ALEXANDER JONES

ON THE RECONSTRUCTED MACEDONIAN AND EGYPTIAN LUNAR CALENDARS

aus: Zeitschrift für Papyrologie und Epigraphik 119 (1997) 157-166

On the Reconstructed Macedonian and Egyptian Lunar Calendars

Documentary sources from Hellenistic Egypt attest to the use of three calendrical systems: the Egyptian civil calendar, which employed years that invariably comprised 365 days (12 months of exactly 30 days plus 5 "epagomenal" days), an Egyptian cult calendar that employed some sort of lunar months, and a Macedonian calendar in which the months were again lunar.[1] The regulation of the Egyptian civil calendar is thoroughly understood, to the extent that we can convert all complete dates in this calendar to their exact equivalents in the modern historian's Julian calendar and *vice versa*. It has for some time been generally believed that we similarly know the principles of regulation of the two lunar calendars. First R. A. Parker reconstructed a calendrical scheme for the Egyptian lunar calendar that tied its months in a recurring 25-year cycle with the months of the civil calendar.[2] Thereafter A. E. Samuel applied the same 25-year lunation cycle to the Macedonian calendar.[3] Small modifications have subsequently been proposed to Samuel's hypothesis concerning the time-lag between the beginnings of the Egyptian and Macedonian lunar months.

The present article sets out to show that the documentary foundation for these reconstructed calendars is much less solid than is usually supposed. In the case of the Macedonian calendar, it turns out that the evidence adduced for the reconstructed scheme tells strongly against it.

Coincidence between schematic calendars.

The calendars discussed below are, or have been presumed to be, "schematic", that is, the sequence of months and the decision whether a given month was "full" (30 days) or "hollow" (29 days) was determined by a repeating cycle rather than by observation or calculation of the positions and appearances of the sun and moon. When we speak of a calendar as "reconstructed", we mean that the rules according to which it is supposed to have been regulated are not found explicitly set out in some ancient text, but have at least partly been conjectured by the historian. The reconstruction can be tested if we possess instances of attested dates that are supposed to be in this calendar and that can be reliably equated, independently of the reconstruction, with dates in the Julian calendar or in another calendar over which we have satisfactory control. The number of matches needed to establish confidence in the reconstruction is to some extent arbitrary, but it is helpful if we can estimate the likelihood that a match could arise accidentally even if the reconstruction was false.

Historians are on the whole more likely to underestimate than to overestimate the probability of coincidences between calendars. A clear illustration of this tendency is provided by a set of four reports of astronomical observations that were made by Timocharis at Alexandria in the early third century B.C., and that have been preserved in Ptolemy's *Almagest* VII 3.[4] Each report gives two versions of the date of observation: one using the Egyptian civil calendar, with years numbered according to the "Era Nabonassar",[5] the other using lunar months bearing names taken from the Athenian calendar, with years numbered according to the "First Callippic Period".[6] The Egyptian dates can be converted into Julian equivalents, and are correct: the astronomical events described can only have been seen on the dates that

[1] For a brief orientation, see A. E. Samuel, *Greek and Roman Chronology* (München, 1972), 145–151.

[2] R. A. Parker, *The Calendars of Ancient Egypt* (Chicago, 1950).

[3] A. E. Samuel, *Ptolemaic Chronology* (München, 1967).

[4] G. J. Toomer, trans., *Ptolemy's Almagest* (London, 1984), 334–337. The observations are discussed by J. P. Britton, *Models and Precision: The Quality of Ptolemy's Observations and Parameters* (New York & London, 1992), 77–88.

[5] Nabonassar year 1 was the Egyptian year that began on February 26, 747 B.C.

[6] Callippic period 1, year 1 began on or within a day of June 28, 330 B.C.

Ptolemy gives. Among the questions that arise from these reports is, what were the rules by which the “Athenian” months in these reports were regulated?

The astronomer J. K. Fotheringham reconstructed a schematic lunar calendar following principles described by the first century B.C. writer Geminus (*Isagoge* 8).[7] In this reconstruction, it is assumed that 19 years contain exactly 235 lunar months, and that a complete Callippic period, comprising four periods of 19 years, contains exactly 27759 days (i.e. the average year is 365 1/4 days). Each month is nominally of 30 days, but every 64th day starting from the beginning of the Callippic period is skipped over so that nearly half the months have only 29 days. Fotheringham found that if the first Callippic period was hypothesized to begin on June 28, 330 B.C., then the day numbers of all four observations of Timocharis according to this reconstructed calendar turn out to match the day numbers in the “Athenian” months according to Ptolemy.

More recently, B. R. Goldstein and A. C. Bowen have hypothesized that the lunar dates of Timocharis’ observations conform to a variant of the Macedonian calendar, such that Athenian month names were used instead of Macedonian ones.[8] Following Samuel, they assume that the calendar was regulated according to a scheme based on the assumption that 25 Egyptian civil years contain exactly 309 lunar months and 9125 days. The pattern of “full” (30-day) and “hollow” (29-day) months is assumed to be the scheme reconstructed by Parker for the Egyptian lunar calendar, but the Macedonian month begins one day later than its Egyptian counterpart. Goldstein and Bowen show that the day numbers of Timocharis’ observations according to their Macedonian calendar coincide with Ptolemy’s day numbers in all four cases.

Fotheringham qualified his remark that the agreement of Timocharis’ dates with his reconstructed calendar confirms the latter with a circumspect “so far as it goes”.[9] Goldstein and Bowen write, rather less cautiously, “we have established that the dates with Athenian month names in the reports of Timocharis’ 4 earlier observations belong to a calendar based on Parker’s scheme;”[10] and the elaborate arguments that they evolve concerning Hellenistic astronomy and calendrics in the remainder of their paper depend on this conclusion. Yet the circumstance that the four lunar dates associated with Timocharis’ observations fit two distinct hypothetical schemes should warn us that these agreements are of scant value as evidence supporting either explanation of the dates, because of course both cannot be correct.

Since we do not independently know how the beginnings of Timocharis’ “Athenian” months were determined, we cannot calculate the probability that an accidental selection of these months would coincide with months of the Fotheringham or Parker scheme. But we can at least estimate the probability that the two schemes will give the same results for a random selection of months. The Parker scheme sets out 309 dates of beginnings of lunar months in 25 Egyptian calendar years, such that the first day of the first month of Year 1 is also the first day of the first lunar month. It is easy to construct a parallel “Geminus” scheme for the same 25 years according to Geminus’ rule that every 64th day is omitted from a sequence of notionally full months, starting with the same epoch (i.e. the first “omitted” day is the 64th of Year 1, making the third lunar month hollow). Table 1 displays the dates according to the Parker scheme together with the deviations of the “Geminus” scheme. Of those lunar months that begin in the odd-numbered civil months of the Egyptian year, almost exactly half turn out to have the same date in both schemes; in the even-numbered months, approximately five sixths have the same

[7] J. K. Fotheringham, “The Metonic and Callippic Cycles,” *Monthly Notices of the Royal Astronomical Society* 84 (1924) 383–392.

[8] B. R. Goldstein and A. C. Bowen, “On Early Hellenistic Astronomy: Timocharis and the First Callippic Calendar,” *Centaurus* 32 (1989) 272–293.

[9] Fotheringham, 390.

[10] Goldstein and Bowen, 282.

dates. Of the 101 exceptions, 88 have the “Geminus” date falling one day later than the Parker date, and 13 have the “Geminus” date falling one day earlier. There are no deviations of more than one day.

Year	I	**II**	III	**IV**	V	**VI**	VII	**VIII**	IX	**X**	XI	**XII**
1	1	**1**	1, 30	**30**	29	**29**	29–	**28**	27	**27**	27–	**26**
2	20	**20**	19	**19**	18+	**18**	18	**17**	16+	**16**	16	**15**
3	9+	**9**	8+	**8**	7+	**7**	7	**6**	5+	**5+**	5	**4+**, 4
4	28+	**28**	27+	**27**	26+	**26**	26	**25**	24+	**24**	24	**23+**
5	18	**18**	17	**17**	16	**16**	16–	**15**	14	**14**	14–	**13**
6	7	**7**	6	**6**	5+	**5**	5	**4**	3+	**3**	3	**2**, 2
7	26	**26**	25	**25**	24	**24**	24	**23**	22+	**22**	22	**21**
8	15+	**15**	14+	**14**	13+	**13**	13	**12**	11+	**11**	11	**10+**
9	4+	**4+**	3+	**3+**	2+	**2+**	2	**1+**	1, 30+	**30**	30	**29**
10	24	**24**	23	**23**	22	**22**	22–	**21**	20	**20**	20–	**19**
11	13	**13**	12	**12**	11	**11**	11	**10**	9+	**9**	9	**8**
12	2+	**2**	1+	**1**	1, 30	**30**	30–	**29**	28+	**28**	28	**27**
13	21+	**21**	20+	**20**	19+	**19**	19	**18**	17+	**17**	17	**16**
14	10+	**10+**	9+	**9+**	8+	**8+**	8	**7+**	6+	**6+**	6	**5+**, 5
15	30	**30–**	29	**29**	28	**28**	28–	**27**	26	**26**	26–	**25**
16	19	**19**	18	**18**	17	**17**	17–	**16**	15+	**15**	15	**14**
17	8+	**8**	7+	**7**	6+	**6**	6	**5**	4+	**4**	4	**3+**, 3
18	27+	**27**	26+	**26**	25+	**25**	25	**24**	23+	**23**	23	**22**
19	16+	**16**	15+	**15+**	14+	**14+**	14	**13+**	12+	**12+**	12	**11+**
20	6	**6**	5	**5**	4	**4**	4	**3**	2+	**2**	2	**1**, 1
21	25	**25**	24	**24**	23	**23**	23–	**22**	21	**21**	21	**20**
22	14+	**14**	13+	**13**	12+	**12**	12	**11**	10+	**10**	10	**9**
23	3+	**3+**	2+	**2+**	1+	**1+**	1, 30+	**30**	29+	**29**	29	**28**
24	22+	**22**	21+	**21**	20+	**20+**	20	**19+**	18+	**18+**	18	**17+**
25	12	**12**	11	**11**	10	**10**	10–	**9**	8+	**8**	8	**7**

Table 1. Beginnings of lunar months in Parker and "Geminus" scheme.

Key:
Roman numerals in column headings = Egyptian civil months
(epagomenals tabulated with XII)
Years = ordinal number of Egyptian year in 25-year cycle
Tabulated numbers = day number in civil month of 1st of lunar month according to Parker's scheme
(dates attested in P. Carlsberg 9 in bold)
+ = “Geminus” date falls one day later
– = “Geminus” date falls one day earlier
(no annotation) = “Geminus” date coincides

We will return presently to the question of why the rates of coincidence are different in the odd and even months; for the moment it is sufficient to remark that the two schemes will give the same date for the first day of a randomly chosen lunar month almost exactly two times out of three (208 coincidences out of 309). Surprisingly, one obtains very close to the same rate of coincidence (199 coincidences in 309 months) if one shifts the “Geminus” scheme to start on the first day of the *second* month of Year 1 in the Parker scheme, even though this shift changes all hollow months into full and most full months into hollow. This situation reproduces the actual alignment of Fotheringham's and Parker's schemes during the 25-year cycle that began in 307 B.C., within which three of the four observations of Timocharis fell.

Now when Fotheringham compared the four "Athenian" dates with his scheme, his procedure amounted to determining an epoch date for the scheme from one of the observation dates, and then checking whether the scheme, starting from this epoch, agreed with the remaining three dates. Goldstein and Bowen have, I believe, effectively done the same thing, since although the Parker scheme had an already established epoch as applied to the Egyptian calendar, they are willing to accept a constant displacement of the "Athenian" dates from the Parker scheme, which turns out to be one day. The probability that the Fotheringham and Parker schemes, both calibrated to coincide on one date, would yield the same dates for the first day of three other randomly chosen months is about 8/27, or nearly one in three. In other words, the coincidence that has happened for Timocharis' dates is not at all remarkable.[11]

The Fotheringham and Parker schemes coincide so often because both are fairly successful solutions of the same problem: to distribute full and hollow months, according to their known proportions, evenly in a recurring cycle. The ratio of full to hollow months in the Fotheringham scheme is equivalent to assuming a mean lunar month of 27759/940 days (approximately 29.53085 days), which is an excellent approximation of the correct value: it is too long by an amount that would not quite add up to one day after 300 years. The Parker scheme effectively assumes a mean lunar month of 9125/309 days (approximately 29.53074 days), which is too long by so little that the error would not quite be one day in 500 years. The divergence of the schemes relative to each other is even slower, increasing by less than one day in 750 years.

Even over spans of time much longer than the 12 years between the earliest and latest of Timocharis' observations, therefore, the Parker and Fotheringham schemes will diverge only as a result of their using different rules for distributing the full and hollow months. In fact *any* two calendrical cycles will coincide in at least half their dates so long as they start from the same epoch, assume nearly the same value for the mean lunar month, and distribute the hollow months evenly; and the agreement can easily rise to near unanimity.[12] Geminus' rule of skipping every 64th day is expressly designed to achieve the most uniform possible distribution of hollow months; as we shall see, Parker's scheme produces a rather less uniform pattern, but in such a way that hollow months are very smoothly distributed among the groups of two or three lunar months beginning and ending in even-numbered Egyptian civil months.

The evidence for Parker's scheme reconsidered.

Parker's and Samuel's investigations of the lunar calendars of Hellenistic Egypt led them to the following conclusions:

(a) The Parker scheme was used to determine the beginnings of the lunar months of the Egyptian cult calendar, and is attested in documents as early as 237 B.C.

---

[11] For the sake of simplicity, the foregoing comparisons disregard the peculiarity in Fotheringham's scheme that a day number is usually skipped in the *middle* of hollow months, so that the remaining days of that month are numbered as if the month had been full and begun one day earlier. Hence the probability that an arbitrary date will have the same day number in the Fotheringham and Parker schemes is not exactly the same as the probability that the corresponding months will begin on the same day.

[12] I doubt whether a small sampling could even reliably distinguish a schematic calendar from one based on observation. Parker found (pp. 16 and 25) that his scheme yielded lunation dates in agreement with dates of first lunar invisibility calculated according to modern astronomical theory in 18 cases out of 25 in the two consecutive years 357/356 and 356/355 B.C., and all the exceptions had the schematic date just one day later than the calculated date.

(b) The Macedonian calendar in Egypt was regulated according to the Parker scheme during the reign of Ptolemy Philadelphus.

(c) The lunar months of the Macedonian calendar, as determined by the Parker scheme, began one day (in Egyptian civil calendar reckoning) later than their counterparts in the Egyptian cult calendar.

Of these, (a) and (b) are now generally accepted as fixed points in the chronology of Hellenistic Egypt, whereas doubts have been raised about (c). In fact the basis for believing even (a) and (b) is much less secure than one might wish.

The foundation of the Parker scheme is P. Carlsberg 9, a demotic papyrus from the second century of our era that contains a list of dates for the first day of lunar months in a repeating 25-year cycle of Egyptian civil years.[13] One date is provided for each of the even-numbered months of each year, so that the dates are at intervals usually of two, occasionally of three, lunar months. Simple arithmetical rules determine all the dates:

(i) the first recorded date, for Year 1 month II, is the 1st day of the civil month;

(ii) if the day specified for a particular civil month is greater than 1, the day for two months later is one less;

(iii) if the day for a particular month is 1, the day for two months later is 30;

(iv) the day for month II of most years is either 6 less or 24 more than the day for month XII of the preceding year;

(v) but for years 5, 10, 15, 20, and 25, the day for month II is either 5 less or 25 more than the day for month XII of the preceding year.

These rules mean that most of the intervals between consecutive recorded dates are 59 days, i.e. a full and a hollow month, but because of rules iii–v some intervals comprise two full months, two full and one hollow, or three full. The deviations from a strict succession of pairs of hollow and full months are spread throughout the 25 years fairly evenly.

While Neugebauer and Volten, the first editors of P. Carlsberg 9, arrived at the foregoing understanding of its contents,[14] it was left to Parker to investigate the possibility that the scheme of the papyrus was the means of regulating lunar months in the Egyptian cult calendar. Parker extended the interpretation of P. Carlsberg 9 in three respects. Firstly, he collected ten Egyptian documents from the years 237 B.C. through A.D. 190 containing 17 equations of lunar calendar dates with civil calendar dates (according to either the unreformed or the reformed version of the Egyptian calendar). From seven of these dates (ranging from 144 B.C. to A.D. 190) one can deduce a date for the first of the lunar month that falls in an even-numbered civil month, and in every instance the resulting date coincides with the date according to the cycle of P. Carlsberg 9; and in the remaining ten cases, the deduced first of the month is either 29 or 30 days after the preceding date in the Carlsberg cycle. Parker inferred that the lunar months were regulated by the Carlsberg scheme. This argument seems to be sound: although the ten intermediate dates are of little demonstrative value because they are not determined by the scheme of the papyrus, the probability of seven coincidental matches would be small (e.g. less than 1/17 if the probability of one match is 2/3). Moreover these matches occur over an interval of more than three centuries, which is long enough that the error resulting from the mean month of the 25-year cycle amounts to more than half a day, so that if lunar dates were based on a different assumed periodicity or on observed lunar phenomena, the probability of accidental agreement in seven cases out of seven would diminish still further.

---

[13] The reformed Egyptian calendar of the Roman period, with its intercalary day after every four years, plays no role in the papyrus.

[14] O. Neugebauer and A. Volten, "Ein demotischer astronomischer Papyrus (Pap. Carlsberg 9)," *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik* ser. B, 4 (1938) 383–406.

This deviation was the starting point for Parker's second contribution. He noted that while the Carlsberg dates tended to correspond to dates of first visibility of the new crescent moon in the middle of the second century of our era, in the third and second century B.C. they mostly fall a day before the new moon. Hence he concluded that the phenomenon that the scheme was intended to approximate must have been the morning of first invisibility of the waning moon; and since the scheme would have been most closely fitted to the actual dates of first invisibility in the middle of the fourth century B.C., he estimated that the scheme was devised about then, with its inaugural cycle perhaps the one such that Year 1 was 357/356 B.C. Supposing, however, that Parker was correct in his identification of the phenomenon nominally marking the beginning of the lunar months during the Hellenistic period, the slowness with which the error in the cycle's periodicity accumulates means that the date of the scheme's invention might have been a small number of cycles earlier or later.

Lastly, Parker attempted to establish rules for the dates of beginning of the lunar months not directly accounted for by the scheme in P. Carlsberg 9. To do this, he used the ten intermediate dates already referred to, and induced from them a pattern such that in certain odd-numbered civil months of all years the same date was consistently assumed as in the preceding even-numbered month, and in other odd-numbered months the same date was assumed as in the following even-numbered month. This reconstruction is open to question on several grounds. First, as Neugebauer remarked, it seems doubtful *a priori* whether there were fixed rules for the intermediate months, since in that case it is hard to see why the papyrus should give only half the dates.[15] Secondly, the number of attested dates that Parker used to reconstruct the scheme is really insufficient to establish that there was a regular patter, and of what sort: thus for only one cycle year is there a run of consecutive dates, and for only one odd-numbered civil month are there more than two attested dates. After all, we are given just 10 out of 159 missing day numbers. Only if we already *knew* that the missing dates were determined, not merely by some rule, but specifically by the kind of rule that Parker hypothesizes, would the attested dates (nearly) suffice to establish the details. Thirdly, whereas the Carlsberg dates for the even-numbered months lead, as we have seen, to a smooth distribution of full and hollow months in clusters of two or three, Parker's additional rules situate the hollow months within the clusters in an irregular way, so that there are many pairs of consecutive hollow months and pairs of consecutive full months. It is hard to see why one would have adopted this complicated and needlessly irregular pattern to fill out the gaps in the elegantly smooth framework of P. Carlsberg 9.

Shortly after Parker's study of the Egyptian calendars was published, a document came to light that proves that a 25-year calendrical cycle was known in Egypt in the early second century B.C., but also proves that the pattern of full and hollow months underlying P. Carlsberg was not the only one in use.[16] This text, *P. Ryl.* IV 589, is exactly dated to 180 B.C., and when complete gave (col. ix) the precise numbers of years, months, and days in the cycle, and, in subsequent columns, civil calendar dates for the beginnings of all the lunar months in the cycle years. Little of the latter survives, but there is enough to show that dates in even-numbered months could differ by one from the Carlsberg dates, and (if the editors have correctly aligned col. xii) dates in odd-numbered months could likewise differ by one from Parker's reconstructed dates.

The Macedonian calendar.

Samuel's reconstruction of the Macedonian lunar calendar in Egypt takes Parker's reconstruction as a given. The evidence for the Macedonian calendar consists of papyrus documents bearing date equations between Egyptian civil calendar dates and Macedonian dates. Before Samuel undertook the analysis of

[15] O. Neugebauer, *A History of Ancient Mathematical Astronomy* (Berlin, 1975) 563 n. 4.

[16] E. G. Turner and O. Neugebauer, "Gymnasium Debts and New Moons," *Bulletin of the John Rylands Library* 32 (1949) 80–96.

this material, it was already known that a disproportionately large number of date equations gave the same day number for both the Egyptian and the Macedonian month. Samuel further recognized that there was a second cluster of equations according to which the Macedonian day number was either 10 greater or 20 smaller than the Egyptian day number. These dates (or most of them) must have resulted from a convention according to which the first day of the Macedonian month was assimilated to either the 1st or the 21st of the Egyptian civil month, without taking any account of the phases of the moon. Samuel quite properly exempted all these dates from consideration.

For the remainder, he compared the implied Egyptian dates for the first of the Macedonian month with the dates according to the Parker scheme, and found (i) that in most cases the Macedonian month began one day later than the Parker scheme lunar month, and (ii) that for many of the remainder the Macedonian month began two days later than the Parker scheme month. He concluded that these Macedonian months were regulated according to the Parker scheme, but starting the new month at sunset on the day following the Parker scheme date (which by presumption began at dawn). The hypothetical relationship between the two methods of counting days is illustrated in Fig. 1, in which black bars represent night, and grey bars represent the time between dawn and sunrise and between sunset and dusk. It can be seen that a document written during the daytime ought to bear a Macedonian day number two less than the appropriate Egyptian lunar date, whereas a document written at night should bear a Macedonian day number one less than the Egyptian lunar date.

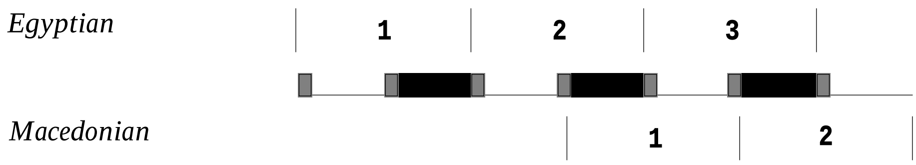

Fig. 1. Egyptian and Macedonian lunar days (Samuel).

Samuel's hypothesis has been subjected to two revisions. Koenen observed that according to Samuel's reconstruction the documents for which the difference between Macedonian and Parker scheme dates is one day, which are the majority, would have had to be written at night, and only the smaller group for which the difference is two days would have been written during the day.[17] He accordingly suggested that the Macedonian month was considered to begin *on the same Egyptian calendar day* as the Parker scheme month, but at nightfall; this would bring the documents with a 1-day difference into the daytime, but fails entirely to account for those with a 2-day difference (Fig. 2). More recently Grzybek has proposed that the Macedonian month began on the day after the Parker scheme month, at sunrise.[18] In this way he accounts for the 1-day differences as documents written during the daytime, and the 2-day differences as documents written between dawn, the beginning of the Egyptian day, and the beginning of the Macedonian day at sunrise (Fig. 3).

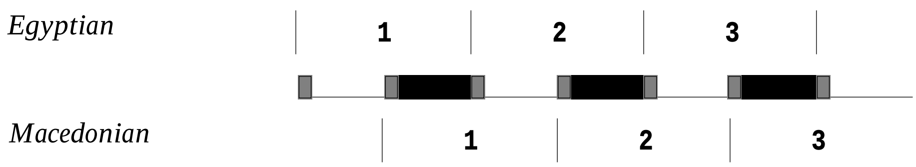

Fig. 2. Egyptian and Macedonian lunar days (Koenen).

[17] L. Koenen, *Eine agonistische Inschrift aus Ägypten und frühptolemäische Königsfeste*, Beiträge zur klass. Philol. 56 (Meisenheim am Glan, 1977), 33ff.

[18] E. Grzybek, *Du calendrier macédonien au calendrier ptolémaïque: problèmes de chronologie hellénistique* (Basel, 1990), 135–155.

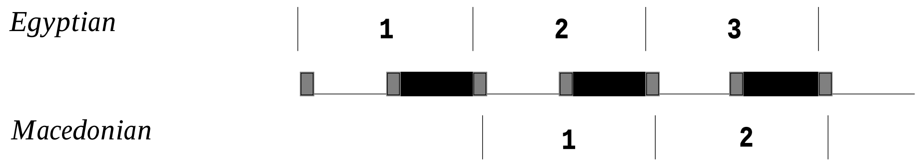

Fig. 3. Egyptian and Macedonian lunar days (Grzybek).

Samuel and Grzybek (and to a lesser extent Koenen) rely on assumptions about when the Egyptian and Macedonian day began. In the case of the Macedonian calendar, our evidence for the practice determining the beginning of the day, i.e. whether a particular night was conventionally regarded as belonging to the preceding or to the following day, is meagre and conflicting.[19] The narrower question of whether the Egyptians counted a new day from sunrise or from the first light of dawn is also the subject of scholarly contention.[20] But setting aside these doubts, both Samuel's and Grzybek's hypotheses seem to imply implausible working habits on the part of the ancient scribes. For if Samuel's model requires that roughly six documents were written at night for every one during the day, Grzybek does not do much better with one document being written during the hour before sunrise for every six during the rest of the day.[21] And it stretches credulity to suppose that these early-rising scribes started the day's work by dating documents with the new Egyptian date but pedantically waited for the sunrise before changing the Macedonian date.

The supposition that there were always two valid date equations between the Macedonian and Egyptian civil calendars for any date, depending on the time of day or night, leads to another improbability that is more measurable. When we possess more than one document written during the very same month, the likelihood that all the documents will have been written, say, during the day (or during the night, or between dawn and sunrise) diminishes with the number of documents in question. If we adopt Grzybek's hypothesis, for example, and base our estimates of probability on the numbers of preserved date equations rather than on *a priori* assumptions about the times of day when people wrote documents, then the probability that a single document would be written after sunrise appears to be about 5/6. Consequently the probability that four documents belonging to the same month would either all have been written before sunrise or all after sunrise is about 1/2, and the probability for five documents is about 4/10. Now it happens that among the 28 relevant examples of Macedonian-Egyptian date equations cited by Grzybek, there are two instances in which four documents were written in the same month, and one instance of five documents in the same month. The probability that in each of the three months the documents would either all have been written before sunrise or all after sunrise ought to be rather small, roughly 1/10. Nevertheless it turns out that all thirteen date equations in these three months correspond to a time after sunrise according to the hypothesis.

In all the disputation over the start of the Macedonian and Egyptian day and the working hours of the Ptolemaic scribes, it has been taken for granted that there is a degree of correspondence between the Parker scheme and the attested Macedonian months high enough to ensure that the Macedonian calendar was really regulated by the Parker scheme. The fact that one sixth of the date equations lead to a difference of two days instead of one has been treated as a secondary problem. In the preceding paragraphs I have tried to show that this approach leads to an impasse. This suggests that we should go back to the original comparison of the dates in the documents with the Parker scheme.

---

[19] This can readily be seen from Grzybek's forced argument for an evening epoch (pp. 142–151).

[20] See the discussion of the problem by C. Leitz, *Studien zur Ägyptischen Astronomie* (Wiesbaden, 1989), 1–6, who argues for sunrise epoch; R. Krauss, "Was wäre, wenn der altägyptische Kalendertag mit Sonnenaufgang begonnen hätte," *Bulletin de la Société d'Égyptologie de Genève* 17 (1993), 63-71 (for dawn epoch); C. Leitz, "Der Mondkalender und der Beginn des ägyptischen Kalendertages," *Bulletin de la Société d'Égyptologie de Genève* 18 (1994), 49-60.

[21] Grzybek, p. 155, counts 23 documents belonging to the day, and 4 belonging to the time between dawn and sunrise. As I will argue below, four of Grzybek's 23 diurnal texts should have been excluded from the list.

No.	*Year*	*Date equation*	*1st of month*	*Relation to Parker scheme*	
1	22:18	Loios 19 = XI 12	X 24	C+1	
2	29:25	Artemisios 23 = VIII 30	VIII 8	C–1	
3	29	Hyperb. 8 = I 9	I 2		P+1
4	*29*	*Hyperb 12 = I 13*	*I 2*		
5	*29*	*Hyperb 20 = I 21*	*I 2*		
6	*29*	*Hyperb 23 = I 24*	*I 2*		
11	30:1	Artemisios 10 = IX 9	VIII 30	C+2	
12	30	Loios 16 = XII 13	XI 28		P+1
13	30	Apellaios 21 = IV 10	III 20		P+1
14	31:2	Dystros 20 = VII 27	VII 8		P+1
15	*31*	*Dystros 22 = VII 29*	*VII 8*		
16	*31*	*Dystros 23 = VII 30*	*VII 8*		
17	*31*	*Dystros 23 = VII 30*	*VII 8*		
18	*31*	*Dystros 23 = VII 30*	*VII 8*		
19	31	Xandikos 15 = VIII 4	VII 20		P+2
20	31	Daisios 2 = IX 18	IX 17		P+1
21	*31*	*Daisios 14 = IX 30*	*IX 17*		
22	*31*	*Daisios 16 = X 2*	*IX 17*		
23	*31*	*Daisios 25 = X 11*	*IX 17*		
24	31	Peritios II 28 = VII 6	VI 9	C+2	
25	32:3	Panemos 26 = XII 1	XI 6		P+1
26	33:4	Daisios 20 = X 14	IX 25		P+1
27	34:5	Dios 22 = III 29	III 8		P+2
28	34	Peritios 28 = VII 3	VI 6	C+1	
29	35:6	Panemos 28 = XI 30	XI 3		P+0
30	36:7	Artemisios 23 = IX 22	VIII 30	C+7	
31	37:8	Hyperb 9 = II 16	II 8	C+4	
32	37	Apellaios 17 = IV 21	IV 5	C+2	

Table 2. Attested equations of Macedonian and Egyptian civil dates.

Key:
No. = number in Grzybek's list
Year = regnal year of Ptolemy II, followed by cycle year in Parker scheme
Date equation = Macedonian and Egyptian dates in document
1st of month = implied Egyptian date of the 1st day of Macedonian month
Relation to Parker scheme = number of days by which the first of the Macedonian month followed either a lunation date recorded in P. Carlsberg 9 [C] or restored by Parker [P].
Date equations that duplicate an already attested month are italicized.

The latest discussion of the evidence, Grzybek's, uses statistics based on 32 attested date equations.[22] Grzybek's list should be followed, since it incorporates additions and corrections to Samuel's shorter list. On the other hand, Grzybek counts as separate items in his tallies the multiple attestations of the same month discussed above. These should be discounted for our present purposes, because they merely establish consistency in the data without adding to the number of attested beginnings of months. Moreover, he lists four equations in which the day number is the same in the Macedonian and Egyptian month.[23] This too is clearly illegitimate, since the only possible reason for including them, out of the

[22] Grzybek, pp. 135–137.

[23] These are his nos. 7–10.

many such equations that Samuel discarded, is that they fit the hypothesis that is supposed to be demonstrated while the others do not.[24]

We are therefore left with just 18 equations, leading to Egyptian calendar dates for the first day of 18 Macedonian months (Table 2). Of these, nine fall one day after the Parker scheme date, five fall two days later, and there remain single instances of 1 day before the Parker scheme date, the same day, four days after, and seven days after. There is nothing about this pattern to suggest any fixed relation between Parker scheme dates and Macedonian months—on the contrary, leaving out of consideration the two wild discrepancies of four and seven days, there is just about the same consistency that we might expect if the Macedonian months were regulated by a *different* schematic cycle. In our earlier comparison of the Parker scheme with a "Geminus" scheme starting from the same epoch, we found that close to one third of the "Geminus" dates fell one day later than the Parker scheme dates, about two thirds coincided, and a small residue fell one day earlier than the Parker scheme dates; with a shift of one day forward this is practically indistinguishable from the distribution we have just arrived at.

If, moreover, we consider only the dates that correspond to even-numbered civil months in P. Carlsberg 9, we find that two Macedonian months started one day after their Carlsberg scheme counterparts, three started two days later, and one each one day before, four days after, and seven days after. In other words, a preponderance of 1-day differences arises only in relation to the suspect dates reconstructed by Parker.

To sum up, the evidence from date equations not only fails to support the belief that Macedonian months were regulated by the Parker scheme, but positively argues against it. Along with this hypothesis, we must abandon the expectation that we can determine exact Egyptian and Julian calendar equivalents for any Macedonian date in Egyptian texts.[25] Of course the conversion tables provided by Samuel and Grzybek will continue to be useful as furnishing equivalents that will usually be within one day of the correct date. The question remains open whether the Macedonian months were regulated by a different scheme based on the 25 year period, or a scheme with another periodicity, or even on observation of the moon's phases.

Department of Classics, University of Toronto Alexander Jones

[24] Grzybek, p. 136 n. 45, cites six further documents with double dates, but rightly leaves them out of the main list because they fit in the class of equations with a 10-day difference that Samuel excluded.

[25] Grzybek, pp. 53–60, and Goldstein and Bowen, pp. 282–286, offer independent (and quite divergent) arguments that the Parker scheme was originally devised for the Macedonian rather than the Egyptian lunar calendar. Such conjectures of course must be abandoned along with the presupposition on which they depend, that the Macedonian calendar was at some historical stage regulated by the Parker scheme.