Using Astronomical References For Biblical Dating Of Noah's Deluge And The Destruction Of Solomon's Temple

Ariel Cohen, The Hebrew University of Jerusalem, Israel

ABSTRACT

In recent years, the astronomy teaching community has been called upon to include more cultural aspects of the influence of astronomy across the world in university courses. As an important component connecting the science of predictable sky alignments with historical human events, students studying the history of science and astronomy often find it cognitively challenging to recognize the fact that till the 16th century AD the most fundamental picture of the planetary system had been distorted with the sun considered to be the fourth planet of the earth rather than the center of our modern planetary system. Similarly, students are often amazed in realizing that the vast majority of all professional and knowledgeable astronomers had also believed that planets control the destiny of all human beings, and, in particular, in predicting extreme events. In this presentation, we concentrate on such impacts of astronomers who stood behind the determination of the chronology of the Bible. Having illustrated that the ancient astronomers believed that when the Sun, the Moon, and the first point of Aries form a straight celestial line, important historical events described in the Bible could be revealed, and one could systematically examine the relative positions of these three celestial objects when events would occur and symbolize for the sages the end of an era. We first describe how the largest celestial separation between the sun, the moon, and the Vernal Equinox (VE) was identified by the writers of the chronology to occur in association with the destruction of Solomon's Temple; and then we illustrate the additional result that such a separation was also made to be associated with a biblical flood.

Keywords: Archeoastronomy; Calendars and Time Keeping; Al-Khwarizmi; Biblical Chronology; Astronomy and Religion

When teaching astronomy, professors nowadays are encouraged to include a detailed discussion of the interplay between science and culture, and in the case of astronomy, its role in supporting religious and cultural basic beliefs. The dependence of biblical chronology on science in general, and astronomy, in particular, has been identified by several authors, including in attempts to specify the year of Christ's Crucifixion (Humphreys & Waddington, 1983, Pratt, 1991). These authors used accurate astronomical calculations related to the first half of the 1st century AD to align with the New-Testament descriptions and parallel works.

In work previously described elsewhere (Cohen, 2018), we have illustrated that the dating of the major events in the Old Testament can be uniquely determined by the writers of the biblical chronology so chosen to have a mystical rare astronomical resemblance to the year of creation. As we have demonstrated in Cohen (2009, 2018), the writers of the Bible seem to have believed that major events were aligned with long, believed and calculated to exist, astronomical cycles: As discussed in those earlier papers, the years in which major rebirth milestones described in the Masoretic Old Testament, such as the Birth of Abraham, Exodus, and the building of the Temples I and II, seem to have occurred in years that were "strikingly" and "mystically" similar (both terms used by the Byzantine Church[1]) in their celestial picture as in Creation. The "mystic" resemblance referred to what was believed to be the accurate celestial longitudes (CLs) of the sun and the moon at the beginning of spring as shown on the left-hand side of Figure 1. Calculations

[1] http://orthodoxwiki.org/Byzantine_Creation_Era
"This system presents in a masterly sort of way the mystical coincidence of the three main dates of the world's history: the beginning of Creation, the incarnation, and the Resurrection of Jesus Christ. All these events happened, according to the Alexandrian chronology, on 25 March; furthermore, the first two events were separated by the period of exactly 5500 years."

presented in Cohen (2018) argued that if we assume the lengths of the year and the mean synodic month (from one sun-moon conjunction to the next, relative to earth) to be Y = 365 days + 6 hours (= 365.25 d)[2], and M_1 = 29.5 days + 793/1080 hours (= 29.530594... d)[3] or M_2 = 29.5 days + 792/1080 hours (=29.530555... d)[4], correspondingly, the astronomical long cycles for the reoccurrence of a conjunction at the VE are 483 Y, 502 Y, or 1468 Y (=483+483+502) for M_1, and 426 Y for M_2 Cohen 2005 and 2018). All 4 cycles result in a more accurate reappearance of the astronomical sun-moon CLs, relative to one cycle of 19 years (Table 1).

Table 1. Large cycles of over four hundred years in which the conjunction of the mean sun and mean moon returns to occur at the same time (within 1 hour) on the first day of spring.

Length of the Cycle **C** ("Julian" years) / Length of the Month M (days)	**19 Y** Y =365.25d	**483 Y** Y =365.25d	**502 Y** Y = 365.25d	**1468 Y** Y = 365.25d
Ptolemy's Almagest (Toomer, 1998) and the fixed Jewish calendar (Merzbach & Raviv, 2021) 29.5 days + 793/1080 hours = **M_1 = 29.530594 days**	**C***Y - 235M_1 = **8 6.94 (min.)**	C*Y - 5974M_1 = **-27.89 (min.)**	C*Y - 6209M_1 = **+59.06 (min.)**	C*Y - 18157M_1 = **-3.28 (min.)**
The ancient Middle East And Islamic Calendar 29.5 days + 792/1080 hours = **M_2 = 29.530556 days**	**C***Y - 235M_2 = **100 (min.)**			426*Y - 5269M_2 = **4 (min.)**

When presenting ancient beliefs related to astronomy to novice astronomy students, the following question seems to capture students' attention and curiosity: If the tight couplings expressed by the assumption that the 0^0 CL of the mean NM represents a celestial astronomical pattern indicative of a new beginning, what would fit a celestial arrangement in which the sun, moon, and the VE are at the maximum separation from each other? What would fit a separation where the sun and the moon are 120^0 and 240^0 apart from VE (0^0) in the ecliptic plane?

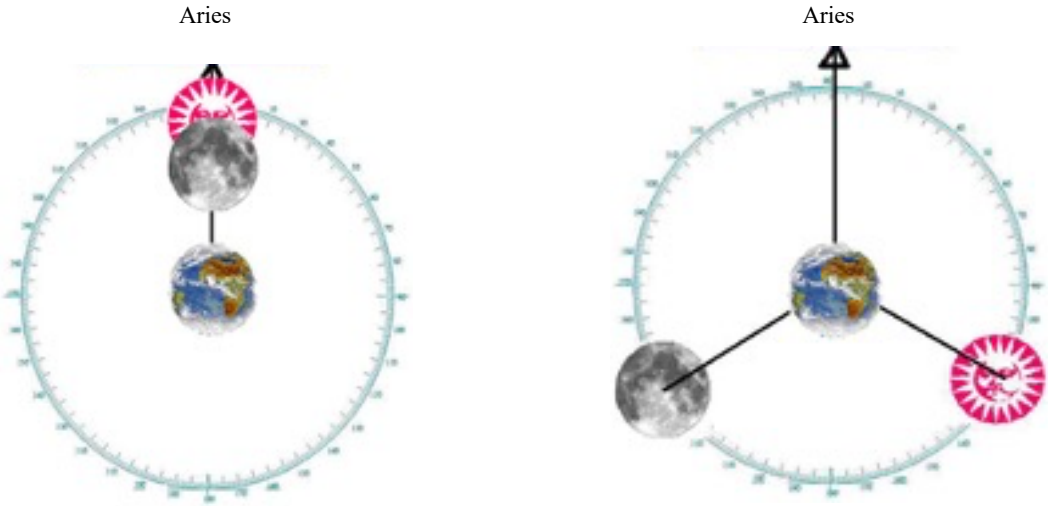
Using Y and M_1 one can readily calculate how many years from the celestial position as in Figure 1a are required to find such a maximum separation between the sun, the moon, and the beginning of the sign of Aries. The result obtained, as shown later in this paper, is that it occurs 70 years before the new beginning.

[2] With this length of the year, after 28 years, the sun returns to the same time of the day on the same day of the week (28* 365.25 Mod 7 = 0): Talmud, M. Brachot 59b: " … Abaye said: Every twenty-eight years when the cycle begins again and the Nisan [Spring] equinox falls in Saturn on the evening of Tuesday, going into Wednesday."

[3] As in the Almagest (Toomer, 1998).

[4] See, for example, Merzbach and Raviv, 2021.

Figures 1a (left) and 1b (right). The mean sun and the mean moon as visualized relative to the VE in their day of creation (1a) and major other milestones in the biblical chronology, against their visualization in times of catastrophes.



In the Old Testament, 70 is the number of years separating between the exact date of the destruction of Solomon's Temple and the rebuilt of the Temple (Temple II). Indeed, the destruction of the Temple symbolizes the end of an era both with to the Jewish religion's most sacred monument and to the end of the homeland of Judea as Jewish land. The date of the destruction is the 10th day of the month of AV, the fifth month starting from the month of Nisan, as described in the Bible:

> Jeremiah, chapter 52/12-13:
>
> *12: Now in the fifth month, in the tenth day of the month, which was the nineteenth year of king Nebuchadrezzar, king of Babylon, came Nebuzaradan the captain of the guard, who stood before the king of Babylon, into Jerusalem;*
>
> *13: ...and he burned the house of the LORD, and the king's house; and all the houses of Jerusalem, even every great man's house, burned he with fire.*

We argue that this biblical well-specified date, exactly in the middle of the day, is amazingly consistent with the celestial description in Figure 1b

We, thus, suggest that this Biblical chronology was based on a pure astronomical-astrological view in which the rare astronomical event of the relative specific and unique conjunction coupled with the greatest separation of the discussed 3 celestial coordinates, provided the necessary conditions for the start (Figure 1a) and the end (Figure 1b) of an era. This is an astronomical-astrological ancient visualization that all students of sciences, in general, and astronomy, in particular, could know to understand the approach used for the dating of major Jewish biblical events based on astronomical-astrological derivations and not on historical facts.

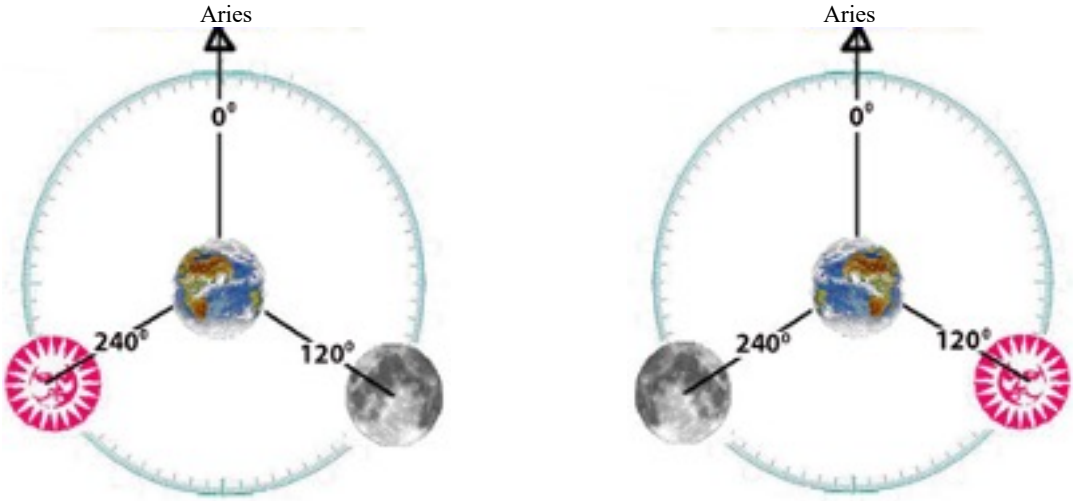
But if this scenario was in fact sufficiently valid to encourage the writers of the Bible to dictate a biblical chronology, inquisitive students might naturally inquire as to what then would have been the astronomical celestial coordinates to be associated with one of the most famous events in the bible in which the whole world of inhabitants were wiped out? Noah's deluge is undoubtedly such an event.

The mathematical association of the destruction of Solomon's Temple with the deluge has been previously noted by biblical scholars such as Borgonovo (2012). But in this paper, we propose that our approach for the dating of the deluge in the Masoretic Bible, at the end of the 17th day of the month of Marheshvan, 1656 years after creation. is the more likely explanation. Our approach shows that the date has been determined by the writers of the Bible to agree with the astronomical visualization expressed in Figure 2b, where the moon is at 120^0 and the sun at 240^0:

Genesis, Chapter 7 /11

In the six hundredth year of Noah's life, in the second month[5] *(Cohen, 2010), the seventeenth day of the month, on that day all the fountains of the great deep burst forth, and the windows of the heavens were opened.*

Figures 2. The destruction of the Temple on the right (2a), and the Deluge on the left (2b).



THE DATE OF THE DESTRUCTION OF TEMPLE I AND THE CELESTIAL LONGITUDES OF THE SUN AND THE MOON

As a matter of instruction, we shall now illustrate how to calculate the CLs of the sun on the 10th day of the month of Av in different years: In the Hebrew calendar, the 1st day of the month of Nisan in the year of creation coincided with the CL of 0^0. But, the length of the Jewish luni-solar year can vary between 12 lunar months (~354 days) and 13 lunar months (~383.5 days). Nevertheless. in all years the 1st of Nisan takes place 118 days before the 1st day of the fifth month of Av[6] or, 127 days before the day of the 10th of Av. On the other hand, in every solar year, the mean sun would cross the CL of 120^0 (measured from the VE) 121.75 days after the beginning of spring (121.75d = 120^0 * 365.25d / 360^0). Consequently, on the 10th day of the fifth month, the sun would be 120^0 away from the VE in a year in which the mean NM of Nisan would occur about 5.25 days (= 127 – 121.75) before the beginning of spring.

[5] Babylonian Talmud, M. Rosh-Hashana 11b: "R. Joshua said: That day was the seventeenth day of Iyar when the constellation of Pleiades sets at daybreak and the fountains begin to dry up, and because they [mankind] perverted their ways, the Holy One, blessed be He, changed for them the work of creation and made the constellation of Pleiades rise at daybreak and took two stars from the Pleiades and brought a flood on the world. R. Eliezer said: That day was the seventeenth of Marheshvan, a day on which the constellation of Pleiades rises at daybreak, and [the season] when the fountains begin to fill".

[6] 118 days is the total number of days in the four lunar months of Nisan (30 days), Iyar (29 days), Sivan (30 days), and Thammuz (29 days).

Based on the Hebrew calendar the lunar months and the solar spring, are interconnected by a basic cycle of 19 lunar years with a varying number of lunar months. In such a cycle there are 12 years with 12 lunar months (and a total of ~354 days on an average lunar year) and 7 intercalated years with 13 months (with an average of ~384 days in each year). The number of lunar months in this cycle is, therefore, 235. The difference between 235 lunar months, M_1, and 19 solar years, Y, is only ~87 minutes[7] (Table 1), and the NM of the 1st of Nisan returns at the end of the cycle of 19 Jewish years to its celestial coordinate at the beginning of the cycle + ~ 0.06^0.

The seven leap years are arranged within the 19 years in such a way that Passover (on the evening of the 15th day of the month of Nisan) would always be after the beginning of spring. This cycle of 19 lunar years was also used by the Christian church during the first 2 centuries AD to determine the date of Easter which is also defined as the feast of spring: The springtime celebration of Easter is the Christian tradition which is also marking the day of a celebration of the changing seasons.

In our assumed length of the biblical Hebrew year (Y), in which the CLs of the sun and the moon coincide on the day of the VE (Figure 1a), its Hebrew date is the 1st of Nisan. Consequently, on the evening of the 15th day of the month, Passover would be on the CL of ~ 14^0. 12 lunar months year later, Passover would start just ~3 days after the VE (with a new moon [NM] at the CL of ~ -8^0). The following year must be an intercalated year of 13 months to prevent the first day of Passover to occur before the beginning of spring. As a result, Nisan 15th would be ~22 days after the VE (= CL of ~ 22^0). Table 2 summarizes the CLs of all first nights of Passover in a cycle of 19 years after which the NM returns to its original CL just ~0.06^0 apart (=b1-b20 in Table 1). All Nisan's first days in a cycle of 19 years relative to the VE (column B in Table 2) would occur 14 days before the number of days C representing the day of Passover in Table 2.

To calculate the values of B and C, we started our steps from the 1st of Nisan at exactly 0^0 in the year of the building of Temple II and continued backwords in cycles of 19 years. The 4th cycle backward started 57 years before the building of Temple II (Table 2):

Table 2. B is the number of days of Passover' "Seder" after the beginning of Spring and C is the number of days, separating between Nisan's NM and the beginning of spring, in a cycle of 19 years. D is the number of the mean synodic months in year A counted backward from the construction of Temple II. The number of lunar months D in each year follows the intercalation system ensuring that all Passovers are starting less than one lunar month (less than ~29.5306 days) after the VE as shown in column C. It is assumed that in the year of the construction of the Temple II, Passover was 14 days after the beginning of spring (Cohen, 2018), with the 1st of Nisan coinciding with the VE.

A	B	C	D	A	B	C	D
57	0.18	14.18	12	67	-9.11	4.89	13
58	11.06	25.06	12	68	1.77	15.77	12
59	-7.58	6.42	13	69	12.65	26.65	12
60	3.30	17.30	12	70	-5.99	8.01	13
61	14.18	28.18	12	71	4.89	18.89	12
62	-4.47	9.53	13	72	-13.76	0.24	13
63	6.42	20.42	12	73	-2.88	11.12	12
64	-12.23	1.77	13	74	8.01	22.01	12
65	-1.35	12.65	12	75	-10.64	3.36	13
66	9.54	23.54	12	76	0.24	14.24	12

As emphasized above, only when the mean NM of Nisan is calculated to be 5.25 days before the VE, the CL of the sun would be 120^0 during the 10th of Av. Therefore, based on the values B in Table 2 it can be seen that 70 years before the construction of Temple II, the NM is 6 days before the VE and the destruction of the Temple would be exactly (within 8 minutes) at midday, 18 hours after the beginning of the 10th of Av[8]. We note that in a period of 100

[7] In the contemporary fixed Hebrew calendar, the length of the Jewish year is 235*M1/19, and, therefore the difference is 0 minutes. See discussion following Table 3.

[8] = 6 +127 – 5.25 = 0.75 days

years before the construction of Temple II we get for the years 13, 32, 51, 70, and 89 close results for B and C showed in Table 3, which seemingly would all permit Figure 1b's event to occur.

Table 3. The columns A, B, C are as in Table 2. Column F presents the deviation in degrees of the sun's CL from 120^0 at Midday of the 10^{th} of Av.

A	B	C	F
13	-6.18	7.82	-2.4^0
32	-6.12	7.88	-1.6^0
51	-6.05	7.95	-0.8^0
70	-5.99	8.01	0^0
89	-5.93	8.07	0.8^0

One might note that the "striking coincidence" between the Biblical dating of the destruction of Temple II as occurring uniquely 70 years before its reconstruction when the above, believed to create a menacing celestial picture, can be emphasized by the following considerations:

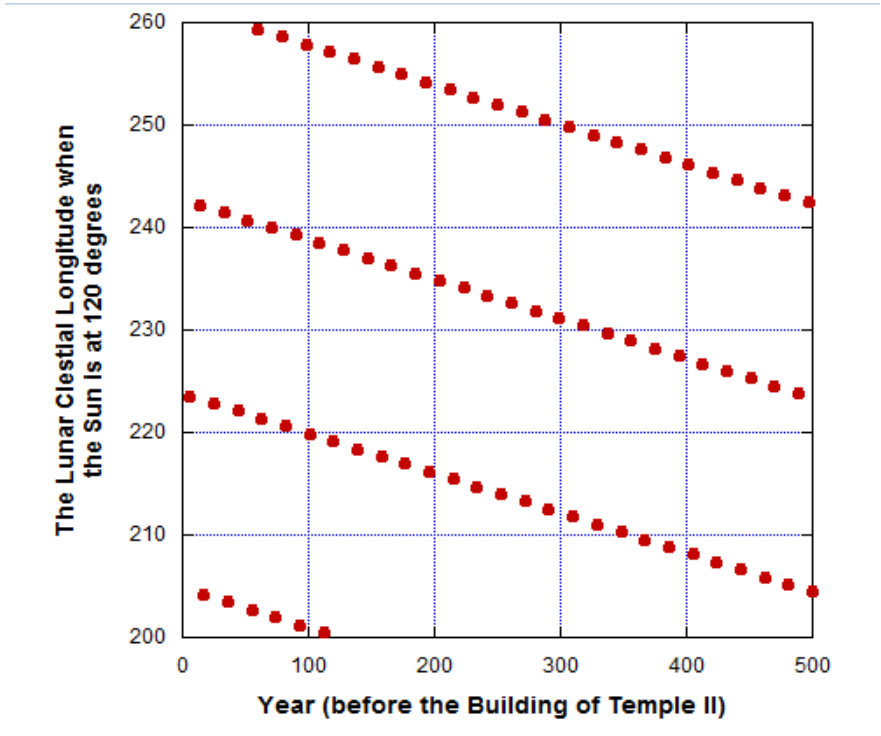
As mentioned above in the present Jewish calendar, 235 mean synodic months (M_1) is exactly equal to nineteen solar years. Consequently, in such a calendar[9], where the length of the year is assumed to be equal to 365.246822 days, all values of B and C in Tables 2 and 3 as well as the corresponding moon's celestial coordinates would be exactly repeating themselves in all cycles of 19 years. But, when the year is equal to 365.25 days the sun's CLs after each cycle of 19 years of 365.25 days each are changing, as discussed above, by about 0.06^0 corresponding to 87 minutes. But 0.06^0 have a much larger value when it comes to the moon:

The mean moon advances $S^*(Y+M_1)/M_1 = 13.17637$ deg/day. It follows that in 87/1440 days the moon changes its CL by, approximately, 0.8^0: close to a full day.

As a consequence, only one value of A in Table 3 would best fit the moon's CL of 240^0 on a given day of the month. We have, therefore, calculated the CLs of the moon when the sun was at 120^0 in all 483 years of a large cycle (after which Nisan's NM reappears within 28 minutes relative to the VE as in the first NM of the large cycle – see Table 1), and the only year in which the moon crossed the CL of 240^0 within less than 6 hours from Midday of the 10^{th} of Av, was when A was equal to 70 (Figure 3):

[9] formally determined several hundred years after the last events described in the Bible - see, for example, Merzbach and Raviv, 2021

Figure 3. The CLs of the mean moon when the sun crosses the 120^0 CL. The horizontal axis represents the number of years before the mean sun-mean moon conjunction 12 hours after the beginning of spring. In a cycle of 483 years, the moon would be 70 years before the building of Temple II within 0.4 of a degree from 240^0.



Jeremiah, chapter 25:

11: And this whole land shall be a desolation, and an astonishment; and these nations shall serve the king of Babylon seventy years.

12: And it shall come to pass when seventy years are accomplished

Indeed, it seems reasonable to advance the notion that all chronologies based on the Bible emphasize the fact that Temple II was built seventy years after the destruction of Temple I, two events described by Figures 1a and 1b, and, thus, the fingerprints of astronomical calculations in the biblical chronology are firmly apparent.

THE DATE OF THE NOAH'S DELUGE AND THE CELESTIAL LONGITUDES OF THE SUN AND MOON

Let us now turn to illustrating a calculation of what CLs was the sun on the 17^{th} day of the second month 1656 years from creation. In the most commonly accepted Hebrew calendar, the "second" month is the month of Cheshvan following the month of Tishrei, even though in all other chapters in the Old Testament, the first month of the year is the month of Nisan, followed by the month of Iyar. But, in the particular chapter in Genesis describing the Deluge, the common opinion is the one of Rabbi Eliezer expressed in the Talmud since the month of Cheshvan is the month in which the rains of autumn and winter begin. This can be reinforced by an astronomical study based on the Talmudic description of the set and rise of the Pleiades during the beginning of the Deluge as detailed in Cohen, 2010.

At the beginning of the month of Nissan in the year of creation, the CL of the sun and the moon were 0^0 as in Figure 1a. Let us, now, calculate what the celestial coordinate of the sun is expected to be 7 months and 17 days in the 1656 year - 1656 years can be divided into the sum 1468 + 188: 1468 years is a large cycle after which the CL of the sun and moon returns to its value as in creation within 3.28 minutes (Table 1)[10]. The remaining 188 years consist of 9 cycles of 19 years + 17 years.

According to Table 1, in each cycle of 19 years the CL changes by ~87 minutes, so in total, after 9 cycles the change will be 13 hours or a little over half a day.

In the last cycle, which is the tenth cycle, Table 4 summarizes the number of days each year in the cycle on which the first day of the month of Nissan is delayed or preceded in respect to the VE.

Table 4. The CL of Nisan's NM (B), or the approximate number of days separating between Nisan's NM and the beginning of spring, in a cycle of 19 years between the years 171 and 190. C is the number of the mean synodic months in the year a of the cycle.

A	B	C	A	B	C	A	B	C
171	-0.54	12	178	11.87	13	185	-5.25	12
172	-11.43	12	179	0.99	12	186	13.40	13
173	7.22	13	180	-9.90	12	187	2.51	12
174	-3.66	12	181	8.75	13	188	-8.37	12
175	-14.54	12	182	-2.13	12	189	10.28	13
176	4.10	13	183	-13.02	12	190	-0.60	12
177	-6.78	12	184	5.63	13	-	-	-

In much the same way, by counting the number of days N between the Biblical date of 7 months and 17 days after Nisan, to the next 1st of Nisan we find a result of 132 days. The reason for counting forward is that the writers of the story of the Deluge in Genesis can be interpreted to be providing us with the lengths of the months that followed the beginning of the Deluge:

> Genesis, chapter 10:
>
> *3: …and the waters receded from the earth continually. At the end of 150 days, the waters had abated;*
> *4. …and in the seventh month, on the seventeenth day of the month, the ark came to rest on the mountains of Ararat.*

The literature suggests that 150 days passed from the beginning of the flood on the 17th of the second month until the 17th of the seventh month. Assuming that the calculation of the 150 days was made from the day time of the beginning of the flood to the 17th day of the seventh month before sunset (as opposed to 150 days and nights), this period must contain 4 out of five lunar months that are 30 days long each as determined by the first newborn crescent of the moon. This method of determination had been replaced by a permanent calendar only in the 4th century AD. As a consequence, we will treat the year of the flood according to the biblical input of the five months following the start of the Deluge.

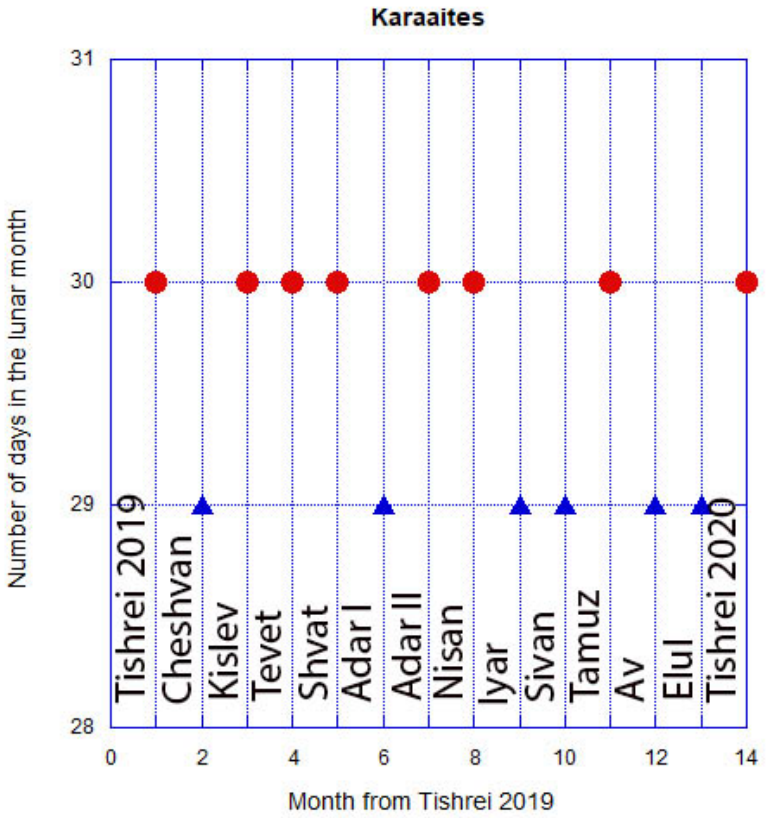
In general, the astronomical knowledge of the ancient world about the varying sun-earth distances during the solar year was well described, for example, in the works of Hipparchus from the second century BC. In his work, we find a determination of the CL in which the sun is in its longest distance from earth (the CL of the aphelion). That CL that was determined based on the astronomical observations made by Hipparchus himself was 65.5^0, a value that was kept constant in the world of astronomy for one millennium until the 9th century AD when al-Battani found that the aphelion constantly increases by 1^0 in about 55 years. The astronomical models as developed from the fourth century BC and detailed in the 2nd century AD Ptolemy's Almagest found that as a result of the varying distance, the sun does not move at a fixed rate, but is slower in the spring and summer months relative to its speed in the fall and winter seasons. Since the mean moon rotates around the earth at a constant rate, the time between consecutive sun-moon conjunctions

[10] Assuming the lengths of the year and the month to be 365.25 days and M_1, as in the previous section.

relative to earth in spring and summer is shorter. On the other hand, the time between conjunctions increases during autumn and winter periods, and, therefore, it is expected that 30-day-long months are more frequent in the winter compared to more 29-day-long months in the spring and summer seasons.

Indeed, examples supporting the descriptions above can be seen by examining contemporary calendars based on the appearance of the new crescent of the moon to declare the start of a new month. The members of the Universal Karaite Judaism organization have never accepted the permanent calendar and they still determine their lunar month as had been done before the 4th century AD modification in the Jewish calendar. Their recent yearly calendars are published online[11]. In Figure 4 we summarize the Karaaites' lengths of the months for the Jewish year 5779 (from October 2018 till October 2019), in which we find 4 30-days-long months out of five winter months.

Figure 4. The Karaaite's calendar for the year Tishrei 2018 to Tishrei 2019. 4 months out of 5 are 30 days long each during the Autumn-Winters months Tishrei-Shvat, against 4 months out of 5 are 29 days long during the Spring-Summer months Sivan-Elul.



Let us, now, return to the value of N:

N = 13 + 30 +30 + 29 +30 = 132.

The beginning of the Deluge is, thus, 132 days away from the following 1st of Nisan of the year 189. But according to Table 4, the 1st of Nisan at that year starts 10.28 days after the VE. It follows that the beginning of the Deluge was N-10.28 = 121.72 days before reaching the VE. But, 121.78 days in degrees are 121.78 x 360 / 365.25 = 119.97^0 and the

[11] http://www.karaite.org.il/services/luah

sun finds itself at the beginning of the Deluge on the CL of 240.03^0. As to the CL of the moon at the end of the 17th day of the month of AV.

By studying the Karaaite calendar it can be seen that the most common number of days between the day of the conjunction and day 1 of the month is 1. But, this number can also be 0, or 2 as was the case in the month of Shvat of the year 5781: The sun-moon conjunction took place on January 13th, 2021 whereas the 1st day of the month was on January 15th. Therefore, our approach suggests that the moon on the 17th close to the 18th day of the month was 19-20 days after the real conjunction. 19-20 days, or ~ 2/3 of a month, after conjunction include the CL of the moon 240 away from the sun as in Figure 2b. We note that it is agreed among modern Biblical researchers that Genesis was written much before the chapters dealing with the destruction of Temple II the writers of which used a more advanced calendar allowing better accuracies in respect to the moon's position. Such accurate luni-solar calendars with a repeatable scheme of intercalation of the years in cycles of 19 years, were used by the ancient Babylonian and Greek civilizations ever since 626 BC as detailed in Parker and Duberstein (1956).

DISCUSSION AND CONCLUSIONS

Joseph Scaliger (1540–1609), the renowned Christian astronomer, expressed a consensus view about the celestial view of creation:

> *The ancient Jews wanted to have the equinox, the fasis (first visibility of the NM), and feria iv (Wednesday) coincide in Creation week, at the beginning of Nisan.*

Scaliger believed this fact, described in Figure 1a, to be an inconsistent interpretation of a divine chronology. But, as we have illustrated, a reasonably consistent chronology of the Bible was likely first written by ancient Jewish scholars using astronomical data to lead to the astronomical event described by Scaliger. Only afterward did their followers make the resulting chronology look as originating from the divine source.

As we presented earlier, the consensus regarding the celestial positions of the sun and the moon relative to the equinox is also emphasized, for example, by the analysis of al-Khwarizmi's treatise (Kennedy, 1964), and Scaliger.

The writers of the Bible seem to have provided the best proof that accurate astronomical-astrological calculations served as their main source for dating major biblical events: We argue that the probability for a coincidence leading to the date of the destruction of Temple I, the 10th day of Av and its dependent on straight forward astronomical calculations is negligible. It is clear that the date was carefully chosen by using the motions of the heavenly bodies, the sun, and the moon, to prophesy the demolishing and burning of Solomon's Temple, and 70 years later starting a new era with its reconstruction. This is particularly emphasized by the fact that the biblical year in the Masoretic text of the destruction of the Temple, is the year 3338 after Adam (Frank, 1956). This biblical year is off by 164/5 years compared to its historical accepted value (Edelman, 2008): The Masoretic text suggests that the destruction happened in 421 BC, 164/5 years off its well documented year of 586 BC. With such a discrepancy, the date within the incorrect year had any meaning other than an astrological vision used to be associated with the destruction.

Finally, since the destruction of Temple I its annual date had been regarded as the annual day in which several major disasters would occur. However, in all other catastrophes, the celestial coordinate of the sun had only been in the vicinity of 120^0 with the moon at about 240^0. We, thus, note that the well-known historian who wrote about the destruction of Temple II (in 70 AD) Josephus Flavius, included in his book "The Works of Flavius Josephus", the following description of the destruction of that Temple:

> *...So Titus retired into the tower of Antonia and resolved to storm the temple the next day, early in the morning, with his whole army, and to encamp round about the holy house. But as for that house, God had, for certain, long ago doomed it to the fire; and now that fatal day was come, according to the revolution of ages; it was the tenth day of the month Lous, [Av,] upon which it was formerly burnt by the king of Babylon.*

This view is consistent with that expressed in the Babylonian Talmud (Rosh-Hashana 18b):

> *Said R. Papa: The fast (ninth day) of Av is different, since many misfortunes occurred on that day, as the master said: On the ninth of Av, the first and second Temples were destroyed, Bethar was captured, and the city of Jerusalem was razed to the ground.*

The astronomy student learning about the destruction of Temple II and our suggested astronomical origin of its dating might naturally find themselves asking, “what about the real historical dates?”

The answer seems to be that the astrologically based "seventy-year" exile prophecy, accepted by all historians to have started with the destruction of the Temple at 586 BC, ended with Babylon's fall in 539 BC, signaling the return of the Israelites to Jerusalem and the rebuilding of the Temple, 47 years later. Not 70.

As to the Masoretic dating of the Deluge, this systematic analysis approach accompanied by our derivations is the only scientific explanation for their exact year from creation and annual dating, reinforced by the mutual similarity between the Deluge and the Destruction of Temple I.

AUTHOR BIOGRAPHY

Dr. Cohen is the Professor in the Institute of Earth Sciences at the Hebrew University of Jerusalem and Chairman of the Jerusalem Society of Science, Computers and Software Engineering. In addition to his considerable experience teaching Earth and space sciences, he was among the founding scientists for introducing remote sensing research in Israel, including laser radar systems and satellite systems. E-Mail: cohariel@gmail.com

REFERENCES

Cohen, A. (2005 printed in 2007). Astronomical Luni-Solar Cycles and the Chronology of the Masoretic Bible. Culture and Cosmos, 9(2) (47-61).

Cohen, A. (2009). The Astronomical Coordinates of the Planets in the day of their Creation as Determined by the Jews in Eretz-Israel in the Pre-Mishnah Era, Judea and Samaria Res. Studies, 18, ed. J. Eshel (Ramat-Gan and Ariel), 356-365 (in Hebrew with an English Abstract).

Cohen, A. (2010). The Rising of the Pleiades and the Determination of the Exact date of the Deluge by R. Yehoshua and R. Eliezer", Judea and Samaria Res. Studies, 19, ed. M. Billig (Ramat-Gan and Ariel), 356-365 (in Hebrew with an English Abstract).

Cohen, A. (2018). The Changes In Calendars In The Ancient World As A Tool To Teach The Development Of Astronomy. Journal of Astronomy & Earth Sciences Education (JAESE), 5(1), 67-84. https://doi.org/10.19030/jaese.v5i1.101935.

Edelman, D. (2008). Hezekiah's Alleged Cultic Centralization", Journal for the Study of the Old Testament, 32, 395 – 434.

Frank, E. (1956). Talmudic and Rabbinical Chronology, Philipp Feldheim, Inc., Publisher, NY, (80 pp), p. 30.

Kennedy, E. S. (1964). al-Khwarizmi on the Jewish Calendar, Scripta Mathematica 27, 55-59.

Humphreys, C. J., and Waddington, W. G. (1983) Dating the Crucifixion, Nature 306 (December 22/29), 743-746.

Merzbach, E., and Raviv, E. (2021). The Fixed Hebrew Calendar, Carmel, Jerusalem, 86-87.

Parker, R.A., and Dubberstein, W. H. (1956). Babylonian Chronology 626 BC-AD 75 (Providence, RI: Brown University Press), v. 25

Pratt, J. P. (1991). Newton's Date for the Crucifixion. Quarterly Journal of Royal Astronomical Society 32, (Sept. 1991), 301-304.

Toomer, G. (1998). Ptolemy's Almagest (Translated and Annotated), Princeton University Press.

NOTES