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[redacted]

Watch Tower
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3 March 2017

Dear Brothers and Sisters,

Thank you very much for your letter on the 27 December, the information has been very useful. I have had a look at the dates using astronomy software, and have a few further questions.

Unfortunately I wasn't able to match all of the observations up to the standard described in the letter and in the Watchtower 2011, I am wondering if I am perhaps looking at the wrong times or misinterpreting the text? I have enclosed details of the dates I was unable to match.

I look forward to your reply.

Many thanks

Jacob Halsey

Method

I am using Starry Night Pro Plus astronomy software with coordinates: Latitude: 32° 32' N, Longitude: 44° 25' E. The enlarge moon size is enabled where possible to aid visibility.

For angular separation I am converting 1 cubit = 2.2° and 1 finger = 0.092°.

Directions / positions of `in front' and `behind' are along the ecliptic (path of the sun), `above' and `below' are perpendicular to the ecliptic.

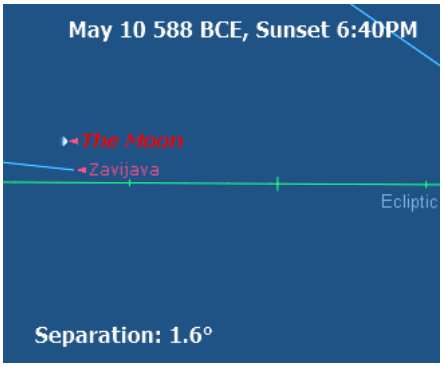
"The Babylonian day began at sunset. Day 1 of the new month was declared at the first appearance of the lunar crescent after sunset, which occurs at most a few days after New Moon."

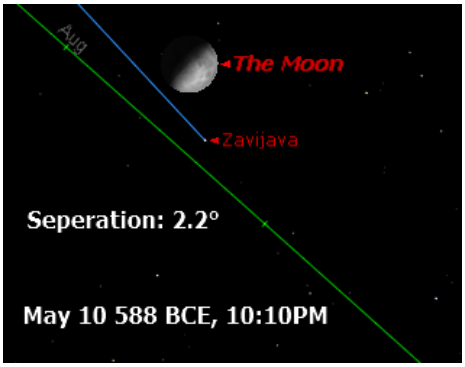
Mathieu Ossendrijver. "Translating Babylonian Astronomical Diaries and Procedure Texts". In: Translating Writings of Early Scholars in the Ancient Near East, Egypt, Greece and Rome: Methodological Aspects with Examples 344 (2016), p. 131.

2. Obv 3, Nisanu 9

May 10/11, 588 Match: Exact

Night of the 9th, beginning of the night, Sîn (Moon) stood 1 cubit (2.2°) in front of the Rear Foot of the Lion (β Virginis / Zavijava).



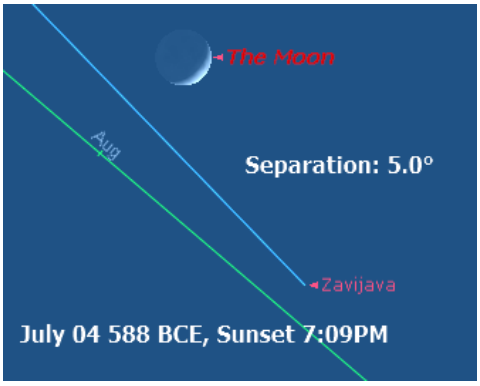


Although I found the separation to match, the Moon appears to be behind β Virginis, definitely not in front, therefore I do not see how it can be described as 'exact'.

5. Obv 14, Simanu 5

July 4, 588 Match: Excellent

Night of the 5th, beginning of the night, Sîn (Moon) passed towards the east 1 cubit (2.2°) ‹above/below› the Bright Star at the Tip of the Lion's Foot (β Virginis / Zavijava).



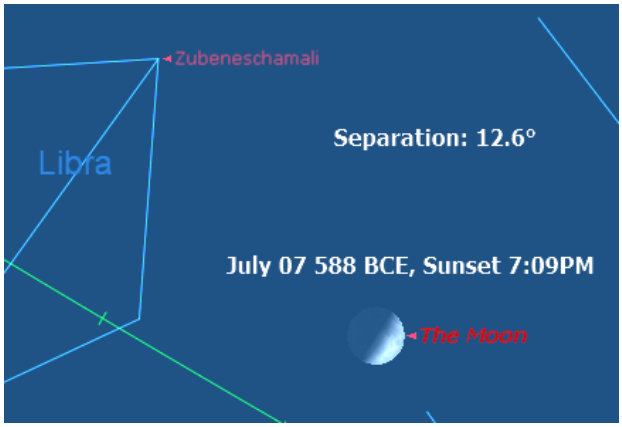
I am assuming that I have correctly identified the star here; Neugebauer and Weidner also considered γ Virginis, but decided that this wouldn't work because "the lion's appearance looks downright grotesque"?

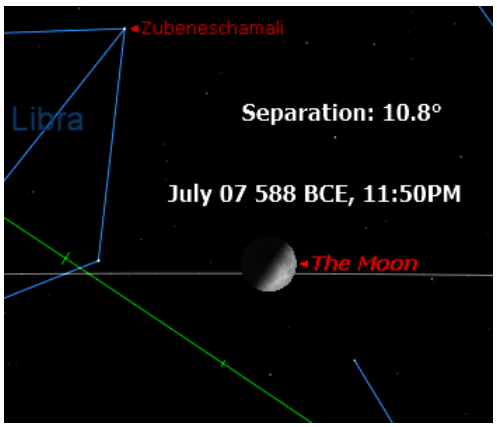
At sunset the Moon is 5.0 ° behind β Virginis, and has moved back to about 6.2° behind, when β Virginis sets at 9:55. I don't understand how this can excellently match 'passing 2.2° above/below'?

6. Obv 15, Simanu 8

July 7 588 BCE Match: Good

Night of the 8th, evening watch, Sîn (Moon) stood 2 1/2 cubits (5.5°) below the Northern Part of the Scales (β Librae / Zubeneschamali).



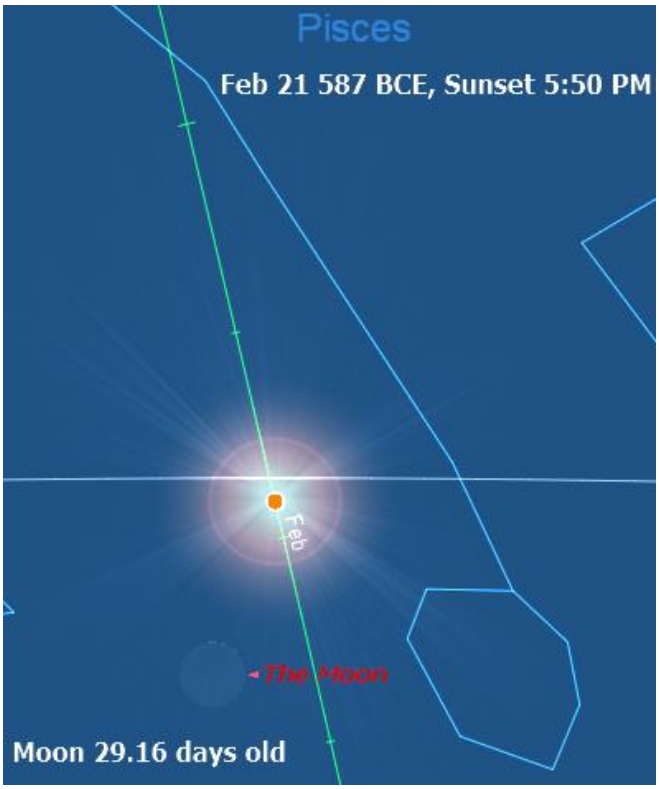


At sunset the Moon is 12.6 ° in front β Librae, and at the last visible time the Moon is still 10.8 ° in front. The angular separation seems quite different, and the position seems better described as in front than below.

8. Rev 5, Sabatu 1

February 21/22 587 BCE Match: Excellent

Šabātu, the 30th (the preceding month had 29 days), Sîn (Moon) appeared in the Swallow (a part of Pisces)



The difficulty which I am having with this observation is that although the Moon is near Pisces, it is not visible

This results in 2 problems, the first is that they cannot see the Moon ‘appear’ in the Swallow.

The second is that the date should not be Sabatu 1, because a new month is began when ‘the thin crescent of the new moon was first visible in the sky at sunset’. At sunset February 21 there is not a new moon yet, neither is it visible.

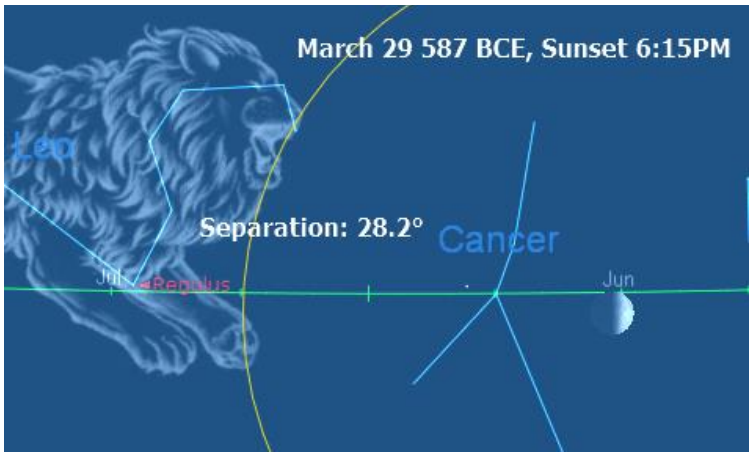
Parker and Dubberstein calculated this month in 587 as starting two days later at sunset February 23 (day portion in 2/24)

I had the same issue with the observations numbered 1, 4 and 11, (although in these cases the month was only behind the visibility tables by one day rather than two).

13. Rev 14/15, Addaru 7

March 29/30 587 BCE Match: The Moon was 29° below α Leonis

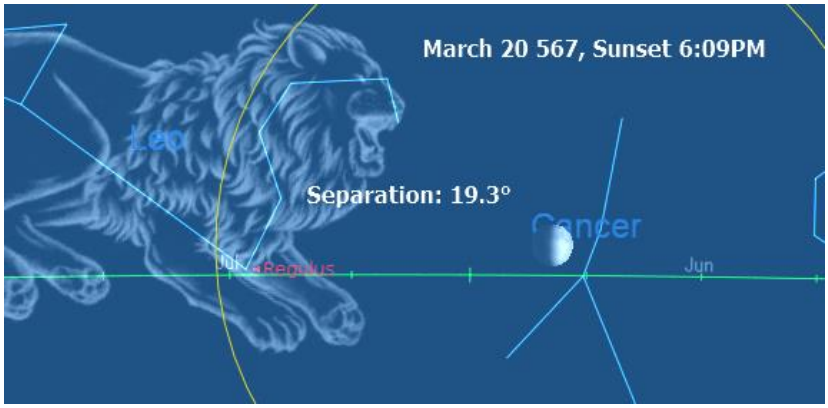
Night of the 7th, Sîn (Moon) was surrounded by a 'fold' (22° halo), the Crab (Cancer) and the King (α Leonis / Regulus) were within [the 'fold', ...]. The 'fold' surrounded the Crab, the Lion (Leo), it was split to the north.



I was able to see that α Leonis was separated 28° from the Moon at sunset, although behind rather than below.

I wasn't however able to understand the explanation given regarding the definition of 'tarbasu'. I was able to find the following on page 33 of ADT which you quoted:

"TÙR "halo" Akk. tarbasu "pen, fold". Haloes are frequently described as "billowing" (iqtur, lit. "it smoked"). If a halo is not closed it is said to have a "gate" in a certain direction. The larger type of halo called supūru is not so far attested in diaries. Sometimes a GIŠ.HUR "drawing" around the moon is reported; this refers to the corona phenomenon, as was seen already by F. X. Kugler."



Sachs and Hunger's seem confident that it refers the smaller halo. For their date in 567, α Leonis and Cancer are within the Halo, and Leo is partially within the Halo. Perhaps I have misunderstood the text, but I was under the impression that it does not require that the constellation to be entirely in the halo?

In theory if the Moon was centred between Leo and Cancer, which are around 50° from one end to the other; then a 22° radius / 44° diameter halo would be able to enclose the majority of their stars (see March 04 below)?

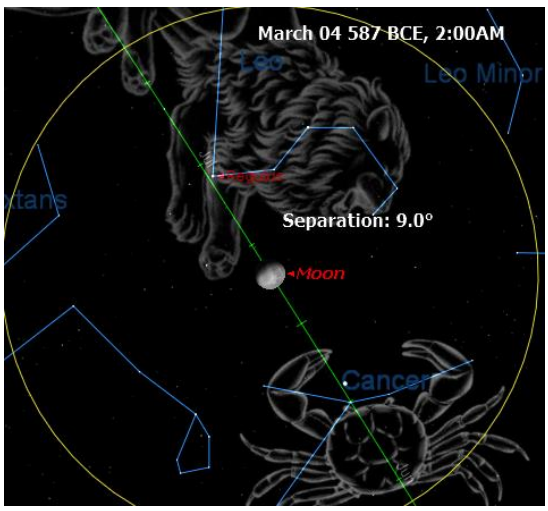
10. Rev 7, Sabatu 11?

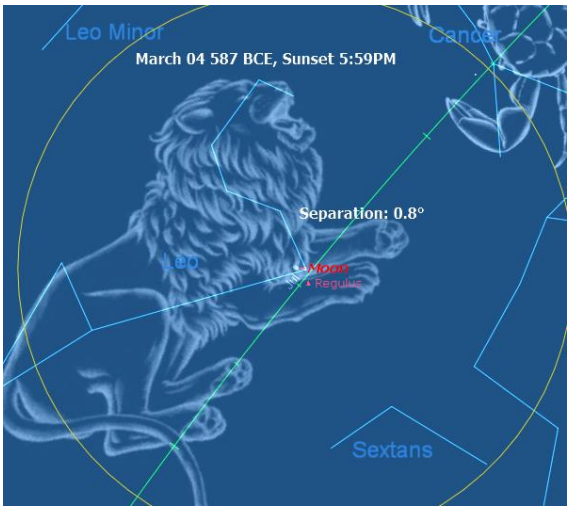
Sabatu 11 - March 4 587 BCE Match: Excellent

Sîn (Moon) was surrounded by a 'fold' (22° halo); the Lion (Leo) and the Crab (Cancer) were inside {inside} the 'fold'. The King (α Leonis / Regulus) was 'balanced' 1 cubit (2.2°) below Sîn.

There is no date given for this observation so it could be on one of a number of different days. The date given in your letter was Sabatu 11.

Presuming that I have understood the calendar correctly if Sabatu 1 spans Feb 21/22, the evening of Sabatu 6 is Feb 26, therefore Sabatu 11 spans March 3/4?





I found that on Sabatu 11, March 4 portion, both Leo and Cancer are within the Halo, however α Leonis is 9° behind the Moon, therefore I do not see how this is excellent.

I did find a potentially better match on Sabatu 12, March 4 portion, where α Leonis is 0.8° below the Moon; much closer to the text. Cancer is partially within the Halo.

Copy of attachment, received 27 December

The Line in Vat 4956	*Babylonian date*	*Julian date*	*Match*
1. Lines 1, 2	Nisanu 1	May 2, 588	Excellent
2. Line 3	Nisanu 9	May 10/11, 588	Exact
3. Line 8	Ayyaru 1	June 1/2, 588	Excellent
4. Line 12	Simanu 1	June 30/July 1, 588	Good
5. Line 14	Simanu 5	July 4, 588	Excellent
6. Line 15	Simanu 8	July 7, 588	Good
7. Line 16	Simanu 10	July 9/10, 588	Excellent
8. Line 5′	Sabatu 1	Feb 21/22, 587	Excellent
9. Line 6′	Sabatu 6	Feb 26, 587	"The Pleiades was 13° from the Moon and thus within the 22°halo."
10. Line 7′	Sabatu 11	March 4, 587	Excellent
11. Line 12′	Addaru 1	March 23/24, 587	Excellent
12. Line 13′	Addaru 2	March 24/25, 587	Excellent
13. Line 14	Addaru 7	March 29/30, 587	"The Moon was [more than] 29° below α Leonis. Does not match 22° halo."

NOTE: The word translated "halo" (*"tarbasu"*) is disputed. The word literally means "pen, fold." This word does not necessarily refer to spherical bodies, but refers to something that the moon is "in" or "inside," just as an animal is in a pen, and a pen need not be spherical. At times a halo may not be perfectly round but may have irregularities that can extend beyond the standard 22° . That in ancient times the halo was not limited to 22° is strongly suggested in line 15′(reverse) where the same word is used. It says that the *"tarbasu"* "surrounded Cancer and Leo," two *constellations* that are over 50 degrees apart at their nearest points.—Sachs and Hunger, pp. 33, 51.

Berichte über die Verhandlungen der Königl. Sächsischen Gesellschaft der Wissenschaften zu Leipzig, Reports Regarding the Discussions of the Royal Saxonian Society of Sciences at Leipzig), Vol. 67, May 1, 1915, article "An Astronomical Observer's Text of the 37th Year Nebuchadnezzar II," ("Ein astronomischer Beobachtungstext aus dem 37. Jahre Nebukadnezars II,") by Paul V. Neugebauer and Ernst F. Weidner, pp. 41, 67-76;

NOTE: Neugebauer and Weidner list 17 lunar observations; however, four of these simply use the expression "the God was seen with the God," which means "full moon." So in these four instances, the moon was not described as being connected to a certain star or constellation. The numbers that are omitted are 3, 9, 13, and 17. Thus, the number of instances where the position of the moon is described in relationship to a certain star or constellation is 13. The 15 sets of planetary observations are on pages 72 to 76; The book *Mesopotamian Planetary Astronomy—Astrology,* by David Brown, published 2000, pages 53 to 57.