied. Note that John Philoponus, in his *De opificio Mundi*, warned against a too literal biblical interpretation of subjects regarding cosmography. For the Chalcedonians, their Councils severely condemned astrological activities. So it is quite easy to understand that few people among them ran the risk of studying works which were also often used by astrologers.

91. See *Handbook of Astronomy*, section 22, f. 58r, transl. in Claude-Villey, *Textes astronomiques syriaques*, pp. 179-82; Severos Sebokht, *Treatise on the Constellations* [transl. Nau], 1-5; see a first analysis of these sources in Claude-Villey, *Textes astronomiques syriaques*, pp. 21-23.

92. According to the CNRS database 'PINAKES' (IRHT, Greek section, Paris), 73 copies of the *Almagest* have been preserved (since the 9th c.), 32 of the *Handy Tables*, 69 of the *Geography*, 79 of Theon's *Little commentary* (since the 9th c.), and 90 of John Philoponus' *Treatise on the Astrolabe*; finally Jean Lempire until now has registered 22 copies of Stephanos of Alexandria's *Astronomical Commentary on Handy Tables* (see Lempire, 'D'Alexandrie à Constantinople', pp. 241-42). Those results are not ridiculous at all, especially if we compare them with the number of copies remaining for the Cosmas Indicopleustes *Christian Topography* (27 registered by PINAKES).

modern scholars have edited and translated those texts.[93] Actually, as already stated, a large number of them remain unpublished.[94]

Nevertheless since institutions for education were maintained by religious men assuming clerical charge, we cannot exclude the hypothesis that the decrease in astronomical works could also have come about because of the difficulty in reconciling religious duties with scientific activities. In the same way we could interpret the writings of both Sergios of Rešʿayna and Severos Sebokht, who much lamented their lack of time for their astronomical studies.[95]

System of argumentation used in Earlier Syriac Astronomical Texts

Another means of investigation for historians could be to observe the system of argumentation found in Christian astronomical compositions.

In the great time of *florilegia* and *testimonia*,[96] a particular characteristic of the four texts I quoted above was never to mention or quote the Scriptures.[97]

Every text deals with one precisely defined astronomical subject. Indeed they all are concerned with the specific field of astronomy and do not touch on meteorology, biology, zoology, ethnology or theology as it occurs in the Ps. Dionysios' *Treatise on astronomy and meteorology*,[98]

93. It is relevant here to record that Paul de Lagarde († 1891), Eduard Sachau († 1930) and especially François Nau († 1931) were the only scholars, as far as I know, who made an effort to make a small part of the cosmographical Syriac literature accessible.

94. In my dissertation I was able to extend my enquiry to some of the biggest Syriac collections in Europe and I composed a list of over 20 unpublished ancient cosmographical and astronomical texts. Research has yet to be extended to the other European Syriac collections and of course to the over 10000 estimated manuscripts preserved in the East.

95. See Sergios of Rešʿayna, Preface to his translation of the *De Mundo*, edited in Paul de Lagarde (ed.), *Analecta syriaca* (Leipzig, 1858), p. 134; transl. in Claude-Villey, *Textes astronomiques syriaques*, p. 289. See also Severos Sebokht, *Letter on Ascending and Descending Nodes*, f. 127v, transl. in Claude-Villey, *Textes astronomiques syriaques*, p. 266.

96. See Averil Cameron, 'New Themes and Styles in Greek Literature: Seventh-Eighth Centuries', in Averil Cameron and Lawrence I. Conrad (eds.), *The Byzantine and Early Islamic Near East: Problems in the Literary Source Material* (Princeton, 1992), pp. 102-103.

97. Actually neither in the works of Severos Sebokht, nor in the *Handbook of Astronomy* (section 22) do we find biblical quotations. Only one quotation appears in the *Treatise on the Constellations* in an introductory chapter dedicated to proving that astronomy was really different from astrology and that, from that point of view, an interest, not in astronomy but in astrology, would mean a denial of free will.

98. See Kugener, 'Un traité astronomique'.

in the famous Ps. Aristotle's *De Mundo*[99] or in the *Livre des trésors* of Yaʿqub Burdʿoyo.[100]

Finally it is relevant to note that the authors of Syriac astronomical treatises used rules of reasoning that they always claimed to take from Aristotle. I would like to give here three illustrations:

The first and maybe most appropriate example I found can be read in the 6th century anonymous *Handbook of Astronomy* (section 22). Its author uses a succession of syllogisms in order to demonstrate that the theory of Atalya, supported by the Chaldeans, is wrong:

> There is also this refutation **[56r]** of the existence of Atalya:
>
> **<SYLLOGISM 1>**
> Indeed, if every time that there is an eclipse, the moon is in Atalya,
> and if every time that it is in Atalya, it is on the ecliptic,
> Then every time that there is an eclipse, it is on the ecliptic.
>
> **<SYLLOGISM 2>**
> Indeed, if every time that there is an eclipse, the moon is in Atalya,
> And if every time that it is in Atalya, it is on the ecliptic,
> Then every time that there is an eclipse, it is on the ecliptic.
>
> **<SYLLOGISM 3>**
> And every time that the moon (rises) in latitude, it is possible that there will be a full moon,
> then every time that the moon is full, it is possible that there will be no eclipse.. [101]

Aristotle had often written in his logical works, and especially in the *Analytica posteriora*, that one characteristic of science is to be expounded through syllogisms called 'demonstration'.[102] The way in which these

99. Ps. Aristotle's *De Mundo* translated in Jules Tricot (ed.), *Aristote, Traité du Ciel* suivi du *Traité pseudo-aristotélicien du monde*, traduction et notes [pour les deux textes] par J. Tricot (Paris, 1949).

100. See François Nau, 'Littérature cosmographique syriaque inédite. Notice sur le Livre des trésors de Jacques de Bartela, évêque de Tagrit', *Journal asiatique* (9e série) 7 (1896), pp. 286-331 (= [Nau], *Astronomie et cosmographie*, pp. 61-106).

101. Personal translation of the *Handbook of Astronomy,* section 22, f. 56r : ܐܝܬܘܗ̇ ܠܒܪ ܕܟܠ ܐܡܬܝ ܕܗܘܐ ܐܩܠܝܦܣܝܣ ܒܐܬܠܝܐ ܗܝ ܣܗܪܐ. ܟܠ ܐܡܬܝ ܕܝܢ ܕܒܐܬܠܝܐ ܗܝ ܒܙܘܕܝܐܩܘܣ ܗܝ ܀ ܟܠ ܐܡܬܝ ܐܢܐ ܕܗܘܐ ܐܩܠܝܦܣܝܣ ܒܙܘܕܝܐܩܘܣ ܗܝ ܀ ܐܚܪܝܢ ܟܠ ܐܡܬܝ ܕܗܘܐ ܐܩܠܝܦܣܝܣ ܒܙܘܕܝܐܩܘܣ ܗܝ ܣܗܪܐ ܀ ܟܠ ܐܡܬܝ ܕܝܢ ܕܠܐ ܒܙܘܕܝܐܩܘܣ ܗܝ ܦܬܝܐ ܗܝ ܀ ܟܠ ܐܡܬܝ ܐܢܐ ܕܠܐ ܗܘܐ ܐܩܠܝܦܣܝܣ ܦܬܝܐ ܗܝ ܣܗܪܐ. ܐܡܬܝ ܕܝܢ ܕܒܦܬܝܐ ܗ̇ܝ ܣܗܪܐ ܀ ܡܫܟܚܐ ܗܝ ܕܬܗܘܐ ܦܢܣܠܢܘܣ. ܐܡܬܝ ܐܢܐ ܕܦܢܣܠܢܘܣ ܗܝ ܣܗܪܐ. ܡܫܟܚܐ ܕܠܐ ܬܗܘܐ ܐܩܠܝܦܣܝܣ.

102. See for example Aristotle, *Seconds analytiques* [Ross], I. 2 ('connaître scientifiquement, c'est savoir par démonstration'). But, as Pierre Pellegrin has already noted: 'on est bien en peine de trouver des syllogismes dans le *Traité du ciel*, la *Physique*, la *Méthaphysique* ou les traités biologiques.' (Pierre Pellegrin (ed.), *Aristote, Seconds analytiques* (Organon 4; Paris, 2005), Introduction, p. 8). So this would be an application of the theoretical considerations of Aristotle in his philosophical work.

syllogisms are used in the Syriac text shows that the author actually retained them as pertinent for his demonstration. But as two of the syllogisms are not well elaborated,[103] we could legitimately wonder whether the Christian author had inherited that kind of demonstration from his studies of the logical works of Aristotle or instead from his *Rhetoric*? Actually Aristotle's *Rhetoric* laid emphasis on the use of the demonstration by syllogism (or *enthymeme*) as the best way to persuade.[104]

Another method of organization of the discourse inherited from Aristotle could be seen in the *Treatise on the Action of the Moon* of Sergios de Reš'ayna and in section 11 of the *Handbook of Astronomy*.[105] They both seek to make a presentation going from the 'general' to the 'particular' and clearly attribute that organization of the discourse to Aristotle. The first example is excerpted from Sergios de Reš'ayna's treatise:

> […]for who is seeking to know what are these particular things (the critical days), as Galen said in the third treatise, it is necessary to know the general discourse on the whole opinion that was that of the astronomers on all the causes that may have an effect on the human realm. Indeed, according to the holy philosophy of Aristotle, if someone knows one of the particular things, he generally will not be able to also know the general points; but if one gets to the general, starting with a knowledge of general points, he will also necessarily be aware of the particularities, because the particularities are contained in the general points. On the contrary, the general points cannot be limited by particularities. Consequently, when someone is trying to know not just from Galen, as it has been said, in his third book on critical days, but also the cause of all the particularities, it will be necessary for him to let the particular things, [f. 141v] to make raise his mind to what is generally said by astronomers on the variations and on the lot of aspects of the moon and of the other stars with which it can enter in conjunction and to extract from it a general way of thinking according to what all what is in this earthly realm can have an effect according to the opinion of these people.[106]

103. The second syllogism is not valid and the third is not complete. I am grateful to Henri Hugonnard-Roche who gave me his expertise of the second syllogism: 'Le second syllogisme n'est pas valide. En effet, l'auteur passe subrepticement de la condition 'à chaque fois qu'il y a éclipse' dans la première prémisse, à la condition 'à chaque fois qu'il n'y a pas éclipse' dans la conclusion. Il y a dans son raisonnement une prémisse cachée, qui s'énonce : 'à chaque fois qu'il n'y a pas éclipse, la lune n'est pas sur l'écliptique', tirée de la première prémisse, mais cette inférence est fausse. De 'si p, alors q', on ne peut conclure 'si non p, alors non q'.

104. See Aristotle, *Rhétorique* [Dufour], I.2, p. 78-79: 'Toute démonstration se fait par syllogisme ou par induction (évidence qui résulte de nos *Analytiques*) […] ; il n'y a pas d'autre moyen de persuader que ceux-là […] les exercices d'école sont les uns à exemples, les autres à enthymèmes. Sans doute on ne se laisse pas moins convaincre aux discours réels qui procèdent par exemples; mais on applaudit davantage les discours à enthymèmes'.

105. In ms. Paris BnF syr. 346, f. 172r-177v.

106. Personal translation of Sergios of Reš'ayna, *Treatise on the Action of the Moon*, edited in Eduard Sachau (ed.), *Inedita Syriaca. Eine Sammlung syrischer Übersetzungen*

The second example can be found in the *Handbook of Astronomy*:

> But since we have to ensure that the person who wants to know these various <topics> gets first knowledge on *generalities* – indeed it is possible to know properly all *particularities*, according to the following word of Aristotle, who instructs us, in that way: the one who has knowledge on the *general*, also knows *particularities*, but the one who has knowledge on *particularities*, does not automatically know the *general* –, we have to establish what is above, in order to explain that point further; then we will deal with the aspects that can occur to the moon step by step.[107]

Furthermore it is clear that in the first four chapters of the *Treatise on the Constellations* Severos Sebokht uses philosophical and linguistic concepts of *Significant* and *Signified* taken from the *Categories*. The name Aristotle in not clearly mentioned, but many logical considerations connected with the expression 'le philosophe éloquent' indicate that Severos Sebokht referred to the Stagirite.[108]

Finally it could also be shown – but it will be the purpose of another article – that ancient Syrian astronomers could also use geometric demonstrations to support their argumentation.[109]

von Schriften griechischer Profanliteratur. Mit einem Anhang. Aus den Handschriften des brittischen Museum (Wien, Halle, 1870), p. ܡܒ ; for a critical edition of this passage with a French translation, see Sergios of Rešʿayna, *Treatise on the Action of the Moon* [Claude-Villey], pp. 196-97.

107. Personal translation of *Handbook of Astronomy*, section 11 in Paris BnF syr. 346, f. 172r : 'ܐܠܐ ܡܛܠ ܕܐܠܝܨܐ ܠܝ ܠܗܢ ܕܨܒܐ ܕܢܕܥ ܗܠܝܢ ܐܫܘܝܬܐ ܀ ܕܡܕܡܟܐܝܬ ܠܗܠܝܢ ܕܓܘܢܐ ܢܗܘܐ ܩܕܡ ܀ ܡܫܟܚܐ ܓܝܪ ܡܥܩܒ ܕܕܝܠܝܬܐ ܢܕܥ ܟܠܗܝܢ ܬܫܝܢܐܝܬ ܀ ܐܝܟ ܡܠܬܐ ܕܐܪܝܣܛܛܠܝܣ ܕܡܠܦܐ ܠܢ ܀ ܗܘ ܕܠܓܘܢܐ ܩܕܡ ܝܕܥ ܐܦ ܠܡܬܦܪܫܬܐ ܀ ܗܘ ܕܝܢ ܕܠܡܬܦܪܫܬܐ ܩܕܡ ܠܗ <ܝܕܥ> ܡܢ ܟܠ ܦܘܡ ܐܦ ܠܓܘܢܐ ܀ ܕܘܠ ܠܝ ܕܠܥܠ ܡܢ ܠܗܠ ܢܣܝܡ ܕܡܘܒܠܐ [ܕܡܘܒܠܐ] ܡܛܠ ܕܢܬܦܪܫ ܝܬܝܪ ܀ ܘܗܝܕܝܢ ܥܠ ܐܣܟܡܐ ܕܓܕܫܝܢ ܠܣܗܪܐ ܒܐܪܚܐ ܒܐܪܚܐ ܐܡܪܝܢ ❖'.

108. See Severos Sebokht, *Treatise on the Constellations*, ff. 78r-78v (ܒܓܢܣܐ ܐܦ ܐܘܪܒ ܗܟܢ ܦܝܠܣܘܦܐ ܡܠܝܠܐ ܐܪܒܥܐ ܗܠܝܢ ܕܡܕܡܟܐܝܬ ܡܬܐܡܪ̈ܢ ܕܦܫܝܛܢ ܀ ܒܗܠܝܢ ܕܡܬܡܠܠܢ ܒܗܝ ܘܡܬܡܠܠܢ ܀ ܨܒܘ̈ܬܐ ܐܡܪ ܐܢܐ ܘܡܚܫ̈ܒܬܐ ܘܡ̈ܠܐ ܘܡܟܬܒܢܘܬܐ) and the transl. in Nau, 'Traité sur les constellations', I.1, p. 345 (=[Nau], *Astronomie et cosmographie*, p. 201): 'Aussi le *philosophe éloquent* plaçait quatre choses que l'on dit tout d'abord être simples, qui doivent être exprimées ou qui seront à exprimer, je veux dire : les évènements, les pensées, les paroles et les écrits [...]'); I am grateful to Henri Hugonnard-Roche who helped me to identify the link between these words of Severos Sebokht and Aristotle, *Peri Hermeneias* (ed. Tricot) 1, 16a, 3-4. François Nau made a bad translation ('les évènements') of the first word *suʿrānē*. The Syriac word is an exact equivalent for the Greek *pragmata*, so a better translation would be 'things' ('choses' in French).

109. Examples are given in *Handbook of Astronomy,* section 22, f. 56r-56v (transl. in Claude-Villey, *Textes astronomiques syriaques*, pp. 171-72); section 11, f. 177r and in Severos Sebokht, *Treatise on the Constellations* [transl. Nau], XIV.13, p. 84 (= [Nau], *Astronomie and cosmographie*, p. 266).

In her article of 2006 Averil Cameron called for a reflection on the 'supposed' link between Christianization and a kind of decline of rationality.[110] Until now no great attention has been dedicated to astronomical texts of that period, maybe because the only known Greek pieces were considered the last heritage of that famous pagan education emanating from Alexandria and Athens. Now with the active studies of Jean Lempire on the *Astronomical Commentary* attributed to Stephanos of Alexandria and in the light of the Syriac astronomical literature of that time, it seems that this judgement has to be qualified. Actually the Syriac testimonies we have preserved – composed in Syrian monasteries, such as Qenneshre (Chalcis), 40 km South of Aleppo – show that some very active Christian scholars were studying philosophy and science and were making a great effort to rationalize during the 6th and the 7th centuries. The efforts of John Philoponus, Stephanos of Alexandria and Severos Sebokht were those of eminent Christian scholars determined to prove that Christianity was not incompatible with the search for knowledge in the particular field of astronomy.

Another relevant point concerns the new method they used to argue: the combination of Aristotelian philosophy and Ptolemaic astronomy needs to be carefully studied, since some of the arguments used to defend Ptolemaic astronomy are not based on observation of the sky, but on *logical* arguments. And it is interesting to see that a number of those arguments, such as syllogisms, are also part of the rhetorical programme expounded by Aristotle in his *Rhetorics*. In view of the existence of the famous schools of rhetoric in Beirut and Antioch[111] it would not be an overstatement to envisage the possibility that rhetorical influence, in addition to philosophical involvement, may have helped the Christian scholars of Byzantium to revive scientific astronomical literature in a new style.

110. Cameron, 'New Themes and Styles in Greek Literature', p. 17.

111. See some interesting elements about the teaching of these schools in Kaufhold, 'Die syrische Rechtsliteratur' in *Sources syriaques* (Paris, 2005), pp. 261-90.