**A tenth-century Jewish correction of the Easter calendar**

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Abstract

A Jewish text from the Cairo Genizah (T-S Ar.29.56), written in Judeo-Arabic, provides a list of the dates of Lent and Easter in the Coptic calendar starting from 930 CE; four years of the roster are preserved. In this article, the text of T-S Ar.29.56 is edited and translated, followed by commentary and discussion. This is one of the very few medieval Jewish texts from Islamic lands that engages with the Christian Easter calendar, and it evidences a sound understanding of its computation. Remarkably, it proposes to correct the epact and hence the dates of Lent and Easter, apparently to bring them more in line with the actual phases of the moon – more than two centuries before Christian scholars in the West began to call for correction of the Easter computation. The author of our text may have corrected the dates of Easter on the basis of the *molad*, the time of the new moon as calculated in the Jewish calendar.

We present in this article a Jewish text from the Cairo Genizah dated to the second quarter of the tenth century, which sets out to correct the Christian calendar dates of Lent and Easter. This newly discovered text, preserved in the Cambridge University Library in a fragmentary manuscript (shelf-marked T-S Ar.29.56), is important for both Jewish history and the history of Christian calendar computation. For Jewish history, it represents one of very few Jewish texts from Islamic lands that engages with the Christian calendar and, more specifically, with the date of Easter[1]. It is also relatively early: although Jewish descriptions and discussions of Easter computation are better attested in the Latin West, these texts are not earlier than the twelfth century, and only become prevalent in the fourteenth-fifteenth centuries[2]. Although a lone and somewhat reticent piece of evidence, this present text

[1] The only other document that we know of from the Cairo Genizah that describes the Easter calendar is T-S NS 98.51. This fragment preserves an apparently much earlier text describing the general principles of the Julian calendar and the Byzantine Easter cycle; it will be the subject of a separate publication. This article was researched and written as part of a project funded by the Fritz Thyssen Foundation, 'Qaraite and Rabbanite Calendars', UCL. We are grateful to Philipp Nothaft for his comments on a draft.

[2] In the Latin West, the earliest known Jewish discussion of the date of Easter and its computation is in Abraham bar Ḥayya's treatise on the calendar (3:10), completed somewhere in France in 1123 (FILIPOWSKI, *Sefer ha-Ibbur*); this is followed by a similar discussion in Isaac Israeli's calendar treatise, *Yesod Olam* (4:17), completed in Toledo in 1310 (GOLDBERG and ROSENKRANZ, *Jesod Olam*). Neither propose a correction to the dates of Easter, although they are somewhat critical of the Easter cycle. Shorter descriptions and tabulations of the Easter cycle and computation of Christian movable feast dates are then attested and become common in many Hebrew manuscripts of the late fourteenth and fifteenth centuries, some French (mss Berlin, Preussischer Kulturbesitz 1198; Budapest, Hungarian Academy of Sciences, Kaufmann A370; and Oxford, Bodleian Heb. g.1; on which see STERN, *Christian Calendars*), Italian (Parma 1961, fol. 19r; Parma 2917, fol. 3v; Budapest, Hungarian Academy of Sciences, Kaufmann A39, fols. 157-8), and Iberian (Parma 2113, fol. 113r, dated c.1381, making it one of the earliest). On Muslim accounts of the Easter computation, most prominently by al-Biruni (early eleventh century), see SALIBA, *Easter Computation*; EHRIG-EGGERT, *Le Comput pascal*.

teaches us something about Jewish engagement with Christianity, or more minimally, with the Christian calendar, in early medieval Egypt.

For the history of Christian calendar computation, this text is important as it presents a uniquely early – arguably, the earliest known – correction of the traditional, Alexandrian Easter cycle. The Alexandrian 19-year cycle was instituted in the fourth century as the foundation of Easter computation, and remained in continuous use in the East, as well as in most of the Latin West, from late Antiquity to the later Middle Ages and beyond[3]. This cycle, which synchronizes the lunar months with the solar years of the Julian calendar (or, in its Egyptian version, of the Coptic calendar), was the basis on which the dates of Easter and other movable feasts, for any given year, were determined. The inaccuracies of this cycle, or to put it better, its discrepancies from astronomical reality, were observed by some Christians in the early medieval period; but it was not for many centuries that proper recognition was given to the problem, and that eventually, proposals were made for the Easter calendar to be reformed. As Philipp Nothaft narrates in his *Scandalous Error*, the western computists of the eighth century, starting from Bede, were the first to discuss the discrepancy that had built up, by then, between the observed moon (its size and phases, or the times of conjunction and opposition) and the calendar's moon, i.e. the dates and ages of the moon as given in the ecclesiastical lunar calendar and cycle. However, this discrepancy was still narrow enough, at the time, to make it possible for Bede and his successors to explain it away. It was only in the eleventh century that Hermann of Reichenau seriously addressed the problem; this led him to construct a list of revised epacts, i.e. of ages of the moon at the first day of each month. The outcome, later to be known as *computus naturalis*, was not intended, however, as a substitute or revision of the Easter calendar, nor even as an explicit critique of it. Serious calls for correction and reform of the dates of Easter were only raised in the thirteenth century by scholars such as Roger Bacon, beginning a process that culminated in the late sixteenth century with the Gregorian reform[4]. The critique, and eventually reform, of the Easter calendar was not only late to develop, but also confined to western Europe. In eastern Christianity, where attitudes to the calendar remained tenaciously traditionalist, the Alexandrian Easter Computus was apparently never challenged[5]; and consequently, the discrepancy between the moon and the ecclesiastical calendar was left to grow, uncorrected, until this very day to as much as about seven days. In this light, the discovery of a proposal from tenth-century Egypt to correct the local, Coptic Easter calendar – albeit at the hand of a Jew – is remarkably early as well as unique in the context of eastern Christianity. It could be dismissed as historically exceptional, but its exceptionality is what makes it all the more interesting.

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[3] See in general MOSSHAMMER, *Easter Computus*, and specifically on the Alexandrian Easter computation, ibid. p. 36-37, 162-203. The Alexandrian 19-year cycle was based on the Alexandrian Egyptian calendar, which was later known as the Coptic calendar. Consequently, the Alexandrian Easter computation and the Coptic (which will be referred to in this article) are essentially one and the same. For an example of a computation of the dates of Easter in the Coptic and Byzantine calendars (in Arabic, from the eleventh century), see SIDARUS and MOAWAD, *Un comput melkite*, and more generally see SALIBA, *Easter Computation*.

[4] NOTHAFT, *Scandalous Error*.

[5] At least not until the fourteenth century, when a small number of Byzantine scholars (but still not Copts or other Christians in Muslim lands) debated the correction of the Easter computation, without this leading however to any calendar reform. See NOTHAFT, *Scandalous Error* p. 223-226; KUZENKOV, *Correction of Easter Computus*; MOSSHAMMER, *Easter Computus*, p. 278-279.

The text, written in Judeo-Arabic[6], provides for a series of years the epact (the age of the moon on the day before the Coptic New Year) and the day of the week of the New Year, and explains how to calculate, from this data, the beginning of Lent and the date of Easter. The year series starts from 1241 of the Seleucid Era, i.e. 929/30 CE; four entries have been preserved, until 1244 SE, and then our text breaks off. As we shall see, the epact that is provided for each year, and consequently its dates of Lent and Easter, differ significantly from those of the Alexandrian cycle. The Egyptian provenance of this text is confirmed beyond doubt by its consistent reference to Coptic months and its use of the original Alexandrian, Coptic method of Easter computation. The year 1241 SE gives us an approximate idea of when the text was redacted, as will be discussed in further detail below. The manuscript itself, however, is a later copy of this text, as it can be dated to the end-tenth or eleventh centuries.

## *1. The manuscript*

The manuscript, or rather its surviving fragment, is a paper bi-folio; but one of its folios is truncated vertically down the middle, so that only half of it is preserved. Fortunately, our text appears in the fully preserved folio, more precisely on the recto right side; this is the text that we shall be editing. Our text does not continue into the fragmentary folio, although the latter clearly belongs to the same treatise, as its handwriting and layout are identical, and it also deals with calendrical matters (though on the Jewish calendar, rather than on the Christian one: it is a polemical text about the Jewish calendar rules of postponement). The textual discontinuity of the folios means that other bi-folios must have been bound inside this one, forming a quire or codex which contained a treatise on the calendar.

Our text begins at the top of the recto right side. The text on the verso (verso left) includes a Judeo-Arabic medical prescription written in a similar hand but in a different ink (black, whereas the rest of the bi-folio is in brown ink), and poorly laid out in the middle of the page; this text partially over-writes an earlier, somewhat faded text in a different hand (and much larger letters), starting from the top of the page but ending somewhere in the middle, with apparently random Hebrew biblical phrases. All this writing is possibly secondary use of an originally blank page that served as cover page of an unbound fascicle or *juzʾ*, of which our calendar text was the beginning.

The dimensions of the fully preserved folio are 17.3 cm high, 10-10.5 cm wide. The text, on the recto right and in the fragmentary folio, is laid out across most of the folio, with very narrow margins (at most, 0.5 cm on all sides; the left inner margin tends to be wider with 1.0 cm, but this limit is frequently trespassed with the writing sometimes reaching the inner fold). There are 27 lines of text in the whole folio, 24-25 lines in the fragmentary one, with moderate spacing between the lines. The spacing between lines 1 and 2 is slightly wider, and probably deliberately so, to enable to scribe to insert a gloss of his own between the lines (although the gloss would have belonged better between lines 2 and 3). Overall, this copy is well laid-out and professionally executed, as would befit the production of a booklet or book.

[6] On the Judeo-Arabic language, see BLAU, *Emergence and Linguistic Background of Judaeo-Arabic*; KHAN, *Middle Arabic*; YESHAYA, *In the Name of the God of Israel*.

In spite of some staining of the paper, a few tiny holes, and some rubbing of the ink, the text is well preserved and clearly legible. It is written in a stylized, serifed Hebrew script, with features of the Babylonian writing style that became common in Jewish Cairo towards the end of the tenth century (which therefore says little of the scribe's geographical origins and affiliations)[7]. On palaeographic grounds, both late tenth and eleventh centuries seem possible[8].

*2. T-S Ar.29.56 recto right: text and translation*

Main text (square brackets represent conjectures, where there are lacunas in the manuscript):

1. על שמך סנה א[ל]ף ר֯מ֯א֯ למנין שטר[ות]
2. תות יום אסבת[9] ומסתהל ברמודה יום [אסבת]
3. אלבקטי א֯כ֯ ומן תות אלא ברמודה ח֯ אשה[ו]ר
4. תאכוד לכל שהר נצף יום תציר ד֯ איאם
5. תזידהא עלא א֯כ֯ יציר ה֯כ֯ ואיצ֯א כ֯ מן
6. ברמודה פדליך ה֯מ֯ תטרח ל֯ יבקא י֯ה֯ יציר
7. כ֯ יום מן ברמודה י֯ה֯ מן ניסאן והו יום כמיס
8. סנה אלף ר֯מ֯ב֯ יום אלחד ברמודה יום אלחד אל
9. בקטי יומין יאכוד ד֯ איאם אלאנצאף אלדי
10. דכרנא מן תות אלא ברמודה ח֯ אשהור ד֯ איאם
11. נצף יום לכל שהר תזידהא עלא יומין צאר ו֯
12. תזיד עליהא ט֯ מן ברמודה יציר י֯ה֯ צאר ט֯
13. מן ברמודה י֯ה֯ מן ניסאן והו יום אלאתנין יצומו
14. כ֯ מן אמשיר יפטירו פי ה֯י֯ מן ברמודה:
15. סנה אלף ר֯מ֯ג֯ והי סנה סית ללקיבט תות יום אל
16. תלאתה וברמודה יום אלתלאתה אלבקטי י֯ד֯
17. ותזיד עליהא ד֯ איאם אלד[10] מן אלח֯ אשהור צאר
18. י֯ח֯ ותזיד עליהא ז֯כ֯ פדליך ה֯מ֯ ידהב ל֯
19. יבקא י֯ה֯ צאר ז֯כ֯ יום מן ברמהאת הו י֯ה֯
20. מן ניסן והו יום גומעה ציאם אלנצאר[ה]
21. פי ז֯כ֯ יום מן טוביה ויפטירו ט֯כ֯ מן ברמ
22. ברמהאת : סנה אלף ר֯מ֯ד֯ תות אלארבעה[11]
23. ברמודה אלארבעה אלבקטי ה֯כ֯ יזיד [עליהא][12]
24. ד֯ איאם אלאשהור נצף יום כל שהר מן [תות]

[7] Judith OLSZOWY-SCHLANGER, *Graphic Cultures,* has recently argued that nearly all the earliest legal documents preserved in the Cairo Genizah, which were produced in Fusṭāṭ (Old Cairo, the location of the Jewish community and the Cairo Genizah) in the late tenth century, are written in a Babylonian script.

[8] In email communications, Ben Outhwaite comments that the serifs on final *nun*, *gimel* and *zayin* look early; Amir Ashur, however, remarks that the paper looks more like eleventh century. We are grateful to both for their advice.

[9] For אלסבת; early Judeo-Arabic phonetic spelling.

[10] For אלדי.

[11] At the end of the line there are undecipherable traces of ink.

[12] As in line 17. Space is limited for this word, but it might have been squashed in.

25. אלא ברמודה צאר טֿכ יום וסית עש[רה]
26. פדליך הֿמ ידהב ל יבקא הֿי מן ניס[ן]
27. יוֿ מן ברמודה יצומו פי דֿכ מן

Insertions:

(Top margin) [אל]חסאב אל[קיב]טי
(Interlinear, between lines 1-2) קאל בעצהם אלבקטי יֿח
(Interlinear, above and after אֿכ in line 3) חי
(Bottom margin) traces of a few letters.

Translation:

1. In Your Name, year 1241 of the Seleucid Era.
2. Tūt is on Saturday and the beginning of Baramūdah[13] is [on Saturday]
3. The epact is 21. From Tūt to Baramūdah there are 8 months.
4. Take half a day for each month, this makes 4 days.
5. Add them to 21, this makes 25. Plus 20
6. from Baramūdah – this is 45. Throw away 30, 15 remain. Hence,
7. the 20th day of Baramūdah is the 15th of Nisan, and it is a Thursday.
8. Year 1242. (Tūt) is on Sunday, Baramūdah is on Sunday. The
9. epact is two days. One should take 4 days (made up from) the half-(days) as
10. we mentioned that there are 8 months from Tūt to Baramūdah, 4 days –
11. half a day for each month. Add them to two days, it makes 6.
12. Add to them 9 from Baramūdah, it makes 15. Hence, the 9th
13. of Baramūdah is the 15th of Nisan, and it is a Monday. They (begin) fasting
14. on the 20th of Amšīr and break the fast on the 15th of Baramūdah.
15. Year 1243, which is a year of six of the Copts. Tūt is on
16. Tuesday, and Baramūdah is on Tuesday. The epact is 14.
17. Add to it 4 days, which are from the 8 months, this makes
18. 18. Add to them 27 – this is 45. 30 go,
19. 15 remain. Hence, the 27th day of Baramhāt is the 15th
20. of Nisan, and it is Friday. The fast of the Christians
21. (begins) on the 27th day of Ṭūbah and they break it on the 29th of
22. Baramhāt. Year 1244. Tūt is on Wednesday,
23. Baramūdah is on Wednesday. The epact is 25. One should add [to them]
24. 4 days of the months, half a day for each month from [Tūt]
25. to Baramūdah. This makes 29 days. Plus sixteen –
26. this is 45. 30 go. It remains that the 15th of Nisan
27. is the 16th of Baramūdah. They (begin) fasting on the 24th of …

Insertions
(Top margin) [The] Coptic computation
(Interlinear, between lines 1-2) Some of them said that the epact is 18

[13] In this article, we transliterate and use the Arabic names of the Coptic months, which appear in the original Judeo-Arabic text. For the benefit of readers more familiar with the Coptic (and Greek) names: Tūt = Thout (Thoth), Ṭūbah = Tobi (Tybi), Amšīr = Meshir (Mecheir), Baramhāt = Paremhat (Phamenoth), and Baramūdah = Parmouti (Pharmouthi).

(Interlinear, above and after ‘21’ in line 3) 18

## *3. Commentary*

*Line 1*

The title ‘The Coptic computation’ (if this is the correct reading) appears to have been inserted later, in smaller writing, in the top margin. In line 1, the common invocation ‘In Your Name’ marks out the beginning of the Easter calendar text. There can be no question that this is the beginning of the text, as it begins at the top of the page, following something quite different on the verso, most likely in fact an originally blank page (see above).

Yet, the choice of 1241 SE (929/30 CE) as first year of this calendar is problematic, because it is not the first year of any cycle. In the Alexandrian (and therefore Coptic) Computus, as in nearly all other Christian computistic traditions, 1241 SE was the last year of the 19-year cycle, whereas one would expect a description of the Alexandrian cycle to start from its first year. This anomaly could be explained in several ways. Since this manuscript is only a copy of an earlier work (see above), it might be suggested that the scribe had lost the first pages of his master copy, and therefore only copied this calendar from the year available to him. This explanation, however, is somewhat unlikely, because of textual indications that the entry for 1241 SE marked the beginning of the original composition. The author takes care, in this first entry, to explain his algorithm – in particular, the addition of 4 days from the 8 months from Tūt to Baramūdah (lines 3-4) – and then cross-refers to this explanation in the second entry (1242 SE, lines 9-10: ‘as we mentioned…’); the fact that 1241 SE serves as a reference point suggests that it is the beginning of this work. A more likely explanation, therefore, is that the year 1241 SE was chosen simply because this was when the author was writing. If so, this would give us precise dating for this work[14].

The use of the Seleucid era is noteworthy, because this era was not in use by the Coptic Church (or by anyone else, indeed, in Egypt); it was a specifically Jewish dating practice, most likely introduced by Jewish immigrants from Babylonia (Iraq) in the course of the tenth century. Although Jewish use of the Seleucid era became common in Cairo by the end of the century, it was still relatively rare in the early tenth century. In fact, if 1241 SE (or 929/31 CE) was the year of composition of this work, our text may represent the earliest known attestation of the Seleucid era that can be firmly provenanced, through its reference to the Coptic calendar, to Egypt[15].

*Line 2*

The months in this text are Coptic. Tūt, the first month, begins on 29 August. In the Coptic calendar, all months count 30 days; the twelve months are followed at the end of the year with five ‘epagomenal’ days (six days in a year preceding a Julian bissextile year, when

[14] When referring to the hypothetical author of this text, we use the masculine pronoun on the historical assumption that he was most likely male.

[15] See KRAKOWSKI and STERN, *Oldest Dated Document*, which analyses another Cairo Genizah fragment (Halper 331) with an earlier Seleucid dating of 1182 CE (870/1 CE), but argues that this text likely originated from outside Egypt, somewhere in the Near East. As shown in that article, the next attestations of the Seleucid era in the Cairo Genizah are legal documents written in Fusṭāṭ that are dated to the 1260s SE (= 950s CE).

February has 29 days – whereupon the preceding Tūt begins on 30 August). Baramūdah, the eighth month, always starts on 27 March. As Tūt and Baramūdah are seven months apart from each other, or 210 days, they always begin on the same day of the week (in this year, Saturday).

*Line 3*

The epact is the age of the moon, in any given year, on the day before 1 Tūt (the New Year). In the Alexandrian 19-year cycle, every year of the cycle is assigned a fixed epact, on the basis of which the date of Easter is calculated.

The epact given for 1241 SE is 21; yet in the Alexandrian cycle, 21 is not the epact of the nineteenth year (which 1241 SE is), nor indeed of any other year in the cycle – epact 21 simply does not exist. This rules out the suggestion that, for example, the author has committed an error in the count of years. Epact 21 on this line is the first indication that the data, throughout our text, have been deliberately altered from what they are in the Alexandrian cycle; as will be argued below, the intention was actually to correct the dates of Easter.

The standard epact for year 19 of the Alexandrian cycle is 18[16]. The scribe has indicated this in an interlinear gloss, one line earlier: 'Some of them said that the epact is 18', and again here, above the number 21: '18'. As mentioned above, these glosses are in the scribe's own hand; indeed, he appears to have deliberately left space between the first two lines in order to insert his longer gloss. He has taken care, however, to preserve his comments as glosses, rather than to correct his text or insert his glosses into the text that he is copying. This demonstrates caution and respect towards his master text. This is further evident from the phrase 'some of them said', which at first sight is odd, given that *all* knowledgeable Christians would have said the epact was 18. This phrase, however, is actually understandable. The scribe clearly had knowledge of Christian Computus, and must have been puzzled as to why the epacts, and consequently all other data in this calendar, were discrepant from the standard values. This would explain why, in his puzzlement, he chose to exercise caution and stated, perhaps hesitantly, 'some of them said', rather than denounce his master text as blatantly and consistently erroneous. From this point onwards, as the text unfolds, the scribe gives up and no longer tries to rectify its deviations from the standard cycle.

*Lines 3-7*

In these lines, the author calculates the date of Easter on the basis of the value of the epact. The basic rule, shared by nearly all medieval Christians, is that Easter falls on the Sunday following the first full moon after the equinox. The equinox, in the Alexandrian tradition, is defined as 21 March, which in the Coptic calendar is 25 Baramhāt. The full moon that comes after it is more precisely Passover or the 14th of the lunar month, when Jesus was crucified (according to the Gospel of John). The following Sunday commemorates his resurrection. In our text, Passover or the full moon are identified instead as 'the 15th of Nisan', i.e. of the lunar month Nisan (the first month in the Jewish calendar) – more on this below. This date, for purposes of calculation of the date of Easter, can be derived from the epact, through a

[16] The Alexandrian epacts are tabulated, for example, in MOSSHAMMER, *Easter Computus*, p. 295.

simple arithmetic procedure.

The first step is to establish the age of the moon on the day before 1 Baramūdah (or last day of Baramhāt), exactly seven months after the epact. As stated above, the months in the Coptic calendar are of 30 days; in contrast, lunar months alternate between 29 and 30 days. This means that every month, the lunar month falls behind the Coptic calendar by an average of half a day. The author states that 'from Tūt to Baramūdah there are 8 months', and hence, that in this period the moon falls behind by four days (lines 3-4). Consequently, four days need to be added to the epact, in order to obtain the age of the moon on the day before 1 Baramūdah (line 5)[17].

The second step is to work out from there the date of the nearest 15th of the lunar month, either in the last five days of Baramhāt, or in the first few weeks of Baramūdah, which is the nearest to the equinox. The author's procedure can be expressed as follows:

epact + 4 + x (mod 30) = 15

where x is the value that we are seeking to establish, i.e. the date in Baramhāt or Baramūdah of the 15th lunar day. Thus in 1241 SE, the 15th lunar day, or 15th of Nisan, falls on 20 Baramūdah. Accordingly, in lines 5-7, the author adds up 21 (the epact) with 4 (the days of the eight months) and 20 (the date in Baramūdah), which makes 45, from which 30 days (a full month) are cast out, leaving 15.

What is bizarre about this calculation, as presented here, is that it assumes advance knowledge of what needs to be determined, i.e. the Coptic date of 15th of Nisan (in the equation, 'x'). In practice, when x is not yet known, this value will have to be determined through a series of approximations, until the numbers add up to the desired result of 15[18].

*Line 7*

As mentioned above, the assumption in our text is that Passover falls on the 15th of Nisan, when the moon is in its 15th day, and that this date is what determines the date of Easter (on the following Sunday). In Christian Computus, however, Passover is deemed to fall on the 14th of the lunar month (in Latin, *luna XIV*), which is indeed its biblical date (Lev. 23:5, Num. 28:16, etc.). The author appears to be influenced by rabbinic tradition, which tends to confuse Passover with the festival of Unleavened Bread and commonly gives Passover the date of 15th Nisan[19]. This creates, however, a consistent error in his dates: for in terms of Christian Computus, all the Passover dates should actually be one day earlier, on the 14th. This error has the effect of bringing his dates closer to those of the standard Easter cycle, and thus, of reducing his correction of the Passover dates by one day. In the entries that are

[17] That there are eight months from Tūt to Baramūdah is only true if the months are inclusively counted. Actually, the interval between them is only seven months (and consequently, as mentioned above, they begin on the same day of the week); so according to the author's arithmetic, this should yield a discrepancy of 3.5 days, thus either 3 or 4 days. However, the sequence of lunar months assumed in the Alexandrian calendar is such that from Tūt to Baramūdah there are three 30-day months and four 29-day months, and hence, the discrepancy between the moon and the calendar months is always 4 days.

[18] This cumbersome procedure would be unnecessary if the following, more intuitive formula were used: x = 15 − epact − 4. In most cases, however, this equation would yield a negative result, to which 30 days would then have to be added. Medieval mathematics are generally averse to negative numbers.

[19] STERN, *Calendar and Community*, p. 129 n. 95.

extant in our folio, this does not affect the author's revised dates of Easter; but it could affect them in other years of the cycle. This erroneous use of 15th of Nisan, probably unintentional, should probably be put down to the Jewish perspective of the author.

In this entry, the author does not conclude by providing the dates of Easter and Lent (perhaps he feels that the entry is long enough as it is). However, the statement that 20 Baramūdah, the 15th of Nisan, is a Thursday, is sufficient information for the reader to work out the date of Easter on the subsequent Sunday (23 Baramūdah).

All this is assuming the author's epact of 21. According to the standard computation and epact of 18, Passover (14th of the moon) falls on Saturday 22 Baramūdah. The date of Easter – which is what counts most – is therefore not affected, as either way it falls on the subsequent Sunday, 23 Baramūdah.

*Line 9*
In the standard Alexandrian computation, the epact of this year – first year of the 19-year cycle – is 0 or 30. Epact 2, again, is not the epact of any year in the Alexandrian cycle. As in the previous year, however, this different epact does not affect the date of Easter for this year.

*Lines 13-14*
In Coptic tradition, the fast of Lent lasts 55 days. Since Passover falls on Monday 9 Baramūdah, Easter (when the fast is broken) is on Sunday 15 Baramūdah. Lent begins therefore 55 days earlier, on 20 Amšīr.

*Line 15*
A 'year of six of the Copts' means that its New Year (1 Tūt) falls after a 6th epagomenal day (on 29 August – see above, *ad* line 2). In the Julian calendar, the subsequent February is bissextile (a 'leap' year).

*Line 16*
In the standard Alexandrian computation, the epact of this year is 11. The given epact of 14 is discrepant, but also problematic for a further reason. In comparison with the previous year, where the given epact was 2, the epact of 14 marks a *saltus lunae* ('skip of the moon'), as normally the epact should have progressed to 13[20], but it has 'skipped' to 14. In the Christian tradition of Computus, the *saltus lunae* would normally occur at the beginning of the cycle, which the year 1243 SE, however, does not appear to be (in the Alexandrian cycle, this is the second year of the cycle). This itself could be regarded as a violation of Easter Computus principles.

In this case, the discrepant epact of 14 has a major effect on the date of Easter. The standard epact of 11 means that Passover (14th of the moon) occurs on 29 Baramhāt, which in this year was a Sunday; consequently, in this year, Easter was postponed to the following Sunday, on 6 Baramūdah. This is a week later than according to our text, which has Passover two days earlier, and thus retains Easter on Sunday 29 Baramhāt (lines 19-22).

[20] Last year's epact + 11 (modulo 30).

*Line 21*
The beginning of Lent should be 4 Amšīr, which is 55 days before 29 Baramhāt, the author's date of Easter. The date given here for the beginning of Lent, 27th of Ṭūbah, is one week too early; this is a simple error.

*Line 23*
In the standard Alexandrian computation, the epact of this year is 22.

*Line 27*
Lent begins on the 24th of Amšīr. The text omits the weekday of 16 Baramūdah, which in this year was Thursday, hence Easter fell on Sunday 19 Baramūdah. In the standard Alexandrian computation, the 14th of the moon was 18 Baramūdah, a Saturday. The date of Easter is therefore unaffected.

## *4. Discussion: the Easter calendar corrected*

The persistent deviation of the data in this document from the standard Alexandrian computation raises a fundamental question about what the author is trying to achieve. His consistent reference to the 15th of Nisan, rather than to the 14th of the Paschal lunar month as in Christian computistic tradition, could be taken at first sight as an indication that he is actually referring to the Jewish Passover. More precisely, the author might be using methods drawn from Alexandrian Computus, albeit with some modifications (in particular of the epacts), to calculate the dates, in the Coptic calendar, when the Jewish Passover is or should be celebrated.

In support of this interpretation, we may note that the relationship between the date of 15 Nisan and the date of Easter – namely, that Easter falls on the Sunday following Passover – is never clarified or explicitly stated. In the first entry, year 1241, Easter and Lent are not mentioned at all. In year 1242, the author calculates the date of 15 Nisan, and then adds: 'they (the Christians) (begin) fasting on the 20th of Amšīr and break the fast on the 15th of Baramūdah' (lines 13-14). The date of 15 Nisan could be read separately, as a date for the Jews, followed by the dates of the Christians, which the author mentions merely for comparative purposes. The same configuration occurs in the last two entries. In year 1243, the dates of Lent and Easter are introduced with the only explicit reference to Christians in the whole page: 'the fast of the Christians (begins) on the 27th day of Ṭūbah and they break it on the 29th of Baramhāt' (lines 20-22). The explicit reference to Christians could be understood as intended to mark a contrast with the foregoing date, 15th of Nisan, which is Jewish (lines 19-20).

However, too many indications point to the contrary, that the intention cannot have been to provide Coptic dates of the Jewish Passover. By the tenth century, the fixed rabbinic calendar had become well established throughout the Near East and Egypt, with its own, sophisticated method of calculating the dates of months and festivals; there was no need for a Jewish scholar writing in Egypt around 930 CE to devise an alternative method, based

on the Christian epact, for calculating the date of Passover[21]. If, more minimally, the intention in this text was only to provide the Coptic equivalent to the dates of Passover as calculated in the fixed rabbinic calendar, then it would have been immediately obvious to the author that his epact-based calculation was a very unreliable method of achieving this, as it yielded patently false results[22]. Indeed, in year 1242, the result of the calculation is that 15 Nisan occurs on a Monday (line 13), and in 1243, on a Friday (line 20) – yet in rabbinic law, Passover (15 Nisan) is prohibited from falling on either of these weekdays[23], so that these Coptic dates could not possibly correspond to the Jewish Passover. In fact, according to the rabbinic calendar Passover (15 Nisan) fell in both cases one day later, on the Tuesday and the Saturday respectively. Furthermore, in 1241, 15 Nisan is dated 20 Baramūdah, whereas in the rabbinic calendar, Passover occurred approximately one month earlier, around the previous full moon (more precisely on 22 Baramhāt, three days before the equinox)[24]. These cases rule out the possibility that the author intended to provide Coptic dates of the Jewish Passover.

It is far more likely, therefore, that the calendar and 15 Nisan dates presented in this text were not intended as Jewish but rather as Christian, even though our Jewish author deviates considerably from the normative dates of the Alexandrian Easter calendar. This is supported by the fact that its epact-based calculation is distinctively Christian, and that the only religious group that is mentioned in this text are the Christians (line 20), together with frequent references to Lent and Easter. Although the author refers, erroneously in our view, to the 15th rather than the 14th of the lunar month, and although he does not make it quite as explicit as one would like it to be, his purpose in calculating the 15th of Nisan must be to determine the *Christian* date of Passover on the basis of which the dates of Lent and Easter can be inferred.

The author, however, has modified all the epact values of the Alexandrian computation, and as a result, the dates of Passover in this calendar differ consistently from those of the standard Easter cycle. These modifications are so persistent that they cannot be accidental

[21] Abundant evidence of the acceptance of this calendar is attested, for example, in the literature produced during the calendar controversy of 921/2 CE, which involved the Rabbanite communities of Babylonia, Palestine, as well as Egypt: see STERN, *Jewish Calendar Controversy*.

[22] An accurate algorithm for calendar conversion Coptic to Jewish (and vice-versa) can be found in Abraham bar Ḥayya's treatise on the calendar (3:9 – see above, note 2), but we have not found any such algorithm in earlier sources or in sources from the Cairo Genizah. In one Cairo Genizah text, Cambridge University Library Or.1080 1.50 (recto left, top section), which can be dated by a paradigm (in verso left, top section) to 1279/80 CE (which is also palaeographically consistent), the Christian epact is used to calculate the Jewish date of the *tequfot* (equinoxes and solstices), on the basis that the autumn equinox, for example, always falls on 27 Tūt (as *per* the rabbinic computation of the *tequfot* attributed to the Talmudic sage Samuel). This method for converting a Coptic date (27 Tūt) back into a Jewish (lunar) date happens to work in 1279 CE, but it is unreliable and does not work in all other years.

[23] STERN, *Calendar and Community*, pp. 166-167 and 194-195.

[24] It must be assumed that the author of this text was affiliated with the Rabbanites, who upheld rabbinic law and hence these calendar rules, and not for example a Qaraite who rejected them together with the whole of the fixed rabbinic calendar. The Rabbanite affiliation of this text is evident from the following: (1) the fragmentary folio, from the same treatise, appears to contain a polemical defence of the Rabbanite calendar postponements; (2) the association of Passover with 15th Nisan (rather than the biblical date of 14th) is specifically Rabbanite, whereas the Qaraites eschewed it; (3) as we shall see below, the epacts in this text are likely to have been corrected on the basis of the (Rabbanite) *molad*, and certainly not on the basis of new moon observation which the Qaraites used at the basis of their calendar.

or merely erroneous[25]. The author has clearly sought to correct, in a certain way, the Easter calendar. When he writes that 'the fast of the Christians (begins) on the 27th of Ṭūbah, and they break it on the 29th of Baramhāt' (lines 20-2), he actually means that this is what they should do; this is not a description, but rather a correction[26]. For he must have known that in the year in question, 1243 SE, the Christians would break the fast and celebrate Easter one week later, on Sunday 6 Baramūdah (see comment *ad* line 16). His intention, in these lines, is surely to correct what he knew as standard Christian practice.

The author's motivation in correcting the dates of Easter is a matter of speculation. He may have intended to show up the error of the Christians, or he may have intended to provide them with genuinely good advice. In any event, the corrections he proposes here do not appear unjustified. In general terms, the difference between his values and those of the standard Easter computation amounts to two or three days, with the effect that his dates of Passover, for example, are two or three days early. In the tenth century, this would have had the beneficial effect of correcting the discrepancy built up, over the past centuries, in the Alexandrian cycle, and of re-aligning it, in broad terms, with the phases of the moon.

The author, however, does not explain how or on what basis he determined that the discrepancy of the Alexandrian cycle from astronomical reality was, in his day, of two or three days, and that this is what needed to be corrected; indeed, the text does not even mention that a correction has been made (although this may have been explained in a part of the text that is now lost). In the absence of any such explanation, the basis on which the author corrected the Alexandrian cycle remains, again, a matter of speculation. But inasmuch as his calculation is epact-based, it seems reasonable to assume that the correction was made at the level of the epact. In most cases, the epact has been increased by three days, but in 1242 SE, only by two; this indicates that the epact was not corrected through the simple addition of a fixed number of days[27].

The epact could have been corrected in a number of ways. It could have been based on empirical observation of the new moon in August, on the basis of which the age of the moon on 28 August (in other words, the epact) could have been calculated. In 929 CE, the new moon was first visible in Cairo on 8 or 9 August in the evening, making the first day of the lunar month 9 or 10 August, and thus the age of the moon on 28 August either 20 or 19 (respectively) – not the value given in our text of 21. In 930 CE, first visibility was on 28 August, yielding an epact of 0 (= 30) which happens to be the standard Alexandrian epact,

[25] The use of epact values 21 and 2, that do not appear anywhere in the Alexandrian cycle, show that the author has not simply erred, for example, in his year numbers (see above, comments *ad* lines 3 and 9).

[26] In grammatical terms, this interpretation is completely possible, and in context, plausible. The expressions used here allow both a descriptive and a prescriptive interpretation, because the Classical Arabic distinction between the indicative and the jussive collapsed in Judaeo-Arabic and the same imperfect form took on both meanings (BLAU, *Grammar of Medieval Judaeo-Arabic*, p. 125-127, paragraphs 175, 176). Although other ways of expressing prescription were available to the author, his decision not to use them was probably dictated by calendar stylistic norms.

[27] In contrast, in Genizah fragment Or.1080 1.50 (above, note 22), the epact is adjusted through the addition of the fixed value of three (more precisely, two days to the epact and one additional day to the calculation – why they are split in this way remains to us unclear). It should be noted that the intention there is somewhat different, as it is not to *correct* the epact or the date of Easter, but rather to adjust it in line with the Jewish calendar so as to make it fit for the purpose of calculating Jewish dates. This method, as noted above, is however very unreliable.

but not the value in our text of 2. Similar results apply in the next two years. Empirical observation is thus unlikely to have been used to correct the epact.

The last column in the table below demonstrates, likewise, that the dates of the fixed Jewish calendar could not have been used to correct the value of the epact: in 929, 28 August fell on 20 Elul (not 21), etc.

The correction of the epact, coming from a Jew, is more likely to have been based on the *molad*, the calculation of the conjunction (astronomical new moon) that lies at the foundation of the fixed Jewish calendar[28]. The *molad* of each month is obtained through a very precise calculation, derived from Ptolemaic astronomical values, which a medieval Jewish calendar scholar would naturally have regarded as scientifically accurate and therefore appropriate for adjusting the dates of Easter. In 929 CE, the *molad* fell on Saturday 8 August around dawn; taking this as the first day of the month, the epact would have been 21, exactly as in our text. The data for all the years is laid out in more detail in the table below. An epact calculated on the basis of the *molad* corresponds in all years to the epact given in our text, with the exception however of 932 CE (24 according to the *molad*, 25 according to our text). This exception is significant. It could be due to error, but it also calls into question whether the *molad* was, in fact, the criterion used for correcting the Easter calendar. This question needs therefore to be left open.

| Year (CE) | Epact (*per* T-S Ar.29.56) | *Molad*[29] | Day 1 of lunar month (= day of *molad)* | Epact (based on *molad)* | Epact (based on Jewish calendar) |
|---|---|---|---|---|---|
| 929 | 21 | 7-11-886 | Saturday 8 August | 21 | 20 |
| 930 | 2 | 6-9-395 | Friday 27 August | 2 | 1 |
| 931[30] | 14 | 3-18-191 | Tuesday 16 August | 14 | 13 |
| 932 | 25 | 1-2-1067 | Sunday 5 August | 24 | 24 |

## *5. Conclusion*

This intriguing text in Judeo-Arabic, written in Egypt most likely around 930 CE, presents an Easter calendar for a period of at least four years in which the data, more precisely the epacts, have been systematically altered. Although this is not explained, the intention appears to have been to correct the Easter calendar and bring it more in line with the phases of the moon. The originator of this corrected epact was most likely Jewish rather than Christian. The Coptic Church, as all eastern Christianity, was traditionally very conservative towards its calendar, and none of its representatives is known to have ever suggested calendar correction or reform. Even in the West, in this period, no one yet was criticizing the Easter calendar. A Jew, as a critical outsider, is far more likely to have

[28] STERN, *Calendar and Community*, p. 191-192, 207-210.

[29] The traditional notation of the *molad* is used in this table, consisting of weekday-hours-parts. Weekdays are numbered 1-7; the 24 hours are counted from the evening, when the calendar day begins; and there are 1080 parts in the hour.

[30] The epact in this year is the age of the moon on 29 August, as there are six epagomenal days and 1 Tūt falls on 30 August.

instigated this correction. The author of this text, quite likely, devised himself this correction.

How this correction was carried out is a matter of speculation, as the text does not provide any explanation. The most likely option is that the author drew on the *molad* (the time of the new moon as calculated in the fixed rabbinic calendar), although this explanation is not fully satisfactory. In using, perhaps, the *molad*, the author's purpose was not to Judaize the Easter calendar (even if, inadvertently perhaps, he takes the 15th of the moon as lunar date of Passover rather than the 14th), but rather only to correct it and make it more accurate for the Christians to use.

The corrections that are proposed are significant, and would often lead to the observance of Lent, Easter, and the other movable feasts on different dates. In the single folio that survives, this occurs in only one of the four years: in 1243 SE (932 CE), Easter was celebrated by the Coptic Church – as indeed most likely by all Christians in this period of history – on Sunday 6 Baramūdah (i.e. 1 April), whereas our text demands that Easter is observed one week earlier, on 29 Baramhāt (25 March). In spite of the text's descriptive, factual tone (e.g. 'they break (the fast) on the 29th of Baramhāt' – lines 21-2), the meaning is likely to be corrective, if not even prescriptive.

The Jewish author of this text was clearly well versed in Easter Computus, even if he committed some errors (15th of the moon, and a one-week miscalculation of the beginning of Lent in year 1243 SE – see comment *ad* line 21). Likewise, the scribe who copied this text in the late tenth or early eleventh centuries, and quite possibly authored the calendar treatise of which it became part, was equally well versed, as he was able to gloss the text with the standard epacts of the Coptic calendar. Easter Computus is not an aspect of Christian tradition that a Jew would have picked up from casual conversation with Christian neighbours; it could only have been absorbed through deliberate investigation and study. Although a seemingly dry and insipid roster, this text has thus much to teach us about interest in, and knowledge of, Christian scholarship by Jews in early medieval Egypt.

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