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Astronomical Luni-Solar Cycles and the Chronology of the Masoretic Bible

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Abstract. An astronomical table found in al-Khwarizmi's 9th century CE treatise, related to the Jewish calendar, is analysed in detail. The analysis is used to establish the evidence that until the last centuries of the first millennium CE, the most important events in Jewish history described in the Masoretic text of the Bible were believed to have occurred simultaneously with the reappearances of new moons at the same celestial longitudes. The astronomical solar year of 365.25 days, in use from the first Millennium BCE throughout most parts of the first Millennium CE, and a mean lunar month of 29.5 days and 793 parts of an hour, are used to explain how they influenced the erroneous dating of major events described in the Masoretic text of the Bible by adopting the previously unknown astronomical cycles of 483 and 502 years. Such major events include Adam's new moon, signifying the 'year of creation' and the epoch of 'Aera Adami', the birth of Abraham, Exodus with the giving of the Torah, and the building of Temples I and II. The results suggest that the chronology of the Masoretic text of the Old Testament was deliberately adapted to conform to what would be presently regarded as astrological concepts.

Introduction

The general approach in current Biblical studies, which also characterizes this paper, is based on the claim that the Biblical stories in their final form (from the last centuries BCE) are fundamentally a reflection of contemporary traditions.[1] In this presentation I aim to show that the

1 In their opening remarks devoted to the understanding of the influence of contemporary sources to several of the Biblical stories, Shinan and Zakovich (A. Shinan and Y.Zakovitch (In Hebrew), *Thats not what the Good Book says*, (Tel Aviv: Yediot Books, Herned Series 2004), emphasize that their work should be regarded as an attempt to enrich our understanding of the traditions that led to the present text. They conclude their chapter of introduction by saying that they hope that the reader would benefit from their work by reading the Bible with a better, much enhanced, perspective and admiration, but, certainly, less innocent.)

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impact of contemporary beliefs was not limited to their incorporation into the Biblical stories, but that major parts of the chronology of the Masoretic text of the Bible were set to agree with contemporary astronomical calculations. However, they reflected the lengths of the year and the month which were accepted at the times during which the chronology of the Masoretic text of the Bible was constructed.

Therefore, the main possible impact of this work is that the Masoretic Biblical dating of events is inaccurate and that the chronology of the Masoretic text cannot be an original chronology. I show that the writers of the chronology made sure that their basic suppositions could be supported by astronomical calculations. However, the basic data of the science of astronomy used in their calculations have been changing constantly along with the progress of science. In different times the chronology based on such calculations would have been different.

My results suggest that similar to the present rejection of the chronologies of the Samaritan and the Septuagint texts of the Bible by all Jews and most Christians (except for, in particular, the Roman-Orthodox church) as being the original chronology, the chronology of the Masoretic text should no longer be treated differently. Moreover, since I show that the dating of the major events in the history of the Jewish people was made to agree with a large astronomical cycle, the chronology of the Masoretic text, including the year of creation, reflects contemporary belief in what would be presently described as astrological notions. These claims, detailed below, resulted from a careful and accurate analysis of a treatise written by al-Khwarizmi:

Muhammad ibn Musa al-Khwarizmi and the Astronomical Table

Muhammad ibn Musa al-Khwarizmi (780-850 AD) made several contributions in the fields of mathematics (algebra and arithmetic), geography and, in particular, astronomy. He also published a summary of the luni-solar Jewish calendar regulations.[2] Kennedy, who analysed al-Khwarizmi's work, included in his publication a table of astronomical

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2 The original work entitled: '*Fi istikhraj ta'rikh al-yahud*' (An Essay on the Jewish Calendar) was written in the ninth century CE by M. ibn Musa al-Khwarizmi, and was discussed and partially translated (into English) in: E. S. Kennedy, 'al-Khwarizmi on the Jewish Calendar', *Scripta Mathematica* (1964), Vol. 27, p 55-9. The work was also translated into Hebrew by: Langermann, Z., 1976 (in Hebrew); 'When was the Jewish calendar written?' *Assufot*, 159-168.

data (Table 1) which he found in al-Khwarizmi's treatise. The table includes a set of data regarding the celestial longitudes of the mean sun and the mean moon for three historical dates:

A. '*The first of the days of Adam*' (as titled by al-Khwarizmi in the table) in which the mean sun and the mean moon were at the 176th degree longitude;
B. '*The building of the Temple'* in which the mean sun and the mean moon were again at the 176th degree longitude; and
C. '*The beginning of the years of the two horns*' (the epoch of Aera Alexandri) in which the mean sun was at the 193rd degree + 0.521667 parts of a degree, and the mean moon at the 127th degree + 0.7636.

al-Khwarizmi's interpretation of the reappearance of the same celestial longitude in (A) and (B), was that the length of the year used in the table was exactly the 19th part of 235 mean months (of 29 days, 12 hours and 793/1080 parts of an hour each), and that therefore it should be expected that all first new moons in all cycles of 19 years would return to exactly the same longitude. Moreover, for any given celestial longitude of the mean sun during the year in a system where the total length of 19 years is coupled with the total length of 235 months, the mean moon must be in one of only 19 possible celestial longitudes, depending on the year in the cycle.

In al-Khwarizmi's treatise the astronomical table includes also data regarding the positions of the planets. In the case of (B) and (C), the celestial longitudes of the planets are expressed in degrees and parts of a degree. Therefore, the 176th degree assigned to the mean sun and the mean moon at (B) should be read as the 176th degree + 0 parts of a degree. With this information on the first new moon of a cycle of 19 years, the closest longitude of the mean moon out of the 19 possible longitudes that would correspond to the mean sun at the epoch of Aera Alexandri, can be calculated in such a system to be the 126th degree + 0.0265 parts of a degree.

The difference between al-Khwarizmi's value and the expected value in the 19-year cycle thus amounts to a small but pronounced value of 0.7371 degrees (compared to an accuracy of 1/3600 of a degree assigned to al-Khwarizmi's data in the columns where the celestial positions are expressed in minutes and seconds of arc). We, can, therefore, conclude that, if the data in the table can be treated as accurate information, they were not calculated for the mean sun and the mean moon in a system

where 235 months are exactly 19 years. On the other hand, by treating the data as based on a solar year of 365.25 with the same length of the month as before (a system that had been in use in several Jewish centers, as specifically discussed by Maimonides[3]), we get a perfect correspondence between (B) and (C) as follows:

> The celestial longitude of the new moons will not be the same after a cycle of 19 years but slightly different. Since now, in the new system, 235 months are shorter than 19 solar years, the first new moon of the second cycle of 19 years will be at the celestial longitude of the 176th degree minus 0.0595 degrees. The first new moon in the third cycle will be already 0.119 degrees away from the original celestial longitude.

But, as the first new moon of the cycle is getting away from the original celestial coordinate, the celestial coordinate of the 100th new moon, the first new moon of the 9th year (after 8 years of the cycle - 3 of which are intercalated), is starting to get closer and closer to the 176th degree with each new cycle of 19 years. In the first cycle, the 100th new moon takes place 99 x 29.530594 = 2923.52882 days after the first new moon of the cycle, or 1.52882 days after the beginning of the 9th solar year. In the second cycle, the 100th new moon will take place 334 x 29.53094 = 9863.21844 days after the first new moon of the first cycle, or 1.46844 days after the beginning of the 9th year in the second cycle. The 100th month in a series of 19-year cycles will, therefore, come closer to the original new moon of the series with the following number of days:

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3 M. Maimonides, *Laws of Sanctification of the New Year* (LSNY) Chap. 9, English translation by Gantz et al (1956); referring to the first centuries CE, Maimonides stated:

> 1-9. As to the solar year, there are certain Jewish Sages who have held that it consists of 365 days and one quarter of a day, which is six hours, while some have held that the fraction is less than a quarter of a day. And the same disagreement may be found also among the Greek and Persian scholars.
>
> 2-9. According to the opinion which holds that the year consists of 365 ¼ days, there remains in each cycle of 19 solar years a balance of 1 hour and 485 parts.

Cycle1=1.52882, cycle2=1.45844, cycle3=1.40806, … , cycle 26=0.01937, cycle27=-0.04101 days.

It will thus take a large cycle of 483 (= 25 x 19 +8), or 502 (= 26 x 19 + 8) years to find again a new cycle of 19 years which will start with a new moon at approximately the same longitude (within 0.03 of a degree) as in the first cycle. A summary of the positions of the new moons at the beginning of such large cycles and their relative distances (in degrees) from the celestial longitude of the 176^{th} degree is given in Table 2.

After three large cycles of 483, 502, and 483 years (1478 years), the new moon will be as close as -0.0022 degrees (= $0.0191^0 - 0.0404^0 + 0.0191^0$) or about 3 minutes off the original celestial longitude. If, as a consequence, we treat the data given for (A) and (B) as the start of such new large cycles, 2936 years apart (composed of the large cycles 483, 502, 483, 483, 502, 483 years long), then the celestial coordinate of the mean moon at the epoch of '*The beginning of the years of the two horns*' (483 + 19 + 6.048671 years later) is exactly the expected coordinate. This agreement is achieved by assuming that the coordinate for case (B) is exactly at the start of the 176^{th} degree (as expressed in Table 2). Starting from the 176^{th} degree to the 193^{rd} degree + 0.521667, 508 years later (which closely corresponds to the Biblical and Talmudic time difference between the building of the first Temple and the epoch of Aera Alexandri), the sun has moved 508 x 360 degrees + 17.521667 degrees. With a solar year of 365.25 days long, this corresponds to 185564.7772 days. On the other hand, from the positions of the mean sun and the mean moon at (C), we can determine that a new moon will occur 5.4761 days after the epoch of '*The beginning of the years of the two horns*'.[4]

The full number of months between (B) and (C) (in a little over than 508 years) is 6283 months. Therefore, the number of months, 5.4761 days after the epoch of '*The beginning of the years of the two horns*', is 6284. And, indeed 6284 x 29.530594 – 5.4761 = 185564.7774 days.

The difference between the two values in the position of the mean sun (0.0002 days) is less than one unit (1/3600 of a degree) in the accuracy

4 This can be done by using the mean daily motions of the mean sun and the mean moon as detailed in: A. Cohen, 'Long Term Astronomical Cycles Calculated by Astronomers During the First Millennium CE and Their Impact on the Jewish Chronology', *Judea and Samaria Res. Studies,* Vol. 13, ed. J. Eshel (Ariel, 2004), ii 331-343 (in Hebrew with an English Abstract) [hereafter 'Cohen 'Cycles'].

given in Table 1. (See Appendix for the detailed calculation in the units used in al-Khwarizmi's table.)

Table 1 was, consequently, made to point out the fact that the first of the days of Adam and the building of the Temple I each occurred at the beginning of a large cycle of 483 or 502 years. Our Tables 2 and 3 show that, in addition, the same correspondence exists for all other major events: the birth of Abraham, Exodus, and the building of Temple II as well.

The Bible and astrological dating

Frank summarizes the chronology of the main events in Jewish history in his book on the Talmudic and Rabbinical Chronology, which we include in Figure 1 to emphasize the results of the comparison with our Table 3.[5] Frank's chronology based on the Masoretic text of the Bible is the accepted interpretation used by all other Jewish Masoretic text chronologists. However, Eusebius, in his introduction to his chronology written in 325 CE, states that the number of years between the birth of Abraham and Exodus is 505 years (and not 500 years) according to all three texts of the Bible: the Septuagint, the Masoretic and the Samaritan texts as well.[6] If we add the 5 years to the Table in Figure 1, the agreement between the corresponding astronomical values and the Biblical chronology of the Masoretic text is almost perfect (Table 3).

Today, it is accepted by most historians that the building of Temples I and II are incorrectly dated in the Masoretic text of the Bible, but the surprising fit between our Tables 2 and 3, and the chronology of the Masoretic Text of the Bible, provide an explanation of the real source of such dating: the belief that the major events must be related to the sun-moon conjunctions taking place on the same seemingly celestial longitudes as in the 'year of creation'. This is well expressed in al-Khwarizmi's titles for the celestial coordinates for (A) and (B) in his astronomical Table.

In the Talmud we find specific regulations and laws which direct the reader as to what prayers should correspond to astronomical

5 Frank, Edgar, *Talmudic and Rabbinical Chronology*, (New York: Inc., Publishers 1956, p. 17.

6 Eusebius, *The Chronological Canons*, 325 CE (*the Latin translation of St. Jerome.)*; see, for example, http://www.attalus.org/translate/eusebius1.html.

reappearances.[7] The fact that after 28 years the sun will rise in the same weekday at the Vernal Equinox (along with the assumption that the length of the year is 365.25 days as mentioned in the description of the 4 seasons in the Talmud in Erubin 56a), created a tradition that is observed by several orthodox Jews even in the present centuries: thousands of believers are welcoming the rising sun on Wednesday morning every 28 years, blessing the Lord for the reappearance of the creation sky.

The last two occasions on which the ceremony took place were in 1953 (= 5712 or 204 cycles of 28 years from the first month of Nisan, when according to the Masoretic Biblical chronology, the sun was created) and 1981 (= 5740 years). The table presented by al-Khwarizmi reveals the fact that in addition to the observed astronomical cycle of 28 years relating between the solar year and the weekday of Wednesday, there was a large cycle of the new moons and the solar year of 483 years (or 502 years) which had a profound meaning in the Jewish religion as long as the length of the year was taken to be 365.25 days.

Due to the fact that the much shorter cycle of 235 new moons, which is the only cycle in the present permanent Jewish calendar, was shorter than 19 solar years, the intercalation sequence described in al-Khwarizmi's treatise had a new start at the beginning of each large cycle of 483 or 502 years. The intercalation sequence, 12, 12, 13, 12, 13, 12, 12, 13, 12, 12, 13, 12, 12, 13, 12, 13, 12, 12, 13 months in a cycle of 19 solar years can be shown to be ensuring that the day of New Year (following the new moon of the month of Tishrei) be always before or on the day of the Autumnal Equinox (table 4). We note that in the present permanent Jewish calendar the 6^{th} and the 17^{th} years replace the 5^{th} and the 16^{th} years as the intercalated years, in an intercalation sequence relating Passover to the Vernal Equinox. However, since there are always exactly 163 days between Passover and the first day of Tishrei, the sequence in table 4 also ensures that Passover would start within a few days (before or after) of the Vernal Equinox. It follows that in a number of cases in a cycle of 19 years, Passover would start before the beginning of spring. Such events occurred when, in the times of the Sanhedrin (as described by Maimonides – see Endnote 3) in the first centuries CE and BCE, the first

7 See Berakhot 59b in, for example, Epstein, Rabbi Dr. Isidore, Editor. *The Babylonian Talmud*, translated into English with notes, glossary and indices, London: Soncino Press, 1935-1948.

day of Nisan was made to be always before the Vernal Equinox, as discussed in detail in Cohen, 2003.[8]

After a large cycle of 483 (or 502) years, the 100th new moon in the cycle of 19 thus becomes the leading new moon relative to which the intercalation sequence can achieve the requirement for the New Year relative to the Autumnal Equinox. The intercalation sequence of 12, 12, 13, 12, 13, 12, 12, 13, 12, 12, 13, 12, 12, 13, 12, 13, 12, 12, 13 months has, thus, a new start at the beginning of each large cycle.

Even though it is known that at least till the 4th century CE (359 CE) the new month was announced after two witnesses had testified seeing the crescent of the new moon, the average dates had to follow the astronomical predictions several centuries prior to the 4th century CE based on the mean known lengths of the solar year and the synodic month.[9] [9]

The great cycles provided a long enough series of new moons to bring the calculated predictions and the sighted new moons practically to coincide (to within the average time difference between the astronomical new moon and the sighting of the first newborn crescent). Therefore, the beginning of the new cycles marked an important repetition of the astronomical conditions associated with the year of creation, so important that the writers of the chronology of the Masoretic text of the Bible assumed that they should also mark a major event in Jewish history.

The dating in the Masoretic text of the Bible of the building of Temple I and Temple II is different by more than 130 years from the dates assigned to such events by the historians. For example, one date between the above two events, namely the date of the destruction of Temple I, is different by 165 years from the historian views as expressed in Frank.[10]

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8 This is discussed in detail in Cohen, A., 'The Epoch of the Jewish Calendar Based on the Rambam [Maimonides] and on Al-Khwarizmi', *Judea and Samaria Res. Studies*, Vol. 12, ed. J. Eshel (Ariel, 2003), ii 361-370 (in Hebrew with an English Abstract), where it is shown that after 483 or 502 years the 100th new moon – at the beginning of the 9th year in a cycle of 19 years -, has the same celestial coordinates as Adam's new moon and thus becomes the first month of the new large cycle of 483 or 502 years as well as the first month of the new small cycle of 19 years.

9 See for example, Stern, S., *Calendar and Community*, (Oxford: Oxford University Press, 2001), p 124.

10 Frank, Edgar, *Talmudic and Rabbinical Chronology*, p 10.

However, on the other hand, the dates of the above two events based on the Masoretic Biblical chronology agree almost accurately with the large cycles of intercalation.

We thus conclude that the chronology of the Masoretic text of the Bible that is based on the belief that major events must be associated with astronomical coordinates of celestial objects, can be considered as one of the earliest astrological records in the history. This is in accord with the view that in the last centuries BCE the Jews accepted astrological concepts as part of their beliefs.[11]

We may conclude that special events in the alignment of the sun and the moon, such as their return to the original celestial coordinates they occupied at the creation, were believed to be accompanied with major historical developments in God's nation. Those beliefs were incorporated into the chronology of the Masoretic text of the Bible.

11 In Chapter 5 of Ness's thesis (Ness, Lester J., 'Astrology and Judaism in Late Antiquity', (PhD Thesis Miami University, Oxford, Ohio, 1990).) he demonstrated that 'in the Hellenistic times Jews adapted the polytheistic assumptions of astrology to their own monotheistic world-view by interpreting the planet gods as planet angels, beings superior to humans, but subordinate to the one genuine God'. Ness added that: 'The sun and the zodiac signs were treated as God's creatures. They carried out His commands as the satraps of His cosmos'.

Appendix: The Celestial Longitude of the Mean Sun and the Mean Moon at (C) Calculated with the Units Used by al-Khwarizmi

The calculations in Table 1 included the following steps:

The new moon corresponding to the building of the first Temple occurred at 5 s, 26; 0', 0" (meaning 5 signs of 30 degrees each + 26 degrees, +0 minutes of a degree, + 0 seconds of a degree), and the longitude of the sun which corresponds to the epoch of Aera Alexandri was 5 s, 19; 31', 18".[12]

After 6283 months = 507 + 0.982814 years, the celestial longitude of the new moon is calculated to be 5 s, 19; 48', 47". This coordinate is 23.70872 degrees or, 24.05447 days, away from the Aera Alexandri epoch. In this number of days the moon travels 24.05447 x 13.176373 (deg/day) = 316.95067 degrees, which brings the moon to 43.049326 degrees = 43 degrees, 2' and 58" away from the longitude of the preceding new moon.

We, therefore, find the moon at the epoch of Aera Alexandri at the celestial longitude of 4 s, 6; 45', 49", which is the Table 1 value.

12 We note that in Cohen, 'Cycles', 2004, we have shown that this celestial coordinate of the sun corresponds to 195 days and 7.9 hours after the Spring Equinox. By assuming that the first Vernal Equinox in the Jewish calendar took place on a Wednesday in Babylon at sunrise, as can be interpreted from a statement in al-Khwarizmi's last paragraph [or, as more often assumed – on the beginning of the night before Wednesday], the epoch of Aera Alexandri as used by the Jews in the ancient Land of Israel, would be on a Monday at noon (12:00) [or, at the preceding midnight] in Athens [believed to be in the first Millennium BCE, 1.9 hours earlier than Babylon], in the year 313 BCE. As emphasized by Frank, *Talmudic and Rabbinical Chronology*, the Seleucid epoch used by most nations was taken to be at least 1 year later and, thus, has also been misinterpreted by al-Khwarizmi's analysis of the data in Table 1.

Table 1. The celestial longitudes of the Mean Sun and the Mean Moon as reported by al-Khwarizmi. The longitudes*, measured from the Vernal Equinox Eastward, are presented for the first days of Adam, for the Building of the Temple and for the Seleucid Epoch. The original table in al-Khwarizmi's treatise includes also the positions of the planets Saturn, Jupiter, Mars, Venus and Mercury, as well as the details of the moon anomalistic and draconic parameters. These additional celestial coordinates are not related to the present work and will be discussed separately, in particular, in view of the fact that no information is provided by al-Khwarizmi regarding the orbital elements of the planets and whether the mean or the real coordinates are presented. In the present work, only the astrological beliefs regarding the Sun and the Moon and their impact when their positions return to the same values as in the day of Adam's creation, are discussed.

	The first of the days of Adam, a Friday*	The building of the Temple*	In degs from the VE	The Epoch of the Seleucid era*	In degrees from the VE
Mean Sun	$5^s\ 26^0$	$5^s\ 26^0$ =	176^0	$6^s\ 13^0$; 31, 18 =	193^0 + 0.5217^0
Mean Moon	$5^s\ 26^0$	$5^s\ 26^0$ =	176^0	$4^s\ 6^0$; 45, 49 =	126^0 + 0.7636^0

* In the original al-Khwarizmi's Table the notation $5^s\ 26^0$ means 5 signs of 30 degrees each + 26 degrees = 176 degrees. Similarly, the notation $6^s\ 13^0$; 31; 18 means 6 x 30 + 13 degrees + (31/60 + 18/60/60) parts of a degree .

Table 2. The reappearances of the mean New Moons at celestial longitude of 176^0 (within 0.03^0) when the solar year is assumed to be 365.25 days.
A. The large cycle number starting from 1 in ''*The first of the days of Adam*'.
B. The number of Mean Months from '*The first of the days of Adam*'.
C. The number of years from '*The first of the days of Adam*'.
D. The deviation in degrees from 176^0 longitude, assuming that the first NM of the 7^{th} large cycle (2936 years after '*The first of the days of Adam*') has a 0 deviation.

A	B	C	D
1	0	0	0.0045
2	5974	(+483) 483	0.0236
3	12183	(+502) 985	-0.0169
4	18157	(+483) 1468	0.0022
5	24131	(+483) 1951	0.0213
6	30340	(+502) 2453	-0.0191
7	36314	(+483) 2936	0.000
8	42288	(+483) 3419	0.0191

Table 3. The reappearances of the mean New Moons at 176^0 (within 0.03^0) as compared to the Chronology of the Masoretic Text of the Bible after the addition of 5 years (according to Eusebius – See Endnote 6).
A. The large cycle number starting from 1 in ''*The first of the days of Adam*'.
B. The major historical event in the history of the Jewish people.
C. The number of years between '*The first of the days of Adam*' and the start of a large astronomical cycle of 483 or 502 years.
D. The number of years between '*The first of the days of Adam*' and the major event according to the chronology of the Masoretic text of the Bible.

A	B	C	D
1	Creation of Adam	0	0
2		483	
3		985	
4		1468	
5	Birth of Abraham	1951	1948
6	Exodus from Egypt	2453	2453
7	First temple Built	2936	2933
8	Second temple Built	3419	3413

Table 4. The closest mean new moons in the first cycle of 19 years to the Autumnal Equinox for the Julian length of the solar year (in days). The first new moon of the cycle is assumed to start in both cases from the celestial longitude at the beginning of the 176^{th} degree. The intercalated years have 13 months to ensure that in the cycle of 19 years the new moon of the month of Tishrei will be the last new moon before the Autumnal Equinox with all Passovers very close to the Vernal Equinox.

Year in the cycle	New moon of Tishrei precedes the AE (in days)	Remarks
1	5.0729	
2	15.9558	
3	28.8387	At the end of this year a 13th month must be added
4	8.1909	
5	19.0738	to be intercalated
6	0.4261	
7	11.3090	
8	22.1918	to be intercalated
9	3.5441	
10	14.4270	
11	25.3098	to be intercalated
12	6.6621	
13	17.5450	
14	28.4279	to be intercalated
15	9.7801	
16	20.6630	to be intercalated
17	2.0153	
18	12.8981	
19	23.7810	to be intercalated

Figure 1. A comparison between the Chronology of the Masoretic text of the Bible as summarized by Edgar Frank (see Reference in Endnote 5, p. 17) and our Table 2. The first two columns on the right are taken from our astronomical Table 2, where (a) is the number of years to be added between the large cycles numbered in column (b). To the left of the corresponding arrows are the chronological dates as presented by Frank. We note that the data related to the birth of Abraham were added by us.

	Creation Era				a	b
	בראשית AM I	ויהי AM II	בן כיום התחיל AM III			
1) Molad Tohu	1			⟷		1
2) Creation of Adam	2	1			(+483)	
3) Adam 1 year old	3	2	1		(+502)	2
4)	+1655	+1655	+1655		(+483)	3
5) Flood	1658	1657	1656		(+483)	4
	+292	+292	+292			
Birth of Avraham	1950	1949	1948	⟷	1951	5
6)	+100	+100	+100			
7) Birth of Isaac	2050	2049	2048		(+502)	
8)	+400	+400	+400			
9) Exodus from Egypt	2450	2449	2448	⟷	2453	6
10)	+ 40	+ 40	+ 40			
11) Entry into Canaan	2490	2489	2488		(+483)	
12)	+440	+440	+440			
13) First Temple built	2930	2929	2928	⟷	2936	7
14) First Temple stood	+410	+410	+410			
15) First T. destroyed	3340	3339	3338		(+483)	
16) Babyl. Captivity	+ 70	+ 70	+ 70			
17) 2nd T. consecrated	3410	3409	3408	⟷	3419	8
18)	+ 40	+ 40	+ 40			
19) Start of SE II	3450	3449	3448			