Some open questions on the Egyptian calendar: an astronomer's view

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The ancient Egyptians had just one calendar in operation, the civil one, during most of their historical period and before the overwhelming influence of Hellenic culture. This calendar could have been invented for a specific purpose in the first half of the third millennium BC, when the previous local Nile-based calendars were rendered useless, as the result of the unification of the country and new social, economic and administrative requirements. The civil calendar always started at the feast of *wp rnpt* in the first day of the first month of the Inundation season (I *3ḫt* 1). Its peculiar length of 365 days might have been established from simple astronomical (solar zenith transit) observations. Lunar festivals were articulated within the framework of the civil calendar, which had a well documented set of 12 month names from the beginning of the New Kingdom, if not earlier. In the Ramesside period or later, several of these months altered their names, probably for social or religious reasons. The role of the festival of the heliacal rising of Sirius (*prt spdt*) within the framework of Egyptian calendrics is actually much more limited that has normally being addressed.

Los egipcios de la época faraónica tuvieron un solo calendario operativo, el civil, mientras duró su civilización y antes de que la influencia de la cultura helena fuese manifiesta. Este calendario habría sido inventado de forma deliberada en la primera mitad del tercer milenio a.C., cuando los viejos calendarios locales basados en la crecida del río Nilo dejaron de ser útiles, debido a la unificación del país y a las nuevas necesidades sociales, económicas y administrativas. El calendario civil tuvo siempre su comienzo en la fiesta de wp rnpt, en el primer día del primer mes de la estación de la Inundación (I 3ḫt 1). Su peculiar duración, de 365 días, podría haber sido estimada por medio de observaciones astronómicas muy sencillas (paso cenital del sol). Los festivales lunares se articularon en el marco del calendario civil que, desde el comienzo del Reino Nuevo o, quizás antes, tuvo una serie de nombres, ampliamente documentada, para sus doce meses. En el periodo ramésida y más tarde, varios de estos meses cambiaron de nombre por razones sociales o religiosas. El papel real jugado por la fiesta del orto heliaco de Sirio (prt spdt), en el ámbito del cómputo del tiempo por parte de los antiguos egipcios, es mucho más limitado de lo que generalmente se había supuesto.

> *Exactly when the second lunar year was introduced remains uncertain, but it was probably not too long after the divergence between the two forms of the year (civil and lunar) became apparent. A good guess might be to put it in the neighbourhood of 2500 BC. From that date the Egyptians had* ***three calendar years****, all of which continued in use to the very end of pagan Egypt.*
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> R.A. Parker (1950): *The Calendars of Ancient Egypt*, 56

> *With the removal of the lunar calendar from all of these scenes, the importance of the civil calendar is stressed. At the risk of anticipating myself, I do not see the lunar calendar playing an important role in Egypt outside of some feasts. It is my contention that the Egyptian calendric system is* ***simpler*** *than usually maintained. ... The implication for a complete revision of Egyptian calendrics is evident.*
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> A. Spalinger (1995):"*Month representations*", *CdE* 70, 122

The two contentions just cited were separated by almost half a century but they are quite representative of the state of studies of the ancient Egyptian calendar at the turn of the 20th century. For almost 50 years, R.A. Parker´s "Calendars" reigned supreme in the view of most Egyptologists as the last word on Egyptian calendrical matters[1]. This

1. R. A. Parker, *The Calendars of Ancient Egypt* (Chicago, 1950).

was so despite of the fact that several of the ideas and hypotheses expressed in that book had scarcely been proven. Hence, one frequently reads in various manuals, either of Egyptology or of the History of Astronomy and Archaeoastronomy[2] that the Egyptians had three calendars working at once, without entering into further discussions or making any attempt to challenge that supposition.

This situation persisted until the mid 1990s when, after Parker´s death, several scholars decided to enter this slippery field of research and started to produce new and interesting approaches to ancient material, proposing new interpretations in several cases, as well as publishing new material, previously unknown or never discussed in a proper way. The name of several of these scholars must be mentioned in this context and the contributions of L. Depuydt, R. Krauss, Ch. Leitz, U. Luft, A. Spalinger and R.A. Wells have been pivotal in the last few years and will be basic to our discussion[3]. We must also take into account the review volumes by M. Clagett and A-S.von Bomhard[4].

After detailed examination of a high percentage of the bibliography generated in the last decade (and most of the relevant earlier works), my main conclusion is that the study of the ancient Egyptian calendar suffers from what I will call the "Ebers syndrome". I say this because I have found that the Calendar written on the verso of the Ebers Medical Papyrus, discovered in Thebes in 1862 and first published a few years later, has contributed little, if nothing, to the solution of any of the open questions on Egyptian calendrics (and even chronology) in the last 140 years. It is important to notice that from the moment of its discovery to present, more than 40 papers have been published on it (14 in the last quarter century alone), most of them presenting attempts at interpretation in open contradiction with one another[5].

Consequently, I have decided to risk proposing a working hypothesis in this essay. I will reconsider the situation by evaluating the idea of what might have happened if the Ebers Medical Papyrus had never been discovered or if its Calendar had never been written by the ancient Egyptians on the verso of the papyrus. I know that this is a revolutionary and hazardous approach since the Ebers Calendar was the first in a series of important documental discoveries associated with Egyptian calendrics and chronology, and has hence always been one of the pivotal aspects of every discussion on the subject. However, it is my contention that by ignoring it, the discussion of Egyptian calendrics becomes much unexpectedly simplified, and that several unresolved problems may easily find a fairly reasonable solution.

From my point of view, there are several questions on the subject of Egyptian calendrics that lack a coherent answer, much less a definitive one. We have selected the following because they fairly represent various problems faced in these studies today. They are:

How many calendars were simultaneously in operation in ancient Egypt?

2. As for example myself in: J.A. Belmonte, "Astronomía y arquitectura: el papel de los astros en la cultura y el arte del antiguo Egipto", in *Arte y Sociedad del Antiguo Egipto*, M.Á. Molinero and D. Sola (eds.) (Madrid, 2000) 109-36.
3. See especially: L. Depuydt, *Civil calendar and lunar calendar in ancient Egypt*, *OLA* 77 (Leuven, 1997); R. Krauss, "Egyptian Calendars and Astronomy", in *Cambridge History of Science* (Cambridge, 2002); C. Leitz, *Studien zur Ägyptischen Astronomie*, *Ägyptologische Abhandlungen* 49 (Wiesbaden, 1991); U. Luft, *Die chronologische Fixierung des ägyptischen Mittleren Reiches nach dem Tempelarchiv von Illahun* (Vienna, 1992); A. Spalinger, "Egyptian festival dating and the moon", in *Under one Sky*, J. M. Steele, A. Imhausen (ed.) (Münster, 2002), 379-404; and R.A. Wells, "Re and the Calendars", in *Revolutions in Time: studies on Ancient Egyptian Calendrics*, A.J. Spalinger (ed.) (1994), 1-37.
4. M. Clagett, *Ancient Egyptian Science II: calendars, clocks and astronomy* (Philadelphia, 1995), and A.-S. von Bomhard, *The Egyptian calendar, a work for eternity.* (London, 1999). See also: A. Spalinger (ed.), *Revolutions in time: studies on ancient Egyptian calendrics* (1994).
5. For a recent review, see: L. Depuydt, "The function of the Ebers Calendar concordance", *Orientalia* 65 (1996), 61-88.

What was the origin of the 365 day calendar?

What were the names of its months?

Did the solstices ever play a role within the framework of the Egyptian calendar?

How many beginnings did the Egyptian year have?

What was the exact role of lunar dates or festivals?

Can Egyptian chronology be fixed astronomically?

And, of course, finally, we feel obliged to face the question:

What might the Ebers Calendar represent?

This is a representative set of questions and, as we will see, we will be able to find more or less coherent answers to all but the last of them. Fortunately, to help us in our research, a good flow of serious scholarship has been devoted to the subject over the last decade by a number of reputed specialists. We will try to make the best of most of this scholarship.

1. How many calendars were in operation simultaneously in ancient Egypt?

This is the basic question to be answered. Without finding a reasonable solution for this, it would be impossible to go any further in the analysis and solve many of the other questions. It is my intention to show that throughout Egyptian history, from the very creation of the civil calendar to the Roman conquest, the Egyptians had only one calendar, the civil one, despite the fact that some of their feasts could be established according to the moon and that under Persian and Macedonian rule (6th to 1st centuries BC), the lunar calendars of these peoples might have produced a certain influence in local calendrics and would also have been used to date documents or monumental inscriptions in Aramaic or Greek, respectively[6].

As most readers will know, the civil calendar of ancient Egypt consisted of 12 months of 30 days each, grouped into three seasons, which from the very beginning received the names of *ȝḫt* (translated as Inundation in Greek texts), *prt* (translated as Winter) and *šmw* (translated as Summer). Each of the months was divided into three decades (*mdw*) of 10 days. This 12 month year amounted to a total of 360 days. Normally, a civil date is expressed by the letter Y (for year) and number for the regnal year (each reign represented a new era in ancient Egypt), followed by a set comprising a Roman numeral for the ordinal month within a season (similar to the actual Egyptian strokes for the numbers), then the season proper and finally the day of the month. One example is III *ȝḫt* 26, which reads as the 26th day of the 3rd month of the Inundation. However, later on, we will argue that, in fact, we should probably read 26th of *ḥwt-ḥr* (Hathor or Athyr in Greek papyri), exactly as we write 28/02/2003 but we read 28th of February of 2003[7].

To the end of this year of 360 days, five extra days known as the "Five above the Year" (5 *ḥryw rnpt*) or epagomenals, were added throughout most of Egyptian history, although there is some evidence that they might have been placed at the beginning in earlier times[8]. However, this discussion is probably nonsense since, in fact, they were considered as outside of the year and were not at all taken into account on most occasions. Furthermore, these five days were reported to have a nefarious character, despite the fact that, thanks to the god Thoth who managed to get those extra days, the "Birth of the Gods" (these were Osiris, Horus the Elder, Seth, Isis and Neph-

6. On the Persians, see: L. Depuydt, "Regnal years and civil calendars in Achaemenid Egypt", *JEA* 81 (1995), 151-173. On the Ptolemaic period, see: A. Spalinger, *Three studies on Egyptian Feasts and their Chronological Implications* (Baltimore, 1992), 41.
7. This idea was first expressed by F.L. Griffith, *Catalogue of the Demotic papyri in the John Rylands Library Manchester*, vol. III: *Key-list, translations, commentaries and indices* (Manchester, 1909), 185.
8. See e.g. Clagett, *op. cit.* ref. 4, fig. III. 81a.

thys) took place during them[9]. With the epagomenals, the civil year completed 365 days, a number very close to the length of the tropic year (the seasonal year) which in 3000 BC lasted for some 365.2425 days. Consequently, the civil calendar has frequently been quoted as the Egyptian "solar" calendar, which, to a first approximation and in one generation (25 years) would be an appropriate term.

However, one peculiarity of the civil calendar is that no days were added to the standard 365 (as we do in leap years) and so the civil dates wandered trough the seasons, completing a circuit in nearly 1506 years. Consequently, important astronomical events, such as the stations of the sun (solstices and equinoxes) and the heliacal rising or settings of stars would also wander trough the civil year, there being roughly a one day's delay each four years and one month's delay each 123 years[10]. One of the bases of Egyptian chronology, as we will see later, is that no reform was performed (although it was attempted) so that the seasons were wandering through the civil year, from the creation of the calendar, in early 3rd millennium BC (see section 2) to Augustus´ reform and the creation of the Alexandrian calendar in 23 BC[11].

One special case is that of Sirius (Egyptian *spdt*, Sothis in the Graeco-Egyptian context), the brightest star in the sky. The high proper motion of this star, owing to its proximity to the Earth, caused the Sothic year (*i.e.* the period of time between, for example, two successive identical position of the star in the Earth-Sun reference framework) to be almost exactly 365.25 days throughout most of the history of ancient Egypt. This meant that the important phenomenon of the heliacal rising of Sirius, known as *prt spdt* since the Middle Kingdom, moved forward by one day in each four-year period (e.g. from II *ꜣḫt* 3 to II *ꜣḫt* 4), wandering through the entire civil year in 1460 years (a Sothic cycle). In fact, during our period of interest, two whole Sothic cycles elapsed, the first from 1454 to 1456 years and the second from 1452 to 1453 years, according to modern calculations[12].

As we saw in the opening paragraphs of this article, R. Parker, one of the most reputed scholars in Egyptian astronomy (including calendrics) during most of the 20th century, strongly supported the idea that in Egypt there were three calendars in operation at the same time, namely:

· The civil calendar, as already discussed.

· The "old" lunar calendar. This, according to Parker, would have been the original calendar prior to the invention of the civil one. It would have worked like a lunistellar calendar, consisting of 12, or seldom 13, lunar months of 29 or 30 days, heralded by the heliacal rising of Sirius, which according to him, had to be called *wp rnpt*, and beginning by the following conjunction or new moon (*psḏntyw*), to be called *tpy rnpt* (see section 5 for an appropriate discussion in these terms).

· The "new" lunar calendar. This would have been invented when the divergence between the civil and the former lunar calendar had become evident. A new set of 12 or 13 lunar months was attached to the civil calendar, heralded by the 1st day of the civil year, I *ꜣḫt* 1, also called *wp rnpt* (a secondary use of the

9. For the epagomenal days, see: A. Spalinger, "Parallelism of thought", *Hommages à Jean Leclant, BdE* 106/4 (1993), 363-377, and A. Spalinger, "Some remarks on the Epagomenal days in ancient Egypt", *JNES* 54 (1995), 33-47.
10. The tropic year varies in length with time. Today it has a value of 365.2422 days. For Egypt, see: von Bomhard, *op. cit.* ref. 4, 28.
11. L. Depuydt, "On the consistency of the Wandering Year as a backbone of Egyptian Chronology", *JARCE* 32 (1995a), 43-58.
12. See, e.g.: M.F. Ingham, "The length of the Sothic cycle", *JEA* 55 (1969), 36-40, and B. Schaefer, "The heliacal rise of Sirius and ancient Egyptian chronology", *JHA* XXXI (2000), 149-55.

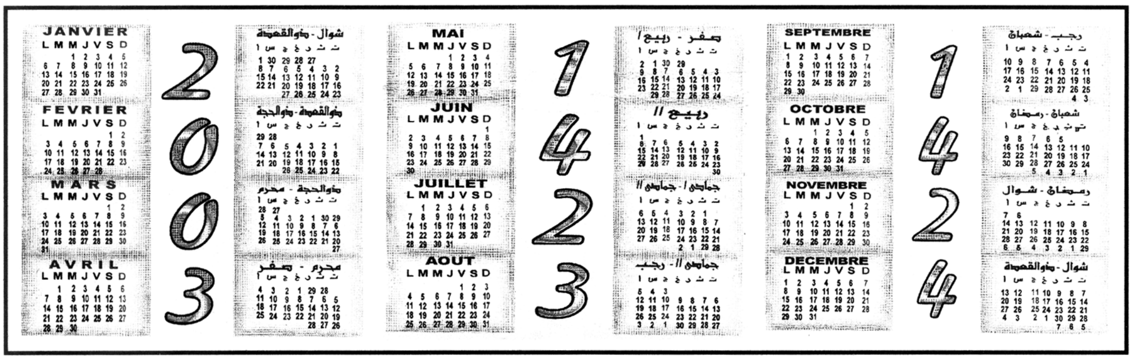


Figure 1: A double calendar sheet edited in Morocco, presenting both the Gregorian calendar (in French) and the Islamic calendar (in Arabic) simultaneously. Obviously, today, the Kingdom of Morocco has two fully developed calendars working at the same time. One is basic for economic and political purposes, the other is basic for religious and social aspects but neither can operate except in concert with the other. There is nothing similar to this in the whole period of pharaonic Egypt

term, according to Parker, but very probably its actual significance)[13].

These ideas (from my point of view, they are too weak to be fairly catalogued as a theory once all the weak points are known) were rarely questioned for several decades and we have to wait for the 1990s for a serious threat to most of Parker's arguments from various scholars such as A. Spalinger, A. Grimm and U. Luft (followed by M. Clagett)[14]. The first of these scholars, fairly productive in the last decade, had even reach the point of questioning the independent operation of any sort of lunar calendar in ancient Egypt, which as he wrote, would make Egyptian calendrics *simpler than usually maintained*, but without jumping completely into the deep end and fully rejecting their existence[15]. However, recently, Parker´s views (especially regarding the existence of the "new" or civil-based lunar calendar) has received a blow of fresh air from the work of the Flemish scholar L. Depuydt, now at Brown University, where Parker spent much of his career. His erudite book on the *Civil Calendar and Lunar calendar in Ancient Egypt*, published in 1997, is a stupendous reference for the comprehension of what has been going on the study of the Egyptian calendar since the 19th century[16], despite of the fact that I disagree with some of his conclusions. As the reader may have imagined, my point of view is much nearer to Spalinger's than to Depuydt's.

The simultaneous use of more than one calendar by a certain culture is not an unusual phenomenon. Furthermore, it is also a well established fact that, once a good calendar has been developed, it is fairly difficult to reform it and, still more difficult if not impossible, to abandon it[17]. Hence, in principle, I would not be against the simultaneous use by the ancient Egyptians of more than one calendar. However, in our context, I have doubts concerning this possibility since it would be in flat contradiction to the Egyptian mentality, simply

13. Parker, *op. cit.* ref. 1. 24-30.
14. A. Grimm. *Die altägyptischen Festkalender in den Tempeln der griechisch-römischen Epoche*, *Ägypten und Altes Testament* 15, (Wiesbaden, 1994), 439. See also: Spalinger (ed.), *op. cit.* ref. 4, Introduction.
15. A.J. Spalinger, "Month representations", *CdE* 70 (1995), 110-122.
16. Depuydt, *op. cit.* ref. 3.
17. As for example, the long lasting problem of the determination of Easter. See: J.A. Belmonte, *Tiempo y Religión*, Ediciones del Orto (Madrid, 2004), in press.

because to have more than one calendar simultaneously in operation might produce chaos and thus it would be contrary to the idea of *mȝʿt*, the Cosmic Order, the pivotal thinking of Egyptian political, social and religious behaviour.

In contrast, as shown in Figure 1, the use of two calendars simultaneously is very common in the Muslim world. This figure presents a draft that is common in Muslim homes, schools and public buildings throughout Morocco. Two calendars, the Gregorian, tied to the tropic year, and the Muslim, tied to the moon, are presented side by side. As can be seen, the Gregorian is predominant, because the nucleus of the diagram is the year 2003 AD and is compared with part of the Hejira years 1423 and 1424. This is so because the former is the calendar that has governed the political and economical affairs of the Kingdom since the time of the French Protectorate. However, the Muslim calendar governs the religious and social life of the people and thus both are deeply interrelated. In Moroccan society, one calendar cannot work without the other and, in this case, the result is two completely independent calendars, one solar and the other lunar, with different dates, different beginnings and different month names (even different weekdays) operating at the same time.

One could argue that this is a modern situation, created in the last century by colonialism, but, since the Muslim conquest in the late 600s, a version of the Roman Julian calendar, needed to follow the pulse of the seasons, was in use for centuries in traditional Morocco. The reason for this is that the Muslim calendar is a purely lunar calendar of 12 lunar months and is thus 11 days shorter than the tropic year, being quite useless for an agrarian culture. Consequently, in every country converted to Islam, it has been almost mandatory to keep older calendars in use for practical purposes (e.g. the Coptic calendar in Muslim Egypt).

This argument has frequently been claimed as the reason for the existence of more than one calendar in Egypt, especially the "earliest" ones, the old Sirius-based lunar and the civil one. This idea is based on the supposed inability of the civil calendar to follow the seasons because it is a vague year. For example, in her recent review book, von Bomhard[18] associated the term *rnpt gbt* (upset year) in the text: *Come to me, oh Amon! save me of this upset year. It happened that the sun did not rise, that winter arrived in summer, month follows month in the wrong order, the hours are disrupted…*, with the 365 day year, thus leaving the impression that the ancient Egyptians considered their civil calendar to be unsuitable.

However, this argument is, to my point of view, aprioristic and fallacious. On the one hand, this text does not apply at all to the civil calendar, since only the sentence *winter arrived in summer* might be applied to it (and precisely not at the epoch when this paragraph was written, in the early Ramesside period), on the other hand, it is completely incorrect to say that the civil calendar was useless in daily life, and that the Sothic heralded lunar calendar was necessary to keep the correct track of the seasons. In fact, the civil calendar was ideal for daily life. It only diverged by 10 days from the tropical year in 40 years (an average human life time in antiquity) and, considering that the most important natural seasonal phenomenon in Egypt, the rise of the Nile, can vary as much as 70 days, it would have been perfectly capable of handling local agriculture and even state administrative policy, over very long periods of time (as we know the civil calendar did)[19].

18. von Bomhard, *op. cit.* ref. 4, 8.
19. The following text is very clear at this point: "*their calendar is in my opinion better than that of the Greeks, because these introduce an intercalary month every two years, in consideration of the seasons, whereas the Egyptians, with their twelve (12) months of thirty (30) days, add five (5) supernumerary days to each year; so that the cycle of the seasons always appears at the same date for them*". Hdt. II, 4.

That the harvest occurs in the season named *3ḫt*, instead than in the season named *šmw* (translated by inference as Harvest by several authors; later we will discuss this particular problem of the season names), as occurred at the end of the Old Kingdom. So what? We have a month with a name that means 7th and it is our 9th month and nobody seems unduly perturbed about that.

There is a further argument to be mentioned against the existence of a well structured original lunar calendar as proposed by Parker. For me, it is quite obvious that if the Egyptians had ever developed such an "old" lunar calendar, they would never have needed (and thus invented) the civil one, since the lunistellar nature of it, having dates in good agreement with the seasons, would have made the implementation of yet another calendar completely unnecessary (and even undesirable according to *m3ʿt*).

However, it is worth mentioning that several pages in Parker's "Calendars" (whose reading I strongly recommend) are devoted to explaining the operation of this "old" (the Sirius based) lunar calendar and to defending its existence. Today, it is quite clear that most of his arguments were fallacious or inaccurate[20]. To mention just a couple of examples, the existence of Thoth as the intercalary lunar month has never been satisfactory proven, and the identification of *prt spdt* with *wp rnpt* is nowadays completely dismissed (see section 5). Actually, today, the only support for the old lunar calendar seems to come from the Ebers Calendar that, which, in terms of the experiment proposed in this paper, had never been discovered and thus, at this precise moment, cannot be used to prove anything.

Moreover, another of the classical alleged proofs, the calendar of supposed lunar months of Papyrus Berlin 10056 A, briefly following the heliacal rising of Sirius, found in the Illahun archive, has been recently challenged by Luft and Krauss. These scholars have demonstrated that the document shows periods not from lunar day 1 (*psḏntyw*) to lunar day 1 (*i.e.* a lunar month), but rather from the second day of the Egyptian lunar month and thus they might be better described by the term *wrš* (moon period service)[21]. Taking this point into consideration, I would even argue against the use of the term "lunar month" in ancient Egypt (unless in the archaic and perhaps Ptolemaic periods) and would instead claim the use of the term lunation for any period of time between two consecutive identical phases of the moon (be it conjunction, first crescent, full moon or any other aspect) and keep the translation "moon service" for the term *wrš*, leaving the term month only for the well attested months of the civil year. This will henceforth be the policy followed in this paper.

To be able to continue with this proposal, we must first show that the other alleged lunar calendar, the civil-based one, was not articulated as an actual calendar and that the term lunar month is consequently not needed. The reason to justify the later invention of the new lunar calendar is less clear than in the case of the Sirius-based lunar calendar (which theoretically even predated the civil one) and, apparently, those defending its existence argue for the correct placing of lunar feast within the framework of the civil calendar. But to have lunar-governed festivals within a calendar does in itself not make a lunar calendar.

The best example is my own calendar, and surely that of most readers. The date of Glory

20. As for example: "*In brief, it appears to me that Parker's opinion that the old lunar calendar was intercalary may be correct (though not certainly so) but that (1) the use of the Sothic heliacal rising as the mechanism of intercalation, that (2) the intercalary month (if it existed) was named Thoth, and that (3) the lunar calendar in schematised form is that given in the Ebers calendar and in the astronomical ceiling of Senenmut's tomb and the Ramesseum are all unproved and indeed untenable*". Clagett, *op. cit.* ref. 4, 31.
21. See: Luft, *op. cit.* ref. 3, 198, and the key paper: R. Krauss, *Arguments in favour of a low chronology for the Middle and New Kingdom in Egypt* (Vienna, 2003) in press. I am indebted to Dr. Krauss for providing me a preprint of his paper prior to publication.

Sunday (Easter) is established by the full moon following the Vernal Equinox. Once this is known, the dates of Ash Wednesday (with Carnival), Palm Sunday, Good Thursday, Good Friday, Pentecost (Pinkster) and Corpus Christi are established accordingly[22]. Hence, we obviously have a large collection of lunar-dictated festivals (religious and profane) but nobody in my (our) culture would claim that we have two calendars in simultaneous operation, a solar and a lunar one. This is so in spite of the fact that the Methonic cycle is used to correlate the phases of the moon and the tropic year, but again a lunisolar cycle does not make a calendar. This same argument could be applied against those using the knowledge by the Egyptians of the Graeco-Roman period of the 25 year cycle found in Papyrus Carlsberg 9 to support the idea of the civil-based lunar calendar. In Papyrus Carlsberg 9, the dates of the beginning of 300 lunations in 25 civil years are presented (out of the 309 lunation possible, those starting in the epagomenals and those belonging to "blue" months are not considered), according to a recent, clever and simple interpretation of the Papyrus[23]. "Blue" months are those civil months where two lunations can start at the same time within a certain year, one in day 1 and the other in day 30.

Only in the case that the civil-based lunar calendar had left unmistakable signs of a complete operative system, might we be confident of its existence. This is in fact what the otherwise excellent work of Depuydt[24] tries to demonstrate, but, in my view, it fails. The core of the argumentation in defence of the civil-based lunar calendar is the existence of three double civil-lunar dates, two in the Ptolemaic period discovered by Brusgch in 1872 at the temple of Edfu and one in an unpublished papyrus (Louvre 7848) of the Saite period, written in abnormal hieratic, first reported by Parker in a paper on the chronology of the reign of Amasis[25]. The hieroglyphic transcription and the corresponding translations of these three double civil-lunar dates are the following:

1. Year 12 of Amasis (P. Louvre 7848)

…m-b3ḥ ḫnsw-m-w3st-nfr-ḥtp ḥ3t-sp 12 II šmw 13 n smdt I šmw

…before Khonsu the Theban, Neferhotep, (in) the year 12, 13 day of the 2nd (month) of šmw for the smdt [full moon] of the 1st (month) of šmw.

Here I have proposed my own translation for the *n* before *smdt* (for the) instead of Parker's "being the".

2. Year 28 of Ptolemy VIII Evergetes II (Edfu)

(*sw*) 18 (15+3) *nt* 4=*nw n šmw dn*(*it*) *sn*=*nw n 3bd* 3 (*n*) *šmw*

(day) 18 of the 4th of šmw, second quarter of the lunation (of) III šmw[26].

3. Year 30 of Ptolemy VIII Evergetes II (Edfu)

ḥ3t sp 30 2=nw n šmw sw 9 …snwt pw nt ḥb ỉnt

Year 30, 2nd of šmw day 9 … this is the snwt [6th lunar day] of the Feast of the Valley.

Here again, I have preferred the logical translation of *ḥb ỉnt* as the Feast of the Valley, instead of translating it as a hypothetical alternative name of the month Payni (*p n ỉnt*), *i.e.* the later name of II *šmw*.

22. See e.g.: Belmonte, *op. cit.* ref. 17.
23. L. Depuydt, "The demotic mathematical astronomical papyrus Calsberg 9 reinterpreted", in *Egyptian religion. Studies Quaegebeur* (1998), 1277-1297.
24. Depuydt, *op. cit.* ref. 3.
25. For the Edfu inscriptions, see: H. Brugsch, *Thesaurus inscriptionum aegyptiacarum*, Vol. I: *Astronomische und astrologische Inschriften altaegyptischer Denkmäler* (Leipzig, 1883). For Papyrus Louvre 7848, see: R.A. Parker, "The length of reign of Amasis and the beginning of the 26th Dynasty", *MDAIK* 15 (1957), 208-12.
26 Depuydt translates: "*second quarter of the 3rd month of šmw*". *op. cit.* ref. 3, 161.

From these, according to Depuydt, the following arguable (indisputable according to him) equivalences are obtained:

1. Civil II *šmw* 13 = Lunar I *šmw* 15
2. Civil IV *šmw* 18 = Lunar III *šmw* 23
3. Civil II *šmw* 9 = Lunar II *šmw* 6,

where the first is the date in the civil calendar and the second would be the date in the correlated civil-based lunar calendar. There are several other double civil-lunar dates that he does not use as arguments because the civil-based "lunar" month is not mentioned and only the lunar day is mentioned in association with a fully written civil date. This, according to his reasoning, is because the "lunar" month is only mentioned if it is needed, *i.e.* if the lunar day is greater than the civil day. We can find two exceptions to this argument.

One is date 3 itself, in which day 6 is lower than day 9, forcing Depuydt to the speculation (unproven as we will see below) that *ḥb ỉnt* is an alternative name of the 10th month of what he calls the Theophoric Lunar Set of months (see section 3) and thus equivalent to "lunar" II *šmw*. As an argument supporting this hypothesis, a list of names "pertaining to months" (according to him), found in one of the gates of the temple of Mut at Karnak, is presented[27]. There, *ḥb ỉnt* is mentioned together, and in the correct order, with other names that surely belong to months. However, these names also belong to festivals and, in fact, the list at this gate is, with the highest degree of probability, a list of feasts (and their associated offerings) and not a list of months. In support of this idea, we may mention a similar list of festivals reported in an inscription found in the statue of a certain Harsiese, living in Thebes in the second half of the 9th century BC. Here, the list is associated with the offerings performed at the altar of Amun-Re in his beautiful feasts of[28] *wp nṯr, ỉpt-rsyt, nḥb-k3w, nb-w3ḥ-n-nn-nswt, ḥb ḫnsw, ḥb ỉnt* and *ỉp-ḥmt=s*, where the order is chronological but *ḥb ỉnt* clearly refers to the Feast of the Valley, as well as *ḥb ḫnsw* refers to his feast and not to the month I *šmw* (*ḫnsw*, later Pachon).

What, then, is the meaning of this double date? It is a fact that the Feast of the Valley was brought by the *psḏntyw* (*i.e.* the 1st lunar conjunction) within the month II *šmw* (*ḫnt ḥtỉỉ-prty*, later Payni) and apparently lasted for two days (see section 6). However, to my knowledge, there is no clear-cut indication that the feast actually occurs only on days 1 and 2 of the lunation (it was simply celebrated after the conjunction) and second, the feast could have lasted for a longer time during the Ptolemaic period. From my point of view, both solutions might be possible and the correct translation for Date 3 might be that day 9 of II *šmw* is the *snwt* of the Feast of the Valley, that either started in or was brought by *psḏntyw* in II *šmw* 4, obviously the first and single conjunction in the month of Payni in year 3 of Evergetes II.

The second exception is a double date which Depuydt discusses in his book, but which, in my opinion, does not merit the required significance because it overtly contradicts his arguments[29]. This double civil-lunar date is from year 23 of Augustus and is thus expressed in terms of the Alexandrian calendar and not of the actual civil calendar (which censed to be official in 23 BC, a few years earlier). However, if the civil-based lunar calendar was in operation in Ptolemaic times, there is no reason to believe that an Alexandrian-based lunar calendar was not in use during the Roman period. The date offers the following equivalence:

27. On the Mut temple festival list, see: Depuydt, *op. cit.* ref. 3, 120.
28. For the inscription of Harsiese, see: A. Spalinger, *The private feast lists of ancient Egypt* (Wiesbaden, 1996), 74.
29. For the date of Augustus and the meaning of *ḥbs tp,* see: Depuydt, *op. cit.* ref. 3, 173.

4. Alexandrian II *šmw* 10 equivalent to *ḥbs tp*

It has been demonstrated that *ḥbs tp* (Covering of the Head) is a term equivalent to *mspr sn-nw* (*i.e.* Second Arrival, see section 6), corresponding to the 16th lunar day. Consequently, since 16 is higher than 10, the month I *šmw* must have been mentioned together with *ḥbs tp*, but it was not. So either we should conclude that an Alexandrian-based lunar calendar never existed or that the rule proposed above has two cases (dates 1 and 2) and one exception (which is not much support for a rule).

Consequently, we should come back now to dates 1 and 2 and try to see if there is an alternative explanation to the mention of the months I and III *šmw*, in close association with what are obvious lunar days (*smdt* and *dnit sn=nw*). The reasoning will be double. On the one hand, these days (full moon and second quarter) were important days within a lunation and they were probably selected for that reason to perform important rituals. In this sense, in the text associated with date 1, it is announced in I *šmw* 21 that certain oath should be offered before Khonsu (a lunar god) on the day of the full moon of the lunation which had started in I *šmw* (his own month *ḫnsw*). From my point of view, these are too many "coincidences". On the other hand, both dates are peculiar in the sense that both belong to years in which blue months were present.

There are only four of this sort of years in a whole 25 year cycle and thus the probability of finding one is small, so when this happened, it would have been better to be cautious and give all the clues so that any information (especially relating important rituals) could not be misunderstood. This might have been particularly dramatic in the case of date 1 since the month IV *prt* of that year would have been a "blue" month. Hence, in the following months, there would have been doubts as to which lunar day belongs exactly to which lunation within a certain civil month and, perhaps for safety, it was stressed in I *šmw* 21, when they were still in the second lunation that had started in IV *prt* (what would its name have been?), that the offerings to Khonsu must be made exactly at the full moon of the lunation which would start a few days later, in I *šmw* 29, the first, single, but very late conjunction on his dedicated month. In the case of date 2, we have another striking situation since, on this occasion, I *3ḫt* 1 was *psḏntyw* and consequently, either I or II *3ḫt* would have been a blue month. The confusing situation might have extended throughout the entire year and thus it was important to mention that this special Second Quarter was the one of the lunation which had started in III *šmw*. Surprisingly, Augustus's year 23 did not have a blue month and, consequently, this might explain why it was not necessary to specify the lunation to which *ḥbs tp* belonged.

These ideas offer, from my point of view, an alternative and simpler plausible explanation for these two (and only two) controversial double dates without needing to resort for the invention of a whole new calendar on the basis of such slender evidence.

In principle, considering the "design" of the civil-based lunar calendar, as Depuydt has already pointed out, there are two possibilities, yearly or monthly pairing. The former means that "lunar" I *3ḫt* would start at the first *psḏntyw* of civil I *3ḫt* and then the "lunar" months would continue their counting consecutively until the end, even in the presence of a "blue" month. The second means that, if a blue month is present, the second lunation within that civil month is not counted (what would its name be?) and it is the following lunation, starting in the appropriate month, that receives the name. From my point of view, this second possibility is completely abnormal and does not define a functioning calendar anywhere on Earth. Curiously, this is exactly the situation that we have confronted in both dates 1 and 2, since the "lunar" months are named according to monthly pairing. If yearly pairing had been applied, the months would have been II *šmw* and IV *šmw*, thus exactly the same as their civil counterparts, further complicating the situation.

It is worth mentioning that there would have been a series of actual and definitive proofs of the existence of the civil-based lunar calendar. For example, one definitive proof would have been established if we had found two "lunar" months mentioned consecutively, both with the same name and simply distinguished by a numeral (e.g. IV *prt* and IV *prt sn=nw*), as in the Babylonian calendar when a full, 13 lunar month, year is present. Although, in this case, it is always found at the middle (Elulu II) or at the end (Adaru II) of the year and not in a random position within the year. Another unmistakable case would have been the report of a proper "lunar" month starting in one of the *ḥryw rnpt* (the straddle month in the 5 cases out of 309 when this happens) and the specification of its name. However, neither of these two cases has ever been reported in the sources!

As we have seen, the proposed civil-based lunar calendar leaves itself open to a series of serious challenges such as the use of the illogical monthly pairing and the open question of what would have been the name of this second lunation within a blue month. Besides, it is based on weak proofs, such as the double civil-lunar dates that we have shown might be interpreted in a different and simpler way. To summarize, from my humble point of view, all this makes the existence of this calendar very unlikely.

To close the question of how many calendars were operating at the same time, we will deal with an argument that is often invoked as a proof of the existence of two calendars operating simultaneously in ancient Egypt. This is the mention of a great (*ꜥ3t*) and a small (*nḏst*) year in one of the lists of feasts in the tomb of the provincial governor Khnumhotep II at Beni Hassan (dated in the 12th Dynasty). The list is presented in Figure 2 and the two "years" can be seen in the second row of the text. The hypothesis is that the "great year" would be associated with the civil (or solar) year of 365 days or, even better, with a full lunar year of 13 lunations of 384 days, and the "small year" with a hollow lunar year of 12 lunations of 354 days. This would be supported, as first noticed by O. Neugebauer[30], by the fact that 16 great years and 9 small years are mentioned in Papyrus Carlsberg 9. This is exactly the correct ratio of 12 and 13 month years in the 25 year cycle presented in the papyrus.

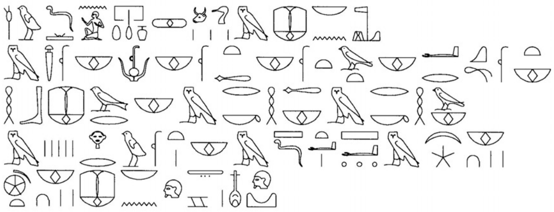


Figure 2: Hieroglyphic inscription of one of the festival lists of the tomb of Khnumhotep II at Beni Hassan. In the second row, the two "beginnings" of the year (tpy rnpt and wp rnpt) and the large and small year feasts (rnpt ꜥ3t and rnpt nḏst) are reported. Notice also the existence of the two Burning festivals (rkḥ ꜥ3 and rkḥ nḏs) in the following row, the five epagomenal days (5 ḥryw rnpt) and the 12 first crescent (3bd) and full moon (smdt) lunar festivals associated with the civil calendar of 12 months. All these items play an important role in our discussion

The problem is that the papyrus, produced in Tebtunis some time after Antoninus's year 7 (144/145 AD), reproduces a simple arithmetic rule applied to the 25 year cycle and not a calendar[31] and, besides, there is a whole 2000 year gap between it and Khnumhotep's list, without another similar case documented in that long period of time. In fact, Spalinger completely rejected that assumption and once

30. O. Neugebauer, "The origin of the Egyptian calendar", *JNES* 1 (1942), 397-43.
31. Depuydt, *op. cit.* ref. 23.

more proposed a "simpler" explanation, that the "small year" and "great year" rather refer to the short civil year of 360 days, frequently used in many aspects of Egyptian society, and to the full year of 365 days, including the 5 *ḥryw rnpt*[32].

For me, there is a further problem, both *rnpt ꜥ3t* and *rnpt nḏst* are within a list of festivals and also both have the determinative of festival close to them (see Figure 2). So, they must refer to specific feasts (either one day or a short-period term) and not to a period of one year considered a feast as a whole (this might already be expressed by the closing formula *ḥb nb* in the last row of the inscription). We will not argue this point further here since it has more to do with the question of how many beginnings the Egyptian year had and we thus postpone the discussion to section 5.

To conclude, after considering all options, I must agree with Spalinger and a few others that Egyptian calendrics must have been much simpler that is usually maintained. However, I will even go one step further in proposing that *one*, and only one, calendar would have been in operation in Egypt from the creation of the civil calendar in the early 3rd millennium BC to the reform of Augustus and the imposition of the Alexandrian calendar in the late 1st century BC. It was, of course, the civil calendar. Obviously, lunar feasts and even lunations were taken into account for various purposes (mostly ritual and religious), but they were always connected to the civil calendar, exactly as they are in present Gregorian calendar, and never as independent features of any alternative calendrical system. This will be discussed further in section 6.

For obvious reasons, this proposal poses new questions regarding the "various" lists of month names, some of which had been assigned to one or other lunar calendar and to the various "beginnings" of the Egyptian calendar "years". We will deal with these open questions in sections 3 and 5. However, prior to that, we have to deal with perhaps the most mysterious of all the questions that we must consider: why, how and when did the Egyptians develop so unusual a calendar of 365 days.

2. What is the origin of the 365 day calendar?

There must have been a powerful reason for the archaic Egyptian society to invent a calendar that, in the words of Neugebauer, was *indeed the only intelligent calendar which ever existed in human history*, or, in my less optimistic opinion (because other clever systems of time-keeping were invented in other places, as for example the Maya long count and the associated circular calendar), one of the most efficient that had ever been developed, surviving in human society since its implementation in the first half of the 3rd millennium BC (see below), until the Julian Date was invented for continuous time keeping and astronomical calculations in the 16th century by the astronomer Scagliero.

However, Neugebauer also pointed out that *every theory of the origin of the Egyptian calendar which assumes an astronomical foundation is doomed to failure*[33]. As an astronomer, I regret such an affirmation because the vast majority of cultures worldwide and throughout history have used the observation of the heavens as the most reliable way of time-keeping and, eventually, creating a calendar. So the origin of the 365 day year is a highly controversial issue that is far from achieving a consensus. Can we reach a reasonable approach?

32. For a discussion on this issue, see: A. Spalinger, *op. cit.* ref. 28, 38.
33. Neugebauer, *op. cit.* ref. 30.

Since the beginning of Egyptology, several theories have been proposed, discussed and established on a certain basis, with more or less success, and almost every scholar (as unfortunately I will try to do here) has tried to postulate his own hypothesis. The most reasonable have been:

a) A Sothic origin, 365 being the average value of days between two successive heliacal risings of Sirius. This has been defended by several scholars since the very beginning of Egyptology (even before the decipherment of hieroglyphs), because several classical sources associated the rising of Sirius with the beginning of the Egyptian year. Considering the length of the Sothic cycle as 1460 years, the inauguration of the civil calendar would have been around 4241 BC, according to 19th century scholars, or around 2781 BC once the origin of Egyptian history was brought to nearly 3000 BC in the early 20th century[34].

b) A solar origin, based on the determination of the period of time between two successive repetitions of the same station of the sun, either a solstice or an equinox. This was never seriously consider (the previous hypothesis was more popular), but it was defended by K. Sethe and A. Gardiner and, recently, it has been revived by Wells[35].

c) A lunar origin, based on an average lunar month and an average lunar year. Parker was the proposer of this hypothesis, based on his defence of the lunar calendar heralded by Sirius[36].

d) A Nilothic origin, based on the average value of the interval of days between successive Nile risings. Neugebauer was the pioneer of this idea[37].

The first two were astronomical and both were discounted by Neugebauer on the grounds that, since the civil year was almost a quarter of a day shorter than the Sothic and tropic years, it would have been very clear from the very beginning (just after 8 or 12 years had passed) that the phenomena would not have been repeated within a period of 365 days. This is not completely true. When the Julian reform was applied to the Roman calendar, leap years were to be included "each four years". However, because of the Roman inclusive way of counting numerals, this was made effective every 3 years. The problem lasted and, in fact, was not corrected until 8 BC by Augustus (all leap years between 8 BC and 8 AD were suppressed), some 36 years after the reform had been introduced.

In fact, the actual problem with the Sothic origin (a), as recently stated by Krauss, is that it is difficult to establish clearly that 365 days is the number of days between two successive heliacal risings of Sirius. On the one hand, one thing that is frequently forgotten is that this celestial event is highly dependent on latitude (with differences of nearly 8½ days for 2800 BC and nearly 6 days for 200 BC between the First Cataract and the Delta, respectively)[38] and on atmospheric conditions, which in Egypt include heavy formation of haze, especially at dawn, and of dust in suspension, especially in summer (the very time of the day and epoch of *prt spdt*), and can be especially sensitive. These effects could have introduced variations of several days in the observation of the phenomenon.

On the other hand, even if we admit that we are faced with a well defined place of obser-

34. E. Meyer, *Ägyptische Chronologie* (Berlin,1904). For the classical sources, see for example: Censorinus XXI, 10.
35. The classical paper is: A. H. Gardiner, "Mesore as first month of the Egyptian year", *ZÄS 43* (1906), 136-144. See also: K. Sethe, *Die Zeitrechnung der alten Aegypter im Verhältnis zu der andern Völker: Eine entwicklungs-geschichtliche Studie* (Berlin, 1919-20), 38. For a recent approach to the problem, see: Wells, *op. cit.* ref. 3.
36. Parker, *op. cit.* ref. 1, 51.
37. O. Neugebauer, "Die Bedeutungslosigkeit der Sothisperiode für die älteste ägyptische Chronologie", *Acta Orientalia* 17 (1938), 169-195. See also: Neugebauer, *op. cit.* ref. 30.
38. For a variation on the date of Sirius' heliacal rising, depending on time and latitude, see: Ch. Leitz, "Bemerkungen zur astronomischen Chronologia", *Ägypten und Levante* 3 (1992), 97-102.

vation (e.g. a temple at the country's capital, Memphis, or a very important sanctuary in a relevant location such as Buto or Elephantine) and a perfect atmosphere, we have yet another problem. Imagine that you are observing the rising for 3 consecutive years (this was Sethe's hypothesis); the sequence of counting days per year would have four possibilities:

365	365	365			
	365	365	366		
		365	366	365	
			366	365	365

So, only in 1 out of 4 possibilities (25%), would we have reached the unequivocal value of 365 days. As a consequence, it is highly improbable that the heliacal rising of Sirius was the phenomenon observed to establish the length of the civil year as 365 days.

Regarding the stations of the sun, forty years of observation must make it obvious that the year fell short by 10 days. But, did the Egyptians ever observe the solstices or the equinoxes? We will come back to this question later on, in section 4. Now, it is worth mentioning that it was proposed almost a century ago that the Egyptian year once started by the summer solstice, or even the winter solstice (the so-called Misore year)[39], and, in recent years, Wells has produced a new, and in some aspects complicated, theory. This relates the mythology of the birth of Re from the sky goddess Nut and the development in Low Egypt of a lunisolar calendar, heralded by the rising sun at the winter solstice (there are no traces of such a calendar in any historical register). Simultaneously, a lunistellar calendar, heralded by the heliacal rising of Sirius (Parker's old one) would have been developed in Upper Egypt. The civil calendar would have been the final result of an amalgamation of both around 3250 BC[40]. As we will see later, the Palermo Stone demonstrates that, very probably, there was no organized calendar in Egypt at such an early epoch.

To avoid Neugebauer´s categorical judgement, Parker proposed instead an astronomical approach, but one that would not suffer from the gradual shift within the year or, if indeed it did suffer such a shift, would not be immediately apparent and thus easily detected. He then arrived at hypothesis (c). The bases of his theory were:

· The presence already of a well regulated and working lunar calendar (the lunistellar one related to Sirius).

· The civil calendar must have been tied not to Sirius but rather to some event that was variable in itself, or that in the forward shift of the year would not be immediately apparent.

· The theory must include an explanation of why the later lunar calendar tied to the civil one was inaugurated.

He, then argues that *there are economic disadvantages of a lunar year of now 12 months, and now 13* (I wonder why, because billions of people do not seem to identify this disadvantage, even today), proposing that a lunar schematic year of 12 months of 30 days was developed and that the extra 5 days would have been easily worked out by averaging the excess between the actual lunar year and the new 360 day year in a period of some 25 years. According to his proposal, he finally argued for an introduction of the calendar between 2937 and 2821 BC.

The idea is not bad. However, I have argued before that if a culture had developed a precise and useful calendar such as the Sirius heralded lunar calendar, probably they would never have felt the necessity of creating yet another calendar, and also that there is no real hint that this calendar was in operation at any stage of

39. Gardiner, *op. cit.* ref. 35.
40. R.A. Wells, "The Mythology of Nut and the Birth of Ra", *SAK* 19 (1992), 305-321. See also: Wells, *op. cit.* ref. 3. 24.

Egyptian history (we will come back to this point in sections 5 and 6). Besides, I hope to have shown in section 1 that there are serious doubts that the civil-based lunar calendar ever existed. Hence, this left us only with point (ii), the necessity of a variable event, as the remaining workable contour condition for any reasonable theory.

Neugebauer sought that event in the inundation of the Nile. Each year, the heavy monsoon rains on the Ethiopian Plateau produce the rising of the waters of the Blue Nile, for early spring the waters reach Khartum and the White Nile, moving north at such a rate that they reach the first cataract and the traditional frontier of Egypt at Elephantine at the latest for the time of the summer solstice (Gregorian 21st of June) and Memphis some 10 days later. Actually, the phenomenon, although cyclic, is highly non-periodic and relatively unpredictable, with reported risings of the waters arriving at Cairo (or Memphis) as early as April 25 and as late as July 3. This means that, within two consecutive Nile risings, a period as short as 10 lunations or as large as 14 might have elapsed.

For the inhabitants of the Nile valley, the most important fact of their year would have been the arrival of the new waters, which would control the whole vegetative cycle and, as a consequence, the economic life of the local societies. Indeed, the arrival of the Inundation (as the name of the first season demonstrates) may have acted as the herald of that calendar and as the point to start the counting of the moons. When the unified state was formed, it was necessary to unify the criteria for the entire country and a new calendar ought to have been developed.

For Neugebauer, the simplicity of the Egyptian calendar was a sign of its primitivity; it *was the remainder of prehistoric crudeness, preserved without changes*. He alleged this primitive astronomy also to be the origin of the 30 day length of the civil month. Hence he proposed than an average Nile year would have been established through observations of successive Nile rising at a certain place. As a first step, a crude average of 360 days (30 x 12) would have been selected and then the 5 remaining days would have been calculated by averaging the differences with 360 during a period (as Parker's lunar) of nearly 25 years.

He pointed out that the civil calendar was developed for the necessity in private and public economy of determining future dates regardless of the irregularity of the moon (and of the Nile risings I would add), following a quite materialistic point of view. However, it is surprising that, at the same time, he had proposed highly developed theoretical astronomy for the Babylonians, who implemented a working lunisolar system, arguing that the differences with Egypt can perhaps be found in the differences of social and economic structures of the two countries. Points like this have been severely criticized for aprioristic and gratuitous.

One important fact is that, considering the high variability of the arrival of the inundation, only after two or three centuries would this Nile calendar be considered as no longer correct (when I *3ḫt* 1 was systematically ahead of the arrival of the inundation anywhere in Egypt), and consequently, he argues, the Egyptians were forced to adopt a new criterion for the flood, which happened to be the reappearance of the star Sirius. I find this last point quite probable as we will discuss further in the following sections.

However, I doubt the possibilities of the averaging method over long periods of time. To do this, it is necessary not only a well organized society deciding where and when the systematic measurements would be done (which is probable), but also somebody, who must have had a long life, with a certain future view and a capacity for predictability, able to decide when the average was suitable. In this sense, curiously enough, the data used by Neugebauer between years 1875 and 1905 to

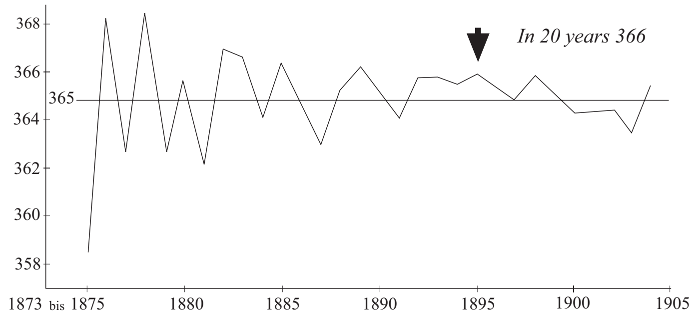


Figure 3: Successive approximations to an average Nile year (interval between two consecutive inundations) through a period of 30 years, between 1875 and 1905. This graph was used to sustain the origin of the 365 day calendar. However, averages of 366 or even 364 might perfectly well have been selected. See text for further discussion. (Adapted from Neugebauer, 1938)

establish his theory fully contradict his own reasoning. Looking at Figure 3[41], if I had been the person in charge of selecting the appropriate average, I would have chosen 366 instead of 365, since for 5 years, between 1892 and 1896, and thus only 20 years after starting the experiment (saving time is always important), an average value of an additional 6 day period to 360 would have been obtained.

Consequently, the discussion has left us with no uncontroversial theory for the origin of the civil calendar[42]. But, there must be one!

To support his theory, Neugebauer felt obliged to close doors to any other options, especially the most challenging for his purposes, the astronomical ones. Indeed, to produce a new reasonable theory is not an easy task and for that I will take the best of previous theories, use new data and allow myself a little bit of speculation.

A couple of years ago, when visiting our institution, Rolf Krauss offered a completely new perspective for the Palermo Stone, which I had already used supporting ideas on pyramid and temple orientations[43]. I had already noticed other relevant aspect of the stone related to calendrics, such as the 100% probability that the 365 civil year was fully implemented in the transition between the reigns of Sahure and Neferirkare (c. 2480 BC); but for me it was completely new to notice that Palermo contained a clue to the importance of the Nile year in ancient Egypt. First, and most important, every year in these annals was identified not only by a special event occurring in it, but also by the height reached by the waters of the Nile somewhere in the country (unfortunately we do not know where). However, it is in the first row of the annals of the kings of the 1st dynasty where we have the most relevant datum. There, we have four consecutive "yearly" registers, with the two central ones (2 and 3) including a certain number of months and days (6 months and 7 days, and 4 months and 3 days, respectively), but just one notation of the flood level below the third register. Besides, between registers 2 and 3, there is the typical vertical stroke, separating two consecutive reigns.

Krauss interprets this fact (and I tend to agree with him) as reflecting a single year, straddling both reigns and amounting to a total of only 10 months and 10 days. Of course, this "year" is too short for either a civil year of 365 days or even for the shortest possibility for any kind of lunisolar or lunistellar year (354 days).

41. Neugebauer, *op. cit.* ref. 37, fig 3.
42. "*A way out of this dilemma is the presumption that the 365-day calendar was intentionally planned and inaugurated as a calendar which move forward through the seasons*". R. Krauss, S*othis und Monddaten*, *HÄB* 20 (Hildesheim, 1985).
43. J.A. Belmonte, "On the orientation of the Old Kingdom pyramids", *Archaeoastronomy* 26 (2001), S1-20.

However, it fits a Nile year perfectly in which a period between 300 and 310 days has elapsed between two successive measurements of the lowest (or highest) level of the inundation. From my point of view, this is perhaps the best proof, not known to Neugebauer, of the possible existence of a Nile-governed calendar before the invention of the civil one.

Another proof would be the names of the seasons. The three seasons (*ꜣẖt*), (*prt*) and (*šmw*) are normally translated as Inundation, Winter or Growing, and Summer or Harvest, respectively, on the basis that this set of names is clearly related to an agricultural year. However, another explanation is indeed possible and perhaps more reasonable. The three seasons refer to three important periods in the Nile year: Inundation, as already stressed, going forth (*prt*) of the land, after the period in which it had been covered by the waters and, finally, drought, with the river at the lowest level and most of the useful water (*mw*) stored in the basins (*š*). The original meaning of the seasons was probably forgotten as time passed, especially when they no longer adjusted the actual behaviour of the river, and, in late epochs, other meanings had to be encountered when the names were translated into foreign languages.

Consequently, I would be tempted to believe that, prior to the invention of the civil year, the Egyptians did have a year connected with the Nile. The logical way of operating it would have been to wait for the arrival of the rising waters and then start to count the months, in this case obviously lunar months, with the first subsequent conjunction or the first crescent visibility (this is not obvious for such an early epoch). This Nile year would then run until the next rising of the waters or perhaps until the end of the harvest epoch. Such a calendar would have been efficient for a small local community, but would have had some problems.

On the one hand, although average years would normally have been 12 or 13 lunar months long, they might occasionally have included only 10 or 11 lunations or as many as 14 lunar cycles. On the other hand, since the flood lasted some 12 days from Elephantine to the Mediterranean, different communities along the river (to the north), would surely have started their year one month after than in the south of the country, whenever a new lunar month had started in any of those 12 days. Once the country was unified, such a situation must have been unacceptable. Considering that we do not know of any procedure (smoke or light signals or similar) that the Egyptians might have used to pass information quickly from the extreme south of the country to the north, it is difficult to imagine what might have been the easiest solution, to choose a single reference place, and then pass the information across the rest of the country, so that every community would start their year in the next conjunction (or new crescent). Obviously, a reform was absolutely necessary. In any case, if this place ever existed, it would probably have been Elephantine, regarded during most of Egyptian history as the place of origin of the Nile floods.

For the new calendar, two solutions were adopted: first, a standard month of 30 days was created, very probably taking as a model the synodic month; then a year of 365 days was inaugurated with an origin that, despite Neugebauer, I will maintain to have an astronomical clue. Both processes are from my point of view intimately related to each other and, at the same time, to the Egyptian way of understanding the cosmos.

Apparently, from the very beginning, the Egyptians used a base ten counting system, which was also applied to time keeping as it is the origin of the decades, an extremely important period of time throughout Egyptian history[44]. A lunar synodic month is on average 29½ days long. In many societies, the best way

44. A.J. Spalinger, "Some times", *RdE* 47 (1996), 67-77.

to approach 29½ is by the alternation of 30 and 29 day periods. However 29 is not divisible by 10 and when creating a new average month, the Egyptians might have preferred to choose a single value that, at the same time, could easily be counted in three decades. The name chosen for that period was  (*3bd*), which is equivalent to the traditional name of the second day of the Egyptian lunation (the first being the conjunction, *psḏntyw*). From my point of view, this might reflect the fact that at the very beginning of Egyptian history, the lunar month of the Nile year might have been considered to start at first crescent visibility. However, very early, this relation might have been completely forgotten in daily life and the months of the civil year might have lost completely any connection with the actual moon, as happened in many other languages and societies (e.g. English with the terms "month" and "moon" is an obvious case).

For the origin of the 365 day period, I will introduce a new astronomical concept which, from my knowledge, has been hardly taken into account in Egyptian historiography. In the second half of the 3rd Century BC, the Alexandrian scholar Eratosthenes, born in Cyrene (in today's Libya), made a revolutionary measurement of the circumference of the Earth[45]. To accomplish this, he made use of what must have been a well known fact to contemporaneous Egyptian society, that the noonday sun at the summer solstice was able to illuminate the water at the bottom of a very deep well (perhaps one of the local Nilometers) in the city of Syene (Aswan). This happened because at that exact moment of the year and at that latitude the sun (in fact only part of it, see below) passed exactly overhead. This is a phenomenon known in astronomy as the zenith pass.

This phenomenon happens in two occasions each year only in those places located between the tropics of Cancer and Capricornus, which of course receive the name of tropical zones. The limits are located exactly at the tropics, where the sun has a zenith pass only once at the day of the local summer solstice, when it reaches its maximum declination. Curiously, in 3000 BC, the maximum declination of the sun was 24° 5', exactly the latitude of central Aswan and, of course, of one of its most important areas, the island of Elephantine.

The island of Elephantine was at that moment already a very important settlement and a sanctuary (and perhaps a Nilometer) would have been already in operation on the site of the later temples of Satet and Khnum (the gods of the first cataract and of the inundation) at least from 3200 BC[46]. Was the zenith pass observed at Elephantine in that epoch? I suggest that it was and, going even further, I speculate that this would have been in fact the way to determine the length of the (solar) year as 365 days.

We have not yet considered the interval between two consecutive sunrises or sunsets at the summer solstice as a good candidate for the determination of the period of 365 days because it had been argued that, within a short time, it would have been obvious that the exact moment of the solstice was moving backwards in relation to the civil year. However, this is not exactly true. During the solstices, the sun stands at almost the same declinations for several days and hence its rising or setting positions arrived at a standstill (hence the name). Even in the case that the proto-dynastic period Egyptians would have been able to determine precisely these positions on the horizon (which we believe they were), they would hardly have reached a precision better than 2', equivalent to 8 days and, considering the wandering of the civil calendar of 4 years per day, it would have lasted at least 32 years before the displacement was obvious.

45. On Eratosthenes, see: Cleomedes, *De motu circulari corporum caelestium* I, 10.
46. For the early archaeology of Elephantine, see: K.A. Bard, *Encyclopedia of the archaeology of ancient Egypt* (London, 1998), 283.

However, the effect becomes much more dramatic when zenith pass is considered. If the non-shadow effect on a gnomon (an obelisk or little pyramid for example, since both are known as extant monuments in early dynastic Elephantine)[47] or either the illumination of a deep well (probably a Nilometer) were the phenomena observed, the length between two consecutive zenith passes would have been easily established as 365 days. But, at the same time, once the civil year had been in operation, it would have been extremely difficult to detect the displacement of zenith pass events during the months.

The reason for this is that the sun is not a point source of light, but rather it has a well defined circular shape with a diameter of some 36'. That is also the reason why the illumination phenomenon was still observed in the well in Aswan in Eratosthenes's times, despite the fact that the extreme declination of the sun at that moment was of only 23° 47' due to the decreasing value of the obliquity of the Ecliptic[48]. Hence, one third of the solar disc was still able to shed light on the bottom of the well.

With this fact in mind, we can even give an estimate of the interval when the civil calendar was inaugurated, provided our hypotheses are correct. Imagine that the civil year was inaugurated at the beginning of a lunar month following the summer solstice and the moment of zenith pass at Elephantine. This was also the latest average date of the arrival of the flood at this particular spot and we can thus consider it as the beginning of the corresponding Nile year. We can easily calculate that the earliest time in Egyptian history when I *ꜣḫt* 1 coincided with the summer solstice was in the four year period centred more or less on 2760 BC. Considering that the new lunar month might have started as much as 29½ days later, this might have happened 118 years earlier. Also, considering reasonable numbers, we can estimate an error of roughly 72 civil years (equivalent to 16', half a solar diameter) before it was obvious that the sun was not clearly crossing at the zenith in I *ꜣḫt* 1. Summing up all these numbers, we reach to an interval roughly between 2950 BC and 2690 BC for the inauguration of the civil calendar. This is an interval of time more or less between the beginning and the end of the protodynastic period, when several relevant aspects of the Egyptian civilization would have been developing. Indeed, the calendar could be one of them.

Another important fact is that a zenith pass event was not produced at any other important city to the north of Elephantine and thus they would have never mind of the phenomenon. This is relevant to Neugebauer's point on the impossibility of an astronomical origin of the calendar because with the nucleus of the kingdom well established in the Memphis region, nobody would have cared about the displacement of the civil year from an unobservable (for them) celestial event.

Once the periods of 30 and 365 were established, the internal distribution of the calendar was forced by the most simple arithmetic: 36 decades of ten days, grouped in 12 months of 30 days, plus 5 extra troublesome days located above the year. As a heritage of the old Nile year, the set of 3 seasons was kept, with 4 months as their standard length (this might not have been necessary the case in Nile years).

To finish my argumentation, I will recall to a cultural parallelism that has never been considered (and perhaps deliberately forgotten) in the discussion of Egyptian calendrics. This is the Mesoamerican calendar of 365 days. Apparently, like the Egyptian civil calendar, it worked with a permanent period of 365 days

47. See: R.H. Wilkinson, *The complete temples of ancient Egypt* (London, 2000), 96.
48. The angle between the rotation axis of the Earth and the plane of its orbit around the sun (the Ecliptic) is not fixed. It is now decreasing at a rate of 0.47" per year.

(without leap years) during well established historical periods such as, for example, during the classical Maya epoch, when the Haab (*i.e.* the 365 day year) was an integrated and dynamical part of a very elaborated system of time keeping, together with the long count, the 260 day ritual calendar, the lunar series and other time cycles (all them well attested by archaeology and ethnography)[49]. Nobody in Mesoamerican studies doubts that the origin of the Mayan and Aztec 365 day year was solar, as nobody in late Antiquity doubted that the origin of the Egyptian civil calendar was also solar[50].

Surprisingly, we can establish two further parallelisms. On the one hand, this year was divided into 18 months of 20 days, summing 360 days, plus five extra day (called Nemonteni by the Aztecs), which were considered nefarious. The reason for this estrange internal distribution was again arithmetical since the Mayas and the Aztecs used a numerical system in base twenty, hence the length of their months, equivalent to the Egyptian decades. On the other hand, zenith pass does occurs twice a year in most of Mesoamerica, including the Mayan and Aztec areas, and several scholars have recalled the important role of those special events within Mesoamerican calendrics[51].

Of course, I do not wish to be misunderstood and I am not at all suggesting that the Mesoamerican calendar system and the Egyptian civil calendar were somehow related or received any sort of mutual influence, but rather that, confronting with similar situations, humans often develop similar intelligent solutions to certain problems.

3. What were the names of its months?

Not surprisingly, there has always been a "problem" with the names of the Egyptian months, considering the permanent discussion on the number of calendars and the chances of what set of month names belonged to what calendar. The problem has reached the level that, in Depuydt´s words, *after many decades of debate, each single item has been tirelessly discussed* [52].

The nucleus of the problem comes from the fact that in the well known and widely used *Concise Dictionary of Middle Egyptian*, R.O Faulkner identifies, for example, *ḥwt-ḥr* as the fourth month of the Egyptian calendar or *ḫnsw* as the 10th, whereas all the documents demonstrate that Athyr (Greek equivalent to Hathor) and Pachon (Greek equivalent to That of Khonsu) where clearly the third and the ninth months of the civil year. The main reason for that is apparently Faulkner´s loyalty to his former master, Gardiner, who, basing his argument primarily on the Ebers Calendar, had proposed that Mesore (a later name of *wp rnpt*) had originally been the first month of the year[53], once more a consequence of the Ebers syndrome.

Thus, for our discussion, we will rely only on the four extant lists of months which have reached us in an almost complete state of preservation (remember that the Ebers Calendar has not been discovered). These are presented in Table 1. The youngest of the four is the list of months on the astronomical frieze of the temple of Edfu. This list, by itself, would have been sufficient to prove the names of 11 of the 12 months of the civil calendar, since these

49. See e.g. A.F. Aveni, *Skywatchers of Ancient Mexico*, University of Texas Press (Austin, 1990), 135-158.
50. As for example: "… *the Egyptians organise months and years in a very special way. Relating the days not to the movement of the moon but of the sun, ...*" Diod. Sic. (I, L); or "*It is said that the priests in Thebes are mostly astronomers and scholars : to the priests we owe the habit of calculating the days, not according to the moon but to the sun, and to add each year 5 days to the 12 months of 30 days each"*. Str. XVII, I, 46.
51. J. Galindo, *Arqueoastronomía en la América Antigua*, Grupo Sirius (Madrid, 1994), 144.
52. See especially: A.H. Gardiner, "The problem of the month-names", *RdE* 10 (1955), 9-31; R.A. Parker, "The problem of the month-names: a reply", *RdE* 11 (1957), 85-107; or the most recent: L. Depuydt, "The two problems of the month names", *RdE* 50 (1999), 107-133.
53. R.O. Faulkner, *Concise dictionary of Middle Egyptian* (Oxford, 1962). He was following: Gardiner, *op. cit.* ref. 35

Senenmut Tomb	Karnak Clepsydra Months	Divinities	Ramesseum Months	Divinities	Edfu Freeze Months	Divinities	Data from Deir el Medina
tḫ	*tḫ*	*tḫ*	I *ꜣḫt*	*tḫy*	*tḫ* I *ꜣḫt*	*tḫ*	*ḏhwty*
mnḫt	II *ꜣḫt*	*ptḥ*	II *ꜣḫt*	*ptḥ rsy=f*	*mnḫ*(*t*) II *ꜣḫt*	*Ptḥ*	*p n ỉpt*
ḥwt ḥr	III *ꜣḫt*	*ḥwt ḥr*	III *ꜣḫt*	*ḥwt ḥr*		*ḥwt ḥr*	*ḥwt ḥr*
kꜣ [*ḥr*] *kꜣ*	IV *ꜣḫt*	*sḫmt*	IV *ꜣḫt*	*sḫmt*	*kꜣ ḥr kꜣ* IV *ꜣḫt*	*kꜣ ḥr kꜣ*	*kꜣ ḥr b*
šf bdt	I *prt*	*ỉmn-rꜥ*	I *prt*	*mn*	*šf bt* I *prt*	*šf bt*	*ṯꜣ ꜥbt*
rkḥ	II *prt*	*rkḥ wr*	II *prt*	*rkḥ wr*	*rkḥ wr* II *prt*	*hippo or pig*	*p n pꜣ mḫyr*
rkḥ	III *prt*	*rkḥ nḏs*	III *prt*	*rkḥ nḏs*	*rkḥ nḏst* III *prt*	*hippo or pig*	*p n ỉmnḥtp*
rnwtt	IV *prt*	*rnnwtt*	IV *prt*	*rnnwtt*	*rnn* (*wtt*) IV *prt*	*rn wtt*	*p n rnnwtt*
ḫnsw	I *šmw*	[*ḫnsw*]	I *šmw*	*ḫnsw*	*ḫnsw ḥb* I *šmw*	*ḫnsw*	*p n ḫnsw*
ḫnt ḫỉỉ prty	II *šmw*	[*ḫnt-ḫtỉỉ*]	II *šmw*	*ḫnt tiy*	*ḥr ỉỉt ḫdtt* II *šmw*	*ḥrt ỉỉ ḫdtt*	*p n ỉnt*
ỉpt ḥmt	III *šmw*	*ỉpt-ḥm*(*t*)	III *šmw*	*ỉpt ḥmt*	*ỉpt hb* III *šmw*	*?*	*ỉp ỉp*
wp rnpt	IV *šmw*	*rꜥ ḥr ꜣḫty*	IV *šmw*	*rꜥ ḥr ꜣḫty*	*rꜥ ḥr ꜣḥty* IV *šmw*	*rꜥ ḥr ꜣḫty*	*Wp rnpt*

Table 1: Extant lists of month names from the tomb of Senenmut (18th Dyn.), the Karnak Water Clock (18th Dyn.), the Ramesseum at Thebes (19th Dyn.) and the astronomical frieze of the Horus temple at Edfu (Ptolemaic Period). In the case of the 3 later examples, the list of accompanying deities is also presented. The last column shows, for comparison, the set of month names that can be obtained from data of Deir el Medina such as the Cairo Calendar (86637, verso), and several ostraca (BM29560, DM1088, DM1265)

names are clearly associated with the seasonal names of the months (e.g. the two *rkḥ* to II *prt* and III *prt*, respectively). Other inscriptions of the temple further emphasized that parallelism for month IV *ꜣḫt*, I *prt*, II *prt* and III *šmw*, and also provide an alternative name for IV *šmw*, *wp rnpt*. However, because of the historical debate, they had been seen alternatively as the names of the civil-based lunar calendar or as the names of the original lunar calendar, that had been borrowed by the civil calendar owing to the archaic style of the inscriptions of Edfu[54].

This is surprising, especially when one compares these names with those in the oldest month list, that of the astronomical ceiling in the tomb of Senenmut (18th Dynasty, c. 1470 BC). Nine names are virtually identical, and those which are not (a couple) are strikingly similar. The twelve, *ḥwt-ḥr* can be found in many other references, including the papyri and ostraca of Deir el Medina, as the name of the third month of the civil year. Thus, from any logical point of view, we might think that in Senenmut we have the oldest list with the proper names of the months of the civil calendar. However, once more, Senenmut´s list has been alternatively identified as the twelve names of the lunar months of the Sirius-based lunar calendar or as a list of festivals associated with those months. Its obvious civil arrangement has been almost always neglected.

However, there is an almost contemporary proof that this set of names is certainly civil and not lunar. This is in the upper rim of the Karnak water clock, dating from the reign of Amenhotep III but probably following earlier models, dating to the beginning of the 18th Dynasty. There, the designer of the clock identified the hour marks for each month of the civil year, starting, curiously, by *tḫ* and not by I *ꜣḫt*, while the rest of the months are clearly identified by their seasonal names, as is demonstrated in Figure 4 and stressed in Table 1. Thus, I *ꜣḫt* is obviously identical to *tḫ* and, if this is so, why not the rest of the whole list?[55]

If any doubt remained, we might still draw the attention of the reader to the oldest refe-

54. See: Depuydt, *op. cit* ref. 52 and *op. cit* ref. 3, 116.
55. For the inspiration of this chapter the work by Spalinger (*op. cit.* ref. 15) has been fundamental.

rence to some of the month names, appearing in the papers of Hekanakhte, a set of hieratical documents dating from the reign of Mentuhotep II (c. 2000 BC). There, the names *šf bdt*, one of the *rkḥ* and *ẖnt ẖtii prty* are clearly mentioned in a civil calendar context for the first time in Egyptian history[56].

The list of names of the months is presented in Table 2. This list is basically that of the tomb of Senenmut with some minor modifications from the other lists. These names, as Edfu demonstrates, were used as the proper names of the months, at least in monumental inscriptions, until the Graeco-Roman period. However, at some moment during the New Kingdom, a new set of names was developed for less official documents, such as papyri and ostraca, which would finally be the origin of the month names known from later Aramaic, Greek and Coptic sources. This new set of names is also presented in Table 2. The corresponding Greek forms of this new set are presented in the first column of Table 3.

As can be seen in Table 2, two names (3 and 4) are identical and another two can be considered as mere New Kingdom variants of previous forms (8 and 9), where the article *pꜣ* and the preposition *n* has been added to the original name. One has suffered a little variance (11) and in the case of the 12th month, *wp rnpt*, this name is kept for hieroglyphic and hieratic sources, while it never appears in the later Aramaic, Greek, Demotic or Coptic documents where the name Misore is preferred (the hieroglyphic counterpart of Misore, *mswt-rꜥ-ḥr-ꜣḫty* is attested in hieroglyphs as a feast name but never as a month name)[57]. For the first month, it might be possible that it was also known as *ḏḥwtyt* in earlier times (see below).

Five months changed their names completely from the old to the new set of names. We have no clear reason for this neither is it possible to find an explanation in the extant sources. However, one fact is clear, months 2 (*p n ỉpt*), 7 (*p n ỉmnḥtp*) and 10 (*p n ỉnt*), and perhaps also 9 (*p n ẖnsw*), reflect the new dominant political, social and religious situation of Egypt in the New Kingdom, since those names clearly derived from three of the most important festivals celebrated in Thebes from that time onwards. So, from my point of view, at some moment during the New Kingdom, the Egyptians changed the names of several of their months (as was the case in our calendar twice), at least in some of their documents and probably in the speech of daily life, so that this new set of names was the one that passed to later sources and survived to our time in the names of the months of the Coptic liturgical calendar.

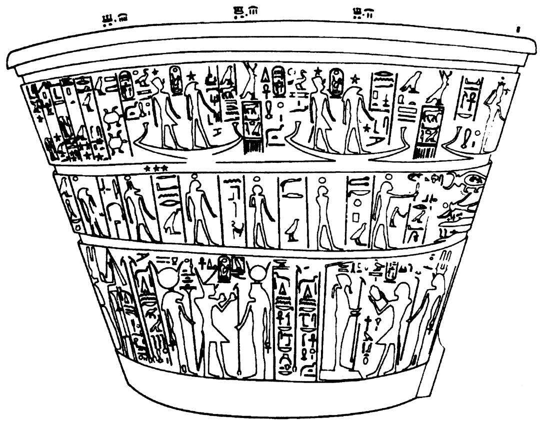


Figure 4: A side of the Karnak Water Clock, showing the three vertical registers (decans and planets in the upper one, northern constellations and "lunar" deities in the middle and the gods of the months in the lower). In the upper rim of the device, the months of the civil calendar were represented to mark the hours of the night, starting with tẖ (instead of I ꜣḫt), II ꜣḫt, III ꜣḫt, and so on, successively. This fact clearly demonstrate that tẖ was the proper name of the first month of the civil calendar I ꜣḫt and not the name of the first month of any hypothetical lunar calendar

56. T.G.H. James, *The Hekanakhte papers and other early Middle Kingdom documents* (New York, 1962).
57. For the name of the months: J. Cerny, "The origin of the name of the month Tybi", *ASAE* 43 (1943), 173-81. The name Misore as the one of IV *šmw* is also reported in Demotic sources: J.F. Quack "Review of F.R. Herbin, *Le livre de parcourir l'éternité*, *OLA* 58 (Leuven,1994)". *Orientalistische Literaturzeitung* 91 (1996) 152-58.

			OLD NAMES		**NEW NAMES**	
1		I *ꜣḫt*	*tḫ(y)*	Drunkenness	*ḏḥwtyt*	Thoth´s
2		II *ꜣḫt*	*mnḫt*	Clothing	*pꜣ n ỉpt*	That of Opet[4]
3	G	III *ꜣḫt*	*ḥwt-ḥr*	Hathor´s	*ḥwt-ḥr*	Hathor´s
4	G[1]	IV *ꜣḫt*	*kꜣ-ḥr-kꜣ*	Ka on ka	*kꜣ-ḥr-kꜣ*	Ka on ka
5	G[2]	I *prt*	*šf-bdt*	Emmer Sallowing	*tꜣ ꜥbt*	The Offerings
6	G	II *prt*	*rkḥ (ꜥꜣ / wr)*	(Great) Burning	*(pꜣ n pꜣ) mḫyr*	Low Lands
7	G	III *prt*	*rkḥ (nḏs)*	(Small) Burning	*p n ỉmn-ḥtp*	That of Amenhotep[4]
8	G	IV *prt*	*rnwtt*	Renutet's	*p n rnwtt*	That of Renutet[5]
9		I *šmw*	*ḫnsw*	Khonsu's	*p n ḫnsw*	That of Khonsu[4,5]
10		II *šmw*	*ḫnt-ḫty*	First of …	*p n ỉnt*	That of the Valley[4]
11	G	III *šmw*	*ỉpt-ḥmt(=s)*	Her majesty Ipet	*ỉp ỉp*	Feast of Ipet
12	G[3]	IV *šmw*	*wp rnpt*	Year Opener	*wp rnpt*	Year Opener
					mswt rꜥ ḥr-ꜣḫty	Birth of Re[6] (Hor-Akhty)

(1) Feast of Nehebkau
(2) Only a possibility. It was celebrated in I *prt* 20 at Dendera
(3) Removing the 5 epagomenal days
(4) Reflects the domination of Thebes, her gods and her festivals
(5) Same name with New Kingdom grammar
(6) Later form of IV *šmw*

Table 2: Proper names of the civil months. For each seasonal month, the old and new proper names are presented, together with their possible translation. G stands for those months suffering the Gardiner Phenomenon: a Feast of the same or similar name in the first day of the following month. In boldface, those months whose name changes completely in the Ramesside period. See text for further discussion

However, Depuydt (see Table 3) has defended the existence of two parallel set of names as due to the fact that one belonged to the lunar calendar (our old set) and the other to the civil calendar (the new set), and that the second derived from the first. However, as I hope to have demonstrated, we do not seem to have any irrefutable proof of the existence of a whole set of 12 (or 13) well articulated lunar months at any moment of Egyptian history.

		Depuydt (1996 & 1999)			**New proposal**	
Greek Forms	*Seasonal Set*	*Theophoric Lunar Set*	*Theophoric Civil Set*	*Seasonal Denomination*	*Earlier Civil Names*	*Later Civil Names*
Thoth	I *ꜣḫt*	*tḫ* or *tḫy*	*ḏḥwty*	I *ꜣḫt*	*tḫ*	*ḏḥwty*
Phaophi	II *ꜣḫt*	*mnḫt* *ptḥ (rsy ỉnb=f)*	*p n ỉpt*	II *ꜣḫt*	*mnḫt*	*p n ỉpt*
Athyr	III *ꜣḫt*	*ḥwt ḥr*	*ḥwt ḥr*	III *ꜣḫt*	*ḥwt ḥr*	*ḥwt ḥr*
Choiak	IV *ꜣḫt*	*kꜣ ḥr kꜣ* *sḫmt*	*kꜣ ḥr kꜣ* *kꜣ ḥb kꜣ*	IV *ꜣḫt*	*kꜣ ḥr kꜣ*	*kꜣ ḥr kꜣ*
Tybi	I *prt*	*šf bdt* *mn* or *ỉmn-rꜥ nsw nṯrw*	*tꜣ ꜥbt* *pꜣ ḫn mwt*	I *prt*	*šf bdt*	*tꜣ ꜥbt*
Mechir	II *prt*	*rkḥ wr*	*p n pꜣ mḫyr* *mḫyr*	II *prt*	*rkḥ (wr)*	*(p n pꜣ) mḫyr*
Phamenoth	III *prt*	*rkḥ nḏs*	*p n ỉmnḥtp*	III *prt*	*rkḥ (nḏs)*	*p n ỉmnḥtp*
Pharmouthi	IV *prt*	*rnwtt*	*p n rnwtt*	IV *prt*	*rnwtt*	*p n rnwtt*
Pachon	I *šmw*	*ḫnsw*	*p n ḫnsw*	I *šmw*	*ḫnsw*	*p n ḫnsw*
Payni	II *šmw*	*ḫnt ḫtii (prty)* *ḥb ỉnt*	*p n ỉnt*	II *šmw*	*ḫnt ḫtii prty*	*p n ỉnt*
Epiphi	III *šmw*	*ỉpt ḥmt(=s)*	*ỉp ỉp*	III *šmw*	*ỉpt ḥmt(=s)*	*ỉp ỉp*
Misore	IV *šmw*	*wp rnpt* *rꜥ-ḥr-ꜣḫty*	*wp rnpt* or *mswt rꜥ-ḥr-ꜣḫty*	IV *šmw*	*wp rnpt*	*wp rnpt* or *mswt rꜥ(-ḥr-ꜣḫty)*
Epagomenoi	5 *ḥryw rnpt*		5 *ḥryw rnpt*	5 *ḥryw rnpt*	5 *ḥryw rnpt*	5 *ḥryw rnpt*

Table 3: Summary of the two most recent proposals for the names of the Egyptian months. I strongly believe that the highest percentage of all the names that are preserved belong to the unique calendar of the ancient Egyptians, the civil one

Consequently, applying the Principle of Economy, we must conclude that in Egypt there was just a single set of 12 names for the twelve months of the civil calendar, at least from the beginning of the New Kingdom, and perhaps even in the Middle Kingdom. For unknown reasons, some of these names were either altered or slightly changed during the New Kingdom or later (the case of Misore), but still keeping the same internal coherency. However, the old set of names was perhaps partially maintained for some monumental inscriptions, as data of Edfu suggest, in parallel to the set of typical seasonal names.

As we have seen, F.Ll. Griffith had suggested and has been followed by many, including me, that the seasonal set of names was written on the inscription but that the proper names of the months were the ones usually read. Can we go further in time to earlier epochs of Egyptian history and try to see what the names of the months of the civil calendar were at the moment of its apparition?

To finish the "problem" of the month names and trying to understand how some of the months earned their names, we must devote some time to discussing the Brugsch and Gardiner phenomena, largely discussed by Depuydt in his *Civil Calendar and Lunar calendar*. I will merely summarize the problem:

The Brusgch phenomenon comes from the fact that the last month of the Egyptian calendar, *wp rnpt*, the Opener of the Year, has a name that apparently refers to a beginning.

The Gardiner phenomenon is connected to the well known fact that several important festivals, which bore the same name as the months, were not celebrated in their eponymous months but rather in the first (or second) day of the following month. Six unmistakable cases of the phenomenon are attested (see Table 2), with two more doubtful.

Depuydt found an explanation for both phenomena in the mutual interferences and derivations produced first between the Sirius-based lunar calendar and the civil calendar and, later, between this and the civil-based lunar one. However, as we have seen, all the names attested so far would have belonged to the civil calendar probably since the Middle Kingdom onwards. What would the original names (if they ever existed) of the Nile year lunar months have been prior to the invention of the civil calendar?

The Old Kingdom inscriptions do not offer much information on this particular issue. However, there is a large number of festivals lists from various sites (especially the necropolises at Giza and Saqqara), which offer a good set of festival names[58]. From a compilation of all the sources, it is clear that the most complete list was that formed by 11 festivals plus the closing formula *ḥb nb* (*rꜥ nb*), completing 12 entrances. However, on several occasions, a twelfth feast, called *wꜣḥ ꜥẖ*, was added frequently between the original 7th and 8th, seldom between 8th and 9th, and rarely in other positions, perhaps indicating a moveable nature. The standard list, including *wꜣḥ ꜥẖ* in the most common eighth position, would be as follows:

(*1*) *wp rnpt*	(*5*) *ḥb skr*	(*9*) *prt mn*
(*2*) *ḏḥwtyt*	(*6*) *ḥb wr*	(*10*) (*ꜣbd n*) *sꜣḏ*
(*3*) *tpy rnpt*	(*7*) *rkḥ*	(*11*) (*tp*) *ꜣbd*
(*4*) *wꜣgy*	(*8*) *wꜣḥ ꜥẖ*	(*12*) (*tp*) *smdt ḥb nb* (*rꜥ nb*)

It is at least striking that the standard list included a total of 12 feasts, exactly the same as the numbers of months in the civil calendar (there was even a closing formula that might stand in the same, and perhaps equivalent, position to the epagomenal days). This might allow a suggestive speculation: that each of these feasts would represent in some way each one of the 12 months of the civil calendar. This hypothesis is schematically presented in Figu-

58. Spalinger, *op. cit.* ref. 28, 110.

re 5, where we have associated the feasts with each of the months.

First, we have the obvious parallelism of *wp rnpt* with day I *ꜣḫt* 1 and with the last month of the year, *wp rnpt* (we will come back to the Brugsch phenomenon later). Then we have the Feast of Thoth (*ḏḥwtyt*), well attested in I *ꜣḫt* 19 in later sources, and even the name of the first month in later sources (was that name as old as the Old Kingdom, *ḏḥwtyt* being another name of *tḫ*?). We will now jump forward and leave *tpy rnpt* without a discussion until section 5. The celebration of the Feast of *wꜣgy* is well attested in I *ꜣḫt* 17 and 18 from the Middle Kingdom onwards. However, in the Old and Middle Kingdom, there was a second, moveable *wꜣgy* Feast. There are firm hints that during the Old Kingdom, it might have been celebrated once in III *ꜣḫt* 28, on lunar day 18 (or 17) of the lunation following either the rising of the Nile waters, the summer solstice or *prt spdt* (see section 5). For IV *ꜣḫt*, we have the well attested Feast of Sokar (*skr*) in IV *ꜣḫt* 26[59].

The list follows with the Great Festival (*ḥb wr*). There is extremely little information on this feast, but in the very late temple of Edfu there is a Great big festival (*ꜥꜣ ḥb wr*) celebrated on II *prt* 4 and thus close to the beginning of the station *prt*. Then comes *rkḥ*. This is one of the long-lasting festivals, giving for sure the name to a couple of months of the calendar, II *prt* and III *prt*. Middle Kingdom sources (the Illahun archives) indicate that the *rkḥ* festival was celebrated twice, in III *prt* 1 and IV *prt* 1 (two instances of the Gardiner phenomenon), and thus we might relate the *rkḥ* of the Old Kingdom list to both of them and, consequently, we may associate it with two months. Eventually, we might assign *wꜣḥ ꜥḫ* to IV *prt* and, by doing that, we have another good hint since, in later sources, the Procession of Min (*prt mn*) was located in connexion with the *psḏntyw* of I *šmw*[60].

This parallelism might also tell us that, in the case of the Old Kingdom, the feast list might reflect a much older situation, one in which we are in fact dealing with an older lunar system, that, as *wꜣgy* demonstrated, was more and more shadowed by the civil calendar as the Egyptian civilization evolved. We speculate that this old system was the original Nile year. The list ends with three events that are clearly lunar. One is poorly known, (*ꜣbd n*) *sꜣḏ*, and it might account for month 10 (11 if *wp rnpt* is counted first, see below). However, (*tp*) *ꜣbd* and (*tp*) *smdt* are clearly the first crescent day feast and the full moon feast and, consequently, they might have been celebrated twelve times per year (see section 6). However, the uncommon adjective *tp* might mean that these were two special events. One possibility might be that these two entrances would be related to the last month in a peculiar way. In the Nile year, the last lunar month (an even the previous one) might not be present in the case of a very short year (as the one in the Palermo stone) and thus they might not have had a proper name assigned, being ignored as in the primitive Roman calendar or simply numbered as our September or October.

Of the original 9 feasts of the Old Kingdom perhaps related to months (see Figure 5), only three survived as month names of the Egyptian calendar in later epochs (*wp rnpt, ḏḥwtyt* and *rkḥ*). Consequently, we should imagine that the names of the months might have been

59. For *wꜣgy* in the Old Kingdom, see: U. Luft, "The Date of the *wꜣgy* feast: considerations on the chronology of the Old Kingdom", *in Revolutions in Time: studies on Ancient Egyptian Calendrics*, edited by A.J. Spalinger (Van Sieclen Books, 1994), 39-44; R. Krauss, "Wenn und aber: das Wag-Fest und die Chronologie des Alten Reiches", *GM* 162 (1998), 53-63, and L. Depuydt, "Sothic Chronology and the Old Kingdom", *JARCE* XXXVII (2000), 167-186. For Sokar: see Sh. El-Sabban, *Temple festival calendars of ancient Egypt* (Liverpool , 2000). See also: S. Sauneron, *Les fêtes religieuses d'Esna aux derniers siècles du paganisme* (Cairo, 1962).

60. On *rkḥ*, see: Luft, *op. cit.* ref. 3, 215. On *prt mn* and *ḥb wr*, see: El-Sabban, *op. cit.* ref. 59, 127 & 173.

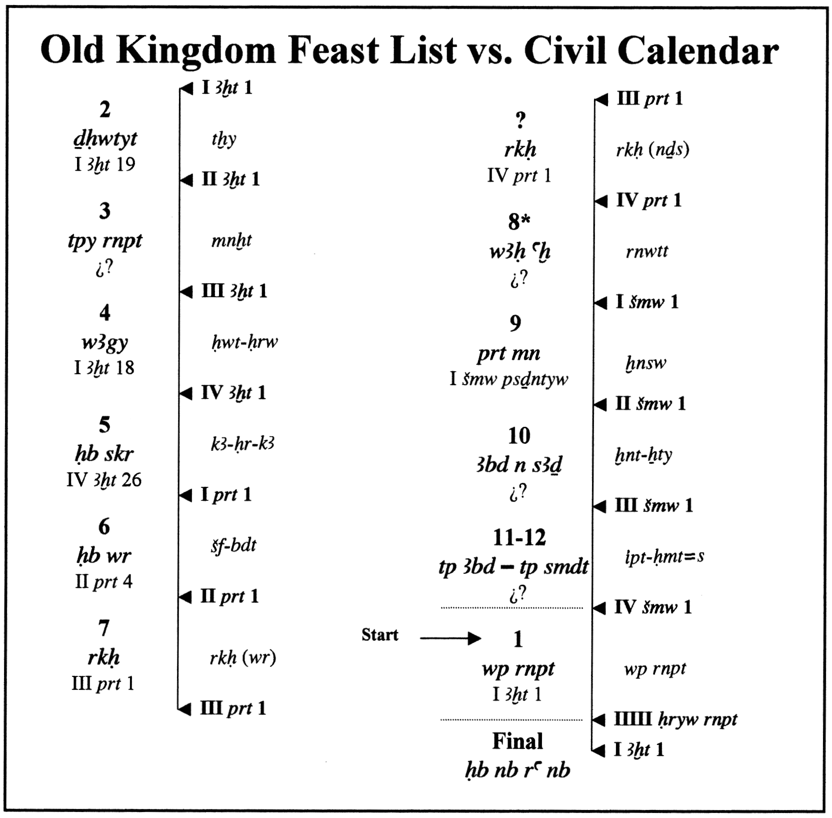


Figure 5: Comparative table between the 12 festivals usually mentioned in the standard feast list of the Old Kingdom and the twelve months of the civil calendar. It is the intention of this diagram to show that, generally speaking, each of these twelve festivals might had been vaguely associated with each of the months within a civil year. See text for further discussion

properly assigned in a later time, perhaps in the Middle Kingdom, when three of them are attested. However, as the late reputed astronomer Carl Sagan used to say, *the absence of evidence is not evidence of absence* and we could argue that the months of the civil year already had a proper name from the very beginning.

In fact, the only way to solve the problem of the Brugsch and Gardiner phenomena is to assume that the vast majority of the months (especially those suffering the Gardiner phenomena) must have taken their names from another source, from the very moment of the inauguration of the civil calendar. This situation is perfectly illustrated in Figure 6.

Let us imagine the moment of creation of the civil calendar and let us assume the following hypotheses:

· The calendar was inaugurated at the same time as a Nile year began, *i.e.* the first I *ꜣḫt* 1 was the first day of a lunar month. From that point to the very end of Egyptian history, I *ꜣḫt* 1 would be the date to celebrate the Feast of *wp rnpt*.

· The Nile year had a set of month names, starting with the Opener of the Year (*wp rnpt*), eponymous with its corresponding feast, followed by *tḫ*, and so consecutively. Not necessarily all the months would have had a name and for those having a name, this does not need to be the same as given in later sources (Dynasty 18, see Table 2). However, for simplicity, we will assume the old set of 12 names in Table 2 already in operation.

· Three normal Nile years of 12 lunar months follow each other.

With these working hypotheses, we might obtain the following conclusions. Already in year 1 of the series, some part of the lunar months of the Nile year would have fallen one month ahead in the civil calendar. In the second year the parallelism would have been substantial and in the third year almost complete so that *wp rnpt* was coincident with IV *šmw*, *tḫ* with I *ꜣḫt* and so successively. Since no name for the intercalary month (if it ever existed) is reported, the situation would have been still more dramatic at the beginning of the 4th year. Hence, we may speculate that at some moment, either in year two or better in year three after the inauguration of the civil calendar, several month names were borrowed by the civil calendar from the simultaneous names of the corresponding lunar months (or lunations we might already call them) of the discredited Nile year, which was in the process of abandonment. This explanation might easily account for the Brugsch phenomenon and might explain why *wp rnpt* was the name of the last month of the year.

What about the Gardiner phenomenon? Here we might find a more global solution that might explain, not only the six months (we have already discussed *wp rnpt* and we will not consider *šf bdt*) affected by the phenomenon but also why other important feasts such as *ḏḥwtyt* (I *ꜣḫt* 19), *tḫy* (I *ꜣḫt* 20), *šf-bdt* (I *prt* 20 in Dendera) or *ḫnsw* (I *šmw* 19) were fixed where they were. As first noticed by Spalinger[61], the special location of the Feast of Thoth within the civil calendar could have something to do with the importance of the god as time-keeper (in his character of lunar god) since the day I *ꜣḫt* 19 had a peculiarity; it corresponds to the difference in days between 13 lunations (384 days) and the 365 day civil calendar. This means that I *ꜣḫt* 19 repeats the lunar phase of the last day of the pre-previous year. This might have been relevant for lunar phase calculations or, perhaps, might simply have had a symbolic character.

For the other feasts, the solution is still simpler. As shown in Figure 6, five instances of the Gardiner phenomenon (*ḥwt-ḥr, nḥb kꜣw*, associated with *kꜣ ḥr kꜣ, rkḥ wr, rkḥ nḏs* and *rnwtt*), celebrated in the first day of months 4, 5, 7, 8 and 9, respectively, are related to days 13 to 16 of the corresponding lunations in the second Nile year of the cycle. Considering that the moon looks full from day 13 to 15 or from 14 to 16, depending on the length of the lunation (29 or 30 days, respectively), all five feasts could have been the *smdt* festivals of their eponymous lunations. Since the feast falls at the same time on a very special day within the civil calendar (the first day of the following month), it might have been decided that this peculiar situation should be frozen within the civil calendar. We might find a similar situation for the feasts of *šf-bdt* and *ḫnsw* (both would be *smdt* of their corresponding eponymous lunations) but on the third year of the cycle and not on the second (thus with no Gardiner phenomenon present), although these feast dates are reported very late and the cause could have been any other and in a later epoch.

Another curious situation is for the case of the Feast of *tḫy* in I *ꜣḫt* 20 (or *tḫ* 20), well reported at least from the Middle Kingdom and perhaps earlier. In this case, the feast is located within its eponymous month. Parker[62] suggested that it should be also associated with a *smdt*; however, as Figure 6 demonstrates, it fits much better if the Feast of *tḫy* was originally the *psḏntyw* of its eponymous luna-

61. A.J. Spalinger, "Thoth and the Calendars", in *Revolutions in Time: studies on Ancient Egyptian Calendrics*, edited by A.J. Spalinger (Van Sieclen Books, 1994), 45-60. See also: A. Spalinger, "Notes on the ancient Egyptian Calendars", *Orientalia* 64 (1995), 17-32.
62. Parker, *op. cit.* ref. 1, 57.

tion[63]. Thus, *tḫy* might have been fixed in day 20 of I *ꜣḫt* as soon as the second year of implementation of the civil calendar, when the corresponding *psḏntyw* occurred exactly on that day. Curiously, a similar line of reasoning (see Figure 6) might have dictated the decision, taken some 12 centuries later, to fix the first day of the Feast of Opet (*ỉpt*) in II *ꜣḫt* 19, since as we can see, it also might have corresponded to the *psḏntyw* of *mnḫt*, the month to be known later as Phaophi (*p n ỉpt*). However, another possibility would have been the special relevance taken by days 18 and, overall, 19 within the civil months as important dates for the celebration of festivals. This might explain the last case of the Gardiner phenomenon, that of *ỉpỉp*, the eponymous feast of *ỉpt-ḥmt=s* (III *šmw*, later Epiphi) but that was celebrated in days 1 and 2 of IV *šmw*, which might have correspond to lunar days 18 and 19 of the "almost" eponymous lunation.

Summarizing, we have tried to demonstrate that there was just one set of month names, pertaining to the civil calendar, which changed some of their names later in Egyptian history. The majority of these names were perhaps taken from a set of original lunar months of the previous Nile-based lunar year, from the very moment of creation of the civil calendar, in the first half of the third millennium BC. This rapid assimilation might explain some problems, later identified as the Brugsch and Gardiner phenomena, that were inherent to the Egyptian calendar from the very beginning, and not the result of the side effect provoked by the interaction throughout history between the civil calendar and the alleged (and far from certain) Sirius-based and civil-based lunar calendars.

4. Did the solstices ever play a role within the framework of the Egyptian calendar?

There has always been, since the beginning of Egyptology, an acrid debate between those scholars supporting knowledge of the stations of the sun by the ancient Egyptians and those attacking that possibility (e.g. the Sethe theory for the beginning of the year at the winter solstice). Recently, Leitz has defended the solar roots of the Egyptian calendar, while Wells has proposed a theory that has related the mythology of the birth of the god Re from the goddess Nut (identified as the Milky Way) with the relative positions of both the sun and the Milky Way at the vernal equinox and at the winter solstice[64]. However, the theory for the calendar, proposed as a corollary of that hypothesis, is unreliable, as we have already mentioned in section 2.

What it is absolutely certain, and difficult to deny any longer, is the fact that several Egyptian temples were orientated towards the equinoxes and the solstices. This is easily demonstrated in Figure 7 where a declination histogram of one hundred temples is presented. The data have been obtained from the literature[65], the author's own measurements for a few temples and archaeological maps and do not have all the precision that we would have wished. However, the histogram presents two significant peaks at the declination of the sun at the equinoxes and at the solstices. These two peaks could be generalized. However, we know that they are basically due to the temples at the pyramid complexes of the Old Kingdom (equinoctial) and from several temples in Upper Egypt of the Middle and New Kingdoms (solstitial). This diagram is an irrefutable

63. A.J. Spalinger, "A chronological analysis of the feast of *tḫy*", SAK 20 (1993), 289-303. See also: Spalinger, *op. cit.* ref. 61.
64. See: Ch. Leitz, "Der Mondkalender und der Beginn des ägyptischen Kalendartages", *BSEG* 18 (1994), 49-60, and Wells, *op. cit.* ref. 40.
65. For data in the literature, see: J.N. Lockyer, *The Dawn of Astronomy*, Kessinger Co., (New York, 1993), new edition; G. S. Hawkings, "Astroarchaeology; the unwritten evidence", in *Archaeo-astronomy in Pre-columbian America*, ed. by A. Aveni (Austin, 1975), 131-62; and R.A. Wells, "Sothis and the Satet temple on Elephantine: a direct connection", *SAK* 12 (1985), 255-302.

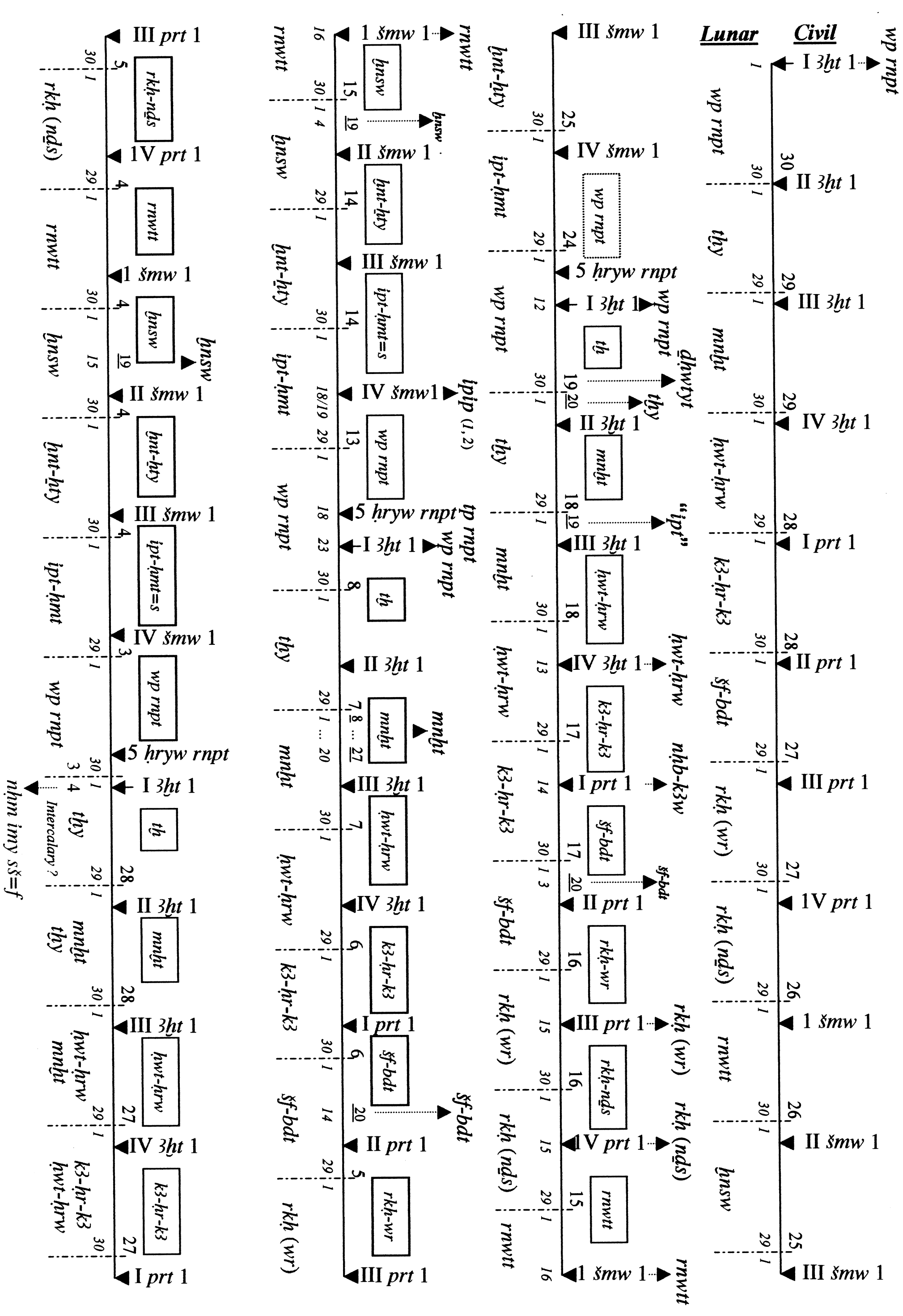


Figure 6: Diagram showing the hypothetical moment in which the civil calendar was created from an original lunar calendar, starting with wp rnpt feast as the first day of both the new civil calendar and the old cycle of lunar months. Within three years, the civil calendar would have run completely independently, keeping within its structure old features of its lunar counterpart that are controversial. These are known as the Brugsch and Gardiner phenomena. See text for further discussion

proof that the Egyptians were interested in the stations of the sun, but was this interest also calendrical or merely symbolic?

It has frequently been claimed that there are two features of the Egyptian calendar that might have a solstitial origin. On the one hand, the name of the 12th month of later periods, Misore, the Birth of Re, and of the eponymous feast at I *3ḫt* 1, have been related to the birth of the sun at the winter solstice, a common link to many other cultures throughout the Mediterranean but (apart from Wells's hypothesis) never undoubtedly characterized for the case of ancient Egypt. On the other hand, the name of the sixth and seventh months, *rkḥ*, *i.e.* "Burning", has variously related to the heat of the sun at the summer solstice, a hypothesis defended by Sethe, and, on the contrary, with a much more prosaic artificial heat needed in Egypt at the time of the winter solstice, a hypothesis proposed and defended by Parker[66].

The name Misore, instead of *wp rnpt*, for the 12th month has been reported only in the Late Period and, especially in the Aramaic, Greek and Coptic papyri written after the conquest of Egypt by the Persians in 525 BC. However, there is an early mention, in a necropolis report from Deir el Medina, of a feast under the name of *mswt rᶜ-ḥr-3ḫty*, celebrated in I *3ḫt* 1 as early as the 20th Dynasty[67]. So the association between the feast of Misore and the first day of the civil year must be much older, but how much? We are going to propose the hypothesis that this link can effectively be associated with a moment when I *3ḫt* 1 was at the time of the winter solstice, but not in prehistoric or proto-historic times, as generally argued, but well into the historic period. To be precise, because of the wandering of the civil calendar across the seasons, there have been two occasions when I *3ḫt* 1 has fallen at the moment of the winter solstice: in a four year period centred on 2004 BC and in 500 BC, respectively, as shown in Figure 8. Considering the 19th Dynasty mention of the feast, we cannot consider 500 BC. This brings us to the year 2004 BC.

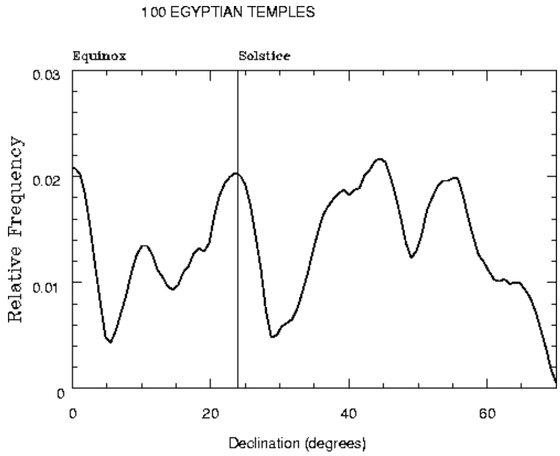


Figure 7: Orientation histogram of a hundred Egyptian temples in terms of absolute astronomical declination, as obtained from the literature, the author's own measurements and site maps. Despite the uncertainties associated with the quality of part of the data, there are two obvious, statistically significant peaks related to the declination of the sun at the equinoxes (0°) and solstices (±24°), showing that these crucial "stations" of the sun should have been important in ancient Egypt

This was a very interesting moment in Egyptian history. Accordig to most accepted chronologies, Menthuhotep II from Thebes had just re-unified the country and new buildings, on a monumental scale, were constructed for the first time in the very south of the country. The most significant of all was his mortuary temple at Deir el Bahari. Also, a few years later, the temple of a new aspect of the solar god, Amun-Re, was re-erected by Senuseret I on the other side of the river, in Karnak, also on a larger monumental scale[68]. Not surprisingly, both mo-

66. Sethe, *op. cit.* ref. 35.
67. Gardiner, *op. cit.* ref. 35. The name Misore may have a possible precursor in Amarna where a festival *mswt-itn* took place in I *3ḫt* (R. Krauss, *GM* 162, 1998, 53-63).
68. For a discussion of these issues, see: J.A. Belmonte, "Astronomy on the horizon and dating, a tool for ancient Egyptian chronology?", in *Handbook of Egyptian Chronology*, edited by R. Krauss (Berlin, 2004), in press.

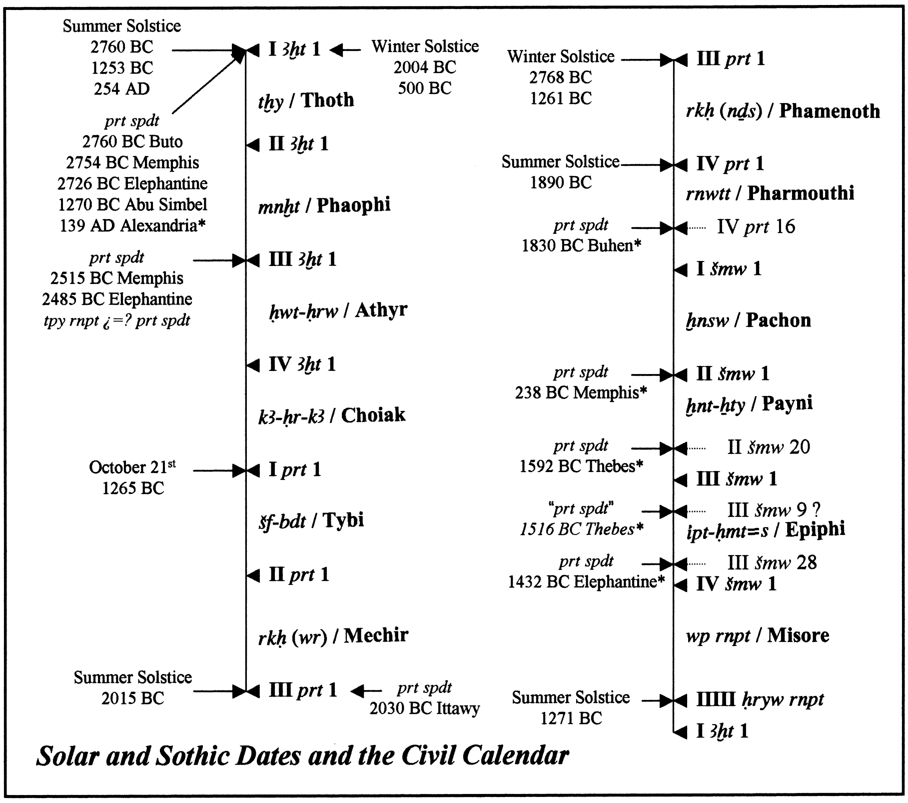


Figure 8: Civil dates of the solstices as a function of time and of the heliacal rising of Sirius (prt spdt) as a function of both time and location. Those marked with an asterisk are those reported by ancient sources. The Ebers Sothic "date", discussed separately in this work, is printed in italics

numents were orientated to the rising of the sun at the winter solstice and thus, for a few years, to the rising of the sun at the first day of the civil year, I *ꜣḫt* 1. We speculate that at this precise moment, when the actual Birth of Re at the winter solstice occurred in I *ꜣḫt* 1, the feast was frozen at this date for the rest of Egyptian history.

A reflection of this ancient tradition, could have been inherited by two of the most important festivals of Amun celebrated during the Ramesside period when the winter solstice was not centred on I *ꜣḫt* 1, but rather occurred at the time of the months II *prt*, III *prt* and IV *prt*. These were the Festival of "Lifting Up the Sky" (*ʿḥ pt*), celebrated from II *prt* 29 to 30, ending when the god "Enters the sky" (*ʿq pt*) in III *prt* 1, followed by the festival of "Entering the Sky" from III *prt* 29 to 30, and finishing when the god "Re-enters the sky" (*sʿq pt*) in IV *prt* [69]. In 1261 BC (see Figure 8), in year 18 of Ramesses II, the winter solstice occurred more or less at III *prt* 1 and we speculate that this is what was commemorated at the very moment when the god "enters" the sky. Obviously, this would have occurred just for a period of a few years but, in any case, the winter solstice would have fallen in II *prt* or III *prt* during most of the New Kingdom.

This fact connects with the problem of the two *rkḥ*. This was the name of two months of the civil calendar (II *prt* and III *prt*, months 6 and 7 respectively) and of two eponymous festivals celebrated in III *prt* 1 and IV *prt* 1, res-

69. El-Sabban, *op. cit.* ref. 59, 60.

pectively, as the Illahun archive clearly showed. Since the Middle Kingdom (see Figure 2), both were distinguished by the adjectives "great" (*ꜥꜣ* or *wr*) and "small" (*nḏs*). Originally, in the Old Kingdom, just one *rkḥ* feast was reported in the 7th position of the standard festival list. We have argued that this might have been the name of months 6 and 7, within the civil calendar, since its invention (c. 2768 BC), and thus during that period, *rkḥ* would have fallen more or less at the time of the winter solstice. Hence, in the Ramesside period, when the *rkḥ* feasts are not mentioned at all, the equivalent Amun winter solstice festivals took their place. Taking this hypothesis into account, Parker´s idea of "burning", meaning artificial heat, does not sound unreasonable.

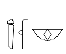
However, there is another possibility. At the archive of Illahun there is a document which shows a list of revenues for the temple of Anubis, at the pyramid complex of Senuseret II, which are delimited to an interval of a year, from year 1 III *prt* 1 to year 2 II *prt* 30[70]. During the Middle Kingdom, the summer solstice was moving from III *prt* 1 in 2015 BC (see Figure 8) to IV *prt* 1 in 1890 BC and beyond. So, during this period, a Nile year interval would have fallen more or less as described in the Anubis's temple account. Furthermore, it is at Illahun were the two *rkḥ* festivals are reported exactly at those dates, the first days of III and IV *prt*. Another possibility would be that *rkḥ* was in fact a term for the epoch of the summer solstice and that, in a similar manner as *mswt-rꜥ*, it might have been frozen within the civil calendar, in association with months 6 and 7, exactly in that epoch. Against this idea, we have the striking evidence presented before that *rkḥ* might have been associated in some way with months 6 and/or 7 already in the Old Kingdom. Currently, I am unable to give preference to one hypothesis or the other.

However, following the same kind of reasoning, there is a final hypothesis that would explain why the name Misore supplanted that of *wp rnpt* as the name of month IV *šmw* only in the Late Period (as a matter of fact, not in the Deir el Medina documents, where the rest of the new names, as *p n ỉpt* or *p n ỉnt*, are already present). From approximately 645 BC to 520 BC, the winter solstice, perhaps the original meaning of *mswt-rꜥ*, fell in the month IV *šmw*. In 525 BC, Egypt was conquered by the Persians, for whom the association of the winter solstice with the birth of the sun god Mithra might have been obvious. Finally, in 500 BC, I *ꜣḫt* 1 and the winter solstice were once more coincident. This might have been the detonative for the definitive association of Misore with month IV *šmw* and of the Feast (of the Birth) of the Sun (*ḥb rꜥ*) with New Year's day.

5. How many beginnings did the Egyptian year have?

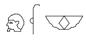
From any logical point of view, if there was just one calendar in ancient Egypt, there must have been just one starting point of the year. However, the perennial discussion on the existence of other calendars has tried to find "beginnings" for the different proposals. Besides, it is an established fact that, in ancient Egyptian sources, there are mentions of more than one term that might be interpreted as the first day of the year. In this line of argument, from the feast lists of the Old Kingdom (see section 3) and of the Middle Kingdom (see Figure 2), we have at least two terms that could be interpreted as the beginning of the year. These would be:

 , *wp rnpt* (*ḥb*), the Opener of the Year (Festival), and

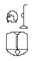
, *tpy rnpt* (*ḥb*), the First of the Year (Festival).

70. Spalinger, *op. cit.* ref. 6, 8.

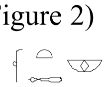
The second one must not be confused with the also very common term

, *tp rnpt* (*ḥb*), Head, At the Front or Beginning (also First) of the Year (Festival).

Fortunately, it is practically accepted to be an alternative term for the first of the epagomenal days (also known as *mswt-wsir*) that could also be considered to be at the "beginning" of the year[71]. This must be distinguished from:

, *tp tr*, the Beginning of the Season.

Also, to this sample we might add (see Figure 2)

, *rnpt ꜥ3t* (*ḥb*), the Great Year (Festival), and

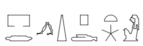
, *rnpt nḏst* (*ḥb*), the Small Year (Festival),

terms which, as we have seen, are very difficult to interpret. Fortunately, for the End of the Year we found just a single term:

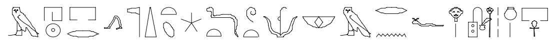
, *ꜥrq rnpt* (*ḥb*), the Closing of the Year (Festival),

which is always undoubtedly associated with the last day of the civil year, excluding the 5 *ḥryw rnpt*, IV *šmw* 30[72].

The situation, however, is further complicated by the appearance in the Middle Kingdom of the term[73]

, *prt spdt*, the Going Forth of Sothis (Heliacal Rising of Sirius).

This was from the very beginning of Egyptian calendrical studies associated with the term *wp rnpt* especially for two reasons, emanating from two documents: the Ebers calendar (which does not exist, according to our exercise) and the Tanis version of the Decree of Canopus. In the hieroglyph section of this extremely important bilingual inscription we can read:



on the day of the Going Forth of Sothis, called wp rnpt in name in the writings of the House of Life.

From this and other lesser documents, such as the astronomical ceiling of the temple of Dendera, Parker proposed the validity of the equation *wp rnpt* = *prt spdt* since the very beginning of Egyptian history. As a consequence, *tpy rnpt* was proposed as the first day of the Sirius-based lunar calendar, a hypothesis that has not been seriously contested yet.

However, this is not the case for the equation *wp rnpt* = *prt spdt*, which has been severely challenged, as the vast majority of the documents from the Old Kingdom (Abusir Archive), passing through the Middle Kingdom (Illahun Archive) to the New Kingdom (Buto Stele) and beyond clearly demonstrate that *wp rnpt* was from the invention of the civil calendar the name of the feast associated with the first day of the civil year I *3ḫt* 1[74]. What shall we do then with the clear statement of the Canopus Decree? Spalinger[75] has argued that the most reliable version of the decree is the one written in Greek, and that the Demotic and

71. A.J. Spalinger, "A mark of renewal", *SAK* 17 (1990), 289-294.
72. Spalinger, *op. cit.* ref. 6, plate IV.
73. Spalinger, *op. cit.* ref. 28, 68. See also: R. Krauss, "Altägyptische Sirius- und Monddaten aus dem 19. und 18. Jahrhundert vor Christi Geburt (Berliner Illahun-Archiv)". *Ägypten und Levante* 8 (1998a), 113-123.
74. For Abusir, see: P. Posener-Kriéger, *Les archives du temple funéraire de Neferirkare-Kakai (Les papyrus d'Abousir)*, 2 vols. (Cairo, 1976), 571 with note 3. For Illahun, see: Luft, *op. cit.* ref. 3. For Buto, see: S. Bedier, "Ein Stiftungsdekret Thutmosis' III aus Buto", in *Aspekte Spätägyptischer Kultur*, ed. by M. Minas and J. Seidler (Mayence, 1994), 35-50, or A. Spalinger, "The Festival structure of Thutmose III's Buto Stele", *JARCE* XXXIII (1996), 69-76.
75. Spalinger, *op. cit.* ref. 6, 31.

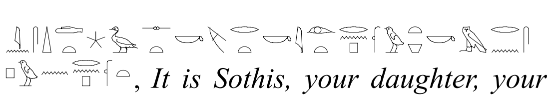
hieroglyphic version are mere translations of the former.

The Greek version states: *on the day of which the star of Isis heliacally rises which is regarded in the sacred writings to be a new year*; which gives in the Demotic version the term *ḥꜣt rnpt*, the "beginning" of the year, not the "opener". So what the Decree clearly says, as Spalinger has pointed out, is that *prt spdt* is associated with the beginning of a new era and not necessarily with the precise date of *wp rnpt*. However, it is obvious that Sothis was somehow associated with the beginning of the year, and that a certain sort of year begins with its rising (see also section 6), as several later period texts demonstrate. For instance, one example from Dendera explains that: , *years are reckoned from her shining-forth*.

The special relation between Sothis and *wp rnpt* might have been generated in the New Kingdom, when the star actually had its heliacal rising during the month *wp rnpt* (IV *šmw*) and, depending on the latitude, exactly at I *ꜣḫt* 1 in the decades around the beginning of Ramesses II reign, as the famous inscription in the Ramesseum apparently demonstrates:

, *let you bright as Sothis on the sky in the morning of the Opening of the Year.*

However, it is important to notice that we lack evidence of any other earlier connection between Sothis and *wp rnpt*. Anyway, it is clear that Sirius was in some way or other related to the calendar even in the Old Kingdom, since in the utterance 965 of the Pyramid Texts[76] we can read:

, *It is Sothis, your daughter, your beloved, who has made your year-offerings in this her name of Year*.

The direct calendrical meaning is not obvious, but the assimilation of Sothis with the goddess Renpet, companion of the god Min and one of the goddesses in charge of counting the years (together with Seshat) might have interesting implications for such an early epoch.

The basic problem is that the term *prt spdt* is not mentioned until the Middle Kingdom, when it frequently appears in festival lists and is mentioned twice in the Illahun Archive (the famous and controversial Sothic date of IV *prt* 16, see below). Does this mean that the heliacal rising of Sirius was not observed (or was of lesser importance) in previous periods of Egyptian history, including the Old Kingdom?

Perhaps what might have been the "earliest" reference to the use of the term is found in a festival list dated at the reign of Amenhotep I, currently at the Open Air Museum at Karnak[77]. In that list, *prt spdt* is located in a position that apparently would locate the heliacal rising of Sirius between the days I *prt* 3 and I prt 20. Because of the wandering nature of the civil year, these dates define an interval between 2301 BC and 2182 BC for the observation of the astronomical event. This is obviously a period of time extremely earlier than the reign of Amenhotep I (c. 1510 BC) and it has been reasonably argued that this is a copy of a much older decree, probably of the Middle Kingdom and perhaps of the Old Kingdom (as the dates suggest, but not the use of the term). So we would have indirect evidence that *prt spdt* might have been observed at least in the final stages of the Old Kingdom, perhaps when the difference between the civil year and the seasons would have started to be dramatic. However, Krauss has gone even further and has suggested that knowledge of the progressive delay of the heliacal rising of Sirius had been a planned part of the firm establishment of the civil calendar of 365 days since its very beginning[78].

76. R.O. Faulkner, *The Ancient Egyptian Pyramid Texts* (Oxford, 1969).
77. Spalinger, *op. cit.* ref. 6, plate II.
78. Krauss, *op. cit.* ref. 3.

To save the situation, Spalinger, after disqualifying Parker's equation (*i.e. wp rnpt = prt spdt*), has re-enacted a proposal made in the 1950s by the Hungarian scholar V. Wessetzky[79], according to which the Old Kingdom term for *prt spdt* was none other than *tpy rnpt*, so conspicuous in festival lists and located, in the standard arrangement, after *wp rnpt* and *ḏḥwtyt*. In our discussion of these lists (see Figure 5), we had associated *tpy rnpt* with month II *ꜣḫt* and the transition to III *ꜣḫt* (with *wꜣgy* associated with the following month). Effectively, as shown in Figure 8, *prt spdt* would have taken place in III *ꜣḫt* 1 in the decades around 2500 BC, in the middle of the Fourth Dynasty (according to most accepted chronologies) and at the precise moment when the festival lists started to appear in the private necropolises at Giza and Saqqara. Another fact has been claimed to support this hypothesis: that *tpy rnpt* is sometimes present in typical Middle Kingdom festival lists (where *prt spdt* is not explicitly mentioned) just after *rkḥ*. Considering that at the beginning of the Middle Kingdom, *prt spdt* took place, in the decades around 2030 BC, at III *prt* 1 (see Figure 8), the classical date of *rkḥ*, it would have occurred after that date during most of the Middle Kingdom, exactly as the feast lists suggest[80].

However, unfortunately, a doubt could arise from Middle Kingdom data as well. In a statue of a certain Amenemhet, found at Abydos and dated during the reign of Senuseret I or Amenemhat II, the following list of festivals is reported[81]:

ꜣbd / smdt tp / wꜣgy / ḏḥwtyt / ḥb wr / ḥb skr / prt mn / prt spdt / tpy rnpt / wp rnpt / ḥb rꜥ nb

Although the order does not seem fully chronological (the location of *wꜣgy* before *ḏḥwtyt* is an innovation of the end of the Old Kingdom, when the civil-based *wꜣgy* was settled in I *ꜣḫt* 18 just before *ḏḥwtyt* in I *ꜣḫt* 19), there is one important objection: *prt spdt* is mentioned near both *tpy rnpt* and *wp rnpt*. So, unless we accept the correction that *tp rnpt* (standing for the first of the epagomenal days, see above) should have been written instead of *tpy rnpt*, we would be facing a serious challenge to the hypothesis proposed above.

Consequently, the equation *prt spdt = tpy rnpt* is not as obvious as we would have liked and we might search for an alternative explanation for the term *tpy rnpt* as the beginning of something. My answer is that this alternative can be found in the Nile year that we have widely discussed throughout the paper. Once the civil calendar was inaugurated, the Nile year probably ended operation. However, the arrival of the rising waters must still have been a primordial event, even within the frame of the wandering civil calendar. Since a feast is unlikely to be celebrated surprisingly, when the arrival of the waters were detected at the Nilometers, it is possible that the celebration of the flood would have been moved to either *psḏntyw, ꜣbd, smdt* or any other important day of the following lunation, which, in fact, would have been the first (*tpy*) event of that class in the new Nile year (which might also be called *rnpt*). Of course, this does not mean that a whole set of lunar months would have been counted after that event, although there might perhaps have been some special lunations or lunar festivals whose dates could have been estimated from that point onwards.

In the same sense, there is yet another important point to discuss: if *prt spdt* (either if it was identical to *tpy rnpt* in the Old Kingdom or not) could be considered as the beginning of some of these periods of time, either a certain set of lunations (not properly a year) or a set of lunar festivals, as has been frequently claimed. We will deal once more with this particular

79. See: V. Wesstzky, *Bulletin de Musée Hongrois des Beaux Arts* (1954) 3-10, and Spalinger, *op. cit.* ref. 28, 36 with note 18.
80. Spalinger, *op. cit.* ref. 28, 44.
81. Spalinger, *op. cit.* ref. 28, 47.

point, regarding either *prt spdt* or a first lunar event after the arrival of the flood, in section 6.

One particular problem of these two "beginnings" is that both have a markedly local character. The inundation would arrive, in average, twelve days earlier at Elephantine than at Buto in the Delta, and, in a similar fashion, the heliacal rising of Sirius would have been observable, under good atmospheric conditions, 8½ (c. 2800 BC) to 6½ (c. 200 AD) days before at Elephantine (latitude 24°) than at Buto (latitude 31°). This means that any lunar event calculated from those "beginnings" could have a difference of a whole lunar month from Elephantine to some important city further to the north. This will be relevant for the argumentation in the following section.

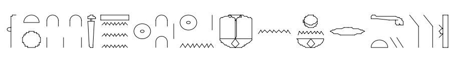
To finish this discussion on the "beginnings" of the year, we should proceed with a brief discussion on the festivals known as *rnpt ꜥꜣt ḥb* and *rnpt nḏst ḥb* that can be found in a few feast lists of the Middle Kingdom (see Figure 2). I can hardly imagine another festival, with a different name, celebrated either on the first day of the civil calendar (*wp rnpt*), on its last days (*ꜥrq rnpt*) or on any of the epagomenal days (5 *ḥryw rnpt*) since all of them are already present in the list, as shown in Figure 2. Thus, for me, Spalinger´s idea that these terms might represent a festival associated with the "great" year of 365 days and another one with the "small" year of 360 is difficult to maintain.

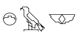
Should we go back then to a lunar interpretation? We have seen that this was Neugebauer's idea in connection with Papyrus Carlsberg 9. Also, in a Demotic papyrus edited by Parker[82], a mention of "small" and "great" years is associated with the key word *wrš*, which, as we have seen, could be translated as a lunation period of service (not necessary a lunar month). So it is probable that the Festivals of the Great and of the Small Year might have been celebrated at some particular lunar events.

However, with the current data it is impossible to take these conclusions any further.

6. What was the exact role of lunar dates or festivals?

It is unmistakable that the ancient Egyptians were specially keen on the phases of the moon, and that several of their major festivals were celebrated at key moments of the lunar cycle, either for every lunation within the civil calendar or in some important ones. However, it is also very clear that these lunar feasts were always articulated within the framework of the civil calendar, and that there are no proofs that these lunar festivals were ever articulated in the form of a calendar once the civil calendar was in operation. This is illustrated by the fact that, in the feast lists of the tomb of Khnumhotep II (see Figure 2), there is a mention of 12 *ꜣbd* and 12 *smdt*, despite the fact that, in some years, there could have been an extra *ꜣbd* or *smdt* either in one of the *ḥryw rnpt* or as an additional one in a civil "blue" month. Apparently, these extra lunar events were not taken into account. Spalinger[83] has gone one step further in proposing that the 12 *ꜣbd* and the 12 *smdt* of the lists might actually refer to days 2 and 15 of the 12 civil months. However, I do not find this hypothesis reasonable, given that there are several occasions when a clear lunar event is reported with an independent civil date, such as the famous occasion of a *psḏntyw* (predicted or observed, nobody knows) at the battle of Meggido, which is reported to be exactly at day I *šmw* 21 in the 23rd year of Thutmosis III:



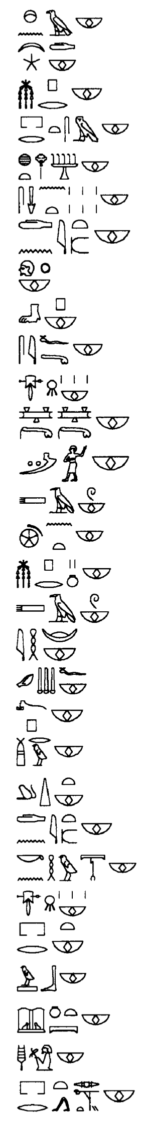
and where *pšdntyw* corresponds to the day of new moon or conjunction, the first day of the Egyptian lunation (synodic month) according to most authors. This feast day is already mentioned in the Pyramid Texts where, however, it is written without the preposition *n*: .

82. R.A. Parker, A *Vienna Demotic papyrus* (1952) 8-9; in Spalinger, *op. cit.* ref. 28, 38 with note 27.
83. A.J. Spalinger, "The lunar system in festival calendars: from the New Kingdom onwards", *BSEG* 19 (1995), 25-40.

Other common lunar days since the Old Kingdom onwards were , or simply , *3bd* (First Crescent), for the 2nd day, or , *smdt* (Full Moon, read also *mḏ-ḏi-nt*, according to Luft), for the "15th" day of the cycle (also reported as). In the Middle Kingdom, also *snwt*, the 6th day, is reported.

However, in the sources of the Graeco-Roman period, we can find a whole set of days of the month, which we can take from the eclectic list reported by Parker in his *Calendars*, with minor modifications:

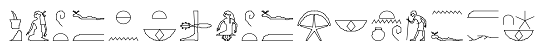
1.	*psḏntyw*
2.	*3bd*
3.	*mspr*
4.	*prt sm*
5.	*iḫt ḥr ḫ3wt*
6.	*snwt*
7.	*dnit*
8.	*tp*
9.	*k3p*
10.	*sif*
11.	*stt*
12.	
13.	*m33 sty*
14.	*si3w*
15.	*smdt*
16.	*mspr sn-nw*
17.	*si3w*
18.	*iʿḥ*
19.	*sḏm mdw=f*
20.	*stp*
21.	*ʿprw*
22.	*pḥ spdt*
23.	*dnit*
24.	*knḥw*
25.	*stt*
26.	*prt*
27.	*wšb*
28.	*ḥb-sd nwt*
29.	*ʿḥʿ s3w*
30.	*prt mn*



Considering that the list offers 30 days, and that it is located within a civil calendar context, it has been argued that these are actually the proper names of the thirty days of the month of the civil calendar. In fact, many of them have never been reported, either in a lunar or in a civil context and some others, as day 18th, *iʿḥ* ("moon") has only ever been found in a civil context, representing day 18 of a certain civil month[84].

It is not easy to deny this hypothesis. However, it is quite clear that several of these names (for days 1, 2, 4, 5, 6, 7, 10, 15, 16, 27, 29 and 30) have been reported in a quite obvious lunar context, and thus it is highly probable that the whole set would have been developed to offer suitable names for each day of a lunation. This might have been especially important since it would have not been clear exactly when the lunation commenced.

Since Parker's "Calendars", it has usually been accepted that the Egyptian lunation started at *psḏntyw*, on the day following that in which the last crescent of the moon could be seen at dawn. Frequently, an illustrative text at the Ptolemaic propylon of the temple of Khonsu at Karnak is advocated, supporting this idea[85]:

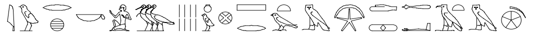


He (Khonsu) is conceived (bq3) on psḏntyw, he is born in 3bd, he grows old after smdt.

However, the are scarce mentions of *psḏntyw* in the Old Kingdom (while *3bd* and *smdt* are very frequent). The same can be said for the Middle Kingdom. For example, in the Illahun Archives, *psḏntyw* is mentioned three times, while *3bd* and *smdt* have more than 15 entries each. Most important, calculating the distance between various *3bd* and their corresponding *smdt*, it has been demonstrated that it is seldom that there are not 12 full days between one and the other (as would be expected

84. Depuydt, *op. cit.* ref. 3, 84.
85. Brugsch, *op. cit.* ref. 25.

if they were always days 2 and 15 of the lunation), but sometimes rather 11 or 13, indicating that we might be faced with a real (and not a calculated) lunation, started by the evening visibility of the first crescent, which then grows until full moon. This idea might be reinforced by the following text, also of Middle Kingdom provenance:


 *I know, O souls of Hermopolis, what is small on ꜣbd and what is great on smdt, it is Thoth.*

Of course, this fact also speaks against an articulated lunar month (at least in the Middle Kingdom) and thus against any possible well structured lunar calendar[86].

In fact, however, the most important day of each Egyptian lunation was probably day 29. This day was called *ꜥḥꜥ sꜣw*, which might be translated as the "Standing Guardian", with the most probable significance that somebody (probably an *ỉmy wnwt*) was observing at the end of the night on that day (it should be remember that the Egyptian day started at dawn, at the moment of *ḥḏ-tꜣ*)[87], trying to see the last crescent of the moon. If it was clearly visible, then the next day would still be day 30 of the current lunation, but if, on the contrary, the last crescent was not visible, then the next day would be *pšḏntyw* of the following lunation. Further more, that day 29 was a prominent day could also be inferred from the list of Feasts of Heaven in the Festival Calendar of the funerary temple of Ramesses III at Medinet Habu, where lunar days 29, 30, 1, 2, 4, 6, 10 and 15 are mentioned and exactly in that order.

Nevertheless, it is highly probable that, at least from the New Kingdom onwards, the ancient Egyptians considered that their lunations started by conjunction, *psḏntyw*, called "*neomenía katà seléne*" (new moon according to the moon) in line 125 of Papyrus Carlsberg 9.

Apart from the lunar day dates, there are frequent references in Egyptian documents and monumental inscriptions that refer to important festivals associated with a particular day of the moon. Frequently, this day of the moon (normally a *psḏntyw*) was at the same time associated with a certain month of the civil calendar. This is obvious for most of the "lunar" feast of the New Kingdom (Opet, *prt mn* or various Amun festivals), as clearly stated in the Medinet Habu calendar[88]. However, several doubts appear when the documentation on the Old and Middle Kingdoms or of the Beautiful Feast of the Valley in the New Kingdom is considered.

In the Illahun Archive, apart from the two mentions of *prt spdt* in day IV *prt* 16 (or 17) in the year 7 of Senuseret III (which we will discuss further in section 7), there are several mentions of some other feasts that has been classified as "lunar" by Luft in his analysis of the data. The most important ones are the Proceeding the Land (*ḫnt nt tꜣ*), Jubilation (*ỉhhỉ*), the Measurement of the Cord of the Nile-mile (*šspt ỉtrw*) and that of Wagi (*wꜣgy*)[89].

86. For distances between *ꜣbd* and *smdt*, see: Luft, *op. cit.* ref. 3, 116 and 198. That *psḏntyw* might not be the first day of the lunation is also challenged by other authors: "*Also, strictly speaking, the conclusion that the lunar calendar commences on the 1st day of crescent invisibility is not certainly proved. I say not certainly proved because the 3* (4) *main pieces of evidence on which the conclusion is based, namely (1) the names of the days of the lunar month, (2) the 25-year lunar cycle of Papyrus Carlsberg 9, and (3) a series of double dates (the lunar month days in the civil calendar)* [and (4) the information about Khonsu in his Karnak temple] *all date from a period more than a millennium or two later than the date when the old lunar calendar flourished*", Clagett, *op. cit.* ref. 4, 22. Even Depuydt (*op. cit.* ref. 3, 183) argues: "*The priests may have observed new moon and full moon without conceiving of articulations of lunar months into lunar days and lunar months into lunar years. The occasional use of ꜣbd "month" and rnpt "year" to refer to lunar intervals would then just be a loose usage of these terms by vague analogy with the civil year*".
87. Rolf Krauss, *op. cit.* ref. 21, *Excursus* III.
88. El-Sabban, *op. cit.* ref. 59, 60.
89. Luft, *op. cit.* ref. 3, 141.

There are more than seven entries for the feast of the Proceeding of the Land and, when dates are reported, it was always celebrated between III *prt* 1 and III *prt* 17. This means that it was very probably located at *psḏntyw* of the civil month III *prt* and was thus probably articulated within the framework of the civil calendar. Regarding *ỉhhi*, there were apparently two feasts of the same name but the most common and most important was always celebrated on I *3ḫt* and probably at the first *psḏntyw* of the civil year. Finally, we have 6 dates for the feast of *šspt ỉtrw*. This has normally been associated with *prt spdt*, on the basis of the argument that it might have been established with the latter as a reference point. However, the extant data show that the feast was celebrated between III *3ḫt* 25 and IV *3ḫt* 14, so we might then relate it with a feast celebrated at the *smdt* (other important lunar day) of the lunation started in III *3ḫt*, which always would fall exactly between III *3ḫt* 15 and IV *3ḫt* 14. Consequently, these three feasts were apparently well articulated within the framework of the civil year, in the same fashion as Easter is articulated within the Gregorian calendar. Hence, there is no need to claim any sort of lunar calendar to explain their behaviour.

The situation of the "beautiful feast of *w3gy*" is further complicated. Unless the others, which never had a fixed civil-based twin, there are news of a fixed *w3gy* feast in I *3ḫt* 18, with its corresponding Eve on day 17, at least from the Middle Kingdom onwards. This situation originated probably during the last years of the Old Kingdom (6th Dynasty), when a new order is imposed on the festival lists, with *w3gy* before *ḏḥwtyt*. However, there was its moveable counterpart whose first mention must be the oldest feast list of the 4th Dynasty and lasted at least until the end of the Middle Kingdom[90].

The *w3gy* feast was probably an important festival associated with wine, as clearly demonstrated by the following utterance (442):

(819c-820b) of the Pyramid Texts. As a consequence, it has been suggested that it may have been a vintage feast, associated with the cult of Osiris (and its celestial counterpart, *s3ḥ*). Curiously, when the other *w3gy* was fixed within the civil calendar, it was located close to *tḫy* (Drunkenness) and *ḏḥwtyt* (Thoth), both festivals clearly associated with wine and inebriation. Another connection between *w3gy* and vintage might come from the Papyrus Berlin 10007 (recto), where an entrance of the moveable *w3gy* (in II *šmw* 10+X), is followed two months later (in IV *šmw* 1) by the performance of *ḥtp nṯr ḥ3t ỉrp*, where perhaps the first divine offerings of wine of the new vintage (after nearly two months of maceration) would be mentioned[91].

In spite of other Mediterranean countries, where it is normally in September, vintage starts much earlier in Egypt because of the special climatic regime of the country, so that the grape harvest normally lasts from mid-July to mid-September[92]. This mean that a feast celebrating vintage could be performed at any point within that period of time. In 2620 BC, nearly at the beginning of the 4th Dynasty (more or less the moment when the first festival lists were recorded), mid-July Gregorian would have correspond to III *3ḫt* 1 in the civil calendar and mid-September to the beginning of I *prt*. In section 2 (see Figure 5), we had provisionally assigned *w3gy* to month III *3ḫt*.

In the archive of Abusir, there is a *w3gy* feast reported (besides the fixed one) at a date III ? 28, where ? could stand for either *3ḫt* or *prt*. If it were III *3ḫt* 28, it would correspond to mid-July around 2500 BC and thus we might be

90. For the new order and *w3gy* in the Old Kingdom, see: Spalinger, *op. cit.* ref. 28, 163, and Krauss, *op. cit.* ref. 59. For the moveable *w3gy* in the Middle Kingdom, see: Luft, *op. cit.* ref. 59.
91. Spalinger, *op. cit.* ref. 6, 8.
92. J. Robinson (ed.), *The Oxford companion to wine* (Oxford, 1999), 253.

faced with a feast associated with the beginning of the grape harvest, before the severe rising of the Nile flooding. If, on the contrary, it were III *prt* 28, we could need to move more than 250 years in Egyptian history (c. 2250 BC, at the end of the Old Kingdom) to be located in mid-September and, consequently, we might be dealing with a feast at the end of the vintage, when the river was already very high. A date nearer to this second possibility sounds more promising because a feast would be better celebrated at the end of an agricultural event and, especially, because a date a little earlier of 2250 BC is much more probable than 2500 BC for the dating of the Abusir archive. How was the date of the feast calculated?

In the case of the Illahun archive, we clearly have two cases of the moveable *wꜣgy* feast in days II *šmw* 29 of the 9th year of a king and in II *šmw* 17 of the 18th year of yet another king. The kings are probably Senuseret III and Amenemhat III. These dates have been assigned by Krauss and Luft to lunar day 17 (or 18) of the second full "lunar month" after the heliacal rising of Sirius (occurring in IV *prt*), considering that *prt spdt* might have acted as a sort of zero point for the determination of at least this lunar event[93]. Curiously, when the same experiment is proposed by Luft for the Abusir archive, the first full "lunar month" after *prt spdt* is the one which is claimed. Besides, in the Old Kingdom, when the fixed *wꜣgy* was located within the civil calendar, days 17 and 18 of the first month of the year *tḫ*, and not of the second, were chosen, accordingly. At the present moment, I cannot offer an easy solution for this apparent dichotomy. I even doubt that *prt spdt*, which is never reported at this early epoch, was the harbinger of *wꜣgy* in the Old Kingdom, but rather *tpy rnpt*. We have seen that this festival could be either the older name of *prt spdt* or the name of the first lunation after the arrival of the flooding.

93. Krauss, *op. cit.* ref. 21, and Luft, *op. cit.* ref. 3, 232.
94. Spalinger, *op. cit.* ref. 83.

In any case, from my point of view, even if the determination of the date of the moveable *wꜣgy* feast through a Sirius-heralded lunar formula were finally demonstrated (associated with either the first or the second lunation after the heliacal rising), it would not permit me to make as firm an affirmation as that recently stressed by Depuydt in his review paper on the Sothic Chronology of the Old Kingdom, namely that *the link of certain lunar dates (such as wꜣgy) to prt spdt, whatever it was, suffices to claim the existence of an original lunar calendar*, in the same sense as in the Gregorian calendar, the link of Easter with the full moon after the vernal equinox does not open the gate to the definition of a equinox-heralded lunar calendar.

As stated before, a final problem has been identified with the Beautiful Feast of the Valley (*ḥb ỉnt nfr*), eponymous festival of the new name of month II *šmw* (*p n ỉnt*, later Payni) of the civil calendar. There are no references to this feast earlier than the New Kingdom and the basic reference for it can be found in the festival calendar of Medinet Habu. Surprisingly, the entrance of this feast is not located within the annual feasts (the *tp trw*) but at the beginning of the calendar, even before the lunar day feasts (the *ḥbw nw pt*). This has been variously interpreted as a later addition to Ramesses II's original list or simply because this was a very special feast in western Thebes[94]. The relevant sections are found in Lists 3 and 4 of the calendar:

List 3 reports at its heading:

> Offerings for Amun-Re, king of the gods, [in his Festival of the Valley (which) happens] in II *šmw*. It is *psḏntyw* (1st lunar day) which brings it in. The first day of offerings to this noble god Amun-Re, king of the gods, in the temple of millions [of years of the *nsw-bty*, Wosermaatre Meriamun in the state] of Amun, ….

List 4, in section 7, reports at its heading:

> Offerings for Amun-Re, king of the gods, in the festival of *ꜣbd* (2nd day) in II *šmw*, day of offering to this noble great Amun-Re, … in his good appearance at the Festival of the Valley, … in western Thebes, (in) II *šmw* on every day that it happens

According to this, the Festival of the Valley would have started at the first lunar day in the 10th month of the civil year (II *šmw*, Payni). On that occasion, Amun visited the west bank of Thebes for two days and rested for two nights in the funerary temple of the king. Therefore, for chronological purposes, a reference to Amun resting in a funerary temple in II *šmw* should be related to a first (*psḏntyw*) or second (*ꜣbd*) lunar day.

In principle, everything seems simple. We have yet another lunar feast celebrated at a new moon which is articulated by the civil calendar. However, the problem arises when the extant dates of the feast, obtained through documents (basically ostraca) found in the west bank of Thebes, are considered[95]. These are, on the one hand, II *šmw* 28 in year 7 of queen Tousre and III *šmw* 9 in year 7 of Ramesses III, and, on the other hand, III *šmw* 9 in year 6, II *šmw* 20 in year 20 and II *šmw* 23 in year 22 of, perhaps, Siptah, Ramesses VI and Ramesses XI, respectively. There are no problems with the dates in II *šmw* (*psḏntyw* of this month could be as late a II *šmw* 30) but the question is what to do with a Festival of the Valley celebrated in III *šmw* 9 in the reign of Ramesses III, exactly in the period when the temple calendar clearly states that it is fetched by the *psḏntyw* of II *šmw*.

Again, to solve the dichotomy, it has been argued that it should be in fact the *psḏntyw* of the 10th "lunar month" within the Sirius-based lunar calendar. In year 7 of Ramesses III (c. 1176 BC) Sirius' heliacal rising at Thebes (if this was the site of observation) was around I *ꜣḫt* 27, so *psḏntyw* of the first lunation after it could be at any moment between I *ꜣḫt* 28 and II *ꜣḫt* 27. Ten lunations after, *psḏntyw* could be between II *šmw* 23 and III *šmw* 22, with an error margin of a couple of days. So, the hypothesis works relatively well for Ramesses III and also for Tousre, Siptah and, marginally Ramesses VI. However, it would not properly work for year 22 of Ramesses XI when II *šmw* 23 would be too early for the tenth *psḏntyw* after *prt spdt*. Neither would it work if Memphis had been the site of observation, even for the case of Ramesses VI.

An alternative explanation might have been that it was *pšdntyw* of II *šmw* which fetches the feast, but it was actually celebrated on other important lunar day of the lunation, such as *smdt* (full moon) or, even better and more probable according to the inscriptions (*i.e. on every day that it happens*), if it lasted more than two days (see section 2), perhaps until full moon. Actually, during the Feast of the Valley, the inhabitants of Thebes visited the tombs of their ancestors in the west bank and spent one night at the necropolises. This would have been much more reliable and safer if a bright moon was present in the sky. This would easily account for all the known dates of the feast, concentrated between II *šmw* 20 and III *šmw* 9.

However, that the feast actually started in *psḏntyw* can be inferred by the inscriptions in the heading of list 4, where *ꜣbd* is most likely mentioned as the second day of the feast and, besides, New Kingdom chronologists surely would not like the idea of a longer festival because it could cause some problems with the chronology of the late Ramesside period if the feast would have been celebrated in any day other than *psḏntyw* or *ꜣbd*. So, we do not have a definitive solution for the problem of *ḥb nfr n ỉnt*.

95. I am indebted to Dr. Krauss for providing me with an unpublished text including a whole discussion on the dates of the Feast of the Valley and their chronological role.

Although I have doubts on the use of *prt spdt* to articulate a complete series of lunations (*i.e.* of lunar months within a Sirius-based lunar calendar) during most of Egyptian civilization, there is one striking piece of evidence that it may have been the beginning of something, at least in the Ptolemaic period, when, as we have mentioned, many inscriptions related Sothis to the "beginning" of the "year". This comes from a double civil-lunar date and the Sothic date of the Decree of Canopus[96]. On the one hand, according to the Decree of Canopus, in 237 BC, the heliacal rising of Sirius took place on II *šmw* 1 (first day of Payni). On the other hand, the double date is the 23rd of August of 237 BC, in year 10 of Ptolemy III, and it reads as follows:

[*ḥ3t sp*] 10 [*sw*] 7 *n ip-ḥmt=s … snwt pw … tpy snwt nb*

[year] 10, 7 day of Epiphi (III šmw), ... it is the 6th lunar day, ... the first 6th lunar day of all.

In principle, the first 6th lunar day after *prt spdt* should have been in II *šmw* (Payni) 7 or 8 and not in III *šmw* (Epiphi) 7. However, other possibility is that, following Parker, the lunation starting by *psḏntyw* in 2 or 3 Payni, which is separated by less than 11 days from the rising of Sirius, was "intercalary" and the first actual lunation of the new cycle was that starting in 2 Epiphi, so that 7 Epiphi could be actually the first 6th lunar day of all. Consequently, it might be possible that *tpy snwt nb* was related to the heliacal rising of Sirius but, at the present state of our knowledge, it is not easy, first to confirm it, and second, to understand the exact articulation of that relationship if it were confirmed. Anyway, the evidence points out to the possibility that, in the Ptolemaic period, *prt spdt* was considered as the beginning (or herald) of a certain cycle of lunar feasts.

We hope, in any case, to have shown that, throughout most of Egyptian history, the vast majority of the lunar feasts within the Egyptian year (with the possible exception of the moveable *w3gy* and some doubts concerning *ḥb int*) were clearly articulated within the framework of the civil calendar, and that they were heralded by civil dates. Consequently, it is my contention that there is no need to claim for any sort of articulated lunar calendar (even in the case of *w3gy*) to explain the *modus operandi* of the lunar festivals in the calendrics of ancient Egypt.

7. Can the Egyptian chronology be fixed astronomically?

It is not the intention of this essay to undertake a complete review of the role played by astronomical calculations in the determination of the chronology of ancient Egypt. However, in this paper, we have used a working hypothesis that it is highly relevant to the issue. If the calendar in the Ebers medical papyrus had never been discovered, we would not have a Sothic date to fix the chronology of the beginning of the New Kingdom (see section 8 and Figure 8). Can this "problem" be solved? The answer is probably yes. To do this, I will rely basically on the work recently developed by Krauss on the lunar dates of the New Kingdom and of the Illahun archive[97].

Lunar dates have been considered problematic by the astronomer B. Schaefer, who has established that at least 15% of any lunar visibility (or invisibility) observation would be wrong simply by human (not atmospheric) failure. In a recent paper, he concludes that the *current large uncertainties in predicting lunar visibility and in ancient Egyptian* (astronomical) *procedures do not allow for any possible astronomical solution of Egyptian absolute*

96. Depuydt, *op. cit.* ref. 3, 123.
97. Krauss, *op. cit.* ref. 21.

chronology with lunar dates[98]. However, Krauss has shown, correctly from my point of view, that this contention is overtly pessimistic.

Krauss's main argument is that the date of a certain lunar phase (for instance last crescent visibility) depends not only on the synodic month, but also on the anomalistic and draconitic months which have different lengths and thus do not repeat in cycles of 25 civil years, as the phases of the moon do. Consequently, the interplay of these and other factors makes the behaviour of the moon, every 25 year period, quite different from one period to the neighbouring ones, resulting in a quite complicated pattern if Egyptian lunar dates are shifted in 25 year intervals (besides of the cumulative 1 hour shift in 25 years). A basic trait of the pattern shows that only about 70% of a set of lunar dates repeat in case of a 25 Egyptian year shift. However, because 150 years comprise an approximately common period of the synodic, anomalistic and draconitic months, more dates repeat at this distance, but with a cumulative relative error of a quarter of a day, which still leads to detectable differences in the patterns. It then follows from these facts that a large set of lunar dates ought to yield only one correct solution, *i.e.* a solution where at least 85% of the recorded dates are astronomically correct.

For the time of the New Kingdom, the solution is apparently quite simple. As Krauss (private communication) argues, *the time of Ramesses II is fixed without any Sothic dates. There are synchronisms between Egypt, Assyria, Babylonia and Hatti. It is a fact that Ramesses II was a contemporary of certain Babylonian and Hittite rulers, who were in turn contemporary with certain Assyrian rulers. The uncertainty of Assyrian chronology in the 13th and 14th centuries BC amounts to 10 years only and, in consequence, year 1 of Ramesses II lies at 1290 BC plus or minus 30 years. Within this interval the lunar date from year 52 of Ramesses II allows only the following possible solutions: year 1 should be either 1304 BC, or 1290 BC, or 1279 BC. If one takes into consideration the Festival-of-the-Valley dates from year 7 of Tousre and year 7 of Ramesses III, which are lunar dates* (here may come my problem with chronologists), *it follows that only 1279 BC is compatible with these and other lunar dates.* After that, lunar dates (like Meggido's) and the Elephantine Sothic date (see below and Figure 8) of the reign of Thutmosis III can be used to fix year 1 of this king in 1479 BC.

According to several scholars (and the present experiment), the Sothic date of Ebers papyrus cannot be used to bridge the gap between the 12th and the 18th dynasties. As we will see below, the parameters of the Sothic date from Illahun are also problematic. Consequently, Krauss has relied only in the 21 lunar dates from the Illahun archive, which has been published by Luft. They span an interval of 42 years between year 9 of Senuseret III and year 32 of Amenemhat III. In his analysis, each 25 year period, from 2300 BC to 1300 BC (and some extra periods before and after), has been tested. As clearly shown in Figure 9, there is only one possibility that satisfies the condition that at least 85% of the recorded dates could be astronomically correct (there might be another, slightly above 80%, some 150 years later but this is too late, even with the shortest possible chronology). The conclusive result of the analysis is that the first year of Senuseret III spans from November 1837 to November 1836 BC[99].

How does this solution fit into the Sothic chronology? Apparently not very well. Using

98. For the sentence see: Schaefer, *op. cit.* ref. 12. For the estimates, see: B. Schaefer and L. Doggett, "Lunar crescent visibility", *Icarus* 107 (1994), 338-403. See also B. Schaefer, "Astronomy and the limits of vision", *Vistas in Astronomy* 36 (1993), 311-361.
99. Krauss, *op. cit.* ref. 21. Figure 9 has been produced by the author using Krauss's results.

the well known Sothic date of the Illahun archive, and apparently also some lunar dates, Luft had recently fixed that IV *prt* 17 of year 7 of Senuseret III would have been the 17th of July of 1866 BC. This would locate the 19 year reign of Senuseret III from 1872 to 1854 BC. Finally, in his new handbook of Egyptian chronology, von J. Beckerath has thrown the weight of his authority behind this date and declared it to be *the earliest absolute date of Egyptian History*[100]. Obviously, we face a problem.

Currently, we have a large set of "Sothic dates" (mentions of *prt spdt* in a civil calendar context), although only some of them would be useful for chronological purposes. It could be interesting to make a summary of them, in a rough chronological order:

1. The two mentions of *prt spdt* at the Illahun archive (see below), dated in the reign of Senuseret III.
2. The 1592 BC actual observation of the heliacal rising at Djebel Tjauti, near Thebes, in II *šmw* 20 of year 11 of an unknown king[101].
3. The disputed mention of *prt spdt* in the controversial calendar of the Ebers medical papyrus (see section 8).
4. A block at the Open Air Museum in Karnak, previously discussed, dated to the reign of Amenhotep I. Apparently, *prt spdt* is located between two feasts celebrated in I *prt* 3 and I *prt* 20.
5. A second block, related to the previous but not so easily dated, where *prt spdt* is located between IV *prt* 1 and an unknown day of I *šmw*[102].
6. The *prt spdt* entrance on the Buto Stele, undoubtly made in the reign of Thutmosis III. The day of crossing of Sothis is placed between two feasts celebrated in I *šmw* 4 and I *šmw* 30.
7. The 1432 BC heliacal rising of Sirius at Elephantine, in III *šmw* 28, in an unknown year of a king which is almost certainly Thutmosis III. This is from a festival calendar of the temple of Khnum at Elephantine[103].
8. The Cosmology of Nut at the Osireion in Abydos, built in the reign of Sethy I. The heliacal rising of Sirius can be dated in IV *prt* 16[104].

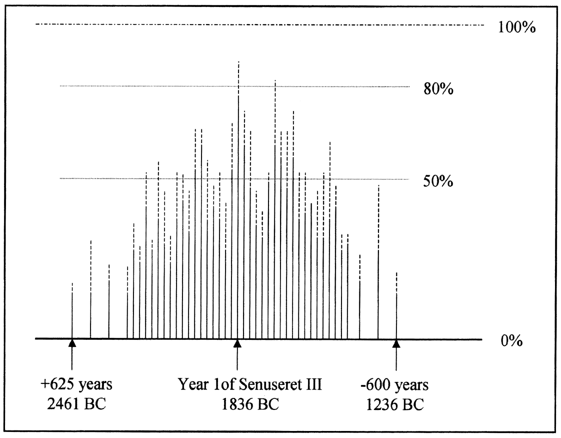


Figure 9: Histogram of 21 lunar dates from the archives of Illahun, from year 9 of Senuseret III to year 32 of Amenemhet III (12th Dynasty), matching the actual behaviour of the moon as a function of time, in intervals of 25 civil years from 2311 to 1386 BC. The only possibility above the 85% line of good hits (theoretically, the maximum one associated with human eye and brain capability) might set year 1 of Senuseret III in 1837/36 BC, independently of Sothic chronology. Solid lines indicate the percentage of those cases in which old crescent visibility would have been observable without reasonable doubt and dashed lines those cases in which the calculated height of the crescent would have been within the zone of uncertain visibility. (Adapted from Krauss 2003)

100. See: Luft, *op. cit.* ref. 3, 224, and J. von Beckerath, *Chronologie des Pharaonischen Ägypten: Die Zeitbestimmung der Ägyptischen Geschichte von der Vorzeit bis* 332 *v. Chr.*, *MÄS* 46 (Mainz, 1997).
101. J.C. Darnell and D. Darnell, "Gebel Tjauti rock inscription 11", in *Theban desert road survey in the Egyptian Western Desert*, Vol. 1. *Gebel Tjauti and Wadi El-Hol rock inscriptions* 1-45 (Chicago, 2002), 49-52.
102. Spalinger, *op. cit.* ref. 6, plates II and III.
103. El-Sabban, *op. cit.* ref. 59, 31.
104. Clagett, *op. cit.* ref. 4, 357.

9. The festival calendar of Ramesses III at Medinet Habu. According to this calendar, *prt spdt* occurred in I *3ḫt* in this period.

10. The Canopus Decree, where there is an attempt to fix *prt spdt* in II *šmw* 1 (First of Payni), as occurred in 238/237 BC, probably in Memphis.

11. The date of instauration of the Alexandrian Calendar. It indicates that in 25 BC, *prt spdt* took place in III *šmw* 25.

12. The credited and famous report of the Roman scholar Censorinus in his *De Die Natali Liber* (XXI, 10). The heliacal rising of Sirius and the First of Thoth (I *3ḫt* 1) coincided in 139 AD, probably in Alexandria. This is the pivotal date for the Sothic approach to Egyptian chronology as the end of a Sothic cycle of, theoretically, 1461 wandering civil years.

Only the last ones are fully reliable but are from an epoch when Sothic dating is not needed. In contrast, none of the dates in the period when the chronology is not fixed by independent sources is completely reliable (*i.e.* before Thutmosis III). As we have seen before, the case is especially dramatic for what has been considered the most important of all Sothic dates in Egyptian historiography, since the discovery of the Illahun archives more than a century ago.

The question is that the information actually compiled at the archive is controversial in nature. On the one hand, in a letter dated in III *prt* 25 of the 7th year of Senuseret III, the Prince of the Overseers of the temple, Nebkaure, informs the chief lector priest Pepyhotep, that the heliacal rising of Sirius will occur in that year in IV *prt* 16 (*i.e.* he is making a prediction). But, on the other hand, in another section of the same document of the archive, the offerings for the feast of the heliacal rising of Sirius (*ḥbyt nt prt spdt*) are brought to the temple in IV *prt* 17.

Normally, the offerings for a feast arrived to the temple one, or even two, days before the proper day of the festival. So, if the offerings arrived in IV *prt* 17, *prt spdt* must have been scheduled in IV *prt* 18 or 19 (or even later). Consequently, Luft and Krauss have argued for a correction of the original date, where an scribal error would have written 16 where actually 18 (or 19, both entries are possible) should have been written[105]. After this correction, Luft obtained his date of 1866 BC for the heliacal rising and the 7th year of Senuseret III, mentioned before, which is in open contradiction with Krauss's estimation from lunar dates of 1830 BC as the date of Senuseret III's year 7. To solve this problem, Krauss[106] has proposed that the date of the feast of the heliacal rising of Sirius was not actually observed locally but rather predicted, within a framework of a permanent four civil year cycle, and calculated for the southern frontier of the country, *i.e.* Elephantine. According to his proposal, the actual heliacal rising of Sirius would have taken place in IV *3ḫt* 18 in Elephantine on July the 9th of 1830 BC.

This situation is illustrated in Figure 10, where the Julian dates of the heliacal rising in 1830 BC, for different locations within Egypt, are presented. However, with this figure in mind, there would be another striking possibility. During the seventh year of Senuseret III, the actual frontier of Egypt was not located at Elephantine but more than two hundred kilometres further to the south, at Buhen. The heliacal rising of Sirius actually would have taken place on IV *prt* 16 at that locality in 1830 BC. So, we could speculate with the idea that, considering the local character of this astronomical event, the date of the rising would have been predicted for the actual day of the rising in the extreme southern limit of the country (Buhen at that moment) and that the actual feast would have been locally cele-

105. For day 18, see: U. Luft, "Remarks of a philologist on Egyptian chronology", *Ägypten und Levante* 3 (1992), 109-14, and R. Krauss, "Egyptian Astronomy", Ph.D. Course. La Laguna University (2002).
106. Krauss, *op. cit.* ref. 21.

brated several days later and not necessarily at the exact date of the event. This might explain why the *ḥbyt nt prt spdt* were actually brought to the temple in Illahun in IV *prt* 17, thereby avoiding the necessity of blaming the scribe, a common practice in Egyptology when the data do not fit the wishes of the investigator.

As a matter of fact, we believe that lunar and (with minor doubts) Sothic dates can fix the chronology of ancient Egypt as far as the beginning of the Middle Kingdom. For earlier periods, from my point of view, the discussion is overtly open[107].

8. What might the Ebers calendar represent?

We have seen in the previous sections that we have been able to find, or at least to glimpse, simple solutions for many tirelessly discussed problems of Egyptian calendrics. I am convinced that we have been successful in our purposes because we have been completely free from the Ebers syndrome.

The Ebers Medical Papyrus is, from the palaeographical point of view, a New Kingdom copy of an earlier document with medical receipts, which had been ascribed by the Egyptians to a king Athothis of the First Dynasty. In the verso of the papyrus, another hand later wrote the famous calendar in a hieratical script that has also been considered typical of the New Kingdom, although this datum would be controversial. It was discovered somewhere in Thebes in the 1860s, becoming available to the researchers since 1862[108]. From its discovery, the calendar was a key point in any discussion on Egyptian calendrics, receiving almost as many interpretations as scholars who have investigated it.

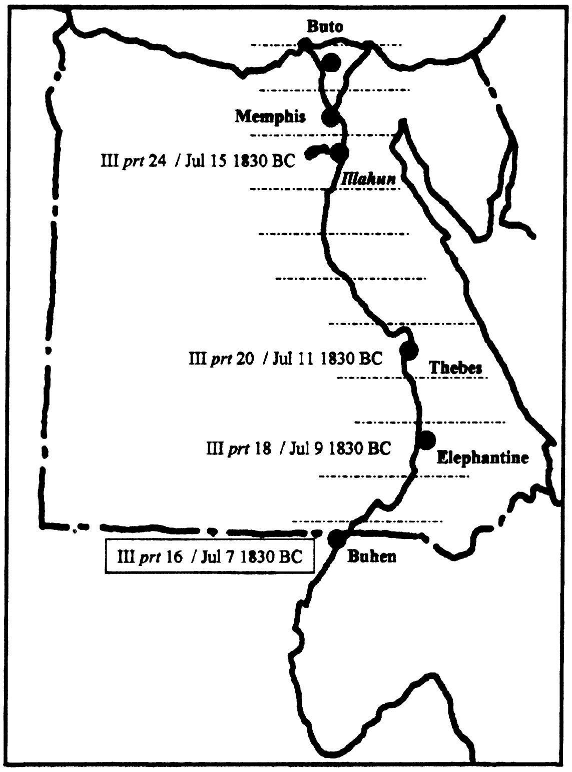


Figure 10: Map of Egypt showing the dates of the heliacal rising of Sirius (Egyptian prt spdt) in July for different geographical locations in the country, in the 3rd month of prt of the 7th regnal year of Senuseret III (1830 BC according to Krauss). At that stage, the southern limit of the country was fixed at Buhen, where the rising (prt spdt) occurred 10 days earlier than in Buto, the sacred city on the Delta

The structure of the "calendar" can be seen in Figure 11, where a facsimile of the original (in Leipzig University) is presented. From right to left, and from top to bottom, it consists of:

· A horizontal row (D), where a typical dating formula is encountered (year 9), which, surprisingly, does not start at the upper-right corner of the text as it would have been expected. The reading of part of the name of the king

107. For discussions on the "astronomical" chronology of the Old Kingdom, see e.g.: K. Spence, "Ancient Egyptian chronology and the astronomical orientation of pyramids", *Nature* 408 (2000), 320-324; Belmonte, *op. cit.* ref. 43; or Depuydt, *op. cit.* ref. 59.

108. For the story of the Ebers, see: Clagett, *op. cit.* ref. 4, 193. See also: Depuydt, *op. cit.* ref. 5.

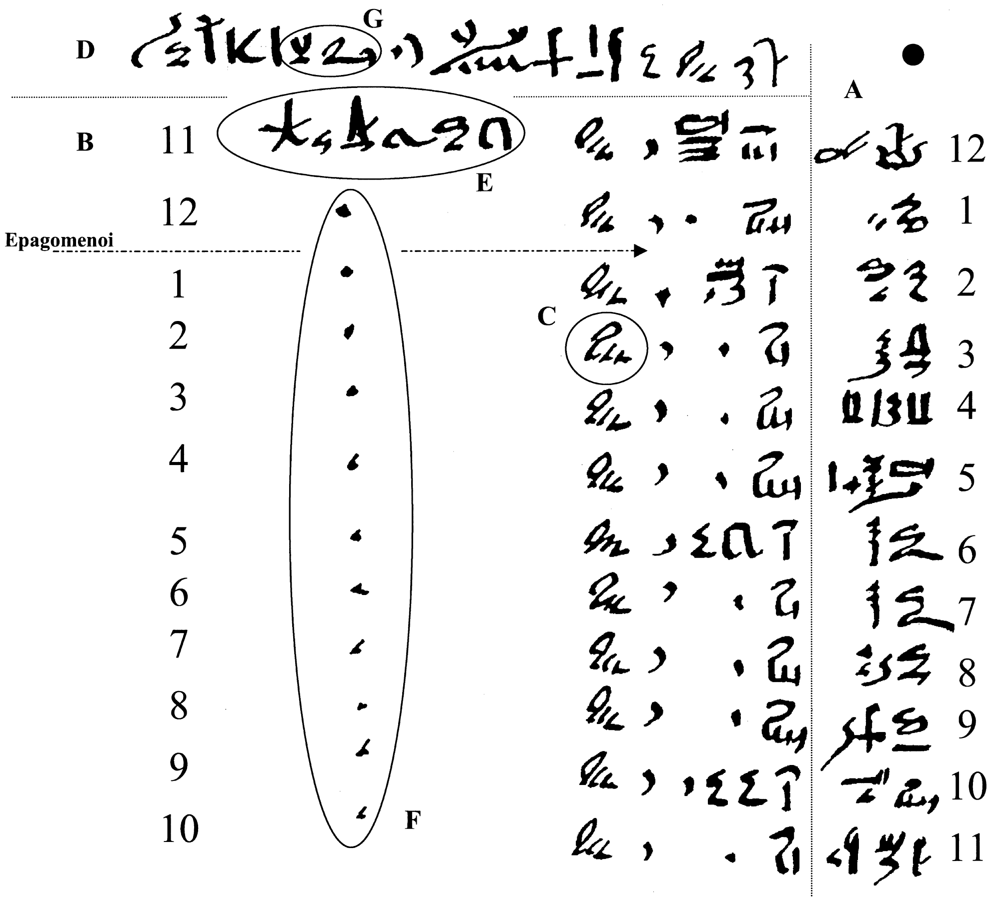


Figure 11: Facsimile of the hieratic original of the Calendar in the Ebers Medical Papyrus, defining the different areas that are relevant to any attempt at interpretation: the month name column (A), the civil date column (B), the number nine (9) column (C), the regnal year row (D), the rising of Sirius (E) and the associated dot column (F) and, finally, the problematic signs of the king's name (G). See the text for further discussion

(G) had been the subject of controversy in the past. However, most scholars agree to read *ḏsr-kꜣ-rꜥ*, the throne name of Amenhotep I, which would place the calendar at the beginning of the New Kingdom rather than in the Middle Kingdom.

· A vertical column (A), with the 12 names, as we have demonstrated, of the months of the civil calendar but in a strange order, starting by the 12th month, *wp rnpt*.

· A column (B), with dates in the civil calendar, using seasonal names and starting with the month III *šmw* (equivalent to *ỉpt-ḥmt=s*). The digit symbol C, following the symbol for day (*sw*) is normally read as 9, but it has been suggested that it could also be read as *psḏntyw*.

· An entrance (E), where the heliacal rising of Sirius (*prt spdt*) is mentioned in apparent association with *wp rnpt* and with III *šmw* 9 (or *psḏntyw*).

· A column of dots (F), just below the heliacal rising entrance.

As can be seen, the structure is really complicated as it relates seasonal and proper names of the months of the civil calendar in a way that is not at all clear and, at the same time, it apparently offers one of those rare jewels for chronologists, a Sothic date. One of the most important problems of the calendar is the complete absence of the epagomenal days, which should have been present between IV *šmw* 9 and I *ꜣḫt* 9 (it should have been 4). Of course, once more the solution has been to blame the scribe for an inexcusable fault. Borchardt[109], when preferring the reading *psḏntyw* for the sign (C), was actually trying to avoid this problem since the 5 *ḥryw rnpt* can be perfectly acquainted between the *psḏntyw* of IV *šmw* and the *psḏntyw* of I *ꜣḫt*.

Of all the possible interpretations that one can find in the more than 40 papers published in the literature on the Ebers calendar, I have made a short selection of the most successful interpretations (in term of their followers, not of real success). These would be:

I. It is a example of the gliding calendar, where a fixed Sothic year is represented together with the wandering civil year. The first column represent a feast calendar in the fixed Sothic year, where the festivals are heralded by the heliacal rising of Sirius (in III *šmw* 9) and are celebrated on day 9 of the consecutive civil months. This old theory has been recently re-enacted by Clagett in his pivotal book on Egyptian astronomy and by von Bomhard in her recent book on the Egyptian calendar[110]. As a matter of fact, Ebers is the only proof of the existence of the fixed Sothic calendar. Of course, there is no other instance in which *tḫy* is to be celebrated in IV *šmw* 9 or *ḥwt-ḥr* in II *ꜣḫt* 9, instead of the well attested I *ꜣḫt* 20 and IV *ꜣḫt* 1, respectively.

II. Parker[111] believed that III *šmw* 9 was not only the date of the heliacal rising of Sirius but also of the beginning of the lunar month *wp rnpt*. He argued that the calendar was *a guide for the physician who must have dispensed his prescriptions with concern to the correct lunar month*. The rest of the series of days 9 would in his view be a "schematic" lunar calendar, starting with *tḫy* as the first schematic lunar month after the lunar month of *wp rnpt*, where *prt spdt* is expected to occur. Of course, the idea of a schematic calendar was to avoid the problem of the absence of the 5 *ḥryw rnpt*. There is no other evidence of such a calendar in Egyptian document except for the Ebers, which once more is proving itself.

III. A very recent idea was proposed by W. Barta in the 1980s and has been enthusiastically followed by Luft, von Beckerath and Spalinger[112]. According to Barta, III *šmw* 9 is the anniversary of the accession day to the throne of Amenhotep I (this might be supported by the fact that a feast of the divine Amenhotep was celebrated on III *šmw* 11-13). Then, the 30 day intervals in the Ebers calendar are historical regnal months, each with a proper name borrowed from the civil (or lunar) calendar, and the whole set would represent a civil regnal year, which in the New Kingdom began with the accession of the king. The epagomenal days would not be counted as it is frequent in other civil arrangements of the year. According to Spalinger, one of the supporters of this theory, *the calendar is more of an intellectual product than a true source for chronology*. As a matter of fact, once again, Ebers is the only proof of the existence of such a civil regnal year, and there is no single document where the names of the months could be assigned to such a year. Also, it is not quite clear how to interpret the mention of *prt spdt* after III *šmw* 9. Either the Sothic rising falls on this day or it falls on any day in the 30 day interval

109. L. Borchardt, *Die Annalen und die zeitliche Festlegung des Alten Reiches der ägyptischen Geschichte* (Berlin, 1917), 56-58.
110. von Bomhard, *op. cit.* ref. 4, 32. See also, Clagett, *op. cit.* ref. 4, 193.
111. Parker, *op. cit.* ref. 1, 37.
112. W. Barta, "Thronbesteigung und Krönungsfeier als unterschiedliche Zeugnisse königlicher Herrschaftsübernahme", *SAK* 8 (1980), 33-53; Luft, *op. cit.* ref. 105; J. von Beckerath, "Bemerkungen zum ägyptischen Kalender III: Zum Kalendarium des Papyrus Ebers", *ZÄS* 120 (1993b), 131-136, and Spalinger, *op. cit.* ref. 61.

following that day. In the latter case, the Sothic dating would lose all significance for the absolute chronology of the New Kingdom.

IV. Depuydt, in his erudite paper on the Ebers[113], also postulates the lunar interpretation of the calendar and defends the idea that the days 9 of column (B) do not represent intervals, but rather points in time. The calendar would be the easiest way, from the arithmetical point of view, for the physician to know in which lunar month he is located, within the Sirius-based lunar calendar. This change in interpretation avoids the problem of the epagomenal days. However, such a "simple" device would be useful for a very short period of time and, at the same time, would be absolutely useless on one third of the occasions (always that *prt spdt* fall in the last third of the lunation). Of course, to support his theory, he does not consider the possibility of (C) being read as *psḏntyw*, arguing that the papyrus better reads *sw* 9 instead of *hrw n psḏntyw*.

V. Krauss, without entering deeply into the details of the calendar operation, accepts its interpretation as a schematic lunar calendar[114]. Then, he follows Parker´s explanation that day III *šmw* 9, in the 9th year of Amenhotep I, is the day of the heliacal rising of Sirius and a first lunar day of a lunar month *wp rnpt*. Hence, the first day of the new schematic lunar year would be the *psḏntyw* of the first lunar month *tḫy* on IV *šmw* 9. He then uses that lunar date for chronological purposes. Once more, I would argue that there is no proof other than the Ebers calendar itself that this set of names was never used to denominate other months, either Sirius-based lunar or civil-based lunar, than those of the civil calendar.

VI. Finally, Leitz[115] has postulated a summer solstice year because schematic lunar months no longer have something to do with the moon, but serve other purposes. Again, the "solar" year does not offer a solution to the problem of the epagomenal days. Once more Ebers comes into its own.

As far as I am concerned, no proposal should receive more credit than any other, even at the risk of losing the possible utility of the hypothetical "Sothic date" for chronological purposes. I suspected that the evident fact that the text in the calendar does not start in the upper-right corner (signalled by a black dot in Figure 11) may be relevant for the correct interpretation of the papyrus. Following this reasoning, I had speculated that column (A), with the name of the civil months in an abnormal order, was not originally written with the rest of the calendar, but added later to the general pattern and would thus possibly be disconnected to the general functioning of the calendar. However, Krauss (private communication), who has personally seen the document, argues against this possibility. Anyway, if this were the case, Depuydt's proposal of days 9 as points of time and not intervals seems to me the most reasonable. We might then even retain the chronological importance of the Sothic date.

However, unless for the rest of the questions presented in this paper, I have no satisfactory answer for the question of what the Ebers calendar represents. In conclusion, we will have to agree with Meyer who already one century ago in his *Ägyptische Chronologie*[116] (it was published in 1904) seemed to give up all hope that the enigma of the Ebers calendar might ever be solved.

113. Depuydt, *op. cit.* ref. 5.
114. R. Krauss, "Das Kalendarium des Papyrus Ebers und seine chronologische Verwertbarkeit", *Ägypten und Levante* 3 (1992), 75-96. See also: Krauss, *op. cit.* ref. 21.
115. Ch. Leitz, "Der Mondkalender und der Beginn des ägyptischen Kalendartages", *BSEG* 18 (1994), 49-60. See also, Leitz, *op. cit.* ref. 3, 26.
116. Meyer, *op. cit.* ref. 34.

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