François de Blois , 'Some early Islamic and Christian sources regarding the Jewish calendar (9th to 11th centuries)', *Time, Astronomy, and Calendars in the Jewish Tradition*, ed. Sacha Stern and Charles Burnett (Brill: Leiden, 2014), pp. 65-78.

BOOK CHAPTER

'Some early Islamic and Christian sources regarding the Jewish calendar (9th to 11th centuries)', *Time, Astronomy, and Calendars in the Jewish Tradition*, ed. Sacha Stern and Charles Burnett (Brill: Leiden, 2014), pp. 65-78.

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The purpose of this paper is to summarize my work on early Muslim and Eastern Christian sources concerning the Jewish calendar and to present a preliminary synopsis of my forthcoming monograph on the subject. This work has focussed on six authors writing over a period of about 200 years, from the first quarter of the 9th century to the first third of the 11th. These texts are important not only as documents for the perception of Jewish institutions among non-Jewish communities – in itself an enormously interesting subject -, but they are also primary sources for the history of the Jewish calendar. All of these works are in fact one to two centuries older than the earliest comprehensive surviving book on the calendar by a Jewish author, namely the book by bar Ḥiyya from the first quarter of the 12th century, and the oldest of them, namely the treatise by al-Xuwārizmī, is a good century earlier even than the Geniza documents relating to the calendar controversies of the mid-tenth century; it is thus the oldest surviving detailed testimony for the Jewish calendar in its Rabbinic form. In the limited space available I will be discussing a few features of these texts.

(1) Muḥammad b. Mūsā al-Xuwārizmī (ca. 823)

The famous mathematician and astronomer Muḥammad b. Mūsā al-Xuwārizmī (also transliterated as al-Khwārizmī or al-Khwārazmī) flourished during the first half of the 9th century. We do not know the exact dates of his birth and his death, but we know that he was active in Baghdad at the court of the caliph al-Ma'mūn, who reigned from 813 to 833. His treatise on the Jewish calendar is not explicitly dated, but it does contain a reference date (that is: a date cited by the author by way of illustration) of 1135 of the Seleucid era (823-4 CE) and it is thus likely that he composed his work in that year, or shortly afterwards. The fact that this date falls in a time when we know from other sources that al-Xuwārizmī was active is in any case a strong argument for the authenticity of the work.

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The treatise has been preserved in a single copy, a very remarkable collective manuscript of mathematical and astronomical treatises put together in Mosul in the Islamic year 632 (1234 CE) and now preserved in the Khuda Bakhsh Library in Patna (Bankipore), India[1]. Although

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[1] *Catalogue of the Arabic and Persian manuscripts in the Oriental Public Library at Bankipore*, Patna 1908 sqq., vol. XXII no. 2468/XXIV. See also: Hogendijk, J.P., 'Rearranging the Arabic mathematical and astronomical manuscript Bankipore 2468', *Journal for the history of Arabic science*', 6 (numbers

the manuscript is of respectable age, its quality is decidedly mediocre. The treatise by al-Xuwārizmī was published, together with several others of the works contained in the same manuscript, in Hyderabad/Deccan in1947, whereby the name of the editor is not indicated in the publication.[2] The edition perpetuates all the scribal errors found in the original manuscript and supplements them with a lot of new mistakes. It is especially unfortunate that the editor obviously did not know how to read the older form of the "Indian" numerals nor did he properly understand the alphabetic notation with abjad numerals with the result that many of the numbers cited in the published text are actually wrong, a rather fatal defect in what is essentially a mathematical text. I have now reedited the Arabic text on the basis of a microfilm of the manuscript and tried to correct the rather copious scribal errors and have also prepared an annotated English translation, to my knowledge the first translation of the work in a European language, though there is a published summary of the work by Kennedy from 1964[3], and a translation in Modern Hebrew by Langermann from 1987[4].

The superscription in the unique manuscript is "Treatise on the computation of the chronology of the Jews and their festivals" (*Maqālatun fī stixrāji tārīxi l-yahūdi wa ʾaʿyādihim*), although there is actually nothing about festivals in the present text. The explicit calls it merely "The chronology of the Jews" (*Tārīxu l-yahūd*). I have divided it into nine sections:

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In the long §1 the Muslim author gives, so to speak, a theological justification of the Jewish calendar, which he sees as part of God's authentic revelation to the prophet Moses and as a necessary tool for the correct observation of the Passover. But this knowledge is preserved (he says) only by small scholarly elite, while the mass of the Jews are ignorant of its workings. The author promises a clear and comprehensible account of the matter.

In §2 he lists the Jewish months (beginning with Nisan), gives the number of days for each (not forgetting that Marcheshvan and Kislev have a different number of days in different types of years) and indicates the place and length of the first and second Adar in an intercalated year.

1&2), 1982, pp. 133-159, where the two treatises on the Jewish calendar are mentioned on p. 142, as nos. A 21 and A 22.

[2] The treatise was printed with separate pagination and a separate title-page bearing the date 1366/1947, and is bound together with others in at least two different collections, one containing nine treatises, with the overall title *ar-Rasāʾilu l-mulḥaqatu bi rasāʾili l-Bīrūnī*, the other with eleven treatises, with a title in rather questionable Arabic, namely *ar-Rasāʾilu l-mutafarriqatu fī l-hayʾati li l-mataqddimīna wa muʿāṣirī l-Bīrūnī*, both dated Hyderabad 1367/1948. The work by al-Xuwārizmī is the first one in both collections.

[3] Kennedy, E.S. (1964), 'Al-Khwārizmī on the Jewish calendar', *Scripta mathematica*, 27, 1964, pp. 55-59.

[4] Langermann, T., 'When was the Hebrew calendar instituted?', in *Assufot* 1, 1987, pp. 159-168 [in Hebrew].

In §3 he discusses the 19-year cycle according to what al-Bayrūnī later calls the g-b-ṭ-b-g system, with a 13-month year in the 3rd, 5th, 8th, 11th, 14th, 16th and 19th year of the nineteen-year cycle.

In §4 we are told that the hour is divided into 1080 parts. The lunar month, from one molad to the next, is 29 days, 12 hours, 793 parts. The length of the 12-month and the 13-month lunar year and of the 19-year cycle are indicated in the same units.

§5 contains a version of what is later called the "four gates", whereby knowledge of the weekday and time of the molad leads to a determination of the weekday of the new year and the character of the year.

In §6 the author gives the length of the solar year as 365 days and 5 $\frac{3791}{4104}$ hours and indicates the number of elapsed years from the creation of Adam until the completion of 1135 Sel. (823-4 CE), presumably the date of composition.

In §7 we have tables[5] with the positions of the sun, moon and planets "on the first day of the days of Adam, and it was a Friday", then "at the time of the building of the temple", and finally at the beginning of the Seleucid era. In the former two instances the sun and moon are in conjunction at 176°.

The last two sections are the most difficult ones, with §8 elucidating a procedure for determining the mean position of the sun and moon on any given date, and §9 ostensibly telling us how to calculate the time of conjunction of sun and moon, in other words: the molad of any month. In §8 the author takes the number of days elapsed since the beginning of the current 19-year cycle, multiplies and divides it by a series of constants leading in the end to a number of degrees and minutes, which we then **[Page 68 →]** add to the position of the sun or the moon "for which I calculated the era", presumably meaning the figures given in the table in §7 for whichever era we are using. The result is "its mean position at the rising of the sun".

This calculation operates with two implicit assumptions: First, that the longitude of the conjunction of sun and moon will be the same at the beginning of every 19-year cycle, and thus also at the epoch of the era. This assumption is (broadly) correct. And second, that the time of the conjunction (the molad) will be the same at the beginning of every cycle, and thus also at the epoch of the era. This assumption is, however, wrong. But the fact that the author is counting the whole number of days (not the sum of days, hours and fractions of an hour) from the beginning of the current cycles suggests that he is really only interested in determining the daily position of the sun and moon with regard to the twelve signs of the zodiac at a conventional time ("at the rising of the sun"), and not with determining their precise position in signs, degrees, minutes, etc. at any specific time of the day.

 But this rough calculation seems to assume that the actual conjunction of sun and moon at the beginning of the era of Adam was "at the rising of the sun", meaning, presumably, not true sunrise, but at notional sunrise, six equinoctial hours after midnight. This contrasts with the statement in the later Jewish sources, and also in al-Bayrūnī and in Elias, that the molad of the creation is Friday, 14 hours and 0 parts after notional sunset. In other words: al-Xuwārizmī put the molad of the creation not at 6,14,0 but two hours earlier at 6,12,0

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[5] These are not set out as tables in the manuscript, but are evidently to be read as such.

("sunrise"). This might be taken as evidence that the (later) "standard" molad was not yet generally accepted in the first half of the 9th century.

§9 tells us how to calculate the molad of any month. We take once again the days elapsed since the beginning of the current cycle and multiply it by the number of cheleqs in one day. Then we divide the product by the number of cheleqs in the lunar month. The resulting whole number gives us the number of elapsed lunar months of the current cycle. The remaining cheleqs can then be converted into the number of days, hours and cheleqs "which have passed of your (current) month since the conjunction". This reckoning will only work if we know the precise time of the molad at the beginning of the cycle. Presumably we are expected to calculate this from the data given earlier about the epoch of the era.

We are left thus with the somewhat disconcerting fact that al-Xuwārizmī does not unambiguously indicate the molad of the era, and that consequently the rules that he lays down for determining the New Year's day (the later so-called four gates) seem to be unusable. It has been argued **[Page 69 →]** that this means that the long section in which these rules are laid down is a textual interpolation. But I think it is possible that al-Xuwārizmī does at least obliquely indicate the molad of the era in his table of the planetary positions in section 7 ("Friday"), supplemented by section 8 ("at the rising of the sun"). In this case the various sections of the treatise would rest on each other and none of them would be superfluous to the author's overall argument.

(2) Ibn Bāmšāδ al-Qāʾinī (ca. 850)

The treatise by Abū l-Ḥasan ʿAlī b. ʿAbd Allāh b. Muḥammad b. Bāmšāδ al-Qāʾinī follows in the Patna manuscript immediately after the one by al-Xuwārizmī and it has virtually the same title ("Treatise of the derivation of the chronology of the Jews"). It too was published in Hyderabad in 1947[6]. There is also a somewhat idiosyncratic English translation and commentary by A. Cohen[7]. The edition is not quite as bad as that of al-Xuwārizmī's opus, but the unique manuscript is very corrupt. We have actually no biographical information about the author. He is, however, cited in one of the mathematical treatises by al-Bayrūnī and this fact led the editor of the Patna colleague[8], and more recently Fuat Sezgin[9], to maintain that al-Qāʾinī was an older contemporary of al-Bayrūnī. But al-Bayrūnī does not actually say anything which implies that the two authors were contemporaries. On the other hand, the treatise under investigation does mention two reference dates: right at the beginning the author mentions the year 1163 Seleucid (851-2 CE), and towards the end he mentions the year 1162 Seleucid, which he equates with the Islamic year 236; this equation holds true

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[6] It is the second treatise in the collection of nine, and the third in the collection of eleven mentioned above in footnote 2.

[7] Cohen, A., 'The Jewish calendar and its relation to the Christian holidays as described by a Muslim mathematician-astronomer in 852 AD', in *Indian Journal of History of Science* 43.3 (2008), pp. 353-379; also in Hebrew in *Judea and Samaria Research Studies*, 16, 2007, pp. 451-470.

[8] See fn. 1.

[9] Sezgin, F., *Geschichte des arabischen Schrifttums*, Leiden 1967 sqq., vol. VI p. 242.

between October 850 and July 851. This suggests that his treatise was written only about 30 years after the one by al-Xuwārizmī and a century and a half before al-Bayrūnī.

The treatise falls into two unequal sections: a long first part, and a much shorter second part, preceded by the word *bāb* ("chapter"). The title given **[Page 70 →]** in the manuscript leads one to believe that this is a treatise about the Jewish calendar, but in fact its first part is devoted entirely to a rather garbled account of Christian Easter computus. The short second section does give a very elementary account of some of the elements of the Jewish calendar: the length of the three types of year (complete, intermediate, defective), the common and intercalated years and the postponement rules (*deḥiyot*), but has nothing about the mathematical and astronomical foundations of Jewish chronology (length of the lunar year, the epoch of the era, the determination of the molad etc.). The text that we have makes the impression of being a badly preserved fragment of a larger work, or perhaps of fragments of two different works not necessarily by the same author.

(3) an-Nayrīzī (ca. 900 CE)

The next text that I have looked at is by the mathematician and astronomer Abū l-ʿAbbās al-Faḍl b. Ḥātim an-Nayrīzī, who flourished at the time of the caliph al-Muʿtaḍid (892-902) and is best known for his commentary on Euclid's *Elements*[10]. On the last three pages of the Edinburgh manuscript of al-Bayrūnī's *Chronology*[11] the scribe has copied out what calls itself a table of "the festivals of the people of the covenant (*ʾahli δ-δimmah*) as calculated by the sage Abū l-ʿAbbās (...) an-Nayrīzī", followed by some remarks on how to use the table. It is based on a 96-year cycle and gives the date and weekday of the principal Christian festivals (Christmas, Epiphany, Easter etc.), but also of what is here called "the Jewish Passover" (*fiṣḥu l-yahūd*). But closer scrutiny reveals that the dates in this column are not those of Passover, but of the Christian luna XIV. The interest of the table in the present context is that it shows that even a professional astronomer at the end of the 9th century was not clearly aware of the difference between the Jewish Passover and the Christian paschal full moon, perhaps confused by a Christian computistic tradition identifying them with one another

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(4) al-Masʿūdī (956 CE)

Our next author is the famous historian al-Masʿūdī in his *Kitābu t-tanbīhi wa l-ʾišrāf*, which he wrote in 956 CE[12], and which contains a brief but very important contemporary account of the calendar controversy between the Rabbanites and Ananites, mentioning Saadya by name.

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[10] See Sezgin V, pp. 283-5; VI pp. 191-2.

[11] See below, fn. 17.

[12] al-Masʿūdī (Abū l-Ḥasan ʿAlī b. al-Ḥusayn), *Kitābu t-tanbīhi wa l-ʾišrāf*, ed. M.J. de Goeje. Bibliotheca geographorum arabicorum, VII, Leiden 1894, p. 219.

(5) al-Bayrūnī (1000 CE)

At the end of the 10th century we have the most important Arabic work on calendars in general and the Jewish calendar in particular, the *Chronology* (*al-ʾāθāru l-bāqiyah ʿani l-qurūni l-xāliyah*), by Abū Rayḥān Muḥammad b. Aḥmad al-Bayrūnī (or al-Bīrūnī)[13], which he wrote in 1311 Seleucid (1000 CE). This book is well known thanks to the edition[14] and English translation[15] by Eduard Sachau in the 1870s. In the context of the current project I have retranslated the sections specifically on the Jewish calendar, consulting the two oldest manuscripts, Istanbul Umumiye 4667, which has a reader's note dated Ramaḍān 603 (1207)[16], and Edinburgh University Library Ms. 161, dated 707/1307-8[17], neither one of which was available to Sachau. It can in fact be demonstrated that the three late manuscripts used by Sachau all derive, directly or indirectly, from the Edinburgh copy.
al-Bayrūnī discusses the Jewish calendar at several points in this book, but in most detail in chapters V and VII.

In chapter V, "On the nature of the months which are used in various eras", the author discusses the principal calendar systems with which he **[Page 72 →]** was familiar and gives a list of the months in each, among them the months of the Jews, with a discussion of the system of intercalation, the three types of years, and then a detailed account of the differences between the Rabbanites and Ananites on the issue of whether the calendar should be based on calculation or observation.

The long chapter VII discusses in exhaustive detail all the mathematical and astronomical problems involved in the Jewish calendar, with various excursions (astronomical calculation of the solstices and equinoxes, names of the planets and zodiacal signs in various languages, etc.). A few pages towards the end of the chapter are missing in the Edinburgh Ms., and consequently in Sachau's edition, but can now be supplied from the old Istanbul manuscript.

Later, in chapter XIV, he describes in detail the festivals and fasts of the Jews, followed by a discussion of the exclusion rules (*deḥiyoṯ*) affecting the Jewish New Year as well as further discussion of the disagreement between Jewish sects on calendar matters.

al-Bayrūnī discusses the Jewish calendar more succinctly in his astronomical compendium *al-Qānūnu l-Masʿūdī*, which he dedicated to the Ghaznavid king Masʿūd (ruled 1031-1041

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[13] For the name, see provisionally my paper: "The Persian calendar", *Iran* XXXIV, 1996, pp. 39-54, fn. 2.

[14] *Chronologie orientalischer Völker von Albêrûni*, herausg. von Eduard Sachau, Leipzig 1878. There is now a new edition of the *Chronology*: *al-ʾāθāru l-bāqiyah ʿani l-qurūni l-xāliyah*, taḥqīq u taʿlīq i Parwīz i Aẕkāʾī, Tehran 2001, mainly based on Sachau, superficially collated with three manuscripts, with a Persian translation of the notes in Sachau's English translation and additional notes by the editor.

[15] *The Chronology of Ancient Nations*, translated and edited, with notes and index, by E. Sachau, London 1879.

[16] Ritter, H., *Istanbuler Mitteilungen* I, 1933, pp. 74-5

[17] See Ashraf ul-Hukk et al., *A descriptive catalogue of Arabic and Persian manuscripts in Edinburgh University Library*, Hertford 1925, no. 161, for a very defective description of the Ms.

CE)[18], and also in his introduction to astrology (*Kitābu t-tafhīm fī 'awā'ili ṣinā'ati t-tanjīm*)[19], which contains a reference date in A.H. 420/1341 Sel./398 Yazd. (1029 CE), but these books do not add substantially to the information on the Jewish calendar contained in his earlier work.

Of the many important pieces of information contained in his great work I will single out only the fact that al-Bayrūnī is the earliest author who specifically mentions the molad of the creation at 6,14,0, and also the first author to give an account of the Jewish theory of the four seasons (*tqufoṯ*) according to the system elsewhere ascribed to R. Samuel, which divides the solar year of $365\frac{1}{4}$ days into four equal parts of 91 days and $7\frac{1}{2}$ hours, but also according to an otherwise apparently unknown "learned" (*muḥaṣṣil*) method, which follows Ptolemy in dividing the year into four unequal seasons. This must not be confused with the system of R. Ada, of which al-Bayrūnī appears to know nothing.

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(6) Elias of Nisibis (1018 CE)

Finally, I would like to discuss in a little more detail a text which has not previously been examined in connection with the Jewish calendar, namely a big book on historical and technical chronology by a famous Nestorian Christian author, Elias bishop of Nisibis. It was compiled, as the author tells us repeatedly, in the year 1330 Seleucid (1019 CE), that is: about 20 years after al-Bayrūnī's *Chronology*, but a decade or two before the same author's *Qānūn*. It is preserved in a unique manuscript in the British Library (Add. 7197) and is bilingual, Syriac in one column and Arabic in another[20]. The Syriac version of the whole book was edited and translated into Latin by Brooks and Chabot under the title *Opus chronologicum* and published in 1909 and 1910[21]. The Arabic version has never been published in its entirety; its sections on the Jewish calendar will printed for the first time in my monograph.

The unique manuscript is not dated, but is obviously very old. The Syriac text and the largest part of the Arabic text are copied in what seems to be the same hand. It is difficult to say this with certainty, as the two columns are written in two different scripts, but the layout of the tables suggests strongly that the same scribe is at work in both columns. The Syriac version is written in what is usually called Old Nestorian script, which is about halfway between the old Edessan Estrangelo and the modern East Syriac (Nestorian) script, and cannot be dated very precisely. The Arabic version however is in a very striking archaic script, almost entirely unpointed, which can be described as transitional between Kufi and Naskh - though I would

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[18] Published in three volumes, Hyderabad/Deccan, 1954-6.

[19] *The Book of instruction in the elements of the art of astrology*, reproduction of a manuscript, with a translation by R. Ramsay Wright, London 1934.

[20] For a recent overview of this work, see: Witakowski, W., 'Elias bar Shenaya's Chronicle', in *Syriac polemics. Studies in honour of Gerrit Jan Reinink*, Louvain, 2007, pp. 219-260.

[21] *Eliae metropolitae Nisibeni Opus chronologicum*, edidit / interpretatus est E.W. Brooks / I.-B. Chabot, in four parts, Leuven, 1909-10.

say on the whole that it is closer to Kufi - which can hardly be much later than the time of composition of the work, that is: the beginning of the 11th century. It has been repeatedly been asserted[22] that the British Library manuscript is in fact an autograph, but no real arguments have ever been adduced to support this. I think it more likely that the manuscript is a fair copy, produced by a professional scribe from the author's rough draft, very shortly after the time of composition. I say this mainly because the mistakes in the manuscript (there are not **[Page 74 →]** many mistakes, but there are some) have more the character of copyists' errors (for example: diplographies) than author's errors.

The two versions (Syriac and Arabic) are very close to one another and clearly point to their being the work of the same author. I do not think that either one can be said to be the original. It is evident that the author has compiled his work from a variety of sources, both in Syriac and in Arabic; in the sections taken from Syriac sources the Syriac version is evidently the original and the Arabic a translation, whereas in the section taken from Arabic sources I would maintain that the Arabic version is the original and the Syriac a translation. I would also maintain that the section on the Jewish calendar is probably based on one or more Arabic sources, as is suggested by the fact that the Arabic version preserves some of the technical vocabulary more precisely than the Syriac.[23]

Elias' description of the Jewish calendar occupies three chapters, of which only the second is complete in the unique manuscript, the other two having lost one or more folios at the end. In the first chapter (beginning fol. 83r) he describes the mathematical foundations of the Rabbinic calendar: the length of the lunation in days, hours and cheleqs, the epoch of the era of Adam 3448 years before the Seleucid era, the formula for calculating the molad of Tishri for any year, the rules for determining whether the year is simple or intercalated. Then he mentions the exclusion rules (the year cannot begin on Sunday, Wednesday or Friday) and then cites the rules for determining the weekday of the New Year's day and the quality of the year arranged in four "gates", whereby the Arabic version uses the word "gates" (*'abwāb*), as in the Jewish sources, while the Syriac version speaks of "four canons" (*qānōnē*).

Intriguingly, Elias tells us that he had previously discussed all of these matters in a separate work on the Jewish calendar, or rather specifically on the critique of Jewish chronology. He writes (fol. 84r):

"Although the measurement of the lunar month (as observed) amongst the Jews is correct, the calculation of their festivals is however not correct for many reasons which I have mentioned in a separate book, where I elucidate the falsity of their doctrine that Adam was created in the season of the autumnal equinox, and that from Adam to the beginning of the era of Dhū l-Qarnayn there are 3448 years. I also elucidate the reason that they make the hour 1080 parts and why they do not make the beginning of Tishri Sunday or Wednesday or

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[22] First explicitly in Baethgen, F., *Fragmente syrischer und arabischer Historiker*, herausg. und übersetzt von F. B., Leipzig, 1884 (=Abhandlungen für die Kunde des Morgenlandes, VIII, 3).

[23] I quote the text according to the folios of the unique Ms., which are indicated in the margins of the edition.

Friday and why if the nativity (i.e., the molad) of Tishri is (only) one cheleq earlier or later, then the beginning of the year is **[Page 75 →]** advanced or delayed by (as much as) two days, and (I elucidate also) the refutation[24] of (all) this point for point. Moreover, I elucidate that their calculation is not correct and that it is not in agreement with the opinion of the sages of past times, and that it is not ancient, as they claim. And I also elucidate how they took it from the ancient Greek pagans[25], and who was the first one who took it and transmitted it to the Jews and how they established the foundation of Passover in ancient times and how it has been corrupted and disturbed in this time (of ours)[26], for it does not agree with the opinion of those who established it, and everything which points to the falsity of their opinion and their calculation."

Unfortunately, this "separate book" does not seem to have survived.

The second chapter (begins fol. 85v) is concerned with the calculation of the Julian equivalent of the molad of Nisan in any given year. The molad of Nisan is of no particular consequence for the calculation of the Jewish calendar, for which only the molad of Tishri is important, but Elias' interest in the conjunction marking the beginning of Nisan is evidently dictated by a desire to use the Jewish system to confirm or possibly even to correct the Christian calculation of the paschal month, although he does not say this explicitly.

In the third chapter (begins fol. 87v) Elias constructs a table "from which can be known in which of the months of the Arabs falls the Jewish Nisan and their other months in any year". Since the Jewish and Arab months both begin at about the time of conjunction, any given Jewish month will overlap with one Arab month, give or take a couple of days at either end. So, in this section the author is concerned with establishing in which Arab month any Jewish month will "fall", that is: with which month it will for the most part coincide. This same sort of "rough" equation between Jewish and Islamic months can be observed also in some of the Geniza documents.

There are two other passages in the *Opus chronologicum* in which Elias refers to the Jewish calendar. In the first of these he is discussing the length of the lunar month. He cites the measurement given by Ptolemy on the authority of Hipparchus, and then continues (fol. 77r):

> "The ancient sages amongst the Jews say in the book of Mishnah[27] also of Gamaliel, the Hebrew wise man whom the Apostle Paul mentions **[Page 76 →]** in the Acts of the Apostles, that he agrees with this opinion when he makes this statement: It is not possible that the lunar month be less than 29 days, and half a day, and two thirds of an hour, and 73 cheleqs, whereby in his opinion and the opinion of all the sages of the Hebrews the hour is 1080 cheleqs."

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[24] Thus in the Arabic version, where, exceptionally, نقض is fully pointed, and also the Syriac (*šrāyā*); Chabot's "solutionem" is too bland.

[25] Ar. *aṣ-ṣābi'ati l-yūnāniyyīn*; Syr. *ḥanpē ḏ-yōnāyē*.

[26] Although this is all rather vague, what the author seems to be saying is that system of calculation of the molad was "taken from the ancient Greek pagans" a long time ago, and was originally "correct", but became corrupted in the recent past.

[27] Thus (*ba-ḵṯāḇā ḏ-mišnā*) in the Syriac version. The words are missing in the Arabic.

Elias converts this sum to 29 days, 12 hours, 48 minutes and 40 seconds, and remarks:

> "This view does not differ from the view of Hipparchus and Ptolemy, the correctness of which can be known from the lunar eclipses which we shall mention afterwards."

The Talmudic passage to which Elias is referring (B. RH 25a) is generally regarded as partially interpolated[28]. It has been stated that the earliest citation of this passage is by bar Ḥiyya, but in fact Elias wrote about a century before the time of bar Ḥiyya. Elias is presumably wrong to identify the Gamaliel mentioned in this passage with Gamaliel I, named as Paul's benefactor in Acts 22.

The last passage that we will be looking at is in the table of historic events from about the time of the birth of Christ down to the author's own time. The table is laid out in six columns. The first three columns are in Syriac: first the year (Seleucid before the beginning of the Islamic era; then hijri with its Seleucid equivalent) spelt out in Syriac; second the source from which Elias has his information; third an account of one or more events in the year in question. The last three columns are for the Arabic text: first the year spelt out in Arabic; the second column (ostensibly for the source) is always left blank; the last column describes the event or events in Arabic. However, very often the Arabic columns in this table have either been left blank, or else they were filled in subsequently by two or three later hands.

The event that interests us is in the box for the year 309 of the hijra (fol. 37v). This entry is only in the Syriac columns; the Arabic version is missing. The box with the date reads: "The year 309 (of the hijrah), beginning Saturday 12 Īyār (May) of the year 1232 of the Greeks [921 CE]". The box for the source is blank. The box for the event reads:

> "In it there befell a division/disagreement (pūlāḡā) between the Jews of the West and the Jews of the East concerning the calculation of their festivals. And the Jews who are in the West made the beginning (rēšā) of their year Tuesday and those of the East (made it) Thursday."

[Page 77 →]

This refers, of course, to the famous calendar dispute between Saadya and Ben Meir. The double dating of the Jewish New year occurs in the Jewish year beginning in the autumn of 922 CE. The molad of Tishri in that year is 3,9,441 (Tuesday), but since this is after the prescribed limit 3,9,204 the Babylonian Jews postponed the New Year until Thursday 26 September 922. The Jews "in the West" (Palestine? Egypt?) did not accept this and celebrated the New Year on Tuesday 24 September. But this is in the hijri year 310, not 309, as indicated in Elias. It could be that the author has telescoped two events: first the "disagreement" amongst the Jews about the *forthcoming* New Year (which would have surfaced already in 921), and then the fact that the Jews of the East and the West did in fact "make the beginning of their year" on two different dates in 922. But perhaps the easiest explanation for the discrepancy is that the author or the copyist has simply put this information in the wrong box of his grid.

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[28] Stern, S. (2001), *Calendar and community. A history of the Jewish calendar second century BCE – tenth century CE*, Oxford, 2001, p. 201

To summarize: I have been examining texts spanning a period of 200 years. During this time there is a significant change in the perception of the Jewish calendar. With al-Xuwārizmī, in the early part of the ninth century, the Jewish calendar is still in a state of flux. Certain elements of the Rabbinic calendar are already established: the fixed 19-year cycle, the postponement rules, the Ptolemaic measure of the mean lunation, and, dependent on all these, the system of four gates. On the other hand, the molad at the epoch of the era is not yet fixed in its final form, and, as a result, the arithmetic foundations of the whole system are still uncertain.

By the beginning of the 11th century, with al-Bayrūnī and his contemporary Elias, all the elements of the Rabbinic calendar are in place, in particular, the molad of the creation at 6,14,0, whereby Elias, at least, dwells specifically on the fact that the Rabbinic calendar is "not ancient, as they claim", but a fairly recent innovation. The testimony of our sources agrees thus with the Geniza fragments in pointing to the 10th century as the decisive moment in the emergence of the Rabbinic calendar in its modern form.