5 Jewish astronomy in Byzantium*

The case of Wellcomensis MS.498

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The codex Wellcomensis MS.498¹ (AD 1492) contains an astronomical treatise by Michael Chrysokokkes (ff. 32–68r) entitled:

Μιχαὴλ νοταρίου τῆς μεγάλῃς ἐκκλησίας τοῦ Χρυσοκόκη, ἔκδοσις γεγонуῖα εἰς τὸ ἰουδαϊκὸν ἑξαπτέρυγον κατὰ τὸ ,ς'αμγ' ἔτος ἀπὸ τῆς ἀρχῆς τοῦ παντός.

Exposition concerning the Jewish Hexapterygion for the year 6943 from the beginning of the world by Michael Chrysokokkes, notarios of the Great Church.

This treatise is a Byzantine adaptation of the Jewish astronomical treatise called *Shesh Kenaphayim*, the *Six Wings*, composed by Immanuel Bonfils for the town of Tarascon (Southern France) around 1350. It offers me an opportunity to present an important scientific trend at the end of the Palaiologan period in the fifteenth century: the introduction of Jewish astronomy into the Byzantine world. Michael Chrysokokkes' treatise, written in 1435, is the first example of the fashion for Jewish astronomical tables in Byzantium; it was followed by the adaptation of the *Cycles* of Bonjorn (written in Perpignan in 1361) by Mark Eugenikos, Matthew Kamariotes' adaptation of the *Paved Way* (*Orah Sellulah*) of Alhadib, and several anonymous treatises inspired by these works.

It might be useful at this point to offer a brief reminder of the history of astronomy in the Byzantine world.² During the Palaiologan period (from the end of the thirteenth century until the fall of Constantinople in 1453), there are two main trends in Byzantine astronomy. First, the restoration and continuation of Ptolemy's astronomy, involving eminent scholars such as Theodore Metochites, Nikephoros Gregoras, Barlaam of Seminara, Isaac

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1 Bouras-Vallianatos (2015: 321–4).

2 On the history of Byzantine astronomy, see Tihon (1994); (1996); (2008); (2009); (2013); and (2017a).

Argyros, and Theodore Meliteniotes. Ptolemy never stopped being studied and used in the Byzantine intellectual milieu. And second, the introduction and use of Arabic and Persian tables, which became widespread thanks to the *Persian Syntaxis* of George Chrysokokkes (ca. 1347). The *Persian Syntaxis* was a Greek adaptation of the *Zīj-i Ilkhānī* by Naṣīr al-Dīn al-Ṭūsī,³ which was widely disseminated in its Byzantine form.

But, by the end of the fourteenth century, Byzantine amateurs of astronomy were not entirely satisfied with these astronomical tables. Ptolemy's tables were obviously by now outdated and they produced an error of some 6° in the longitudes, even though they might sometimes produce good results for the time of a syzygy or an eclipse. On the other hand, the Persian tables were spoiled by some mistakes in the Byzantine adaptations, and also produced errors in the estimation of a syzygy. So, Byzantine astronomers wanted to have astronomical tables that were both reliable and easy to use.

In the Byzantine world, astronomy, with its 'sister' disciplines geometry, arithmetic, and music, was part of the scientific curriculum. The 'four sciences' remained the basis of a Byzantine scholar's education. In the fourteenth and fifteenth centuries, many intellectuals were practising or studying astronomy, not as real scientists, but as clever amateurs. Astrologers, who were flourishing in the Byzantine world in spite of the reluctance of the imperial power and of the Church,⁴ needed updated tables in order to perform the astronomical calculations deemed necessary to establishing an astrological *thema*.⁵ Many physicians were also practising astrology because they believed it could improve their medical practice.

But, more particularly, the Orthodox Church needed a competent clergy with a good training in astronomy. It is striking to see that after the *Astronomical Tribiblos*, written by Theodore Meliteniotes around 1352,⁶ the most important authors of astronomical treatises were members of the Orthodox Church. The reason for this was the need to master the complex problem of Easter computation.⁷ The Church wanted all Christians to be able to celebrate Easter on the same day, while avoiding the celebration of the Christian feast on the same day as the Jewish Passover. Since the Council of Nicaea in 325, the most commonly followed rule for fixing the date of Easter was that it should be on the first Sunday following the first full moon after the spring equinox. Two astronomical problems were thus involved: the date of the spring equinox and the date of the first full moon

3 Mercier (1984). On the introduction of Persian astronomy to Byzantium, see Pingree (1964), (1985-6); and Tihon (1987).

4 Magdalino (2006); (2017).

5 An astrological *thema* is a diagram containing the essential astronomical elements for prediction (e.g. position of the sun, moon, planets, houses).

6 Leurquin (1990); (1993).

7 On the Easter problem, see Grumel (1958); Mosshammer (2008); Lempire (2007); and Tihon (2004; 2011).

after the equinox. The Orthodox Church was still using an Easter canon established by John of Damascus in the eighth century.

Around 1325, Nikephoros Gregoras tried to persuade the Emperor Andronikos II (r. 1282–1328) to reform the paschal canon, arguing, on the basis of Ptolemy, that the date of the equinox was two days late. In 1333, his rival, Barlaam, raised the problem again, showing, also on the basis of Ptolemy, that the length of the tropical year was not right, and moreover that the 19-year cycle on which the traditional canon is based was not exact. Gregoras had suggested reforming the canon, but Barlaam pleaded for the *status quo*, for fear of causing trouble in the Church.⁸ Later on, around 1370, Isaac Argyros raised the problem again, but the question remained unresolved. In manuscripts one can find many Easter canons, some of them reproducing the canon of John of Damascus, others the canon as corrected by Nikephoros Gregoras.

It was in this context that Jewish astronomical tables came to be known to some Byzantine scholars. These tables, which – in their Byzantine form – were only devoted to the calculation of syzygies and eclipses, immediately met with great success.⁹ The first treatise is the aforementioned *Hexapterygon* or *Six Wings*. The *Six Wings* refer to the wings of the Seraphim in Isaiah 6.2–3. Each table is called a Πτέρον ('Wing'). In Wellcomensis MS.498, the name of the Byzantine author is given, i.e. Michael Chrysokokkes, with his position as *notarios* of the Great Church. Nothing is known about him, except that the name Chrysokokkes is attested in the fourteenth century in the case of George Chrysokokkes, author of the *Persian Syntaxis*, and in the fifteenth century for a copyist of some manuscripts (another George Chrysokokkes) and several members of the clergy.¹⁰ The Byzantine adaptation was written around 1435. The author does not explain how he came to know this work; in his preface he justifies the use of a Jewish treatise, comparing himself to the bees who gather nectar from every flower in order to take what is useful for them. The name of the Jewish author is correctly given (Manuel or Immanuel), but the town of reference (Tarascon, in the South of France) is wrongly located in Italy and represented as Terracina. Another manuscript (Vaticanus gr. 1879, fifteenth century) gave the provenance as 'Tarragone' (i.e. Tarragona), which it identified as being in Spain. Apart from the names of Jewish months there are no Hebrew technical terms in the Greek treatise. The *Hexapterygon* was very successful: there are around 15 extant manuscripts, two anonymous adaptations, and a commentary by Damaskenos Stoudites, Metropolitan of Naupaktos and Arta (1574).¹¹

8 Tihon (2011).

9 On Jewish astronomy in Byzantium, see Solon (1968); Solon (1970); and Tihon (2017b).

10 PLP 31141–31145.

11 Nicolaides (2011: 117, 129).

The second treatise mentioned above consists of the *Cycles* of Jacob ben David Yom-Tob (Bonjorn in the Provençal dialect), written for the town of Perpignan, ca. 1361.¹² This work was adapted by Mark Eugenikos (Metropolitan of Ephesus) between 1431 and 1444. The Jewish author is presented as ‘an Italian Mathematician’. In some manuscripts the words ‘a Jew called Jacob’ are added.

Later on, Matthew Kamariotes (ca. 1480[?]) wrote a treatise entitled *Pure Way* (*Ὁδὸς καθαρὰ*), which is an adaptation of the treatise called *Paved Way* (*Orah Sellulah*) by Isaac ben Salomon ben Zaddiq Alhadib (ca. 1370–1426). The Hebrew title comes from Proverbs 15.19, but the Greek translation seems mistakenly based on Isaiah 35.8. Other treatises written in vernacular Greek also circulated at that time.¹³ As one can see, the adaptors of Jewish astronomical treatises are all members of the Church.

The success of Jewish astronomy in Byzantium raises many questions. How does one explain this sudden interest of Byzantine intellectuals in Jewish astronomy, and more generally in Jewish science and philosophy? The contacts between the various Romaniote Jewish communities (whether Karaites or Rabbanites or some other sect) and Byzantine scholars are difficult to trace.¹⁴ The Byzantine sources are indeed very disappointing. Some of them consist of fictitious discussions about the Christian and Jewish faiths and are not reliable testimonies.¹⁵ None of the Byzantine adaptors of Jewish astronomical treatises explain how they became acquainted with Jewish astronomy. The only valuable testimony is the criticism of George Scholarios (later Patriarch Gennadios II, ca. 1400–ca. 1473), who reproaches Pletho for having been instructed by Elisaaios, who was ‘apparently a Jew, but in fact a Hellene [i.e. a pagan]’.¹⁶ It seems that Pletho stayed in Elisaaios’ house in Adrianople (modern Edirne, Turkey) where the Ottoman court had moved in 1365. It is important to note that Scholarios’ criticism is levelled at Pletho not for having studied with a Jewish master, but rather because this man was not a practising Jew, but a follower of some pagan philosophy, Zoroastrianism or perhaps the Illuminism of the Persian philosopher Sohrevardi (1155–91). The Jewish sources are more explicit. Byzantine influence on Romaniote Jewish science is well attested. Around 1374–86, a Jew from Thessaloniki, Shelomo ben Eliyahu, had translated into Hebrew the Persian tables explained in the *Persian Syntaxis* of George Chrysokokkes and by Theodore Meliteniotes.¹⁷ Later, Mordecai Comtino (1402–82)

12 On this treatise, see Chabás I Bergon (1992).

13 Solon (1968), texts 2, 3, and 5; Tihon (2017b: 335).

14 On this question, see Gardette (2010); de Lange (2001) underlines the lack of modern studies on Jewish culture in the Byzantine world.

15 Congourdeau (2011).

16 Pletho, *Manual of Astronomy*, ed. Tihon and Mercier (1998) 6.

17 Goldstein (1979).

defended the Persian tables against criticism from Isaac Argyros and his pupils.¹⁸ Isaac Argyros himself, in his Easter treatise (ca. 1372), remarked that when he was in Ainos (Thrace), some 50 years earlier, the Jews had celebrated Passover on the 20th of March while the Byzantines celebrated Easter on the 23rd of April. Some notes in Hebrew in Parisinus gr. 2501 (ca. 1484) reveal the interest of a Jewish reader in the Byzantine astronomical texts contained in this manuscript.¹⁹

We may now turn to one of the great figures of this time. Mordecai Comtino (or Khomatiano) (1402–82), a famous Jewish exegete and scientist from Constantinople, who was highly regarded as an astronomer.²⁰ In around 1425, he had written a commentary on the Persian tables already cited above. He also wrote a treatise on the astrolabe, another on the *Safihah* (an instrument created by al-Zarqālī, 1029–87), and one on a sundial. He wrote other works dealing with geometry and arithmetic. A physician and travelling preacher, Ephraim ben Gerson, relates that, coming from Veroia and after passing through Zeitun (modern Süleymanlı, Turkey), he went to Constantinople, where he wanted to meet Comtino. During his meeting with the famous scientist, a Greek prince came to see Comtino and consulted him on several difficult questions relating to astronomy, which the master solved with ease.²¹ Comtino himself relates that a Greek priest went to question him about some stones supposedly from Sinai.²² Such tales show that Greek individuals, priests or laymen, did not hesitate to consult a Jewish master whose reputation was known far outside Jewish circles. It is well known that Comtino had not only Jewish pupils, but Christians too. His Jewish pupils also taught astronomy: Eliau Mishrahi, Elia Bashyaci, and his pupil, Caleb Aphentopoulos. Although they seem to have been extremely protective and exclusive about their astronomical knowledge,²³ it is not impossible that they too had Christians among their students.

The political context favoured such exchanges. The situation of Byzantium at that time was disastrous: since 1374 the Byzantine Emperor had been a vassal of the Ottoman Sultan and officials of the Byzantine court were obliged to serve regularly at the Ottoman court. At the Ottoman

18 Schub (1932: 54, n. 3). It should be stressed that in the works of Argyros preserved in Greek manuscripts there is no criticism of the Persian tables, even although he chose to adapt Ptolemy's tables of syzygies in the Julian calendar.

19 Transcription of the notes by Mercier in Tihon (2017b: 345–6).

20 Attias (1991: 72–9).

21 Text given (in French) in Attias (1991: 13).

22 Gardette (2010: 138); and Attias (1991: 37).

23 Attias (1991: 77).

court, which had moved from Bursa to Adrianople, they would have met many Jewish scientists, physicians, and philosophers. A Greek manuscript containing Jewish tables (Mediolanensis Ambrosianus G 69 sup., fifteenth century) has astronomical annotations for the co-ordinates of Adrianople.

But there is also another possible connection, which may explain how Jewish treatises were known in Constantinople. All the Jewish authors adapted by the Byzantines are of Western origin: from Provence (Bonfils, Bonjorn) or Italy and Spain (Alhadib). Their works existed in Latin translation or in vernacular languages. During the Council of Florence-Ferrara (1438/9), intellectual exchanges between Latins and Byzantines intensified. It is not impossible that some Jewish tables were known in Byzantium through their Latin or vernacular versions. Thus, the *Cycles* of Bonjorn are called 'Italian tables' in the Byzantine version given by Mark Eugenikos.

One can also underline a common feature of the Byzantine adaptations of Jewish treatises: the Jewish authors are often badly identified and localised, and the meaning of the Hebrew title *Orah Sellulah* is misunderstood by Matthew Kamariotes. This may suggest that there were no direct contacts between the Byzantine authors and the great Jewish scientists, but that works were transmitted through unknown and perhaps less qualified intermediaries.

One manuscript seems to be better informed than the others: the codex Athous Vatopedinus 188 (ca. 1488), which seems to me to be the model for Wellcomensis MS.498. This manuscript contains medallions with rather clumsy pictures of the zodiac signs with their Arabic names. The same medallions are found in the Vatopedinus (see Figure 5.1), and I have not found them in any other manuscript, although, of course, this would need more investigation. In spite of some small differences in the drawings, or some corrections of the spelling of the Arabic names for the signs of the zodiac in the Wellcomensis (see Figure 5.2), the similarities between the two manuscripts are very striking. The tables have been carefully copied and the numbers seems to have been checked, as indicated by the annotations ἐπισκ- ('examined') in the Vatopedinus and διορθώμενον ('corrected' or 'verified') in the Wellcomensis. My hypothesis is also supported by the fact that recently it has been confirmed that both manuscripts were copied by Manuel Korinthios.²⁴ Mount Athos is close to Thessaloniki where there was an important Jewish community. We also know that the Wellcome manuscript was formerly kept in Nikolsburg, another important centre of Jewish culture from the fifteenth to the eighteenth century and even later. This allows us to suggest a scheme of transmission for this text through Greek-speaking Jewish communities from Thessaloniki to Central Europe before it arrived in the Library at Wellcome Collection in London.

24 Stefec (2013: 316); and Bouras-Vallianatos (2015: 323).

Figure 5.1 Athous Vatopedinus 188, f. 74v.
© Holy and Great Monastery of Vatopedi (Mt Athos, Greece).

Figure 5.2 Londiniensis Wellcomensis MS.498, f. 61v.

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