THE EGYPTIAN CIVIL YEAR — ITS POSSIBLE ORIGINS AND THE SOTHIC CYCLE

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According to Parker (1950) the ancient Egyptians had a luni-solar calendar before they adopted their civil calendar with its year of 365 days. In the earlier calendar the months, tied to the phases of the Moon, were of 29 or 30 days in rough alternation. As a "year" of twelve lunar synodic months total only about 354.36 days, on average, it soon gets out of step with the seasons. Hence a thirteenth or intercalary month was let in after two or, more usually, three years. The Egyptian civil year consisted of 365 days comprising (i) twelve schematic months of 30 days not tied to the phases of the Moon and (ii) five epagomenal days, the latter possibly a vestige of the earlier intercalary month. As the tropical year is almost 365.25 days this Egyptian civil year moved slowly forward through the seasons, hence its Latin name *annus vagus,* the roaming year, poorly translated as "the vague year". It is quite precise and in no way vague in our sense of the word.

The civil calendar seems to have been instituted early in the third millennium B.C., though no serious debate on that question will be entered into here. Whenever it began it was still in operation in Egypt at the beginning of the Christian era. It had been transplanted by the late sixth century B.C. Persian conquerors of Egypt to their homeland and in modified form it constitutes the current Iranian National Calendar. The Parsees in India preserve a slightly earlier Persian modification and the Copts in Egypt and in Ethiopia preserve another modification made by the Emperor Augustus and called the Alexandrian calendar. In all these modifications an extra or sixth epagomenal day is let in about every fourth year making the year in principle like the Julian year.

Further, though the "vague year" was not well based astronomically it appealed through its precision to the Greek astronomers and was still employed by Copernicus for purposes of reckoning.

What I wish to do is to enter into the argument about the bases of choice of a year of 365 days despite its incongruence with some similar astronomical and seasonal periods and to draw attention to an error long recognised by the experts but still perpetuated by many writers on ancient Egypt. The latter concerns the Sothic Cycle said to be 1460 tropical years, during which the beginning of the Egyptian civil year works its way forward through the whole cycle of the seasons or the tropical year.

I

What led the ancient Egyptians, presumably shortly after 3000 B.C. to select a civil or "vague" year of 365 days? There are three astronomical periods which may have had some relevance, though the ancient Egyptians would have had difficulty in distinguishing them and in assessing them with any precision. First, there is the tropical year, which will be explained below. *Circa* 3000 B.C., it was about 365.2425 days. Second, there is the sidereal year, the period between successive conjunctions of the Sun with some fixed star. The sidereal year is about 365.2564 days. Third, there is the period between Sothic heliacal risings, into which I shall go more closely in the next section of this paper. Schoch (1928) has calculated the average period between Sothic heliacal risings at Memphis, an observation and reference point in ancient Egypt akin to Greenwich in modern times, to be 365.2507 days.

It would be unreasonable to expect the ancient Egyptians to have assessed any of these three values with the precision with which they have been stated. It is not unreasonable, however, to expect them to have noticed over even a modest span of years the discrepancy between their "vague year" of 365 days and any of these other periods of about 365.25 days had any of them been deemed to have any relevance. Perhaps the one day discrepancy after about four years or at least the twenty-five days discrepancy after a century should have been noticed.

I wish to discuss three hypotheses concerning the basis of the "vague year" of 365 days, namely those of Neugebauer (1938 and in somewhat amended form in 1942), of Winlock (1940) and of Parker (1950).

Winlock was impressed by the scattered evidence that the Sothic heliacal rising was somehow connected with the beginning of the year. Over and over again there are early references to the going forth of Sothis and the opening of the year. I suggest that Parker successfully explains that this association belonged to the earlier luni-solar calendar. The word *wp-rnpt* referred both to the Sothic heliacal rising and to the lunar month in which the Sothic heliacal rising occurred. If the Sothic heliacal rising occurred late in this month an intercalary or thirteenth month was let into the year so that in the following year *wp-rnpt* in the first sense did not fall after its similarly named month. How, though Sothic heliacal risings as observed from Memphis may have an average period of 365.2507 days, the period between successive Sothic heliacal risings must be stated in whole days. On about three out of four occasions the period will be found to be 365 days and on about the fourth 366 days. Because of poor viewing conditions at one Sothic heliacal rising the period until the next may seem to be only 364 days. Winlock argues that after a few years of observing the ancient Egyptians settled on 365 days and then through their often recognised conservativism stuck to the value. A conservative culture, however, is as likely to be almost as slow in adopting a convention as in abandoning it. Forty years of noting Sothic heliacal risings would favour 365.25 days rather than 365 days. After forty years, a year of 365 days would be beginning about ten days before the Sothic heliacal rising. This proposed origin of the 365 day year lacks plausibility.

Neugebauer, and Parker supports him in principle, argues that the civil year's beginning must have been tied to some recurrent event more variable than the Sothic heliacal rising, because the discrepancy of a fixed 365 days from its average, whatever it was, would be slower in becoming apparent. Neugebauer and Parker differ in respect of what this variable event may have been. I shall state (i) Neugebauer's hypothesis first and objections raised by both Winlock and Parker to it, and (ii) then Parker's hypothesis and my objections to it. Finally I shall return to a weak defence of Neugebauer's hypothesis through some querying of Winlock's and Parker's objections to it.

Neugebauer suggested that the 365 day vague year was based on observations of intervals between the beginning of the flood in the lower Nile Valley. Let me describe in broad terms what we know of the behaviour of the lower Nile during say the last millennium and a quarter (*vide* Popper, 1951). Sometimes around the Summer Solstice the river begins to rise; its rise continues at a positively accelerated rate and then flattens to an asymptote (the maximum); thereafter the level falls exposing the mud-deposited flats; finally there is a season of low water, sometimes so low that it was possible to wade across the river. The Nile has two main sources. One source is in the central East African highlands where rain and melting snow feed a lake system which in turn feeds the White Nile. There is considerable evaporation from the lakes and from the swamps in the Sudan through which the White Nile passes. In the event this source delivers only a fraction of the water in the lower Nile though it does so without great seasonal variation (*vide* Hurst). The other source is in the Ethiopian highlands where rains beginning in the Spring feed tremendous volumes of water and mud into the Blue Nile and to a less extent into the Atbara. Heavy rains in Ethiopia bring early floods of high level, whereas lighter rains result in later and more sparse floods.

Apart from long term variations in metereological conditions in Ethiopia, very recent records of the onset of the flood in the lower Nile are not of much use to us as a consequence of dam-building at the outlet of the lake-system into the White Nile and at Aswan. Winlock cites, and Parker also relies on, some evidence provided by Willcocks in 1889 on periods between successive onsets of the flood. Some are as short as 335 days and some as long as 415. Winlock and Parker consider these periods to be too variable to suggest a central tendency of 365 days. Further, it occurs to me that if some fairly primitive observer wished to find a central tendency in a range extending from 335 to 415 days, he might be tempted to select 375 days. As I shall try to show later I believe Winlock's, Parker's and my initial hunches to be wrong.

Parker produces an hypothesis relying on a somewhat variable period but not so variable as not to suggest a central tendency. Parker convinces me, through his analysis of the Carlsberg papyrus 9, supported by other evidence, that the late schematic luni-solar Egyptian calendar had nine embolistic years with a thirteenth lunar month in a cycle of twenty-five years and that these lunar months of 29 or 30 days related to the phases of the Moon were tied to the civil year. He also convinces me that the luni-solar calendar which existed prior to the institution of the civil calendar with its "vague year" of 365 days, had months which began on the day after the late visible crescent before sunrise and that the intercalary month was let in, as stated above, when the Sothic heliacal rising occurred so late in its month *wp-rnpt,* that it was in danger of falling outside its month in the next year if an intercalary month were not let in. He then goes on to argue that the rate of intercalation in the later schematic luni-solar calendar, as seen in the Carlsberg papyrus, was derived from the rate in this earlier luni-solar calendar and to show that it would yield an average 365 day year. I have two objections. First, I can find no evidence in the data he cites that the early luni-solar Egyptian calendar had nine embolistic years in a cycle of twenty-five years. Second, what I shall call the Carlsberg rate of intercalation would fail to keep the Sothic heliacal rising from slipping out of its month, *wp-rnpt,* in the long run. After 25 years on Parker's calculations the year on the Carlsberg rule averages 364.96 days, a deficiency of .2907 days on average per year or 7.2675 days in 25 years or 30.07 days in a century as compared with the Sothic period. With this rate of intercalation there is simply no way of keeping the going forth of Sothis in the month *wp-rnpt.* I therefore reject Parker's hypothesis.

Let me return now to Neugebauer's hypothesis. Unfortunately we have no records of the dates of the onset of the flood in the early third millennium B.C. so we can not subject his hypothesis to the sort of scrutiny to which I have just subjected Parker's. I shall, however, make use of some data provided over a longer period by Popper than that cited from Willcocks by Winlock and by Parker. They are provided by records from the Cairo nilometer going back to late in the first millennium A.D. There is little direct evidence in these records of the date of the onset of the flood. The best evidence is on the date of "plenitude", when the river reached sixteen cubits (somewhat differently measured at different times) and how high the maximum level was in various years. Unfortunately there are gaps in the records.

As I understand the matter, when the run-off from the Ethiopian highlands is heavy, the onset of the flood in the lower Nile will be early, "plenitude" will be attained early and the maximum water level will be low, whereas when the run-off is low, the onset of the flood will be late, "plenitude", if it occurs, will be late and the maximum water level will be low. As I see the records cited by Popper, "plenitude" about A.D. 1000 to the late 1800s moved forward from about mid-September (Gregorian) to about early August. Over the same period the maximum level rose from an average of about 340 inches to about 424 inches and the minimum level (just before the onset of the flood) from about 98 inches to about 168 inches as measured on the Cairo nilometer. The maximum and the minimum seemed to have reached troughs in about the eighth century A.D. of about 338 inches and 95 inches respectively. In the seventh century A.D. the maximum and the minimum averaged about 340 and 96 inches respectively. I suspect that two factors may be manifested in these data. First, there is clear evidence, presented by Popper, that through silting the river bed in the lower Nile has been slowly rising (and that the channel has been changing). This would tend to have a damming effect slowing down the discharge of the waters as they approached the delta and so building up the height of the flood and advancing the date of "plenitude". Second, though the evidence is slighter there seems to be some cyclical change over time, perhaps related to the variable precipitation on the Ethiopian highlands. In this uncertain context, it is extremely risky to project the records cited by Popper for a substantial part of the second millennium A.D. to the early third millennium B.C. I do so, nevertheless, with a moderate degree of confidence. First, though the date of "plenitude" may have moved forward in our millennium, the average intervals between successive "plenitudes" seem in rather long runs to have been fairly constant. Second, there seems to be long standing evidence that the Sothic heliacal rising was early connected with the onset of the flood. Early in the third millennium B.C., see Table 2 below, the Sothic helical rising occurred at about the Summer Solstice which has been the time when the flood ordinarily begins. The final point I have to deal with is whether the intervals between successive onsets of the flood are too variable to suggest a central tendency. Here I have to rely on the intervals between successive "plenitudes" for two periods namely A.D. 1382-1522 and A.D. 1693-1862 based on the longest runs of near successive annual data provided by Popper (see Table 1). It is true that we find the sort of range reported by Winlock. On the other hand we find a marked tendency for the intervals between successive "plenitudes" to fall within 365 $\pm$ 10 days. This is a sufficient concentration around a given value to prompt a simple-minded people to notice a central tendency and a sufficient variation to hide from them for a long time that they had got the central tendency wrong by about a quarter day. I do not agree with Neugebauer (1942) that because some annual event is recorded in whole days its average in the longer run must come out in a whole day. The data in Table 1 provides clear enough evidence of this. However, assuming that onsets of the floods occurred in patterns like those set out for the "plenitudes" in Table 1, it is not difficult to see that the early Egyptians would take 365 days as a good round estimate of the year which mattered most to them, the "flood", the "showing forth" and the "harvest", whatever Sirius might be doing.

Intervals in days	Period A.D. 1382-1522	A.D. 1693-1862
334-337	0	1
338-341	1	0
342-345	2	0
346-349	4	1
350-353	11	2
354-359	10	5
358-361	15	10
362-365	18	20
366-369	10	21
370-373	14	12
374-377	7	4
378-381	4	1
382-385	6	1
386-389	2	1
390-393	1	0
394-397	1	0
Total	104	79
Mean	364.88 days	365.27 days
355 to **375 d.**	69 (66%)	71 (90%)
350 to **380 d.**	87 (84%)	75 (95%)

Table 1. Frequency distributions of the intervals in whole days between "plenitudes" in two periods.
(Data based on Popper.)

II

As the Egyptian civil year was only 365 days, events such as the heliacal rising of Sirius (or Sothis) and say the Summer Solstice which occurred at intervals of about 356.25 days progressed through the civil year at about the rate of one day in four years. Apparently the Greeks, but possibly the Egyptians before them, worked out that the progress of such events through the whole calendar year occupied 1460 years; whoever did the calculation assumed the value of the Sothic years and of tropical years to be axactly 365.25 days. Eudoxos in the fifth century B.C. reported that the Egyptians had discovered the true year to be 365.25 days, so I assume that the calculation of the Sothic Cycle of 1460 years may have been made sometime in the second half of the first millennium B.C. But when it was made is not crucial to this comment.

Censorinus in *De die natali* (written apparently in A.D. 238) reported that the first day of the Egyptian civil year and a Sothic heliacal rising coincided on 21st (or perhaps 20th) July (Julian dates) in A.D. 139. Because of some identification of the beginning of the Egyptian year with the Sothic heliacal rising (*vide* Parker, 1950) some Egyptologists, e.g. Meyer (1904), argued that the civil calendar of 365 days must have been instituted on the occasion of some earlier coincidence. Using the 1460 year estimate of the Sothic Cycle, coincidences preceding that reported by Censorinus would have occurred in 1322 B.C., 2782 B.C. and 4242 B.C. Believing that there was archaeological evidence of the civil calendar's existence before the 28th century B.C., Meyer declared 19th July, 4241 B.C. to be the first certain date in history. Later scholars, e.g. Winlock (1940), Neugebauer (1942) and Parker (1950) consider the late fifth millennium an altogether too early date and favour an institution somewhere around 3000 B.C. or a little later. That issue, however, is not my present concern. I cite the example to illustrate the weight the Sothic Cycle of 1460 (Julian) years has been asked to bear.

I should like to cite a possibly misleading though correct statement about the Sothic heliacal rising. Parker, after citing certain astronomical considerations, states that observed from Heliopolis and Memphis the Sothic heliacal rising would have occurred on 17th to 19th July (Julian) throughout Egyptian dynastic history. I take the period to be from about 3000 B.C. to about 500 B.C. (or if we add the Persian dynasty, the subsequent short-lived native resurgence and the Hellenistic dynasty the period comes to near the beginning of the Christian Era). I recognise the convenience of reckoning back in terms of the Julian calendar but it is peculiar to remark on an apparent stability of some event in a calendar for some three millennia before that calendar was devised and even more peculiar when it is known that the calendar concerned had an error in it which slowly put it out of step with the seasons.

After these preliminaries I wish to treat in turn some features of (i) the tropical year, (ii) the interval between successive Sothic heliacal risings and (iii) the Egyptian civil calendar with its schematic or "vague years" of 365 days.

The year of the seasons in its strict sense (the tropical year) is to be recognised in terms of the varying north-south positions of the Sun in the sky and of the varying ratios of daylight to night. In a looser sense it is to be recognised in varying mean maximum and minimum temperatures, in cycles of rain and shine or in the case of Egypt of flood and deficiency of water in the Nile, in growth and fruiting of the crops, in mating and lambing or calving among the flocks and herds and so on. The seasons in the looser sense are related to a greater or less degree to the tropical year of about 365.25 days.

The tropical year is the period between successive Spring (or Autumn) Equinoxes or between successive Summer (or Winter) Solstices. An equinox is the occasion when the Sun crosses the Celestial Equator and a solstice when the Sun reaches its maximum position north or south of the Equator. The best modern estimate of the period is (365.24219879—0.00000614 T) days, where T is expressed in centuries after A.D. 1900. This estimate indicates that the tropical year is slowly decreasing. Thus according to it the tropical year *circa* 1500 B.C. was 365.24241055 days whereas *circa* A.D. 1 it was 365.24231545 days. Such differences are scarcely worth noticing but as some of my subsequent calculations will extend over a millennium or more I shall take them into account. Not so that I can be confident about naming 19th July, 4241 B.C. as Meyer did, but instead to show that one cannot be so confident.

The period of the tropical year is very near to the period of the sidereal year which is now estimated to be 365.25636042 days (and increasing by an amount much less than the slight amount by which the tropical year is decreasing). The sidereal year is the interval between successive conjunctions in longitude between the Sun and some fixed star. Kidinnu may have discovered the difference between the tropical and sidereal years, *circa* 300 B.C. (*vide* Cumont 1912, Lockyer, 1894, Fotheringham, 1931), but Neugebauer (1950) has cast serious doubt on this view. Hipparchos certainly demonstrated it in the latter part of the second century B.C. (*vide* Pannekoek, 1961). Using the modern values it may be readily calculated that the Summer Solstice would move forward completely through the Egyptian 365 day year in about 1505.7 tropical years or 1506.7 Egyptian years and the date of a conjunction of the Sun with some fixed star would do so in about 1423.7 sidereal years or 1424.7 Egyptian years.

The heliacal rising of a star occurs just before sunrise after a period during which the star has been blotted out from sight by the brighter light of the Sun as seen from the Earth. A few weeks before conjunction with the Sun, the star wiill be seen setting for the last time just after sunset. Some weeks after conjunction it will be seen rising for the first time just before sunrise: the latter is its heliacal rising. In the case of a star such as Regulus or *alpha Leonis* which lies on or near the Ecliptic (the Sun's apparent path among the fixed stars) the average interval between heliacal risings will be the same as the sidereal year or nearly so. A particular interval must, of course, be in whole days, so most often it will be 365 days but about once in four years it will be 366 days. Failure to see the star on some occasions, because of poor viewing conditions at the horizon as a result of mist, dust and the like, varies the interval by another day or two either way. Sirius or *alpha Canis Majoris,* and with many other aliases such as Sothis, the watchdog of the Nile and the Dogstar, lies some 40° south of the Ecliptic and so has its heliacal rising affected by the slow precission of the equinoxes. Though it remains in fixed (or almost fixed) position relative to the Ecliptic it shifts relative to the Celestial Equator. The average date of its heliacal thus changes over time and the interval between its heliacal risings also varies with the terrestrial latitude of the observer. Birkerman (1968) gives some values at 200 year intervals from 500 B.C. to A.D. 300 for observers at latitudes 46°N, 42°N, 38°N and 34°N. There is one obvious error, judging from a break in the symmetry of the values, but I can readily avoid it. There is another peculiarity in the values which I believe I understand. How could a Sothic heliacal rising occur shortly after midday on 2nd August (Julian) in 500 B.C. for an observer at 42°N? I pass over this puzzlement on the ground that these are possibly calculated times and dates when Sirius is sufficiently far ahead of the Sun to be seen were the Sun about to rise. Using these values I arrive at the following values for average intervals between Sothic heliacal risings:

365.249112 days at 46°N (about the latitude of Zagreb)
365.249612 days at 42°N (about the latitude of Sophia)
365.250050 days at 38°N (about the latitude of Athens)
365.250475 days at 34°N (about the latitude of Beirut)

Extrapolating from these values I arrive at 365.2508 days for an observer at 30°N which is slightly north of Memphis. Schoch found a value of 365.2507 days as the average period at Memphis. Using Schoch's value for the average interval between Sothic heliacal risings at Memphis, the Sothic Cycle is about 1455.9 Sothic "years" or 1456.9 Egyptian years, not much different from Censorinus' 1460 Julian years or 1461 Egyptian years but different enough to take a little wind out of Meyer's alleged claim that 19th July, 4241 B.C. was the first *certain* date in history.

The months in the Egyptian civil calendar were grouped in sets of four to constitute three seasons. The names of the seasons have been variously interpreted. The first seems to be generally taken to mean "the flood". The second variously as "the showing forth" (either of the land as the waters recede or of the verdure) or as "the planting". The third as either the "deficiency of the waters" or "the harvest". All of them seem clearly related to the seasons pivoted on the flooding of the Nile, which is, of course, related to the tropical year modified by meteorological variations in the Ethiopian sources of the Nile. There have been trends and perhaps cycles in the flood. All I need to say here is that quite often the Nile was rising or was in flood at some date in July (Julian) even though the highest levels may not have occurred until later (*vide* Popper 1951) in the season.

I wish to make some further comments. I shall begin with a closer examination of what Censorinus had to say. The text edited by Jahn gives the dates on two occasions of the beginning of the Egyptian civil year, one, *hoc anno,* presumably the year in which he was writing and the other in the hundredth (keep in mind Roman inclusive counting) year before in the consulship of Imperator Antoninus Pius and Bruttius Praesens. Bickerman's list of Roman consuls reveals that the earlier year was A.D. 139, so the later one must have been A.D. 238. The date of the beginning of the Egyptian year on the later occasion is given as *ante diem VII Kai Jul.* (that is, 25th June) and on the earlier occasion, when there was also a Sothic heliacal rising *(quo tempore solet canicula in Aegypto facere exortum),* as *ante diem XIII Kal. Aug.* (that is 20th July). In a footnote to this second date Jahn indicates that *XIII* is a variant of *XII* which appeared in Haverkamp's edition (1743) and in four of the several codices used in preparing the text. In the interval between A.D. 139 and A.D. 238 (ninety-nine years) there would be 25 Julian leap years. Thus if the Egyptian New Year's Day did coincide with 25th June in A.D. 238, then it would have been 25 days later in A.D. 139, that is on 20th July.

I have done some calculation from Bickerman's data for Sothic heliacal risings and conclude that at Memphis in A.D. 139 it may have been on 19th July but more likely 20th July (the Jahn amended date). Censorinus does not say "at Memphis" but merely "in Egypt". Had the observation been made at Thebes, my calculations indicate 16th July as the likely date.

I have already noted Parker's claim that during Egyptian dynastic history the Sothic heliacal rising at Memphis occurred on 17th to 19th July (Julian). My own extrapolations from Bickerman's values indicate that it may have been as early as 17th July *circa* 3000 B.C. and not earlier than 19th July *circa* 500 B.C. Rather than locating it within the Julian calendar, which did not exist until the end of Egyptian dynastic history, it would be better to locate it in an ideal tropical year calendar (the Gregorian is nearer to this than the Julian). I shall not, however, project the Gregorian calendar back to say 3000 B.C. because it has an error in it which is almost corrected by the additional omission of a leap year every four millennia. Instead I shall use the modern estimate of the tropical year which for this purpose I shall assume begins with the Summer Solstice. One needs an anchor point or bench mark which I thought at first might be provided (I was looking for as early a date as I could find) by the oft reported finding of the Council of Nicaea that whereas the Spring Equinox occurred on (it should be "on or about") 25th March when Julius instituted his calendar in 45 B.C. it was occurring on (again better "on or about") 21st March when the holy and presumably learned fathers assembled in A.D. 325. After some thought about the correction which Gregory later made to the Julian calendar I recognised that Julius' excessive use of leap years could not account for four days' change in the date of the Spring Equinox between 45 B.C. and A.D. 325; indeed it accounts for only about 2.8 days' change, which would show up as about three days.

Consulting Tuckerman's tables (1962) I find that on best available modern estimates the Spring Equinox occurred in the early hours of 23rd March (regarded as beginning at midnight) at Rome in 45 B.C. From the same source I calculate that the Summer Solstice occurred in 45 B.C. at Memphis (I am allowing here for the difference in local time) late on 24th June (if measured from midnight or early on that day if measured from sunrise as was the Egyptian practice). Using the difference between the average Julian year (365.25 days) and the modern estimate of the tropical year *circa* 1500 B.C. (365.24241055 days), I extrapolate back from 24th June, 45 B.C. to arrive at about 16th July, 3000 B.C.

Table 2 sets out dates I have calculated for (i) the beginning of the Egyptian civil year, (ii) the Sothic heliacal rising at Memphis and (iii) the Summer Solstice, the second and third being only approximate, in the years 2900, 2800 and 2700 B.C.

B.C.	Civil year beginning	Sothic heliacal rising	Summer Solstice
2900	21st June	— 17th July	— 16th July
2800	16th July	— 17th July	— 15th July
2700	10th August	— 18th July	— 14th July

Table 2. Julian dates of the beginning of the Egyptian civil year, the Sothic helical rising at Memphis and the Summer Solstice in the years 2900, 2800 and 2700 B.C.

Assuming that the Egyptian civil calendar may have been instituted early in the third millennium B.C. as recent Egyptologists seem to agree that it was, it seems interesting to me that in about 2800 B.C. there was a near coincidence of the Summer Solstice, of the Sothic heliacal rising (which was shifting slowly away backwards from the Soltice) and the Egyptian New Year's Day (shifting fairly quickly forwards from both the Soltice and the Sothic rising). In addition in most years the Nile was rising but had not reached its maximum.

It might seem that I have talked myself into a Meyer type conclusion, while ignoring the archaeological evidence which led him to move back from the early third to the late fifth millennium. However, my main purposes have been: first, to call into question the alleged period of 1460 years for the Sothic Cycle; second, to call into question the assumption that there was an identical movement through the Egyptian year of the Sothic heliacal and some tropical event such as the Summer Solitice; third, to draw attention to the fact that the further one goes back in Egyptian dynastic history the closer is the occurrence of the days on which the Summer Solstice and Sothic heliacal rising happen. For good measure I have thrown in the rising of the lower Nile. Not only is the rise of the Nile variable but also within much narrower limits is the determination both of the Summer Solstice and of the Sothic heliacal rising by such means of observation as the early dynastic Egyptians had available to them.

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