



Thebes versus Hattusha: two different ways of understanding time at the end of the Bronze Age

Tebes versus Hattusha: Dues maneres diferents d'entendre el temps al final de l'edat del bronze

The multinational Hittite Empire and the powerful theocratic Ramesside monarchy of Egypt clashed along the shores of the eastern Mediterranean during the Late Bronze Age. Numerous sources shed light on how the Egyptians measured time during that period through their civil calendar. Interestingly, this calendar more or less followed the rhythm of the climatic seasons newly in this period after centuries of wandering on the seasons tapestry. However, evidence as to how the Hittites measured time is scarce and less explicit. The little data from Hattusha nonetheless suggest a lunar calendar attempting to keep pace with the seasons based on a mostly unidentified pattern which might have included an intercalary month. This study briefly summarises and confronts each of the time-keeping systems. They indeed obey to different climatic and sociological conditions. The calendar of the Hittites may have collapsed with the abandonment of Hattusha in the early 12th century BC, whereas that of Egypt survived a period of uncertainty to eventually rule the whole world through its offspring, the Julian and Gregorian calendars.

Keywords: Ancient Egypt, Hittite Empire, Late Bronze Age, calendar: civil, calendar: lunisolar, *Peret Sopdet*, Rameside star-clocks.

L'imperi multinacional hitita i la poderosa monarquia teocràtica ramèssida d'Egipte es varen enfrontar al llarg de les costes de la Mediterrània oriental durant l'edat del bronze final. Nombroses fonts donen llum sobre com els egipcis mesuraven el temps durant aquest període a través del seu calendari civil. Curiosament, aquest calendari seguia més o menys el ritme de les estacions climàtiques, una novetat en aquest període després de segles de vagar pel tapís de les estacions. No obstant, les evidències de com els hitites mesuraven el temps són escasses i menys explícites. Tot i això, les escasses dades procedents de Hattusha suggereixen un calendari lunar que intentava seguir el ritme de les estacions basant-se en un patró majoritàriament desconegut que podria haver inclòs un mes intercalari. Aquest estudi resumeix breument i compara aquests dos sistemes de mesurar el temps. De fet, aquests sistemes obeeixen a diferents condicions climàtiques i sociològiques. El calendari dels hitites pot haver desaparegut amb el col·lapse de Hattusha a principis del segle XII aC, mentre que el d'Egipte va sobreviure a un període d'incertesa per acabar dominant el món sencer a través dels seus descendents, els calendaris julià i gregorià.

Paraules clau: antic Egipte, imperi hitita, bronze final, calendari civil, calendari lunisolar, *Peret Sopdet*, rellotges d'estrelles ramèssides.

Introduction

The two great powers of the eastern Mediterranean toward the end of the Late Bronze Age (LBA) (mid-1200s BC) (see von Beckerath 1997 and Hornung *et al.* 2006 for the chronology of this period) settled on a truce after decades of conflict as their endless clashes almost exhausted their economic and human resources. Their rulers Ramesses II and Hattusili III (fig. 1) thus signed the first peace treaty reported in human history. The act was so far-reaching that a replica of it welcomes foreign delegations in the entrance hall of the United Nations building in New York (Bryce 2024). In the treaty the King of Hatti, in need of legitimation, and the powerful Pharaoh of Egypt concurred that trade and mutual support were more beneficial than a permanent state of war which only favoured their rising enemies

such as the Kingdom of Assyria. The truce was consolidated by the marriage of the eldest daughter of Hattusili and Paduhepa to Ramesses II, the latter having recently lost his beloved wife (possibly Nefertari).

These two powers differed greatly regarding several social, political, and economic aspects, as well as in their approach to time and how to design a calendar. These last points, the main focus of this essay, illustrate how contemporary neighbouring cultures can in fact differ in key features of daily life as the control of time.

Ramesside Egypt was a centralised state where the ruler played an overwhelming role in every sphere of life. After Akhenaten's attempt to place in check the power of the priests, notably those of Amon, former general Horemheb and his Ramesside successors restored order under a military dictatorship. The intention was to reinstall

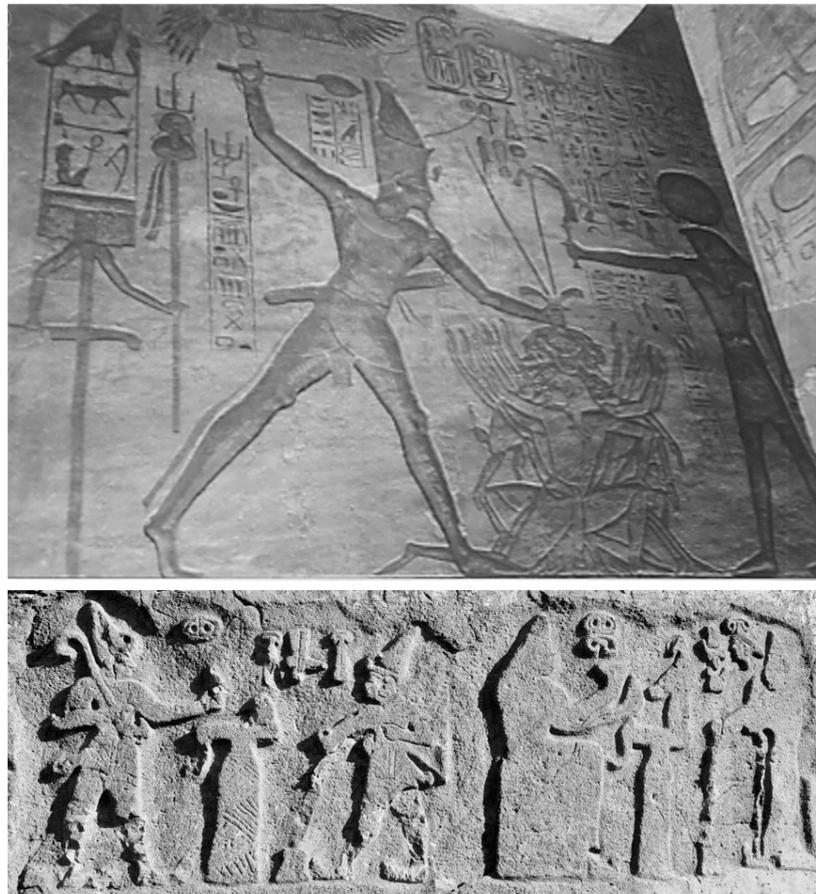


Figure 1. Two different perspectives of the two great antagonists of the Late Bronze Age. Top: King Userma'atra Ramesses (II) executing Hittite enemies after the battle of Qadesh in the freezes of the temple of Abu Simbel. (Photograph by author). Bottom: Fraktin relief in the Taurus Mountains depicting Hittite King Hattusili III (who participated in the Battle of Kadesh as a prince) making an offering to God Teshub. To the right is his wife, Queen Tawannanna Puduhepa, making an offering to Goddess Hebat. (Photograph courtesy of wikimedia-commons).

	CLASSIC SOURCES	CIVIL MONTHS	OLD NAMES	TRANSLATION	NEW NAMES	TRANSLATION
1	Thoth	I <i>3ht</i>	<i>th(j)</i>	Drunkenness	<i>dhwtyt</i>	Thoth's
2	Phaophi	II <i>3ht</i>	<i>mnht</i>	Clothing	<i>p3 n jpt</i>	That of Opet
3	Athyr	III <i>3ht</i>	<i>hwt-hr</i>	Hathor	<i>hwt-hr</i>	Hathor
4	Choiak	IV <i>3ht</i>	<i>k3-hr-k3</i>	Ka on ka	<i>k3-hr-k3</i>	Ka on ka
5	Tybi	I <i>prr</i>	<i>šf-bdt</i>	Emmer Spring	<i>t3 ʿbt</i>	The Offerings
6	Mechir	II <i>prr</i>	<i>rkh (ʿ3/wr)</i>	(Great) Burning	<i>(p3 n p3) mhyr</i>	Low Lands
7	Phamenoth	III <i>prr</i>	<i>rkh (nds)</i>	(Small) Burning	<i>p n imn-htp</i>	That of Amenhotep
8	Phasmouthi	IV <i>prr</i>	<i>rnwtt</i>	Renutet's	<i>p n rnwtt</i>	That of Renutet
9	Pachon(s)	I <i>šmw</i>	<i>hnsu</i>	Khonsu's	<i>p n hnsu</i>	That of Khonsu
10	Payni	II <i>šmw</i>	<i>hnt-hty</i>	First of ...	<i>p n int</i>	That of the Valley
11	Epiphi	III <i>šmw</i>	<i>jpt-hnt.s</i>	Her majesty Ipet	<i>jp jp</i>	(Feast of) Ipet
12	Misore	IV <i>šmw</i>	<i>wpt rnpt</i>	Year Opener	<i>wpt rnpt</i> <i>mswt rʿ hr-3hty</i>	Year Opener Birth of Re ⁶ (Hor-Akhty)
	Epagomenoi	<i>dw [5] hrwy rnpt</i>		5 upon the year		

Figure 2. Proper names of the 30-day long months of the civil calendar plus the five *epagomenoi* (upon or above the year). Besides the classic names, the old (traditional) and new proper Egyptian names are listed, together with their hypothetical translation. A series of month names changed completely in the Ramesside period to adapt to important festivals in the area of Thebes such as *Opet* (*Phaophi*) or the Feast of the Valley (*Payni*). The 12th month changed its name from *Wepet Renpet* to *Misore* at an undetermined moment in the first millennium BC. (Adapted from Belmonte and Lull 2023: Table 5.3).

Egyptian power in the Levant and in Nubia as far south as the fourth cataract (Shaw 2000). In order to control Palestine and the south of Syria, a new capital was founded at Pi-Ramesses. However, Thebes, where the kings were buried, still retained religious primacy with an unprecedented construction programme.

The Egyptian population was presumably a very coherent ethnic group in spite of comprising Nubians as well as Syrians from the petty vassal states south of the Lebanese Mountains. Even if 'Middle Egyptian' still served for monumental inscriptions, a new language, 'New Egyptian', which included determinative articles, was presumably dominant in daily life. A particularly relevant example of this was the creation, perhaps in Thebes, of a new set of names for the months of the civil calendar (fig. 2), as will be discussed below.

The Hittite Empire, on the contrary, was a multi-lingual and multi-cultural state that controlled Anatolia and northern Levant for more than three centuries. From their homeland in the Land of Hatti, and their capital in Hattusha, the Hittite rulers dominated a vast territory with varying frontiers. This 'empire' at its maximum extension in the late 13th century BC included, thanks to a network of vassal states, the vast majority of Anatolia and the north of Syria. The nucleus of the kingdom was formed by the Land of Hatti, the adjacent Upper and Lower Lands, and the neighbouring territories of Kizzuwatna and Tarhuntassa. The region was inhabited by a variety of peoples, including the Hittites, who spoke the 'Nesite' language, an Indo-European language. This was

written in cuneiform script and its name comes from the still unidentified city Nesha. However, the Hittite population of the LBA also comprised numerous groups of Luwians who spoke another Indo-European language written in Luwian hieroglyphs (fig. 1). The Hurrians, particularly in the region of Kizzuwatna, also contributed to the linguistic diversity. There are arguments that Nesite was only used for state politics and religious acts at the end of the kingdom, while Luwian was the language spoken by the vast majority of the population (Bryce 2005; Melchert 2003).

The religious practices and social customs of the Hittites comprised a complex and diverse amalgamation of traditions. The case of religion is of particular significance in this framework given that Hittite and Luwian creeds, influenced by Assyrian traditions, superseded the original substrate of ancient Hattian beliefs (see Taracha 2009 for an examination of the Hittite religion). This situation was further complicated by the influence of Hurrian beliefs on the Hittites. This may have taken place in Hattusha after the seizing of power by Tudhaliya I (c. 1400 BC) and his successors (possibly of Kizzuwatnean origin). Taracha (2009: 33) asserts that this dynasty was instrumental in the creation of the empire. It is thus not surprising that the primary sources referred to the 'Thousand Gods of Hatti'. Therefore, Hittite religion, in its strictest sense, has been described as a syncretistic system endorsed by the state (Singer 1994). The Hittite calendar thus possibly resulted from similar variegated influences.

However, before delving into the debate of how the problem of time control was confronted by these contemporary civilisations of the LBA, it is necessary to devote a few paragraphs to the ultimate reason why keeping time in a simple and coherent manner was so difficult in the past. This leads to the discussion of the problem of incommensurability.

How to face incommensurability

The need to resort to specific astronomical events in order to control time has been subjected since ancient times to one of the problems that has caused the most trouble for astronomers of all times, the notion of ‘incommensurability’. These include phenomena such as the solstices and ‘equinoxes’ (Belmonte 2021), or the rising or setting of certain stars, such as Sirius or the Pleiades. Hence, the natural duration of the most important cycles of time, the tropical year and the synodic month, appear to have been ‘invented’, so to speak, to complicate humans lives.

The lunar month or lunation is a unit of time that is very appropriate to subdivide the seasonal cycle into shorter periods. The full moon likewise must have been very decisive for people possessing no electric light. It is for this reason that the moon served for calendars of almost all cultures of the planet (Stern 2012). However, the first problem of measuring time based on the moon is that the synodic month averages 29.5306 days. The easiest solution was to alternatively define months of 29 and 30 days, not necessarily in a regular basis, leading to an average ‘month’ of nearly 29 and a half days.

This yielded a year consisting of 12 lunar months broken down into 354 days. However, this lacked 11 and a quarter days in round numbers to complete a tropical year of 365.2425 days in Antiquity. This led to the question of what to do with these days? Some cultures or religions, such as Islam, completely ignored them. Others like the earlier Babylonians or ancient Romans occasionally resort to intercalary months with solstices, and maybe equinoxes, or the rising and setting of the stars, as milestones. Others simply ignored the true lunar month and ended up developing a unit bearing the same name that had nothing to do with the phases of the moon (today’s Western culture is a case in point). Finally, certain cultures possessing an advanced mathematical knowledge developed stable systems, intercalating months in cycles of three, eight, or nineteen years to solve the incommensurability.

The simplest nearness between the lunar and solar cycles occurs every three years (fig. 3) as 37 synodic months equates to a total of 1,093 days

yielding an average of three solar ‘years’ of 364¼ days. However, this would be one day shorter than the real one. Therefore, adding an intercalary month of 30 days every three pure lunar years resulted in a reasonable means to adjust the calendar for the typical period of a human life span, which in the past equated with 30 to 40 years. However, finer adjustments were needed for longer periods of time. Hence, this cycle still resulted in a vague lunisolar calendar that required periodic reforms and adjustments.

The next moment of nearness is every 2,923 days (more or less one day) as 99 synodic months are almost equivalent to eight tropical years. The difference is slightly more than one and a half days after eight years, or approximately one month every 150 years. This cycle is called the ‘octaeteris’. This served as the base of the calendar of most Hellenic cities since its ‘discovery’ by Cleostratus in the early 5th century BC and subsequent refinements by Eudoxus of Cnidus in the middle of the 4th century BC.

However, the best possible estimate is due to that 235 synodic months corresponds with astounding accuracy to 19 tropical years, with a dif-



Figure 3. Bronze disc discovered in one of the pre-Hittite so-called royal tomb in Alaça Hüyük (perhaps ancient Arinna). This complex object may have a strong astronomical symbolism with the disc divided in 14 crossed sections, crowned by 12 appendices (one lost) and completed by 3 hanging ‘solar’ crossed symbols. It might schematically represent a year of 12 moons counted 3 times, the simplest way to produce a working lunisolar cycle by adding one intercalary month. This is perhaps being represented by the central disc itself. Being a singularity, there is no additional evidence supporting this hypothesis. (Photograph by author, courtesy of the Museum of Anatolian Civilizations, Ankara).

ference of only two hours and eight minutes per cycle or one day every 213 years. This exceptional coincidence is the basis of the 'Metonic cycle' (named in honour of the Athenian astronomer Meton), who presumably discovered it in 432 BC. However, it is more likely that this cycle, along with the method of intercalating the months serving to work it out, saw and earlier developed in Mesopotamia, where it was adopted as the basis of the calendar. Or perhaps not? A compelling proposal in this sense is discussed below.

It is due to these issues that astronomy was entrusted, among other facets, with the task of adjusting the calendar. It is also likely that the need to control the seasonal cycle led to the first serious attempts to identify the trajectories of the celestial bodies, specifically, the sun, moon, planets, and main stars. This was the case of Egypt and Mesopotamia, and other neighbouring regions. However, the insertion of intercalary months does not seem to have followed any established rule. It was not until the 5th century BC that a stable cycle of intercalations was developed based on the 19-year cycle that served as the basis of the official calendar of Babylon during the Seleucid Empire (and perhaps earlier). This was ultimately spread by the Jewish diaspora and from there passed on to the Christian church, where it served as the basis to calculate the dates of Easter well into the 16th century.

The problem of adequately squaring the seasonal cycle with the movements of the sun and the moon provoked King Alfonso X of Castile, to complain about the God's 'subtlety' when creating such a complex scheme. This ruler known as the 'Wise' went as far as to argue that if it had been his duty to create the Cosmos, he would have made it less complicated.

The Civil Calendar of ancient Egypt

One of the greatest mysteries remaining today, despite the spectacular advances of Egyptology since the decipherment of the hieroglyphs almost two centuries ago, is the question of the origin of ancient Egypt's 'civil' calendar which served as the basis of calendrics in the Nile Valley. Several hypotheses have been the subject of endless debate (Parker 1950; Spalinger 1994; Wells 1994; Depuydt 1997; von Bomhard 1999; Spalinger 2018). This analysis retains the hypothesis we have defended for years (Belmonte 2003) that has been recently upgraded by Belmonte and Lull (2023: 320).

This 365-day civil calendar, which can be catalogued as a solar calendar, probably dates to the outset of the Pharaonic Era, presumably during the 2nd Dynasty, when there is the first evidence of the Cult of the Sun-God Ra (Krauss 2011). It

was fully developed during the Old Kingdom as it served to govern the offerings in the cemetery of Saqqara. This is evidenced by papyri dating to the reign of Userkaf that cite events that took place at the end of the 4th Dynasty under the rule of Menkaura.

This revolutionary calendar consisted of twelve months of 30 days each, divided into three decades totaling 360 days. To these were added the 'Five upon the Year' (fig. 2), five additional days called *epagomenoi* in Hellenistic sources. These were dedicated, at least since the New Kingdom (as it was thought they rhymed with their moment of birth), to five of the greatest ancient Egyptian deities: Osiris, Isis, Seth, Nephthys, and Horus the Elder. These five days, which upped the total to 365, stood apart (hence the name) and were not taken into consideration within the general computation of the year.

The months, in turn, were grouped into three 'seasons' of four months (fig. 4), known since the earliest documents as Inundation (*Akhet*), Going Forth (*Peret*), and Drought (*Shemu*, perhaps literally meaning 'water in the ponds'). The last two were at times in Hellenic texts termed as winter and summer. These designations, with season and an ordinal number from I to IV, were common throughout the Pharaonic period. In fact, they are the only cases that appear to be standard among the monumental hieroglyphic inscriptions.

However, the months in Greek and Aramaic papyri from the Hellenistic period and in later Coptic texts are not named in this way but referred to by a series of standard proper names. These include the names of certain divinities. Figure 2 lists the names in later sources (and Coptic) and the old and new names of the months as reported in Pharaonic registers. It is compelling that these have been preserved in spoken Arabic in Egypt and are still used by the Coptic Church to establish the corresponding Christian festivals.

These names, which can be traced back to the original Egyptian language, have been the subject of great controversy. Almost all of these names have been found in lists of festivals, where they may correspond to proper names of months, and in hieratic inscriptions, written mostly on ostraca and papyri dated to the LBA. These have been mostly discovered at Deir el Medina, the village of the workmen who built the royal tombs at Thebes. The fundamental discrepancy is the name of the twelfth month, *Misore*, which clearly relates to the Egyptian *mswt-ra* ('birth of Ra'). However, this name does not appear in that form in the inscriptions as it was most often replaced by *Wepet Rempet* (i.e., 'the one that opens the year'). Of interest is also the use in I *Akhet* 1, the First of Tehy among the older names, and the First of



Figure 4. Relief depicting the three seasons of the Egyptian calendar (*Akhet*, *Peret* and *Shemu*) originally based on the Nile cycle. The scene decorates a door-jamb at the gate of the Tomb of Mereruka (Vizier of King Teti, 6th Dynasty) in Saqqara. The 'Five upon the Year' are absent from the scene. (Photograph by author).

Thoth among the new versions of the Egyptian New Year festival (fig. 2).

The civil months depicted in the friezes of the Hellenistic Temple of Horus at Edfu appear associated with a series of proper names that only minimally align with those discussed above. These other names do appear on other occasions in hieroglyphic inscriptions, such as that of the Tomb of Senenmut (where the last month is nonetheless *Wepet Renpet*). These probably are the original names of the months of the civil calendar (Spalinger 2018; Belmonte and Lull 2023: 335). However, worth noting is the suggestion by Depuydt (1997) that this was somehow related to a parallel lunar calendar, an argument not espoused by Belmonte (2003).

One of the peculiarities of the 365-day calendar is precisely its length. The duration of the tropical year being about a quarter of a day longer implies that all cyclical events, including those of astronomical nature, are delayed by one day every four years (fig. 5). Among these singular events was the heliacal rising of the star Sirius (*Sothis* in Hellenic sources) called *Peret Sopdet*, a key festival of the annual calendar since it was supposed to be the harbinger of the flooding of the Nile. It was indeed a vital climatic phenomenon of social and economic significance throughout Pharaonic history (fig. 6). A delay of one day every four years meant that the timing of *Peret Sopdet* rotated throughout the civil calendar over a period of 1,460 years, known as a Sothic Cycle. The actual period is shorter, about 1,453 years, due to the

star's proper motion. According to Krauss (1985), the civil calendar was designed from its inception with this in mind, meaning that *Peret Sopdet* would be delayed one day every four years. However, there is hardly any evidence backing this in ancient sources.

It has often been assumed since first proposed by Parker (1950), but never absolutely proven, that *Peret Sopdet* equated with *Wepet Renpet* at the dawn of Egyptian civilisation when the civil calendar was created. This latter was the beginning of the civil calendar on the first day of the first month of the Inundation (I *Akhet* 1), when this and the beginning of the actual Flooding must have nearly coincided in time.

However, there is no trace of *Peret Sopdet* prior to the Middle Kingdom (see Krauss *in press* vs. Habitch *et al.* 2015). It is for this reason that Belmonte (2003) defended that the coincidence between the observation of the solar zenith-pass, during the summer solstice at Elephantine, with the arrival of the true flooding, was a better milestone to mark the origin of the civil calendar in the Protodynastic period. The timing of the *Wepet Renpet* subsequently began to wander through the climatic seasons (approximately one day ahead every four years) completing a cycle in about 1507 years. This period is slightly longer than, albeit similar in scale, the Sothic cycle (fig. 5).

This delay certainly did not go unnoticed. However, the point is that it was not considered sufficiently relevant to alter the normal course of things and merit modifications to the calendar. It

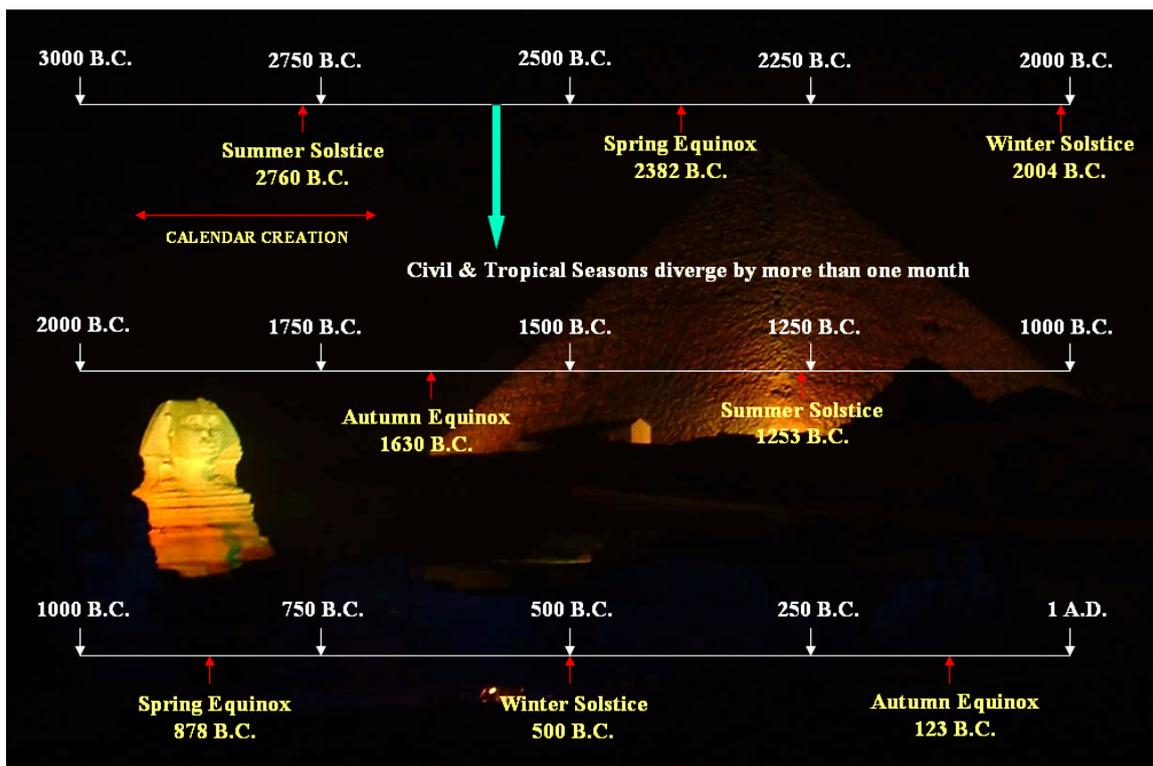


Figure 5. The New Year Festival (*Wepet Renpet*) of the Egyptian civil calendar as a wandering date on the season tapestry versus time, circling in c. 1507 tropical years. It is noteworthy that the civil and climatic seasons were in phase again c. 1250 BC during the reign of Ramesses II, for the first time after the creation of the calendar in a period centred in c. 2760 BC. This will not repeat until the Roman era. (Schema by author).



Figure 6. The Nile Flooding covering the fields of Egypt to the desert limits in the late 19th Century. This event marked the beginning of the economic year in ancient Egypt. It also precisely signalled the beginning of the civil calendar, with the first day of the first month of the Inundation (*I Akhet 1*), only when the calendar was created just before the era of the pyramids, and, fifteen centuries later, during the Ramesside period. (Adapted from an original old image by Lehnert and Landrock).

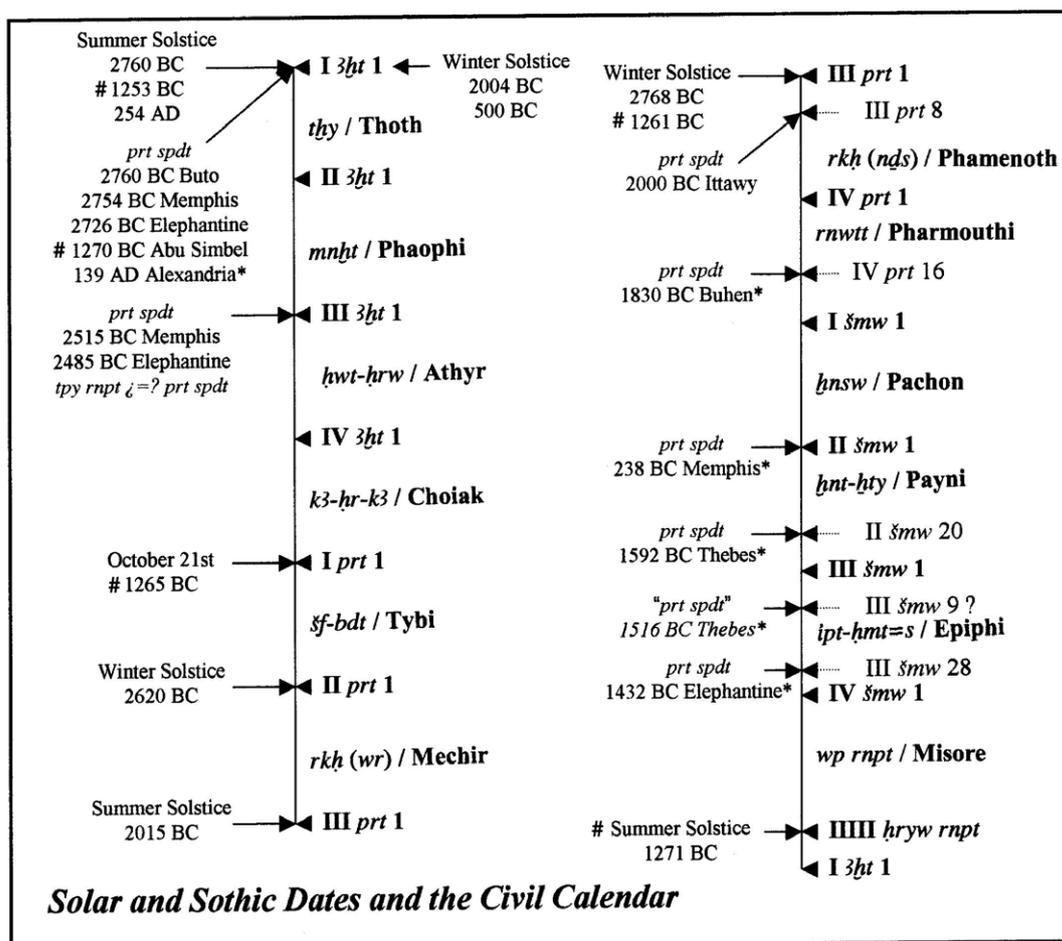
represented a time-keeping system whose great regularity from the economic, fiscal, administrative, and social standpoints rendered it so powerful that it apparently remained unchanged for more than 2,500 years.

Ptolemy III during the Hellenistic period unsuccessfully attempted to reform it in 238 BC by adding a sixth epagomenal day every four years (fig. 7). This reform known as the Decree of Canopus was only imposed under Caesar Augustus once Egypt had lost its independence (the Alexandrian calendar, which is still used by the Coptic church). In any case, the civil calendar continued in use in parallel to the new calendar. It was applied by the astronomer Claudius Ptolemy in all his calculations and 'endured' until the Renaissance, as Copernicus based his measurements on it.

This circumstance rendered it possible to determine when Thoth 1 coincided with the helia-

cal rising of Sirius, already in Roman times. This took place according to Censorinus in his *Die Natali Liber* in 139 AD under Emperor Antoninus Pius.

This information served as a milestone rendering it possible to establish the Egyptian chronology with relative accuracy. This is possible because the Egyptians referenced (albeit rarely) the date of the heliacal rising of Sirius in the civil calendar (fig. 7). Therefore, it is sufficient to calculate retrospectively, from the initial date provided by Censorinus, in order to know, in theory, with a small margin of error, on what Gregorian (or Julian) proleptic date such a notation was made. There exist several Sothic dates (Belmonte and Lull 2023: 365). One appears in the Decree of Canopus itself, which fits perfectly with the chronology established by alternative methods. Those of truly useful nature correspond to earlier dates that were registered, if it were not for the fact that



they are not always as accurate as one would expect or desire.

Another critical controversy regarding Egyptian calendrics is the role of religious festivals in society and, above all, their correct placement within the timeframe in the civil calendar. Numerous festival calendars are known from the Old Kingdom to the Graeco-Roman period. Two are notable for their length, number of festivals, and corresponding offerings (El Sabban 2000). On the one hand, there is The 'Million-Year' Temple of Ramesses III at Medinet Habu, which coincided with the collapse of LBA societies of the Levant. On the other hand, there is that of Dendera which is much later. Most calendars from the middle of the New Kingdom onwards, including certain from earlier times, mark festivals that relate to dates in the civil calendar. There is thus little doubt that the civil calendar from the 14th or 13th centuries BC onwards (if not even earlier) controlled much of the country's religious life.

Important singularities are the most relevant moments of the lunar phases (conjunction, first crescent, full moon, and the two quarters). These were always significant to Egyptian religion (unfortunately, there is not enough evidence to determine if they were also relevant to civil society). The civil dates of these lunation days varied from

year to year due to the very structure of the calendar. It was later discovered that 25 calendar years fairly accurately covered a period of 309 synodic months, a notion gleaned from Papyrus Carlsberg 9 dating from Roman times. Therefore, the civil calendar was also a powerful tool serving to predict lunar dates. However, it remains unknown whether the cycle was already recognised and used in earlier moments of Egyptian history, notably during the Ramesside Period. In any case, the moon played a significant role in the Egyptian worldview (fig. 8).

There is nonetheless a hypothesis explaining why the civil calendar gained such a key role in every profane and religious aspect of life. This is based on the fact that the heliacal rising of Sirius in the decades around the turn of the 14th to the 13th centuries BC, depending on the latitude, again coincided with I *Akhet* (fig. 9). A similar circumstance presumably occurred for the actual climatic seasons which again appear, after 15 centuries of wandering, to have matched those of the civil calendar. This means that the Flooding once again took place during *Akhet* (Inundation) and the lower levels of the Nile coincided with *Shemu* (aka Drought). This took place during the reign of Ramesses II (fig. 7) suggesting that the population at the time, including the king himself, must

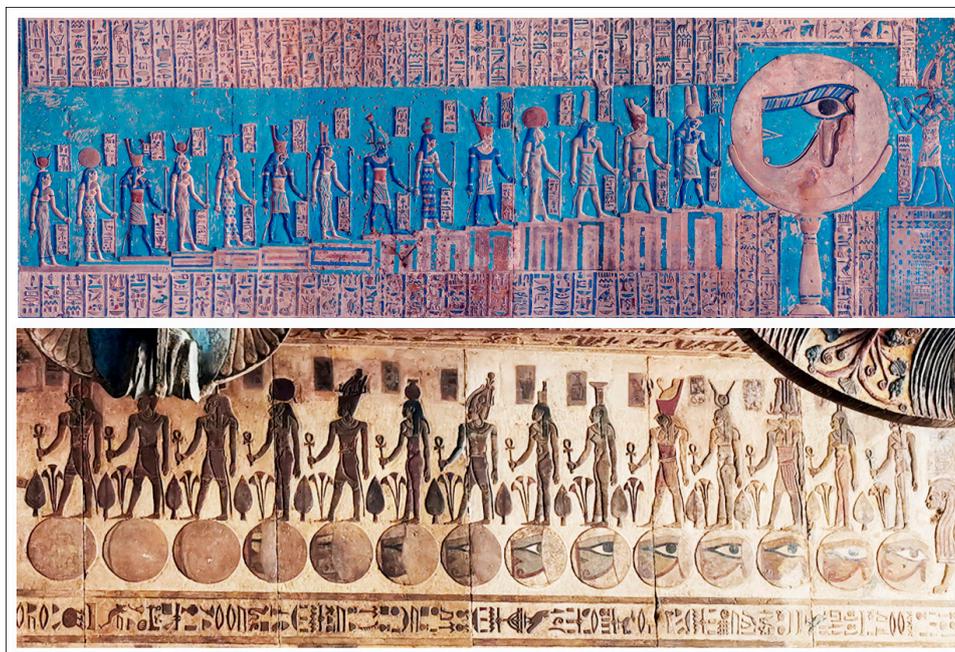


Figure 8. The ancient Egyptians tracked control of the lunar days of a lunation. These days received proper names (Belmonte and Lull 2023: Table 5.4), but also were related to certain deities who enter or depart from the moon at certain lunar days during the waxing and waning phases. This aspect is illustrated in the astronomical ceilings of the hypostyle halls of Hathor (up) and Khnum (down) temples at Dendera and Esna, respectively. The deities and dates are almost, but not exactly, identical, with local peculiarities. (Diagram by the author; lower image courtesy of Artiom Gizum).



Figure 9. The column to the right of the month of IV *Shemu* in the astronomical ceiling of the Ramesseum at the Western Bank of the Nile at Thebes reads: ‘may you bright as Isis-*Sopdet* in the sky in the morning of *Wepet Renpet*’. This indicates that at a period during the reign of Ramesses II, *Peret Sopdet* was in coincidence with the season wandering first day of the civil calendar or *Wepet Renpet*. (Photograph by author).

have felt that the logical order of time once again were in accord with the organisation of the cosmos and that they were living in an epoch blessed by the gods.

The same obviously does not apply to the earlier periods. An example is the existence in the Old Kingdom of two *Wagy* Feasts, the most important associated with Osiris. One was fixed within the civil calendar (I *Akhet* 18), while the commemoration of the other fluctuated over time. The latter was perhaps determined by the first full moon, or another important moment in the lunar cycle, after the outset of the actual Flooding (Spalinger 1994). This was delayed during the late Old Kingdom by several months to the beginning of the season of the Inundation (*Akhet*) and by half a year during the Middle Kingdom. Subsequently, only the former, the civil *Wagy*, endured, and during the New Kingdom, notably during the Rames-

side Period, the 365-day civil calendar reigned in solitude.

However, there is no doubt that the Egyptian religion was affected by the persistence of a series of festivals linked to various relevant phases of the moon, notably the ‘Beautiful Festival of the Valley’, or *p n int*, the origin of the month *Payni* (fig. 2). These are likewise key to establishing chronological issues. Moreover, certain stellar deity festivals such as *Peret Sopdet* also prevailed. Although governed by the moon cycles or the stars, they also remained firmly within the framework of the civil calendar. Their timeframes functioned similarly to how the current Gregorian calendar includes celebrations such as Easter or the Pentecost (or even profane festivals such as Carnival) calculated by phases of the moon.

Another theme worthy of mention is that of the Egyptian systems of night-time measurement, the star-clocks (Neugebauer and Parker 1960-69; Leitz 1995; Belmonte and Lull 2023: 113). Three types have been identified: diagonal decanal clocks; the ‘Fundamentals of the Courses of the Stars’ (von Lieven 2007) formerly known as the Cosmology of Nut; and the Ramesside transit stellar clocks. The first saw use during the First Intermediate Period and the Middle Kingdom. The last two, probably used during the New Kingdom, have been unearthed in tombs and cenotaphs of the Ramesside period (see fig. 10 for examples in paintings from the transition of the LBA to the Iron Age).

The diagonal decanal clocks, the oldest of the three, have been identified on the lids of certain coffins of officials and priests from the First Intermediate Period and the Middle Kingdom. Although dated to the late third millennium BC, they may be earlier. Based on the civil calendar, their name comes from the assignment of a special star or asterism to each decade of the calendar, hence the term ‘decan’. The second type, the ‘Fundamentals’ model, appears to be an evolved version of the decanal. It came into use when the former ceased to be functional around 1800 BC due to the precession of the equinoxes. Examples of this type are associated with the representation of the sky Goddess Nut on the ceilings of the funerary chamber of Ramses IV in the Valley of the Kings (fig. 10) and on the cenotaph of Seti I in Abydos. Hence, this is the name by which they were known in earlier times: the Cosmology of Nut.

Depictions of Ramesside star-clocks, the last of the three, have been found on the ceilings of the Tombs of Ramesses VI, Ramesses VII, and Ramesses IX (fig. 10) in the Valley of the Kings (hence their name). They seem to reflect an entirely new system developed to measure night-time hours at the beginning of the New Kingdom

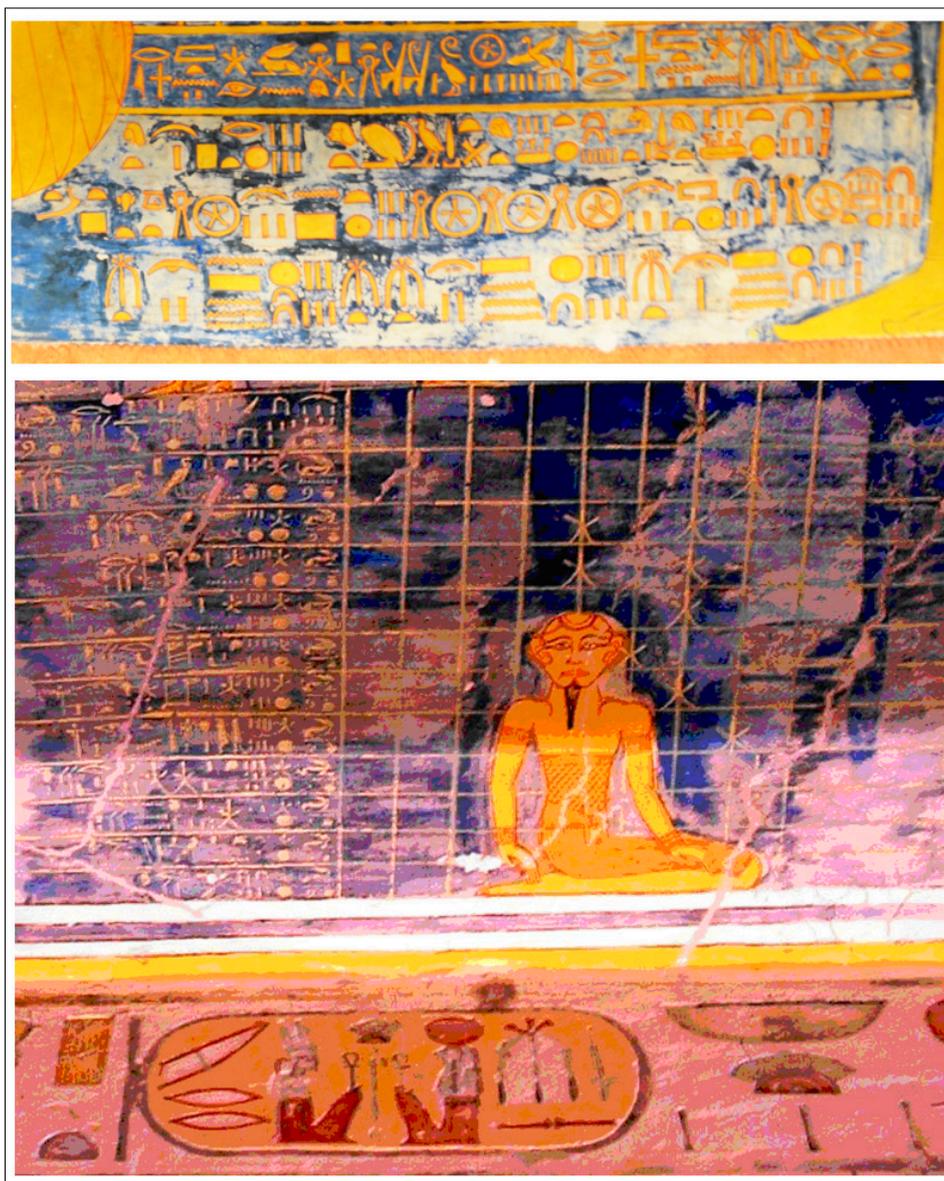


Figure 10. Stellar clocks of the Ramesside period in the Valley of the Kings: a fragment of the Fundamentals of the Course of the Stars as part of the Cosmology of Nut in the astronomical ceiling of the tomb of Ramesses IV (KV2) (top). A complete fortnight list of the 12 stars marking the hours of the night in the ceiling of the tomb of Ramesses IX (KV6) (bottom). (Photographs by the author).

based on an entirely different set of stars (with a few exceptions) from that of the decanal clocks (Belmonte and Lull 2023: 132). Although their precise means of operation is the subject of much debate, it is assumed that they were used in temples by 'horologists' (i.e., hour-priests) to calculate the hours of the night (Belmonte and Lull 2023: 57). This was perhaps essential to properly establish the beginning of the cult schedule at dawn. However, star-clocks may also have served for more prosaic purposes in civilian life.

All form part of the funerary equipment, either in the coffins of high dignitaries or in the

so-called astronomical ceilings of the New Kingdom pharaohs, meaning they must also have been laden with a strong religious symbolism. This is perhaps due to that they served as indicators of cycles of time, repeated over and over again, or possibly were meant to assist the deceased cope with the difficulties of the night-time journey to the afterlife.

Egyptian star-clocks ultimately stem from two systems of structuring time that have survived to our days. The first, universally serving both the profane and sacred, is the division of the day into 24 hours. The second is the division of the

twelve zodiacal signs into 36 houses or decans, each bearing its symbolic peculiarity. This can be attributed to a modern way of structuring sacred time as astrology is without a doubt a modern form of religious belief.

Therefore, it is possible to argue, as a preliminary conclusion, that the current way of measuring time owes two of its fundamental pillars to the Egyptians: the 365-day 'solar' year (filtered by Roman and Christian tradition), and the division of the day into 24 hours. It is noteworthy, however, that these aspects were never adopted by Egypt's contemporary Hittite State.

Sacred time in the Land of Hatti: Hittite festivals, calendars, and cycles

The ancient Middle East is characterised by a plethora of cultic calendars, and dozens of local variants (Cohen 1993; Stern 2012), which can prove challenging to even the most dedicated scholar. This assertion is indeed valid for Hittite Anatolia, where the fragmentary and, at times, contradictory nature of the written records impedes a precise identification of their calendar.

This even includes its well-documented period of the Hittite Empire (14th and 13th centuries BC) preceding its collapse in about 1190 BC. Although a challenging task, the variety of sources nonetheless offers enough information that can be arranged in a more or less logical pattern.

The celebration of festivals dedicated to specific deities at their proper time was essential to the ancient Hittites in maintaining the order of the universe (Taggar-Cohen 2006: 117). Each temple was staffed by priests of different categories performing a variety of duties. Certain were entrusted with special missions such as carrying out the celebration of festivals in a timely manner. Along this line are records signalling that the 'SANGA-priest of the Sun-Goddess of the Earth' regularly slept 'under the stars' in the temple courtyard (Taggar-Cohen 2006: 181). It is possible that one of his night-time duties was to observe the sky so as to determine the timing of offerings and festivals to the deities (fig. 11). Possibly pertinent in this regard is the reference to the Pleiades associated with rituals observed during the *Purulli* festival given that this prominent asterism has globally served as a seasonal and temporal indicator. However, it is noteworthy that there is



Figure 11. Relief of King PUGNUS-meli of Melid (present day Malatya) making an offering to the greatest deities of the Hittite pantheon. These include the Moon and Sun-gods (top), the Storm-god, and Goddess Shausga (Venus, bottom). It is noteworthy that the celestial deities are represented with wings either through personification or, in the case of the Sun-god, as a winged-disc. This neo-Hittite relief follows imperial traditions as depicted in fig 16. (Photos by author, courtesy of the Museum of Anatolian Civilizations, Ankara).

nothing analogous to the ubiquitous star-clocks of Pharaonic Egypt among the epigraphic evidence of the Hittite world.

Lists of festivals from both the Old Hittite Kingdom and Hittite Empire have been discovered in Hattusha and in minor sacred villages of the Land of Hatti. As in the case of numerous other historical and contemporary cultures, sacred time was governed by a yearly seasonal cycle. Although longer periods were also possible, as will be discussed in more detail below, they were undoubtedly connected to agricultural activities. In this sense, the pivotal periods of the agricultural year in Central Anatolia were autumn (September to November) and spring (mid-March to mid-June). These respectively align with sowing and reaping which correlate to the moments of two of the most important Hittite feasts: the *nuntarriyashas* and the AN.TAH.SUM.

The AN.TAH.SUM (Güterbock 1960; Houwink ten Cate 1986) was named after a flower (often identified as a crocus or a fennel) that formed part of the rituals. It was a significant festival which lasted approximately 38 days (perhaps occasionally longer or shorter). This was a time when the king and the queen (i.e., Labarna and Tawananna; see fig. 1) travelled between the city of Hattusha and other minor cult centres such as Zippalanda or Arinna (fig. 12) in the company of other high-ranking priests and priestesses. Although its precise timing remains unknown, it could have been fixed by the first lunation af-

ter the 'spring equinox'. Another less likely option is that it took place during the period of invisibility of the Pleiades, between the cluster's heliacal setting and rising (González-García and Belmonte 2011).

The final form of this festival was defined by Hattusili III (c. 1267-1237 BC) (fig. 1), a contemporary of Ramesses II (1279-1213 BC). This took place following its presumed inauguration by King Suppiluliuma I (c. 1344-1322 BC), which was preceded by the religious reform imposed by Hattusili's father, Mursili II (c. 1321-1295 BC). The feast was dedicated to the supreme deities of the land, the Sun-Goddess of Arinna and the Storm-God of Hatti, later assimilated with the Hurrian deities Hebat and Teshub (fig. 1). It comprised a number of peculiarities, notably that the activities commemorated on its 11th day symbolically convey the 'old year' to the *hešta*-house of Hattusha (a sacred feature linked to the cult of the ancestors) (van de Hout 2002). This aspect is potentially very significant for the interests of this study.

It is clear that the Hittites resorted to a lunar-based time-keeping system due to the existence of the 'festival of the month'. However, there is little certainty as to the precise organisational structure of this calendar, and the method by which it was synchronised with the lunar year and the cycle of the seasons (governed by the tropical year). It is noteworthy, as state above, that the duration of a pure lunar year (354 days) differs from



Figure 12. Reliefs forming part of the monumental Sphinx Gate in the archaeological site of Alaça Hüyük (perhaps ancient Arinna), depicting a Hittite King performing a ritual. The rite is carried out in front of a cult statue of a bull, perhaps representing the Storm-god of Hatti. This was one of the cities visited by the royals in a pilgrimage during the main Hittite festivals during the empire. (Photograph by author).

the average solar year made up of 365 days. This discrepancy of eleven days is significant in the context of the AN.TAH.SUM festival, as its 11th day may carry a particular significance within the framework of a suitable working lunisolar cycle. This issue will be revisited below in the conclusion of this section.

The other memorable festival, the *nuntarriyashas* (Houwink ten Cate 1988: 167), shared numerous parallels with that of the ‘crocus’. Translated as the ‘festival of haste’, it is thought to have lasted for at least 40 days and was celebrated on the occasion of the king’s return from the battlefield before the onset of winter. There is evidence, at least during the Late Imperial Period, suggesting that another key festival, the KI.LAM (Singer 1983), was celebrated as part of the main one. However, this festival was celebrated independently during the Old Hittite period and was the most important commemoration honouring the tutelary divinities of the Land of Hatti. In spite of this, its precise timeframe remains uncertain.

One of the most significant Hittite festivals was the *Purulli*, originally celebrated in the sacred city of Nerik. This city fell to the northern enemies for nearly a century until its recovery by Hattusili III during the reign of his brother Muwatalli. This explains why it was subsequently moved to Hattusha, where it was celebrated near or even as part of the AN.TAH.SUM which was held ‘when the land prospers and thrives’, as ancient text remark (Hoffner Jr. 1998: 11). Kellerman (1981) advanced the idea that the *Purulli* was the inaugural

pre-Indo-European Hattic New Year festival observed in the winter months, and that it was subsequently transferred to the spring following the reforms implemented by Mursili II. By changing it to this moment it would have marked the transition of the new year from one season to another. However, this remains ambiguous.

The situation is further complicated by the words of an oracle that stated that ‘this year His Majesty proposes to winter in Hattusha. He will celebrate the customary festivals, the festival of the year, the thunder festival in Hattusha...’ (Taggar-Cohen 2006: 302). This ‘festival of the year’ (EZEN-*witassiya*) was celebrated in winter and apparently marked the moment normally chosen to enthrone the king.

Another challenge is whether the ‘Festival of the Year’ corresponds to the ‘Winter Festival’ observed in honour of the Sun-Goddess of Arinna in Hattusha (Taracha 2009: 29; Popko 2003). This leads to the question whether it, or eventually both of them, were connected to the winter solstice.

Winter solstice alignments were not rare in Hattusha (fig. 13) and could relate to this phenomenon (González-García and Belmonte 2011). In this sense, the sources also cite the *hahratar*, the festival of the harvest that, considering the annual cycle of central Anatolia, was celebrated in summer, perhaps in relation to the summer solstice (fig. 14), or somewhat later. Hence solstices and ‘equinoxes’ (whatever the nature of the latter, Belmonte 2021) could have acted as



Figure 13. Cyclopean false-domed aedicule in the *Südbug* of Hattusha oriented to winter solstice sunrise. Although the actual meaning of the building is unknown, its orientation suggests it played a religious or calendric role, as other similar monument in the vicinity. (Photograph courtesy of Eberhard Zangger).



Figure 14. Sunset at summer solstice on a distant hill (perhaps Mount Tudhaliya), aligned with the foundations of what was once the monumental gate of the rock sanctuary of Yazilikaya, in the vicinity of Hattusha, perhaps the most important sacred precinct of the Late Hittite Empire. (Photograph by author).

milestones or harbingers within an operative lunisolar cycle.

This leads to the discussion regarding the intrinsic nature of the Hittite festival calendar. There is evidence of a cycle of thirteen regular festivals in the cult of the divine couple formed by Teshub and Hebat of Halab at Hattusha. The couple were Hurrian divinities of the city of Halap, modern Aleppo in northern Syria. Thoroughly assimilated by the Hittites, the two were, as argued above, identified with the Hittite supreme deities, the Storm-God of Hatti and the Sun-Goddess of Arinna as evidenced by the reliefs both of Hall A at Yazilikaya and Fraktin (fig. 1). These festivals were celebrated in Hattusha on a monthly basis. A thirteenth festival is recorded as having taking place when an additional intercalary lunar month was required to align with the lunar and seasonal cycles. Consequently, one can conclude with a high degree of certitude that the Hittites possessed a form of lunisolar cycle potentially subjected to meticulous scrutiny. This particular

context recalls the words of Hattushili's son, King Tudhaliya IV, who stated: 'I shall never omit the festivals again, nor shall I interchange them and celebrate them at the right time'.

The question is thus how did the Hittites adjust the cycles of the sun and the moon (fig. 15). There is scattered evidence that certain festivals, both major and minor, were not celebrated on a regular yearly basis but at larger intervals of time. Some have suggested that the local festivals were celebrated biennially. There is also some evidence maintaining that certain large festivals (or parts of them, such as the ceremonies on the 11th day of the AN.TAH.SUM) were commemorated every six years. Finally, there are grounds to believe that the festival of the god Telipinu in the city of Hanchana was celebrated every nine years, eight if an inclusive way of counting is considered (see Taracha 2009: 70 and 136 for a general discussion on these intriguing options).

As noted above, provided it is calibrated through independent solar or stellar observations, a minimum span of three years is required for the operation of a viable simple lunisolar cycle (fig. 3). Furthermore, six and nine are both multiples of this period. Hence, the aim of this analysis is to ascertain whether the ceremonies of the AN.TAH.SUM on the 11th day were connected to the coupling of the monthly and yearly cycles, a possibility that should be taken into account. This information is paramount and relevant to archaeoastronomical analyses of Hittite landscapes and architecture.

Zangger and Gautschy (2019), inspired by similar Egyptian evidence (fig. 8), recently proposed that the reliefs of Hall A of Yazilikaya (c. 1240 BC) were actually a systematic, symbolic, perhaps even functional, representation of a far more elaborate lunisolar cycle (fig. 16). This was founded either on the octaeteris (when following a simplified scheme) or possibly even the 19-year Metonic cycle, which would require accepting a series of hypotheses and reconstructions of certain parts of the reliefs that were damaged in Antiquity. The absence of evidence on the intercalary month required for such a diagram to be operative undermines this proposal. However, if this were true means that the eight or 19-year lunisolar cycle was known in Anatolia centuries earlier than expected, perhaps through Hurrian influence, and, certainly, much earlier than the cycle applied in Athens by astronomer Meton. This opens an intriguing prospect that the Hittites or their heirs (the Luwian speaking kingdoms of the Iron Age) could have transmitted this astronomical knowledge to the Hellenic world, either from their bases in Anatolia, Kizzuwatna, or in the Northern Levant.



Figure 15. Rock relief of the twelve Gods of the Underworld in Hall B of the sacred precinct of Yazilikaya, possibly the cenotaph or even the place of deposition of the ashes of King Tudhaliya IV, Hattushili's son and successor. Belmonte (1999) had speculated that the relief could also represent the twelve months of a lunar year with the scimitars in form of a lunar crescent. An equivalent series at the end of the row of male deities of Hall A of the sanctuary has been interpreted in similar manner by Zangger and Gautschy (2019; see fig. 16). (Photograph by author).

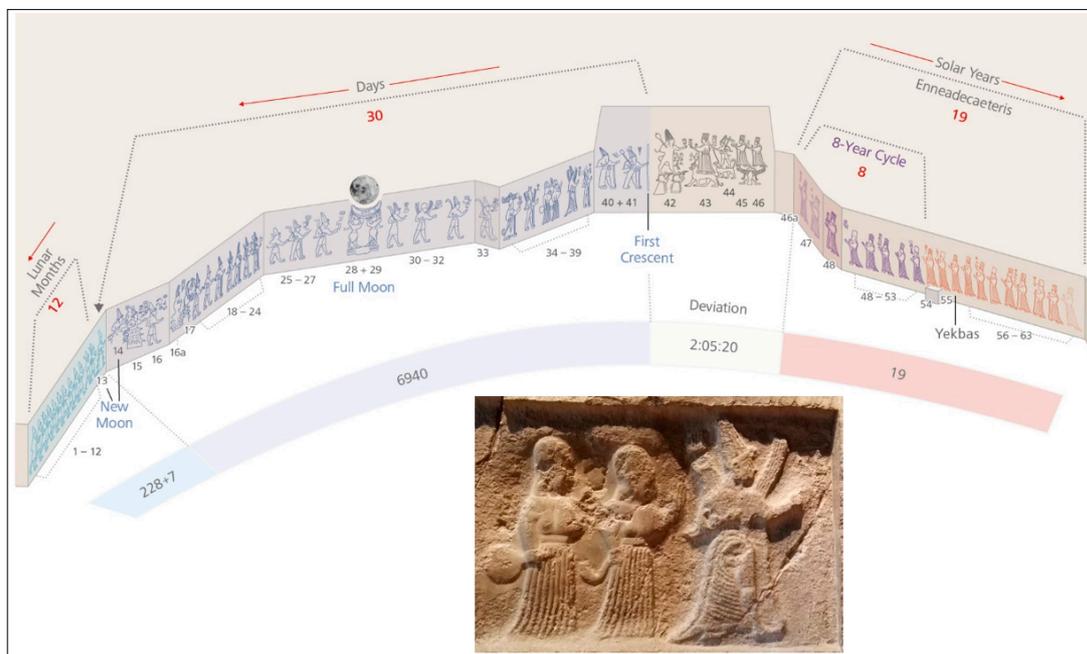


Figure 16. Schema of the rock-carved reliefs in Hall A of Yazilikaaya, illustrating the central panel, and the two rows of male and female deities, to the left and right respectively. Inspired by similar Egyptian representations (fig. 8), Zangger and Gautschy (2019) have proposed that this elaborate series of reliefs might represent a lunisolar calendar. The days of the lunation could be represented by the row of male deities, the months by the 12 Gods of the Underworld, and the years by the row of female deities, representing either an eight or 19-year cycle. The insert represents Goddess Shaushga (Hittite Ishtar) and her attendants. It is of interest that they are integrated within the male deities and supposedly representing days three to five of the lunation. (Diagram by author, adapted by courtesy from Zangger and Gautschy (2019), bottom photograph insert by author).

Conclusions

Two great powers, the Hittite Empire and the New Kingdom Egyptian Monarchy, reigned supreme and controlled the coastline of the Levant during the Late Bronze Age. This state of affairs soon collapsed as the Hittite Kingdom by the outset of the 12th century BC had vanished and Egypt was reduced to a mere regional power for several centuries. This decline continued even if the two powers in the mid-13th century had signed a truce to preserve the status quo for an 'eternity'.

The Egyptian civilisation was a very old and attained a centralised state with a level of power during the Ramesside period that had hardly been seen before, since the time of the great pyramid builders. One of the extraordinary features reinforcing the state was its civil calendar (Belmonte and Lull 2023: 307), a time-keeping system with 15 centuries of history at that moment. Despite being a 'wandering' solar calendar devoid of leap years, it perfectly served the needs of a society subject to the flooding of the Nile. While Ramesses occupied the throne, the seasons of the civil calendar (Inundation, Going Forth, Drought) were again in line with the actual behaviour of the Nile several centuries after implementation of the calendar. This is a remarkable fact that did not pass unnoticed among his contemporaries (fig. 17).

Not only were important lunar festivals such as the 'Beautiful Feast of the Valley', the *Opet*, and the Ptah Feasts, as well as other stellar festivals such as *Peret Sopdet* (fig. 9), perfectly timed within the civil calendar. Apart from certain minor doubts, they served to support the chronology of the Amarna and Ramesside Periods (see e.g., Gautschy 2014; Krauss 2015; 2016; Belmonte 2022; Belmonte and Lull 2023: 505; *in press*). This was even the case when contemporary Egyptian historical sources were tendentious and hide relevant information (fig. 18).

Two of the best sources which cast light on how ancient Egyptians resorted to the stars to measure time also date from this period: the earliest version of the 'Fundamentals of the Courses of the Stars' and the Ramesside star-charts (fig. 10) (Belmonte and Lull 2023: 2013). They are behind the current way of dividing the day into 24 hours. Therefore, there is ample evidence to interpret the way ancient Egyptians understood sacred and profane time, and used it to their own benefit.

On the contrary, there is scant evidence on how the Hittites viewed sacred time, and the little that does exist suggests it differed greatly from that of Egypt. The Sun is thought to have been paramount (fig. 11), and at least two of the most significant Hittite deities are said to possess solar traits. It is therefore logical that solar features be reflected in their calendar and in the celebration



Figure 17. In Abu Simbel great temple, at sunrise during the first day of the seasons of *Peret* and *Shemu* close to 1265 BC (respectively, c. October 21 and February 20 in the Gregorian proleptic calendar), the rays of the Aten illuminate the statues of the solar triad formed by Amon-Ra, King Ramesses II and Ra-Horakhty. Underworld God Ptah always remains in darkness. The last rays of sun illuminate an erased papyrus in the hands of Ra-Horakhty. (Photos by author).



Figure 18. The end of the 18th and the beginning of the 19th Dynasties in the Ancestors List of the temple of Sethy I in Abydos. In an effort to control time and the historical discourse, the first Ramesside kings attempted to obliterate the memory of five pharaohs linked to the Amarna period (Akhenaten, Semenkahre, Neferneferuaten, Tutankhamen and Ay). The relief directly jumps from Amenhotep III to Horemheb. Obviously, and fortunately, they failed. (Photograph by author).

of certain festivals. The 12-13 festivals dedicated to the cult of the divine couple (Teshub and Hebat) celebrated on a monthly basis suggests the presence among the Hittite time-keeping system of an intercalary month and the option of a working lunisolar cycle.

This assertion is substantiated by the celebration of local festivals taking place at intervals of three, six, or nine (eight) years. It has been posited that a minimum of three years is required for workable simple lunisolar cycle to operate (fig. 3), with six and nine being multiples of this fundamental periodicity. Determining the existence and timing of these festivals could indeed be achieved by resorting to astronomical observations (González-García and Belmonte 2011) (figs. 13-14).

In this respect, it is worth considering whether the ceremonies on the 11th day of AN.TAH.SUM were connected to a coupling of the monthly and yearly cycles, a hypothesis that requires further testing. The paucity of Hittite records renders apparent the need of future rigorous research in the discipline of cultural astronomy.

Therefore, the Double Land of the Pharaohs and the Land of Hatti, after years of enmity, reversed their relationship and developed tight bonds of friendship. Each shared worship of powerful solar deities. The rulers of Egypt were considered the Son of Ra, the Sun-God, and, in the case of the Hittites, avatars of the sun himself. The empires influenced each other, notably in military practices, and even the means of writing. It is indeed possible that Luwian glyphs were inspired by their Egyptian counterparts.

Yet, in spite of sharing many features, the time-keeping systems of the Egyptians and Hittites differed completely. Egypt possessed a long standing, solar-inspired civil calendar while that of the Hittites was lunisolar, probably based on

local tradition and perhaps influenced by the Hurrian model (hence bearing Mesopotamian astronomical aspects). Ultimately, the Egyptian calendar survived to modern times whereas that of the Hittites has been lost in the fog of history. This is the fate of two empires possessing dissimilar but complementary worldviews throughout one of the most fascinating periods of Antiquity.

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