

## THE ABSOLUTE CHRONOLOGY OF THE NEO-BABYLONIAN ERA

AS EXPLAINED earlier in chapter 2, an absolute chronology is usually best established by the aid of ancient astronomical observations.

Although no observations usable for dating purposes are recorded in the Bible, it was pointed out that at 2 Kings 25:2, 8 the dating of the desolation of Jerusalem to “the eleventh year of King Zedekiah,” the last king of Judah, is synchronized with “*the nineteenth year of King Nebuchadnezzar,*” the Babylonian desolator of the city. If the reign of Nebuchadnezzar could be fixed astronomically to our era, it would be possible to establish the B.C.E. date for the desolation of Jerusalem.

In this chapter it will be demonstrated that the *whole* Neo-Babylonian period, including the reign of Nebuchadnezzar, may be established as an *absolute chronology* by the aid of astronomical cuneiform documents found in Mesopotamia.

### *The study of the Babylonian astronomical documents*

The study of the astronomical cuneiform texts started more than one hundred years ago. One of the leading Assyriologists at that time was J. N. Strassmaier (1846-1920). He was a diligent copyist of the cuneiform texts that from the 1870's onwards were being brought from Mesopotamia to the British Museum in enormous quantities.

Strassmaier found that a great number of the texts contained astronomical data. He sent copies of these texts to his colleague J. Epping, who taught mathematics and astronomy in Falkenburg, Holland. Thus Epping (1835-1894) was to become the pioneer in the

study of the Babylonian astronomical texts. After his death another of Strassmaier's colleagues, Franz Xaver Kugler (1862-1929), took over the work of Epping.

Few, if any, have contributed as much to the study of the astronomical texts as Kugler. He published his results in a series of monumental works, such as *Die Babylonische Mondrechnung* (1901), *Sternkunde und Sterndienst in Babel*, Vol. I and II (1907-1924), and *Von Moses bis Paulus* (1922). The last two works include detailed studies of ancient chronology, in which the astronomical texts are fully developed and studied in depth.<sup>1</sup>

After Kugler's death in 1929 some of the key names in the study of the Babylonian astronomy have been P. J. Schaumberger (deceased 1955), Otto Neugebauer (1899-1990), and Abraham J. Sachs (1914-1983). Many other modern scholars have contributed much to the understanding of the astronomical texts, some of whom have been consulted for the following discussion.

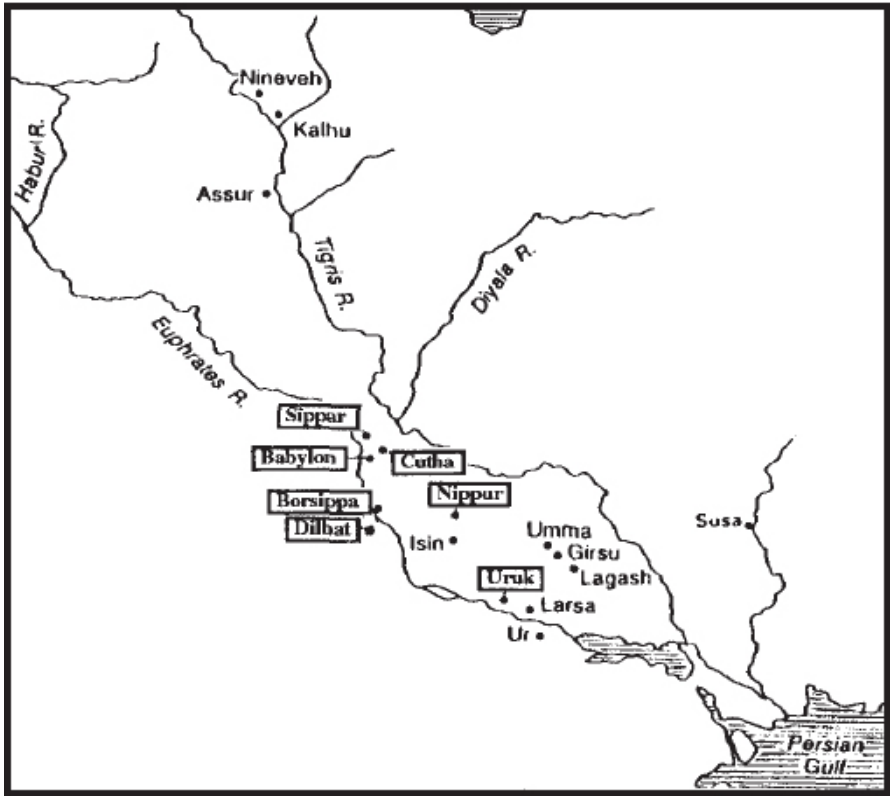
### *Ancient astronomy*

As can be deduced from the Babylonian astronomical tablets, a regular and systematic study of the sky began in the mid-eighth century B.C.E., perhaps even earlier. Trained observers were specifically employed to carry out a regular watch of the positions and movements of the sun, the moon and the planets, and to record from day to day the phenomena observed.

This regular activity was performed at a number of observational sites in Mesopotamia, located in the cities of Babylon, Uruk, Nippur, Sippar, Borsippa, Cutha, and Dilbat.<sup>2</sup> (See the accompanying map.)

As a result of this activity, the Babylonian scholars at an early stage had recognized the various cycles of the sun, the moon and the five planets visible to the naked eye (Mercury, Venus, Mars, Jupiter, and Saturn), enabling them even to predict certain phenomena, such as lunar eclipses.

- 1 Kugler's results are of lasting value. Dr. Schaumberger states that Kugler "on all essential points has fixed the chronology for the last centuries before Christ, having thus performed an invaluable service to the science of history."—P. J. Schaumberger, "Drei babylonische Planetentafeln der Seleukidenzeit," *Orientalia*, Vol. 2, Nova Series (Rome, 1933), p. 99.
- 2 In Assyrian times, such observations were also performed in the cities of Assur and Nineveh. The observations in Babylonia were possibly performed on top of temple-towers, *ziggurats*, such as the ziggurat of Etemenanki in Babylon.



**Astronomical Observation Sites in Babylonia**

Finally, in the Persian and Seleucid eras, they had developed a very high level of scientific and mathematical astronomy that had never been reached by any other ancient civilization.<sup>3</sup>

*The nature of the Babylonian astronomical texts\**

Although astronomical cuneiform texts have been found also in the ruins of Nineveh and Uruk, the bulk of the texts—about 1,600—comes from an astronomical archive somewhere in the city of Babylon. The

3 It has often been pointed out that the Babylonian interest in the sky to a great extent was *astrologically* motivated. Although this is correct, Professor Otto Neugebauer points out that the main purpose of the Babylonian astronomers was not astrology, but the study of calendaric problems. (Otto Neugebauer, *Astronomy and History. Selected Essays*. New York: Springer-Verlag, 1983, p. 55.) For further comments on the astrological motive, see the Appendix for chapter four, section 1: “Astrology as a motive for Babylonian astronomy.”

\* Consideration of astronomical evidence inescapably involves much technical data. Some readers may prefer to bypass this and go to the summary at the end of this chapter. The technical data is nonetheless there for corroboration.

archive was found and emptied by local inhabitants from nearby villages, and the exact finding spot within the city is not known today. Most of the texts were obtained for the British Museum from dealers in the latter part of the nineteenth century.

About 300 of the texts are concerned with scientific mathematical astronomy and belong to the last four centuries B.C.E. Most of them are *ephemerides*, that is, tables with calculations of the positions of the moon and the five naked-eye planets.

The greater part of the remaining texts, however, about 1,300 in number, are non-mathematical and principally *observational* in nature. The observations date from about 750 B.C.E. to the first century of the Christian era.<sup>4</sup> The great number of observational texts are of the utmost moment for establishing the absolute chronology of this whole period.

With respect to content, the non-mathematical texts may be subdivided into various categories. By far the largest group are the so-called *astronomical "diaries."* These record on a regular basis a large number of phenomena, including the positions of the moon and the planets. It is generally accepted that such "diaries" were kept continuously from the mid-eighth century B.C.E. onwards. The other categories of texts, which include *almanacs* (each recording astronomical data for one particular Babylonian year), texts with *planetary observations* (each giving data for one specific planet), and texts recording *lunar eclipses*, were apparently excerpts from the "diaries."

Thus, although only a handful of diaries from the four earliest centuries are extant, quite a number of the observations recorded in other diaries compiled in this early period have been preserved in these excerpts.

A comprehensive examination of all the non-mathematical texts was started several decades ago by Dr. A. J. Sachs, who devoted the last thirty years of his life to the study of these texts.<sup>5</sup> After his death in 1983, Sachs' work has been continued by Professor Hermann Hunger (in Vienna, Austria), who today is the leading expert on the astronomical observational texts. Both of these authorities were consulted for the following discussion.

4 Asger Aaboe, "Babylonian Mathematics, Astrology, and Astronomy," *The Cambridge Ancient History*, Vol. III:2 (Cambridge: Cambridge University Press, 1991), pp. 277-78. The observational texts may also occasionally contain descriptions of eclipses calculated in advance.

5 The various kinds of texts were classified by A. J. Sachs in the *Journal of Cuneiform Studies*, Vol. 2 (1948), pp. 271-90. In the work *Late Babylonian Astronomical and Related Texts* (Providence, Rhode Island: Brown University Press, 1955), Sachs presents an extensive catalogue of the astronomical, astrological, and mathematical cuneiform texts, most of which had been copied by T. G. Pinches and J. N. Strassmaier in the late nineteenth century. The catalogue lists 1520 astronomical texts, but many more have been discovered since.

## A. THE ASTRONOMICAL DIARIES

A “diary” usually covers the six or seven months of the first or second half of a particular Babylonian year and records, often on a day-to-day basis, the positions of the moon and the planets in relation to certain stars and constellations, and also gives details of lunar and solar eclipses. Much additional information is added, such as meteorological events, earthquakes, market prices, and similar data. Sometimes also historical events are recorded.<sup>6</sup> Over 2,000 years old, it is only to be expected that these clay tablets are often fragmentary.

More than 1,200 fragments of astronomical diaries of various sizes have been discovered, but because of their fragmentary condition only about a third of the number are datable.

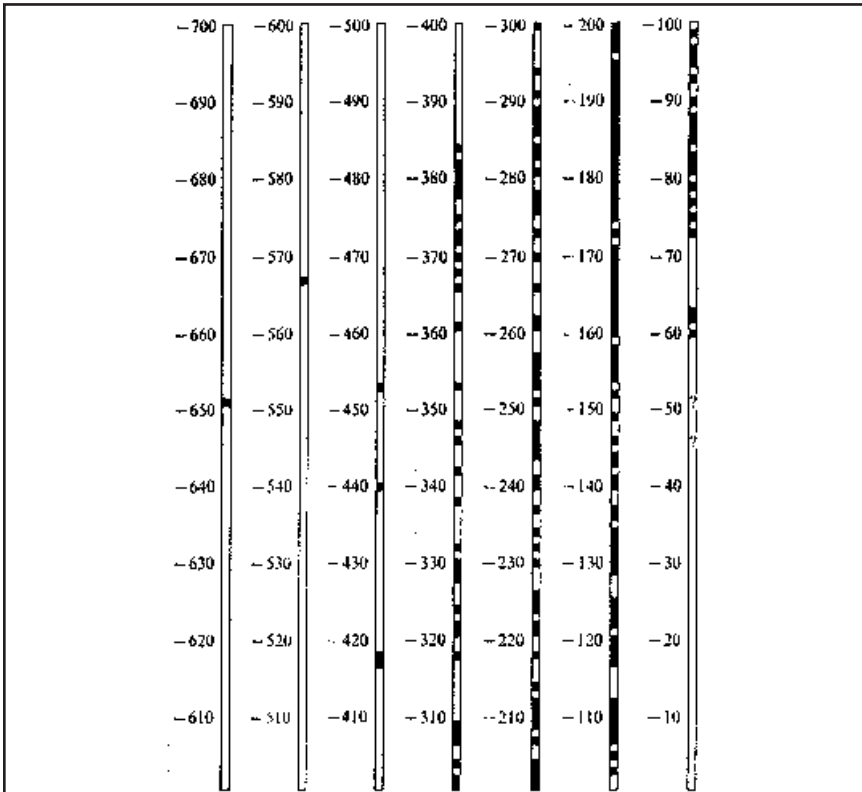
Most of these cover the period from 385 to 61 B.C.E. and contain astronomical information from about 180 of these years, thus firmly establishing the chronology of this period.<sup>7</sup>

Half a dozen of the diaries are earlier. The two oldest are *VAT 4956* from the sixth and *B.M. 32312* from the seventh centuries B.C.E. Both provide absolute dates that firmly establish the length of the Neo-Babylonian period.

### *A-1: The astronomical diary VAT 4956*

The most important astronomical diary for our discussion is designated *VAT 4956* and is kept in the Near Eastern department (“Vorderasiatischen Abteilung”) in the Berlin Museum. This diary is dated from Nisanu 1 of Nebuchadnezzar’s thirty-seventh regnal year to Nisanu 1 of his thirty-eighth regnal year, recording observations from five months of his thirty-seventh year (months 1, 2, 3, 11 and 12). The most recent transcription and translation of the text is that of Sachs and Hunger, published in 1988.<sup>8</sup>

- 6 The scribes evidently kept running records of their day-to-day observations, as may be seen from smaller tablets that cover much shorter periods, sometimes only a few days. From these records the longer diaries were compiled.—A. J. Sachs & H. Hunger, *Astronomical Diaries and Related Texts from Babylonia*, Vol. I (Wien: Verlag der Österreichischen Akademie der Wissenschaften, 1988), p. 12.
- 7 Otto Neugebauer, for example, explains: “Since planetary and lunar data of such variety and abundance define the date of a text with absolute accuracy—lunar positions with respect to fixed stars do not even allow 24 hours of uncertainty which is otherwise involved in lunar dates—we have here records of Seleucid history [312-64 B.C.E.] which are far more reliable than any other historical source material at our disposal.”—*Orientalistische Literaturzeitung*, Vol. 52 (1957), p. 133.
- 8 Sachs–Hunger, *op.cit.* (1988), pp. 46-53. The first translation of the text, which also includes an extensive commentary, is that of P. V. Neugebauer and Ernst F. Weidner, “Ein astronomischer Beobachtungstext aus dem 37. Jahre Nebukadnezars II. (–567/66),” in *Berichte über die Verhandlungen der Königl. Sächsischen Gesellschaft der Wissenschaften zu Leipzig: Philologisch-Historische Klasse*, Band 67:2, 1915, pp. 29-89.



### The extant datable astronomical diaries

The earliest diary is from 652/51 B.C.E. Then follows VAT 4956 from 568/67 B.C.E. Most cover the period from 385 to 61 B.C.E., containing astronomical information from about 180 of these years. — The chart is reproduced from A. J. Sachs, “Babylonian observational astronomy,” in F. R. Hodson (ed.), *The Place of Astronomy in the Ancient World* (London: Oxford University Press, 1974), p. 47.

Among the many observed positions recorded on VAT 4956, there are about thirty which are so exactly described that modern astronomers can easily fix the precise dates when they were seen. By doing so they have been able to show that all these observations (of the moon and the five then known planets) must have been made during the year 568/67 B.C.E.

If Nebuchadnezzar’s thirty-seventh regnal year was 568/67 B.C.E., then it follows that his first year must have been 604/03 B.C.E., and his eighteenth year, during which he desolated Jerusalem, 587/86

B.C.E.<sup>9</sup> This is the same date indicated by all the *seven lines of evidence* discussed in the previous chapter!

Could all these observations also have been made twenty years earlier, in the year 588/87 B.C.E., which according to the chronology of the Watch Tower Society's Bible dictionary *Insight on the Scriptures* corresponded to Nebuchadnezzar's thirty-seventh regnal year?<sup>10</sup> The same dictionary (page 456 of Vol. 1, where VAT 4956 is obviously alluded to) acknowledges that "Modern chronologers point out that such a combination of astronomical positions would not be duplicated again in thousands of years."

Let us consider one example. According to this diary, on Nisanu 1 of Nebuchadnezzar's thirty-seventh year the planet Saturn could be observed "in front of the Swallow," the "Swallow" (*SIM*) referring to the south-west part of the constellation of the Fishes (Pisces) of the Zodiac.<sup>11</sup> As Saturn has a revolution of c. 29.5 years, it moves through the whole Zodiac in 29.5 years. This means that it can be observed in each of the twelve constellations of the Zodiac for about 2.5 years on the average. It means also that Saturn could be seen "in front of the Swallow" 29.5 years previous to 568/67 B.C.E., that is, in 597/96 B.C.E, but certainly not 20 years earlier, in 588/87 B.C.E., the date the Watch Tower would like to assign for Nebuchadnezzar's thirty-seventh regnal year. That is simply an astronomical impossibility, even in the case of this one planet. But there are *five planets* that figure in the diary's astronomical observations.

Add, therefore, the different revolutions of the *other four planets*, the positions of which are specified several times in the text, along with the positions given for the *moon* at various times of the year, and it becomes easily understood why such a *combination* of observations could not be made again in thousands of years. The observations recorded in VAT 4956 must have been made in the year 568/67 B.C.E., because they fit no other situation which occurred either thousands of years before or after that date!

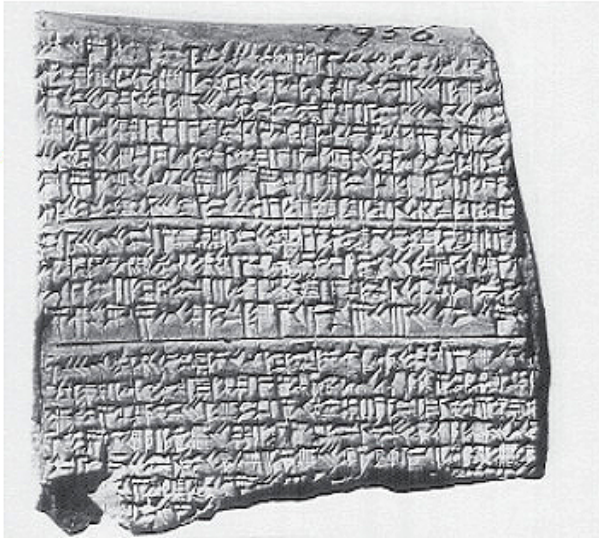
9 The diary clearly states that the observations were made during Nebuchadnezzar's thirty-seventh year. The text opens with the words: "Year 37 of Nebukadnezzar, king of Babylon." The latest date, given close to the end of the text, is: "Year 38 of Nebukadnezzar, month I, the 1st."—Sachs–Hunger, *op. cit.*, pp. 47, 53.

10 *Insight on the Scriptures*, Vol. 2 (Brooklyn, New York: Watchtower Bible and Tract Society, 1988), p. 481, under the subheading "Takes Tyre."

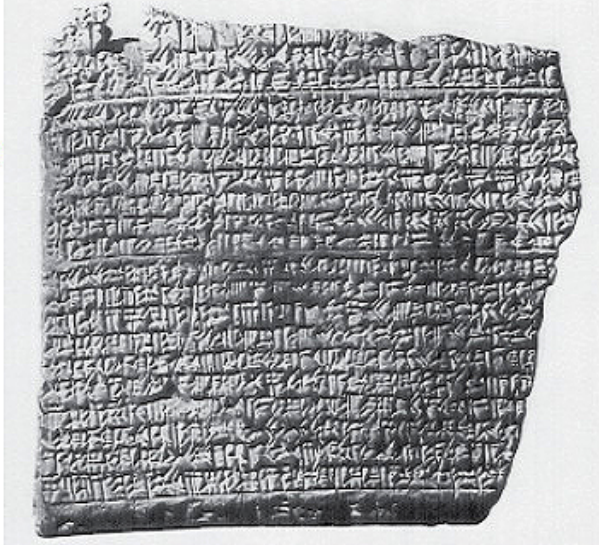
11 Sachs–Hunger, *op. cit.*, pp. 46–49. The expression "in front of" in the text refers to the daily westward rotation of the celestial sphere and means "to the west of". (*Ibid.*, p. 22) For a discussion of the Babylonian names of the constellations, see Bartel L. van der Waerden, *Science Awakening*, Vol. II (New York: Oxford University Press, 1974),



Obverse



Reverse



### The astronomical diary VAT 4956

VAT 4956, now in the “Vorderasiatischen Abteilung” in the Berlin Museum, gives details on about 30 positions of the moon and the five then known planets from the 37th year of Nebuchadnezzar (568/67 B.C.E.), *establishing that year as the most reliable absolute date in the sixth century B.C.E.*—Reproduced from A. J. Sachs & H. Hunger, *Astronomical Diaries and Related Texts from Babylonia*, Vol. I (Wien: Verlag der österreichischen Akademie der Wissenschaften, 1988), Plate 3. Photo used courtesy of the Vorderasiatisches Museum in Berlin.











Obverse

Reverse

**The astronomical diary B.M. 32312**

This diary gives details on the positions of Mercury, Saturn, and Mars, which date it to the year 652/51 B.C.E. An historical notice, also repeated in the *Akitu Chronicle* and there dated to the 16th year of Shamashshumukin, fixes that year to 652/51 B.C.E., which prevents any extension of the Neo-Babylonian era backwards in time. Photo used courtesy of the Trustees of the British Museum.

***A-2: The astronomical diary B.M. 32312***

In an article published in 1974, Professor Abraham J. Sachs gives a brief presentation of the astronomical diaries. Mentioning that the oldest datable diary contains observations from the year 652 B.C.E., he explains how he was able to fix its date:

When I first tried to date this text, I found the astronomical contents to be just barely adequate to make this date virtually certain.

It was a great relief when I was able to confirm the date by matching up a historical remark in the diary with the corresponding statement for –651 in a well-dated historical chronicle.<sup>21</sup>

As this diary seemed to be of great importance for the question of Babylonian chronology, I wrote to Professor Sachs back in 1980 and asked two questions:

1. What information in the diary makes the date –651 [=652 B.C.E.], “virtually certain”?
2. What kind of historical remark in the diary corresponds with what statement in which well-dated chronicle?

In his answer Professor Sachs enclosed a copy of a photograph of the diary in question, *B.M. 32312*, and added information which fully answered my two questions. The astronomical contents of the diary clearly establish the year as 652/51 B.C.E. when the observations were made. Sachs writes that “the preserved astronomical events (Mercury’s last visibility in the east behind Pisces, Saturn’s last visibility behind Pisces, both around the 14th of month I; Mars’ stationary point in Scorpio on the 17th of month I; Mercury’s first visibility in Pisces on the 6th of month XII) *uniquely determine the date.*”<sup>22</sup>

Interestingly, it cannot be claimed that this diary was redated by later copyists, because the name of the king, his regnal year, and month names *are broken away*. Yet these data may justifiably be supplied because of a historical remark at the end of the diary. For “the 27th” of the month (the month name is broken away) the diary states that at the site of “Hiritu in the province of Sippar the troops of Babylonia and of Assyria fou[ght with each] other, and the troops

21 A. J. Sachs, “Babylonian observational astronomy,” in F. R. Hodson (ed.), *The Place of Astronomy in the Ancient World (Philosophical transactions of the Royal Society of London, ser. A, 276, London: Oxford University Press, 1974)*, p. 48. – For the purpose of facilitating astronomical computations, the year preceding 1 C.E. is called 0 instead of 1 B.C.E. and the year preceding 0 is called –1 instead of 2 B.C.E. The year 652 B.C.E., therefore, is astronomically written as –651.

22 Letter Sachs-Jonsson, dated February 10, 1980. The diary has since been published in Sachs-Hunger, *op. cit.*, Vol. I (1988; see note 6 above), pp. 42-47. Of the first two events, the scribe says: “I did not watch because the days were overcast.” (*Ibid.*, p. 43) This statement does not make the astronomically fixed date of the positions less certain. As pointed out earlier, the Babylonian scholars not only knew the various cycles of the visible planets, but they also regularly watched their daily motions and positions relative to certain fixed stars or constellations along the ecliptic. Thus, even if a planet could not be observed for some days due to clouds, its position could easily be deduced from its position when it was last seen.



of Babylonia withdrew and were heavily defeated.”<sup>23</sup> Fortunately, it is possible to place the time of this battle since it is also mentioned in a well-known Babylonian chronicle.

The chronicle is the so-called *Akitu Chronicle*, B.M. 86379, which covers a part of Shamashshumukin’s reign, especially his last five years (the sixteenth to the twentieth). The battle at Hiritu is dated in his sixteenth year as follows:

The sixteenth year of Shamash-shuma-ukin: ... On the twenty-seventh day of Adar [the 12th month] the armies of Assyria and Akkad [Babylonia] did battle in Hirit. The army of Akkad retreated from the battlefield and a major defeat was inflicted upon them.<sup>24</sup>

The astronomical events described in the diary fix the battle at Hiritu on Adaru 27 to 651 B.C.E.<sup>25</sup> The *Akitu Chronicle* shows that this battle at this place on this day was fought in the sixteenth year of Shamashshumukin. Thus Shamashshumukin’s sixteenth year was 652/51 B.C.E. His entire reign of twenty years, then, may be dated to 667/66 – 648/47 B.C.E.

Now this is the way historians have dated Shamashshumukin’s reign for a long time, and that is why Professor Sachs concluded his letter by saying: “I should perhaps add that the absolute chronology of the regnal years of Shamash-shuma-ukin was never in doubt, and it is only confirmed again by the astronomical diary.”

Shamashshumukin’s reign has been known, for example, through the Royal Canon which gives him twenty years and his successor Kandalanu twenty-two years. Thereafter Nabopolassar, Nebuchadnezzar’s father, succeeded to the throne.<sup>26</sup> These figures are in good agreement with the ancient cuneiform sources. Business documents, as well as the *Akitu Chronicle*, show that Shamashshumukin ruled for twenty years. Business documents, supported by the Uruk King List, also show that from the first year of Kandalanu to the first year of Nabopolassar was a period of twenty-two years. Thus the

23 Sachs-Hunger, *op. cit.*, p. 45. For a discussion of this battle, see Grant Frame, *Babylonia 689-627 B.C.* (Leiden: Nederlands Historisch-Archaeologisch Instituut te Istanbul, 1992), pp. 144-45, 289-92.

24 A. K. Grayson, *Assyrian and Babylonian Chronicles* (Locust Valley, New York: J. J. Augustin Publisher, 1975), pp. 131-32.

25 As the first month, Nisanu, began in March or April, 652 B.C.E., Adaru, the twelfth month, began in February or March, 651 B.C.E.

26 That Kandalanu was succeeded by Nabopolassar is directly stated in the *Akitu Chronicle*: “After Kandalanu, in the accession year of Nabopolassar.”—Grayson, *op. cit.*, p. 132.

chronology of that era, supplied by these sources, is as follows:

Shamashshumukin	20 years	667 - 648 B.C.E.
Kandalanu	22 years	647 - 626 B.C.E.
Nabopolassar	21 years	625 - 605 B.C.E.
Nebuchadnezzar	43 years	604 - 562 B.C.E.

The diary B.M. 32312, although establishing a date *prior to* the Neo-Babylonian period (which began with Nabopolassar), again coincides with and helps corroborate the chronology of that era.

This diary, then, adds yet another witness to the increasing amount of evidence against the 607 B.C.E. date. A change of Nebuchadnezzar's eighteenth year from 587 to 607 B.C.E. would also change Shamashshumukin's sixteenth year from 652 to 672 B.C.E. But the diary B.M. 32312 rules out such a change.

And, as already pointed out, no one can claim that later copyists inserted "the 16th year of Shamashshumukin" in this diary, because the text is damaged at this point and that datum is broken away! It is the unique historical information in the text, information repeated in the Akitu Chronicle, that fixes the diary to Shamashshumukin's sixteenth year.

This diary, therefore, may be regarded as an independent witness which upholds the authenticity of the dates given in VAT 4956 and other diaries.<sup>27</sup>

27 A catalogue of business documents compiled by J. A. Brinkman and D. A. Kennedy that includes the reigns of Shamashshumukin and Kandalanu is published in the *Journal of Cuneiform Studies* (JCS), Vol. 35, 1983, pp. 25-52. (Cf. also JCS 36, 1984, pp. 1-6, and the table of G. Frame, *op. cit.*, pp. 263-68.) Cuneiform texts show that Kandalanu evidently died in his twenty-first regnal year, after which several pretenders to the throne fought for power, until Nabopolassar succeeded in ascending to the throne. Some business documents span the period of interregnum by artificially carrying on Kandalanu's reign after his death, the last one (B.M. 40039) being dated to his "22nd year" ("the second day of Arahsamnu [the 8th month] of the 22nd year *after Kandalanu*"). This method is also used by the Royal Canon, which gives Kandalanu a reign of twenty-two years. Other documents span the period differently. The Uruk King List gives Kandalanu twenty-one years, and gives the year of interregnum to two of the combatants, Sin-shumlishir and Sin-shar-ishkun. (See chapter three above, section B-1-b.) The Babylonian chronicle B.M. 25127 states of the same year: "For one year there was no king in the land." (Grayson, *op. cit.*, p. 88) All documents agree, however, to the total length of the period from Shamashshumukin to Nabopolassar. (For additional details on Kandalanu's reign, see the discussion by G. Frame, *op. cit.*, pp. 191-96, 209-13, 284-88.)

### **B. THE SATURN TABLET (B.M. 76738 + B.M. 76813)**

One of the most important astronomical texts from the seventh century B.C.E. is the Saturn tablet from the reign of the Babylonian king Kandalanu (647-626 B.C.E.), predecessor of Nabopolassar, Nebuchadnezzar's father.

This text consists of two broken pieces, B.M. 76738 and B.M. 76813.<sup>28</sup> The text was first described by C. B. F. Walker in 1983 in the *Bulletin of the Society for Mesopotamian Studies*.<sup>29</sup> A transcription and a translation with a full discussion of the text by Mr. C.B.F. Walker has recently been published.<sup>30</sup>

As explained earlier (section A-1 above), the planet Saturn has a revolution of c. 29.5 years. Due to the revolution of the earth round the sun, Saturn disappears behind the sun for a few weeks and reappears again at regular intervals of 378 days.

The Saturn tablet gives the dates (regnal year, month, and day in the Babylonian calendar) and the positions of the planet Saturn at its first and last appearances for a period of fourteen successive years, specifically, the first fourteen years of Kandalanu (647-634 B.C.E.). The name of the king, given only in the first line, is partially damaged, but may be restored as [*Kand*]alanu. The name of the planet is nowhere mentioned in the text, but the observations fit Saturn and no other planet.

As Mr. Walker explains:

The name of the planet Saturn is not given on the tablet, and the name of Kandalanu is to be restored from only a few traces in the first line. It is, however, certain that we are dealing with Saturn and Kandalanu. Saturn is the slowest moving of the visible planets, and only Saturn would move the distances indicated between successive first visibilities.<sup>31</sup>

The text is damaged in several places, and many of the *year numbers* are illegible. Years 2, 3, 6, 7, 8, and 13 are undamaged, however.

28 Listed as AH 83-1-18, 2109+2185 in E. Leichty et al, *Catalogue of the Babylonian Tablets in the British Museum*, Vol. VIII (London: British Museum Publications Ltd, 1988), p. 70.

29 C. B. F. Walker, "Episodes in the History of Babylonian Astronomy," *Bulletin of the Society for Mesopotamian Studies*, Vol. 5 (Toronto, May 1983), pp. 20, 21.

30 C. B. F. Walker, "Babylonian observations of Saturn during the reign of Kandalanu," in N. M. Swerdlow (ed.), *Ancient Astronomy and Celestial Divination* (Cambridge, Massachusetts, and London: The MIT Press, 2000), pp. 61-76.

31 Walker, *ibid.*, p. 63.

Besides this, each year is covered by two lines in the text, one for the last appearance of the planet and the other for its first, the total number of lines covering the fourteen years, therefore, being twenty-eight. With this framework there is no problem in restoring the year numbers that are damaged.

Most of the *positions* given for Saturn at its first or last appearance are legible.<sup>32</sup> The entry for year eight, which is almost wholly preserved, is quoted here as an example:

Year 8, month 6, day 5, behind the Furrow ( $\alpha$ + Virginis), last appearance.

[Year 8], month 7, day 5, ‘between’ the Furrow ( $\alpha$ + Virginis) and the Balance (Libra), first appearance.<sup>33</sup>

What is the implication of this astronomical tablet for the chronology of the Neo-Babylonian era?

As noted, Saturn has a revolution of 29.5 years, which also means that the planet moves through the whole ecliptic in this period.

But for the planet to be seen again at a specific point (close to a certain fixed star, for example) of the ecliptic *at the same time of the year*, we have to wait for 59 solar years (2x 29.5). This interval, actually, is much longer in the Babylonian *lunar* calendar. As C. B. F. Walker explains:

A complete cycle of Saturn phenomena in relation to the stars takes 59 years. But when that cycle has to be fitted to the lunar calendar of 29 or 30 days then identical cycles recur at intervals of rather more than 17 centuries. Thus there is no difficulty in determining the date of the present text.<sup>34</sup>

In other words, the absolute chronology of Kandalanu’s reign is definitely fixed by the Saturn tablet, because the pattern of positions described in the text and fixed to specific dates in the Babylonian lunar calendar *is not repeated again in more than seventeen centuries!* The first fourteen years of his reign mentioned in the document are thus fixed to 647-634 B.C.E. As Kandalanu’s total reign may chronologically be counted as twenty-two years (twenty-one years plus one

32 In three cases the dates given for the first or last appearance are followed by the comment “not observed”, the reason in two cases being said to be clouds; and in another case it is said to have been “computed” (for the same reason). As suggested by Walker, “in these cases the date of theoretical first or last visibility was deduced from the planet’s position when first or last actually seen.” —*Ibid.*, pp. 64, 65, 74.

33 *Ibid.*, p. 65.

34 *Ibid.*, p. 63.

year “after Kandalanu”; see section A-2 above), our tablet establishes the absolute chronology of his reign as 647-626 B.C.E.<sup>35</sup>

Like the previous text discussed earlier (B.M. 32312), the Saturn tablet puts a definite block to the attempts at lengthening the chronology of the Neo-Babylonian period. If twenty years were to be added to this period, the reign of Nabopolassar, the father of Nebuchadnezzar, would have to be moved from 625-605 back to 645-625 B.C.E., and this in turn would mean moving the reign of his predecessor, Kandalanu, from 647-626 back to 667-646 B.C.E. The astronomical data on the Saturn tablet makes such changes completely impossible.

### C. THE LUNAR ECLIPSE TABLETS

Many of the Babylonian astronomical tablets contain reports of consecutive lunar eclipses, dated to the year, month, and often also the day of the reigning king. About forty texts of this type, recording several hundreds of lunar eclipses from 747 to about 50 B.C.E., were catalogued by Abraham J. Sachs in 1955.<sup>36</sup>

In about a third of the texts the eclipses are arranged in 18-year groups, evidently because the Babylonians knew that the pattern of lunar eclipses is repeated at intervals of approximately 18 years and 11 days, or exactly 223 lunar months (= 6585 1/3 days). This cycle was used by the Babylonian astronomers “to predict the dates of possible eclipses by at least the middle of the 6th century B.C. and most probably long before that.”<sup>37</sup>

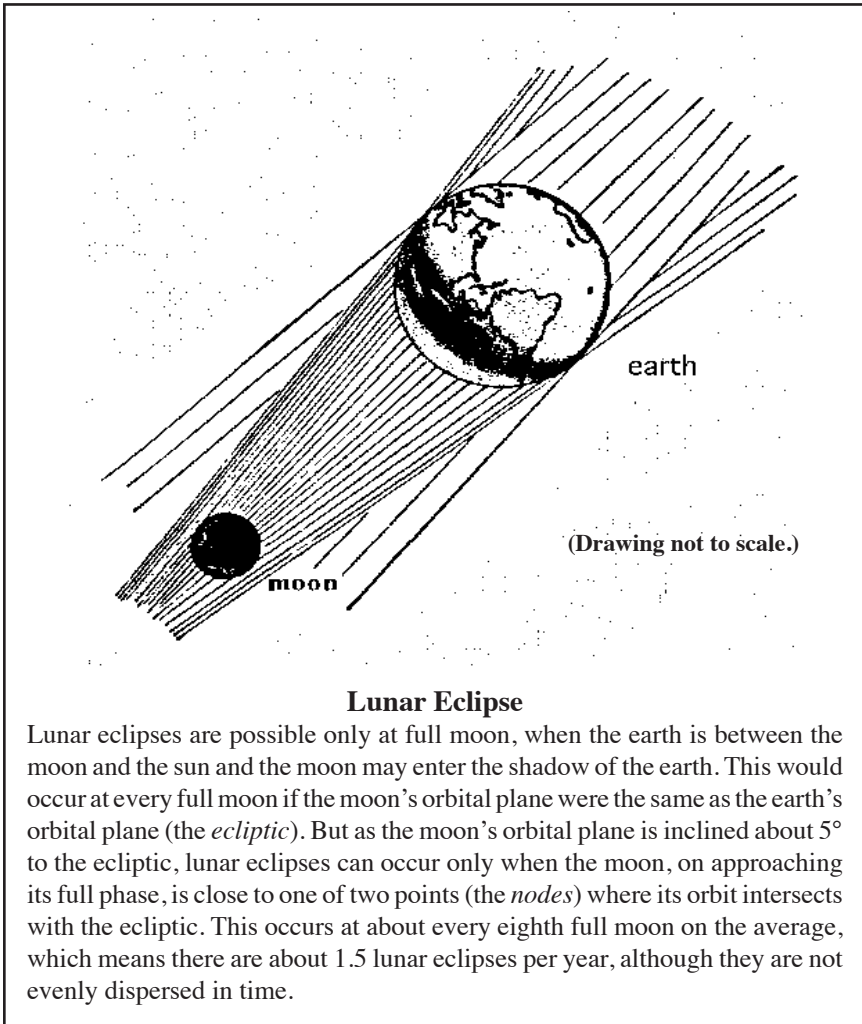
As modern scholars call this cycle the *Saros cycle*, the 18-year texts are often referred to as the *Saros cycle texts*.<sup>38</sup> Some of these texts record series of 18-year intervals extending over several centuries.

35 In his earlier discussion of the tablet, Walker points out that the pattern of Saturn phenomena described in this text, dated in terms of the phase of the moon, “will in fact occur approximately every 1770 years.”—C. B. F. Walker, “Episodes in the History of Babylonian Astronomy,” *Bulletin of the Society for Mesopotamian Studies*, Vol. 5 (Toronto, May 1983), p. 20.

36 Abraham J. Sachs, *Late Babylonian Astronomical and Related Texts* (Providence, Rhode Island: Brown University Press, 1955), pp. xxxi-xxxiii. See nos. 1413-30, 1432, 1435-52, and 1456-57. For translations of most of these, see now H. Hunger et al. *Astronomical Diaries and Related Texts from Babylonia* (ADT), Vol. V (Vienna, 2001).

37 Paul-Alain Beaulieu and John P. Britton, “Rituals for an eclipse possibility in the 8th year of Cyrus,” in *Journal of Cuneiform Studies*, Vol. 46 (1994), p. 83.

38 The Greek word *saros* is derived from the Babylonian word *SAR*, which actually denoted a period of 3,600 years. “The use of the term ‘Saros’ to denote the eclipse cycle of 223 months is a modern anachronism which originated with Edmund Halley [*Phil. Trans.* (1691) 535-40] ... The Babylonian name for this interval was simply ‘18 years’.” —



Most of the lunar eclipse texts were compiled during the Seleucid era (312-64 B.C.E.). The evidence is that the eclipse records were extracted from astronomical diaries by the Babylonian astronomers, who evidently had access to a large number of diaries from earlier centuries.<sup>39</sup> Thus, even if most of the diaries from the earliest centuries

<sup>39</sup> "It is all but certain that these eclipse records could have been extracted only from the astronomical diaries." — A. J. Sachs, "Babylonian observational astronomy," in F. R. Hodson (ed.), *The Place of Astronomy in the Ancient World* (*Philosophical Transactions of the Royal Society of London*, ser. A. 276, 1974), p. 44. See also the comments by F. Richard Stephenson and Louay J. Fatoohi, "Lunar eclipse times recorded in Babylonian history," in *Journal for the History of Astronomy*, Vol. 24:4, No. 77 (1993), p. 256.



are missing, many of their entries on eclipses have been preserved in these excerpts.

Many of the eclipse texts were copied by T. G. Pinches and J. N. Strassmaier in the latter part of the nineteenth century, and these copies were published by A. Sachs in 1955.<sup>40</sup> Translations of a few of the texts appeared in print in 1991.<sup>41</sup> The rest of the texts, translated by H. Hunger, were published in ADT V, 2001. (See footnote 36 above.)

A preliminary typescript with transliterations and translations of most of the lunar eclipse texts was prepared in 1973 by Professor Peter Huber, but he never brought it into a form ready for publication, although it has been unofficially circulated among scholars for a long time. Huber's memoir has been consulted in the following discussion, but every passage used has been checked, and in several cases improved upon or corrected, by Professor Hermann Hunger, whose transliterations and translations of these eclipse texts have since been published.

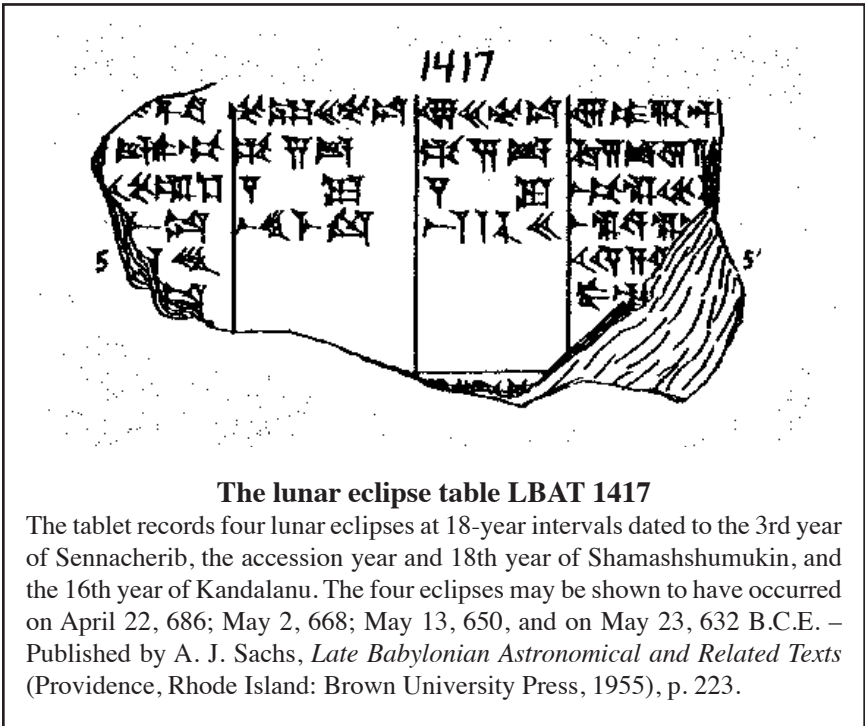
The texts recording the earliest lunar eclipses are LBAT 1413–1421 in Sachs' catalogue. Only the last four of these, nos. 1418–1421, contain eclipses from the Neo-Babylonian period. But as LBAT 1417 contains eclipses from the reigns of Shamash-shum-ukin and Kandalanu, the last two Babylonian kings prior to the Neo-Babylonian period (cf. sections A-2 and B above), this text, too, is an important witness to the length of the Neo-Babylonian period.

A discussion of four of these texts and their implications for the Neo-Babylonian chronology of the Watch Tower Society is presented in the following section.<sup>42</sup>

40 A. J. Sachs, *op. cit.* (1955; see note 36 above), pp. 223ff.

41 A. Aaboe, J. P. Britton, J. A. Henderson, O. Neugebauer, and A. J. Sachs, "Saros Cycle Dates and Related Babylonian Astronomical Texts," in *Transactions of the American Philosophical Society*, Vol. 81:6 (1991), pp. 1-75. The Saros cycle texts published are those designated LBAT 1422, 1423, 1424, 1425, and 1428 in Sachs catalogue. As these texts belong to a separate small group of *theoretical* texts, none of them are used in the present study. (See J. M. Steele in H. Hunger, ADT V, 2001, p. 390.)

42 A discussion of LBAT 1418 is not included here, as this is one of the theoretical texts referred to in note 41 above. It contains no royal names, just year numbers. (Royal names are usually mentioned only with a ruler's first year.) Still, as pointed out by Professor Hermann Hunger, "the records of lunar eclipses are detailed enough that they can be dated." The preserved part of the text gives years and months of lunar eclipse possibilities at 18-year intervals from 647 to 574 B.C.E. The eclipses dated in the text at 18-year intervals to years "2", "20", "16", and "13", for example, correspond to eclipses in years "2" and "20" of *Kandalanu* (646/45 and 628/27 B.C.E.), year "16" of *Nabopolassar* (610/09), and year "13" of *Nebuchadnezzar* (592/91). Thus LBAT 1418 strongly supports the chronology established for the reigns of these kings.—A transliteration and translation of this tablet is published by Hunger, ADT V (2001), pp. 88, 89.



**The lunar eclipse table LBAT 1417**

The tablet records four lunar eclipses at 18-year intervals dated to the 3rd year of Sennacherib, the accession year and 18th year of Shamashshumukin, and the 16th year of Kandalanu. The four eclipses may be shown to have occurred on April 22, 686; May 2, 668; May 13, 650, and on May 23, 632 B.C.E. – Published by A. J. Sachs, *Late Babylonian Astronomical and Related Texts* (Providence, Rhode Island: Brown University Press, 1955), p. 223.

***C-1: The lunar eclipse tablet LBAT 1417***

LBAT 1417 records four lunar eclipses at 18-year intervals from 686 to 632 B.C.E. It seems to be a part of the same tablet as the previous two texts in the series, LBAT 1415 and 1416. The first entry records an eclipse from Sennacherib’s third year of reign in Babylonia,<sup>43</sup> which may be identified with the eclipse that took place on April 22, 686 B.C.E. Unfortunately, the year number is damaged and only partially legible.

The next entry, dated to the accession year of Shamashshumukin, gives this information:

Accession year Shamash-shum-ukin,  
 Ayyaru, 5 months,  
 which passed by.  
 At 40° after sunrise.

43 Babylonian chronicles and king lists show that the Assyrian king Sennacherib also, for two periods, was the actual ruler of Babylonia, the first time for two years (dated to 704-703 B.C.E.), and the second time for eight years (dated to 688-681 B.C.E.). Our text evidently refers to the second period.

At a cursory glance this report seems to give very little information. But there is more in the few brief lines than one might possibly imagine.

The Babylonian astronomers had developed such an abbreviated technical terminology in describing the various celestial phenomena that their reports assumed an almost stenographic character. The Akkadian phrase translated “which passed by” (*shá DIB*), for example, was used in connection with a *predicted* eclipse to indicate that it *would not be observable*.

As Hermann Hunger explains, “the eclipse was known to the Babylonians as occurring at a time when the moon could not be observed. It does *not* show that they looked for an eclipse and were disappointed that it did not occur.”<sup>44</sup> The Babylonians had not only computed this eclipse some time in advance by means of a known cycle (perhaps the Saros cycle); their computation also showed it would not be observable from the Babylonian horizon.

This is also implied in the next line, “At 40° after sunrise.” 40° is a reference to the movement of the celestial sphere, which, due to the rotation of the earth, is seen to make a full circle in 24 hours. The Babylonians divided up this period into 360 time units (degrees) called *USH*, each of which corresponded to four of our minutes. The text, therefore, tells us that the eclipse had been calculated to begin 160 minutes (40 *USH* x 4) after sunrise, which means it would take place in the daytime and thus not be observable in Babylonia.

Modern astronomical calculations confirm this. If Shamash-shumukin’s first year was 667/66 B.C.E. as is generally held (see above, section A-2), his accession year was 668/67. The eclipse is dated to Ayyaru, the second month, which began in April or May. (The “5 months” indicates the time interval from the previous eclipse.)

Was there an eclipse of the type described in our text at that time of the year in 668 B.C.E.? Yes, there was.

Modern lunar eclipse catalogues show that such an eclipse took place on May 2, 668 B.C.E. (Julian calendar). It began at about 9:20 local time\*, which only roughly agrees with the Babylonian computation that it would begin 160 minutes—2 hours and 40 minutes—after

44 Letter Hunger–Jonsson, dated October 21, 1989. (Cf. also note 15 above.) In a later letter (dated June 26, 1990) Hunger adds: “The technical expression if the observer waits for an eclipse and finds that it does not occur is ‘not seen when watched for’.”

\* Note: Times listed in this discussion are according to a 24-hour format, rather than the 12 hour a.m./p.m format.

sunrise. As sunrise occurred at about 5:20, the error in computation was ca. 1 hour and 20 minutes.<sup>45</sup>

In the chronology of the Watch Tower Society the accession year of Shamashshumukin is moved back twenty years to 688/87 B.C.E. No lunar eclipses occurred in April or May that year, but there was a total one on June 10, 688 B.C.E. Contrary to the eclipse recorded in our text, however, this one *was observable* in Babylonia. It is, therefore, an impossible alternative.

The next entry in the text is dated to the eighteenth year of Shamashshumukin, that is, 650/49 B.C.E. This eclipse, too, was a computed one, predicted to “pass by” in the second month. It would begin about four hours (60 USH) “before sunset”. According to modern calculations the eclipse took place on May 13, 650 B.C.E. The canon of Liu and Fiala shows it began at 16:25 and ended at 18:19, about half an hour before sunset at that time of the year.<sup>46</sup>

According to the chronology of the Watch Tower Society this eclipse occurred twenty years earlier, in 670 B.C.E. No lunar eclipses took place in April or May that year, but there was a total one on June 22, 670 B.C.E. However, it *did not* occur “before sunset”, as did the one recorded in our text, but early in the forenoon, beginning about 7:30. So, again, it does not fit.

The next and last entry in LBAT 1417 is dated to the sixteenth year of Kandalanu. The eclipse recorded was observed in Babylonia and several important details are given:

(Year) 16 Kandalanu  
 (month) Simanu, 5 months, day 15. 2 Fingers (?)  
 on the northeast side covered (?)  
 On the north it became bright. The north wind [blew]  
 20° onset, maximal phase, [and clearing.]  
 Behind Antares ( $\alpha$  Scorpio) [it was eclipsed.]

As indicated by the question marks and the square brackets, the text is somewhat damaged at places, but the information preserved is

45 See Bao-Lin and Alan D. Fiala, *Canon of Lunar Eclipses 1500 B.C.—A.D. 3000* (Richmond, Virginia: Willman-Bell, Inc., 1992), p. 66, No. 2010. As demonstrated in Dr. J. M. Steele's detailed study of the Babylonian lunar eclipses, the accuracy of Babylonian timings of *observed* eclipses was within about half an hour as compared to modern calculations, while the accuracy of the timings of *predicted* eclipses usually was about an hour and half. It should be noted that before about 570 B.C.E. the Babylonians also rounded off their timings to the nearest 5-10 USH (20-40 minutes). Although rough, these timings are close enough for the eclipses to be identified. (See John M. Steele, *Observations and Predictions of Eclipse Times by Early Astronomers*, Dordrecht, etc: Kluwer Academic Publishers, 2000, pp. 57-75, 231-235.) For further comments on the identification of ancient lunar eclipses, see the Appendix for chapter four: “Some comments on ancient lunar eclipses”.

46 Liu/Fiala, *op. cit.*, p. 67, No 2056. Steele's computation shows it began at 16:45.

sufficient for identifying the eclipse. It took place on “day 15” of Simanu, the third month, which began in May or June. “2 fingers” means it was partial, with only two twelfths of the moon’s diameter being eclipsed. The total duration of the eclipse was 20°, that is, 80 minutes.

If Kandalanu’s sixteenth year began on Nisan 1, 632 B.C.E., as is generally held (compare above, sections A-2 and B), we want to know if there was a lunar eclipse of this type in the third month of that year.

Modern calculations show there was. According to the eclipse canon of Liu and Fiala the eclipse began on May 23, 632 B.C.E. at 23:51 and lasted until 1:07 on May 24, which means its total duration was about 76 minutes, that is, very close to the period given in the text. The same canon gives the magnitude as 0.114.<sup>47</sup>

These data are in good agreement with the ancient record. In the chronology of the Watch Tower Society, however, this eclipse should be looked for twenty years earlier, in May, June, or possibly July, 652 B.C.E. It is true that there was an eclipse on July 2 that year, but in contrast to the *partial* one recorded in our text it was *total*. But as it began about 15:00 no phase of it was observable in Babylonia.

In summary, LBAT 1417 records four lunar eclipses at successive 18-year intervals (18 years and nearly 11 days), all of which may be easily identified with those of April 21, 686; May 2, 668; May 13, 650, and May 23, 632 B.C.E. The four eclipse records are interlaced by the successive Saros cycles into a pattern that fit no other series of years in the seventh century B.C.E.<sup>48</sup>

The last three dates are thus established as the absolute dates of the accession year and the eighteenth year of Shamashshumukin and the sixteenth year of Kandalanu, respectively. The Watch Tower Society’s attempt to add twenty years to the Neo-Babylonian era, in that way moving the reigns of the earlier kings twenty years backwards in time, is once again effectively blocked by a Babylonian astronomical tablet, this time by the lunar eclipse text LBAT 1417.

### ***C-2: The lunar eclipse tablet LBAT 1419***

LBAT 1419 records an uninterrupted series of lunar eclipses at

47 Liu/Fiala, *op. cit.*, p. 68, No. 2103.

48 It is to be noted that the Saros cycle does not comprise an *even* number of days; it consists of 6585 1/3 days. The excess third part of a day (or c:a 7.5 hours) implies that the subsequent eclipses in the series are not repeated *at the same time of the day*, but about 7.5 hours later after each successive cycle. The duration and magnitude, too, are changing from one eclipse to the next in the cycle. An eclipse, therefore, cannot be mixed up with the previous or the next ones in the series. — See the discussion by Beaulieu and Britton, *op. cit.* (note 37 above), pp. 78-84.

18-year intervals from 609/08 to 447/46 B.C.E. The first entries, which evidently recorded eclipses that occurred in September 609 and March 591 B.C.E., are damaged. Royal names and year numbers are illegible. However, two of the following entries are clearly dated to the reign of Nebuchadnezzar (the words in parentheses are added to elucidate the laconic reports):

14th (year of) Nebukadnezar,  
month VI, (eclipse) which was omitted [literally, “passed by”]  
at sunrise,  
.....

32nd (year of) Nebukadnezar,  
month VI, (eclipse) which was omitted.  
At 35° (= 35 USH, i.e. 140 minutes) before sunset.

The royal name in the original text is written as “Kudurri”, which is an abbreviation of *Nabu-kudurri-usur*, the transcribed Akkadian form of Nebuchadnezzar.

Nebuchadnezzar’s fourteenth and thirty-second years are generally dated to 591/90 and 573/72 B.C.E., respectively. The two eclipses recorded, one Saros cycle apart, both took place in the sixth month (Ululu), which began in August or September. Both eclipses had been calculated in advance, and the Babylonians knew that none of them would be observable in Babylonia. The first eclipse began “at sunrise”, the second 140 minutes (35 USH) “before sunset.” Thus both of them occurred in the daytime in Babylonia.

This is confirmed by modern calculations. The first eclipse occurred on September 15, 591 B.C.E. It began about 6:00. The second took place in the afternoon on September 25, 573 B.C.E.<sup>49</sup> Both eclipses, then, fit in very well with the chronology established for the reign of Nebuchadnezzar.

In the chronology of the Watch Tower Society, however, the two eclipses should be sought for twenty years earlier, in 611 and 593 B.C.E. But no eclipses that fit those described in the text occurred in the autumn of any of those years.<sup>50</sup>

The next entry, which records the subsequent eclipse in the 18-year cycle, gives the following detailed information:

49 Liu and Fiala, *op. cit.*, pp. 69-70, Nos. 2210 and 2256. The entries also record eclipses in the twelfth month of both years, but the text is severely damaged at both places.

50 On Sept. 26, 611 and Oct. 7, 593 B.C.E. there were so-called *penumbral* eclipses, i.e., the moon passed through the half-shadow (*penumbra*) outside the shadow (*umbra*) of the earth. (Liu & Fiala, *op. cit.*, pp. 68-69, nos. 2158 and 2205.) Such passages are hardly observable even at night, and the Babylonians evidently recorded them as “passed by”. The first eclipse (Sept. 26, 611 B.C.E.) began *well after sunset, not at sunrise* as is explicitly stated in the text. The penumbral phase of the second eclipse (Oct. 7, 593 B.C.E.) began *well before sunrise, not before sunset* as stated in the text. Both alternatives, therefore, are definitely out of question anyway.



Month VII, the 13th, in 17° on the east side  
all (of the moon) was covered. 28° maximal phase.  
In 20° it cleared from east to west.  
Its eclipse was red.  
Behind the rump of Aries it was eclipsed.  
During onset, the north wind blew, during clearing, the west wind.  
At 55° before sunrise.

As stated in the text, this eclipse took place on the thirteenth day of the seventh month (Tashritu), which began in September or October. The royal name and the year number unfortunately are missing.

Yet, as Professor Hunger points out, “the eclipse can nevertheless be identified with certainty from the observations given.”<sup>51</sup> The various details about the eclipse—its *magnitude* (total), *duration* (the total phase lasting 112 minutes), and *position* (behind the rump of Aries)—clearly identify it with the eclipse that took place in the night of Oct. 6-7, 555 B.C.E.<sup>52</sup>

According to the generally established chronology for the Neo-Babylonian period, this eclipse took place in the first year of Nabonidus, which began on Nisan 1, 555 B.C.E. Although the royal name and year number are missing, it is of the utmost importance to notice that the text places this eclipse *one Saros cycle after* the eclipse *in the thirty-second year of Nebuchnezzar*. As the last eclipse may be securely dated in 555 B.C.E., it at once also places Nebuchadnezzar’s thirty-second year eighteen years earlier, in 573 B.C.E.

Consequently, all three eclipses in our text concur in establishing 591 and 573 B.C.E. as the absolute dates of Nebuchadnezzar’s 14th and 32nd regnal years, respectively.

The Saros cycle text LBAAT 1419 thus provides yet another independent evidence against 607 B.C.E. as the eighteenth year of Nebuchadnezzar. If, as is established by the text, his thirty-second year was 573/72 B.C.E. and his fourteenth year was 591/90 B.C.E., then his first year was 604/03, and his eighteenth year, in which he desolated Jerusalem, was 587/86 B.C.E.

51 Letter Hunger-Jonsson, dated October 21, 1989.

52 According to the calculations of Liu and Fiala the eclipse, which was total, began on October 6 at 21:21 and ended on October 7 at 1:10. The total phase lasted from 22:27 to 0:04, i.e. for 97 minutes, which is not far from the figure given in the text, 28 USH (112 minutes).—Liu and Fiala, *op. cit.*, p. 70, no. 2301.

### *C-3: The lunar eclipse tablet LBAT 1420*

Instead of recording eclipses at 18-year intervals, LBAT 1420 contains *annual* eclipse reports. All eclipses in the text are from the reign of Nebuchadnezzar, dating from his first year (604/03 B.C.E.) to at least his twenty-ninth year (576/75 B.C.E.).

The first entry, which records two eclipses that “passed by” (that is, though correctly predicted would not be observable), is damaged and the year number is illegible. But the last part of Nebuchadnezzar’s name is preserved:

[(Year) 1 Nebuchadn]ezzar, (month) *Simanu*.

The name of the king is not repeated in the subsequent entries, indicating that the king is the same during the whole period. This is also confirmed by the continuous series of increasing year numbers right until the last year preserved in the text, “(Year) 29”.

The entries recording eclipses in the period 603-595 B.C.E. are very damaged, too, and the year numbers for this period are missing. The first entry in which the year number is preserved records two eclipses from the eleventh year:

(Year) 11, (month) Ayyaru [... ...] 10(?) *USH* after sunset and it was total. 10 [+x ...] (Month) Arahsamnu, which passed by. Addaru<sub>2</sub>.

The eleventh year of Nebuchadnezzar began on Nisan 1, 594 B.C.E. “Addaru<sub>2</sub>” is added to indicate that there was an intercalary month at the end of the year.

There is no problem in finding both of these eclipses. Ayyaru, the second month, began in April or May, and Arahsamnu, the eighth month, began in October or November. The first eclipse occurred on May 23, and the second one on November 17. The eclipse canon of Liu and Fiala confirms that the first eclipse was total and was observable in Babylonia, as stated in the text. It began at 20:11 and ended at 23:48. The second eclipse “passed by” (was unobservable) as it occurred in the daytime. According to the canon of Liu and Fiala it began at 7.08 and ended at 9:50.<sup>53</sup>

Most of the year numbers from the twelfth to the seventeenth year (593/92-588/87 B.C.E.) are legible.<sup>54</sup> Thirteen lunar eclipses are de-

53 Liu & Fiala, *op. cit.*, p. 69, nos. 2201 and 2202.

54 In the entries for the fourteenth and fifteenth years the year numbers are damaged and only partially legible. But as these entries stand between those for years “13” and “16”, the damaged numbers obviously were “14” and “15”.

scribed and dated in this period, eight of which “passed by” and five were observed. Modern calculations confirm that all these eclipses occurred in the period 593–588 B.C.E.

After the seventeenth year there is a gap in the record until the twenty-fourth year. The entry for that year records two eclipses, but the text is damaged and most of it is illegible. From then on, however, year numbers and also most of the text are well preserved.

These entries contain annual records of a total of nine eclipses (five observable and four that “passed by”) dating from the twenty-fifth to the twenty-ninth year (580/79–576/75 B.C.E.). There are no difficulties in identifying any of these eclipses. They all occurred in the period 580–575 B.C.E. It would be tiresome and useless to expose the reader to a detailed examination of all these reports. The entry for year “25” may suffice as an example:

(Year) 25, (month) Abu, 1 1/2 *beru* after sunset.  
(Month) Shabatu, it occurred in the evening watch.

Abu, the fifth Babylonian month, began in July or August. The Babylonians divided our 24-hour day into twelve parts called *beru*. One *beru*, therefore, was two hours. The first eclipse is said to have occurred 1 1/2 *beru*, that is, three hours, after sunset. As Nebuchadnezzar’s twenty-fifth year is dated to 580/79 B.C.E., this eclipse should be found in July or August that year, about three hours after sunset.

The eclipse is not difficult to identify. According to the canon of Liu and Fiala it was a total eclipse which began on August 14, 580 B.C.E. at 21:58 and ended at 1:31 on August 15.<sup>55</sup>

The next eclipse occurred six months later in Shabatu, the eleventh month, which began in January or February. It is said to have occurred “in the evening watch” (the first of the three watches of the night).

This eclipse, too, is easy to find. It took place on February 8, 579 B.C.E. and lasted from 18.08 to 20.22. according to the canon of Liu and Fiala.<sup>56</sup>

In the chronology of the Watch Tower Society the twenty-fifth year of Nebuchadnezzar is dated twenty years earlier, in 600/599 B.C.E. But no lunar eclipses observable in Babylonia occurred in 600 B.C.E. And although there was an eclipse in the night of February 19–20, 599 B.C.E., it did not occur “in the evening watch” as the one reported in our text.<sup>57</sup>

55 Liu & Fiala, *op. cit.*, p. 69, no. 2238. Sunset occurred at ca. 19:00.

56 *Ibid.*, p. 69, no. 2239.

57 *Ibid.*, p. 69, no. 2188. The eclipse began at 23:30 and ended at 2:25. There were four eclipses in 600 B.C.E. (Liu & Fiala, nos. 2184–87), but all these were *penumbral* and thus not observable (see note 50 above).

Details on some *two dozens of lunar eclipses*, dated to specific years and months in the reign of Nebuchadnezzar, are preserved on LBA 1420. Not one of them is found to agree with the Watch Tower Society's chronology for the reign of Nebuchadnezzar.

Together these lunar eclipses form an irregular but very distinct pattern of events scattered over the first twenty-nine years of Nebuchadnezzar's reign. Only on the assumption that his reign began in 604 B.C.E. do we find a far-reaching correspondence between this pattern and the celestial events that gave rise to it. But if Nebuchadnezzar's reign is moved back one, two, five, ten, or twenty years, this correlation between the records and reality *immediately dissolves*. LBA 1420 alone, therefore, suffices to disprove completely the idea that the eighteenth year of Nebuchadnezzar should be dated to 607 B.C.E.

#### *C-4: The lunar eclipse tablet LBA 1421*

The preserved part of LBA 1421 records two eclipses observed in Babylonia in the sixth and twelfth month of year "42", evidently of the reign of Nebuchadnezzar:

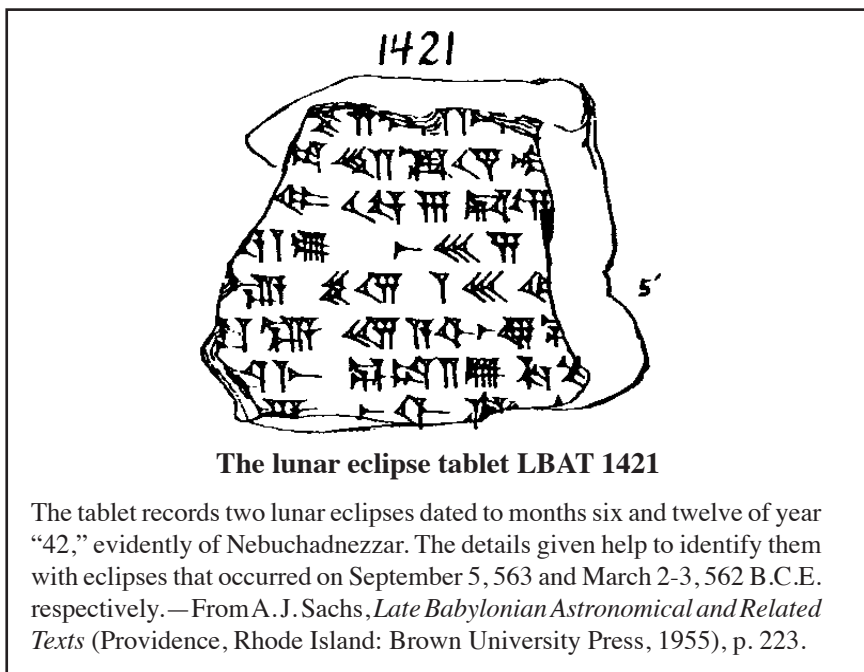
(Year) 42, (month) Ululu, (day) 14. It rose eclipsed [...] and became bright. 6 (USH) to become bright.  
At 35° [before sunset].

(Month) Addaru, (day) 15, 1,30° after sunset [...].  
25° duration of maximal phase. In 18° it [became bright.]  
West(wind) went. 2 cubits below  
γ Virginis eclipsed  
[...            ...]

Provided that these eclipses occurred in the forty-second year of Nebuchadnezzar—and there was no other Babylonian king ruling that long in the sixth, seventh, or eighth centuries B.C.E.—they should be looked for in 563/62 B.C.E. And there is no difficulty in identifying them: The first, dated in the sixth month, occurred on September 5, 563 B.C.E., and the second one, dated in the twelfth month, occurred on March 2-3, 562 B.C.E.

The first eclipse "rose eclipsed", meaning that it began some time before sunset, so that when the moon rose (at about 18:30 at that time of the year), it was already eclipsed. This agrees with modern calculations, which show that the eclipse began about 17:00 and lasted until about 19:00.<sup>58</sup>

58 Liu & Fiala, *op. cit.*, p. 70, no. 2281.



The canon of Liu and Fiala confirms that the second eclipse was total. “1,30° [six hours] after sunset” probably refers to the beginning of the total phase, which began after midnight, at 0:19, and lasted until 2:03, i.e. it lasted for 104 minutes.<sup>59</sup> This is in good agreement with our text, which gives the duration of the maximal phase as 25 USH, that is, 100 minutes.

In the chronology of the Watch Tower Society, Nebuchadnezzar’s forty-second year is dated to 583/82 B.C.E. But no eclipses of the type described in our text occurred in that year.

A possible alternative to the first one might have been that of October 16, 583 B.C.E., had it not began too late—at 19:45 according to Liu and Fiala—to be observed at moonrise (which occurred at about 17:30). And as for the second eclipse, there were no eclipses at all that could be observed in Babylonia in 582 B.C.E.<sup>60</sup>

The lunar eclipse texts presented above provide four additional independent evidences for the length of the Neo-Babylonian period.

<sup>59</sup> *Ibid.*, p. 70, no. 2282. Sunset began ca. 18:00.

<sup>60</sup> In 582 B.C.E. there were four lunar eclipses, but all of them were penumbral. — Liu & Fiala, *op. cit.*, p. 69, nos. 2231-34.

The first text (LBAT 1417) records lunar eclipses from the accession year and eighteenth year of Shamash-shum-ukin and the sixteenth year of Kandalanu, turning these years into absolute dates that effectively block any attempt to add even one year to the Neo-Babylonian period, far less twenty.

The other three texts (LBAT 1419, 1420, and 1421) records dozens of lunar eclipses dated to various years within the reign of Nebuchadnezzar, thus time and again turning his reign into an absolute chronology. It is like fastening a painting to a wall with dozens of nails all over it, although but one would suffice.

Similarly, it would have sufficed to establish only one of Nebuchadnezzar's regnal years as an absolute date to overthrow the idea that his eighteenth year began in 607 B.C.E.

Before concluding this section on the lunar eclipse texts, it seems necessary to forestall an anticipated objection to the evidence provided by these texts. As the Babylonian astronomers as early as in the seventh century B.C.E. were able to *compute in advance* certain astronomical events such as eclipses, could it be that they also, in the later Seleucid era, were able to *retrocalculate* lunar eclipses and attach them to the chronology established for the earlier centuries? Could the lunar eclipse texts simply be the results of such a procedure?<sup>61</sup>

It is certainly true that the various cycles used by the Babylonians for *predicting* eclipses just as well could be used for *retrocalculating* eclipses, and there is a particular small group of tablets showing that Seleucid astronomers did extrapolate such cycles backwards in time.<sup>62</sup>

However, the observational texts record a number of phenomena that were impossible for the Babylonians to predict or retrocalculate. Of the records in the diaries and planetary texts Professor N. M.

61 This idea was held by A. T. Olmstead, who in an article published back in 1937 (in *Classical Philology*, Vol. XXXII, pp. 5f.) criticized Kugler's use of some of the eclipse texts. As explained later by A. J. Sachs, Olmstead "completely misunderstood the nature of a group of Babylonian astronomical texts which Kugler used. He was under the misapprehension that they were *computed* at a later date and hence of dubious historical value; in reality, they are compilations of extracts taken directly from authentic, contemporary Astronomical Diaries and must therefore be handled with great respect."—A. J. Sachs & D. J. Wiseman, "A Babylonian King List of the Hellenistic Period," *Iraq*, Vol. XVI (1954), p. 207, note 1.

62 These texts do not record any observations at all and are, therefore, classified as *theoretical texts*. They are quite different from the diaries and the eclipse texts discussed above. Five such theoretical texts are known, four of which were published by Aaboe *et al* in 1991 (see note 41 above). Two of these are known as the "Saros Canon" (LBAT 1428) and the "Solar Saros" (LBAT 1430). The fifth tablet is LBAT 1418, described in note 42 above.—See J. M. Steele in Hunger, ADT V (2001), p. 390.



Swerdlow points out that, although the distances of planets from normal stars could be predicted, “Conjunctions of planets with the moon and other planets, with their distances, could neither be calculated by the ephemerides nor predicted by periodicities.”<sup>63</sup> With respect to lunar eclipses, the Babylonians could predict and retrocalculate their occurrences, “but none of the Babylonian methods could have allowed them to calculate circumstances such as the direction of the eclipse shadow, the visibility of planets during the eclipse, and certainly not the direction of the wind during the eclipse, which we find in early reports.”<sup>64</sup>

Thus, although the Babylonians were able to calculate certain astronomical phenomena, the observational texts record a number of details connected with the observations that they were unable to predict or retrocalculate. This disproves conclusively the idea proposed by some that the data may have been calculated backwards from a later period.

### SUMMARY AND CONCLUSION

In the previous chapter the length of the Neo-Babylonian era was firmly established by seven different lines of evidence. All of them were based upon ancient Babylonian cuneiform texts such as chronicles, kinglists, royal inscriptions, and tens of thousands of economic, administrative, and legal documents from the Neo-Babylonian period.

In this chapter *another seven independent evidences* have been presented. All of these are based on ancient Babylonian *astronomical* texts, which provide a whole string of absolute dates from the sixth and seventh centuries B.C.E. These tablets establish—over and over again—the *absolute chronology* of the Neo-Babylonian era:

63 N. M. Swerdlow, *The Babylonian Theory of the Planets* (Princeton University Press, 1998), pp. 23, 173.—The diaries also record a number of other phenomena that could not be calculated, such as solar halos, river levels, and bad weather—clouds, rain, fog, mist, hail, lightning, winds, etc. Some data in the diaries were computed because of bad weather, but most are observations. This is also evident from the Akkadian name of the diaries engraved at the end of their edges: *natsaru sha ginê*, “regular watching”.

64 Communication J. M. Steele-Jonsson, dated March 27, 2003. As pointed out in footnote 45 above, there is also a clear difference of accuracy in the timings given for observed and predicted eclipses.

**(1) *The astronomical diary VAT 4956***

The diary VAT 4956 contains about thirty completely verified observed astronomical positions from Nebuchadnezzar's thirty-seventh regnal year.

Such a combination of astronomical positions is not duplicated again in thousands of years. Consequently, there is only one year which fits this situation: 568/67 B.C.E.

If this was Nebuchadnezzar's thirty-seventh regnal year, as is twice stated on this tablet, then 587/86 B.C.E. must have been his eighteenth year, in which he desolated Jerusalem.

**(2) *The astronomical diary B.M. 32312***

B.M. 32312 is the *oldest preserved astronomical diary*. It records astronomical observations that enable scholars to date this tablet to 652/51 B.C.E.

A historical remark in the text, repeated in the Babylonian chronicle B.M. 86379 (the "Akitu Chronicle") shows this to have been the sixteenth year of Shamashshumukin. The diary, then, fixes his twenty-year reign to 667-648 B.C.E., his successor Kandalanu's twenty-two-year reign to 647-626, Nabopolassar's twenty-one-year reign to 625-605, and Nebuchadnezzar's forty-three-year reign to 604-562 B.C.E.

This, again, sets Nebuchadnezzar's eighteenth year and the destruction of Jerusalem at 587/86 B.C.E.

**(3) *The Saturn tablet B.M. 76738+76813***

The Saturn tablet records *a successive series of positions of the planet Saturn at its first and last appearances*, dated to the first fourteen years of Kandalanu.

Such a pattern of positions, fixed to specific dates in the Babylonian lunar calendar, is not repeated again in more than seventeen centuries.

This text, then, again fixes Kandalanu's twenty-two-year reign to 647-626 B.C.E., Nabopolassar's twenty-one-year reign to 625-605, and Nebuchadnezzar's reign to 604-562 B.C.E.

**(4) *The lunar eclipse tablet LBAT 1417***

LBAT 1417 records *four lunar eclipses*, each succeeding the other at intervals of 18 years and nearly 11 days, an eclipse period known as the *Saros cycle*.

The eclipses are dated to the third year of Sennacherib's reign in Babylonia, to the accession year and the eighteenth year of Shamashshumukin, and to the sixteenth year of Kandalanu, respectively.

The four interrelated eclipses may be clearly identified with a series of eclipses that occurred in 686, 668, 650 and 632 B.C.E. This tablet, therefore, once again fixes the absolute chronology for the reigns of Shamashshumukin and Kandalanu, and also—indirectly—for the reigns of Nabopolassar and Nebuchadnezzar.

### ***(5) The lunar eclipse tablet LBAT 1419***

LBAT 1419 contains reports of an *uninterrupted series of lunar eclipses* at 18-year intervals *directly from the Neo-Babylonian era itself*.

Two of the eclipses are dated to the fourteenth and thirty-second years of Nebuchadnezzar. They may be identified with eclipses that occurred in 591 and 573 B.C.E., respectively, confirming again at these points the chronology established for the reign of this king.

Although the royal name and year number are missing in the report on the next eclipse in the 18-year series, the very detailed information makes it easy to identify it with the eclipse that occurred on October 6-7, 555 B.C.E. This date, therefore, confirms and adds further strength to the two earlier dates in the 18-year series, 573 and 591 B.C.E.

As these years correspond to Nebuchadnezzar's thirty-second and fourteenth years, respectively, his eighteenth year is, of course, once again fixed to 587/86 B.C.E. by this tablet.

### ***(6) The lunar eclipse tablet LBAT 1420***

LBAT 1420 gives an *annual record of lunar eclipses* from the first to the twenty-ninth years of Nebuchadnezzar, except for a gap between his eighteenth and twenty-third years. The entries in which regnal year numbers are preserved—about a dozen—give details on some *two dozens of eclipses*, all of which are found exactly in the B.C.E. years that has been established earlier for the regnal years mentioned in the text.

As this specific compound of dated lunar eclipses does not tally with any corresponding series of eclipses that occurred in the immediate preceding decades, this tablet alone suffices to establish the absolute chronology of Nebuchadnezzar's reign.<sup>65</sup>

65 This tablet "was probably compiled shortly after -575 [576 BCE]."—J. M. Steele in Hunger, ADT V, p. 391.

**(7) *The lunar eclipse tablet LBAT 1421***

LBAT 1421 records *two eclipses* dated in the sixth and twelfth months of year “42”, evidently of Nebuchadnezzar, generally dated to 563/62 B.C.E. And both eclipses are also actually found in these months of that year. But no eclipses of the type recorded in the text occurred in 583/82 B.C.E.—the date of Nebuchadnezzar’s forty-second year in the chronology of the Watch Tower Society. This tablet, therefore, provides an additional proof of the falsity of that chronology.

**(8-11) *Another four astronomical tablets***

The seven astronomical texts discussed above provide more than enough evidence against the Watch Tower Society’s 607 B.C.E. date. And yet this is not all. Another four texts have recently been published that will be described only briefly here. Translations of three of these are published in Hunger, ADT V (2001).

The first is LBAT 1415 which, as mentioned on page 174 above, is part of the same tablet as LBAT 1417. It records lunar eclipses dated to year 1 of Bel-ibni (702 B.C.E.), year 5, evidently of Sennacherib (684 B.C.E.), and year 2, evidently of Shamash-shum-ukin (666 B.C.E.).

The second is lunar eclipse text no. 5 in Hunger, ADT V. It is badly damaged and the royal name is missing, but some historical remarks in the text shows it is from the reign of Nabopolassar. One of the eclipses described is dated to year 16 and may be identified with the eclipse of September 15, 610 B.C.E.

The third is text no. 52 in Hunger, ADT V. This is a planetary text containing over a dozen legible records of the positions of Saturn, Mars, and Mercury dated to years 14, 17, and 19 of Shamash-shum-ukin (654, 651, and 649 B.C.E.), years 1, 12, and 16 of Kandalanu (647, 636, and 632 B.C.E.), and years 7, 12, 13, and 14 of Nabopolassar (619, 614, 613, and 612 B.C.E.). Like some of the previous texts discussed above, these three texts effectively prevent all attempts at lengthening the chronology of the Neo-Babylonian period.

The fourth is a planetary tablet, SBTU IV 171, which records first and last appearances and stationary points of Saturn in years 28, 29, 30, and 31 of an unknown king.<sup>66</sup> However, as Professor Hermann Hunger has demonstrated, the year numbers combined with the position of Saturn in the constellation of Pabilsag (roughly Sagittarius)

66 Hermann Hunger, “Saturnbeobachtungen aus der Zeit Nebukadnezars II.,” *Assyriologica et Semitica* (=AOAT, Band 252), (Münster: Ugarit-Verlag, 2000), pp. 189-192.

exclude all alternatives in the first millennium B.C.E. except years 28-31 of Nebuchadnezzar, fixing these to 577/76– 574/73 B.C.E. Again, this establishes his 18th year as 587/86 B.C.E.

As has been clearly seen, the Watch Tower Society's interpretation of the "Gentile Times" requires that these have a starting date of 607 B.C.E., their claimed date for the fall of Jerusalem. Since that event took place in Nebuchadnezzar's eighteenth year, that regnal year must also be dated as of 607 B.C.E. This creates a gap of twenty years when compared with all existing ancient historical records, since these place the start of Nebuchadnezzar's eighteenth year in 587 B.C.E. How can this twenty-year gap possibly be explained?

In this chapter it has been demonstrated that the ten astronomical texts presented establish the absolute chronology of the Neo-Babylonian period at a number of points, especially within the 43-year-reign of Nebuchadnezzar. Their combined witness proves beyond all reasonable doubt that his reign cannot be moved backwards in time even one year, far less twenty.

Together with the evidence presented in Chapter 3, therefore, we now have *seventeen different evidences*, each of which in its own way overthrows the Watch Tower Society's dating of Nebuchadnezzar's eighteenth year to 607 B.C.E., showing it to have begun twenty years later, that is, in 587 B.C.E.

Indeed, few reigns in ancient history may be dated with such conclusiveness as that of the Neo-Babylonian king Nebuchadnezzar.

Suppose for a moment that *Berosus'* figures for the reigns of the Neo-Babylonian kings contain an error of twenty years, as is required by the chronology of the Watch Tower Society. Then the compiler(s) of the *Royal Canon* must have made exactly the same mistake, evidently independently of Berosus!

It might be argued, though, that both simply repeated an error contained in the *sources* they used, namely the Neo-Babylonian chronicles. Then the scribes of Nabonidus, too, who possibly used the same sources, would have had to have dropped twenty years from the reign of the same king (or kings) when they made the inscriptions of the *Hillah stele* and the *Adad-guppi' stele*.

Is it really likely, however, that those scribes, who *wrote right during the Neo-Babylonian era*, did not know the lengths of the reigns of the kings under whom they lived, especially since those reigns also functioned as calendar years by which they dated different events?

If they really made such a strange mistake, how is it possible that contemporary scribes *in Egypt* also made the same mistake, dropping the same period of twenty years when making inscriptions on *death*

*stelae* and other documents?

Curiously then, the Babylonian astronomers must also have regularly made similar “mistakes” when dating the observations recorded in VAT 4956, LBAT 1420, SBTU IV 171, and also other tablets from which later astronomers abstracted their *Saros cycle eclipse records*—unless of course changes were purposely made by copyists in the Seleucid era, as the Watch Tower Society posits.

Still more incredible is the idea that scribes and astronomers could remove twenty years from the Neo-Babylonian era several years *prior to* that era—as is shown by the oldest diary, *B.M. 32312*, the lunar eclipse tablets *LBAT 1415+1416+1417* and *ADT V, no. 5*, the *Saturn tablet B.M. 76738+76813*, and the planetary tablet *ADT V, no. 52*—all the five of which inexorably block all attempts at lengthening the Neo-Babylonian period.

But the most remarkable “coincidence” is this: *Tens of thousands* of dated economic, administrative and legal documents have been excavated from the Neo-Babylonian period, covering every year of this period—except, as the Watch Tower Society would have it, for a period of twenty years from which *not one tablet has been found*.

Again, most curiously, according to this logic, that period happens to be exactly the same as that lost through a series of other “mistakes” by scribes in Babylon and Egypt, and by later copyists and historians.

Either there was an international agreement during several centuries to erase this twenty-year period from the recorded history of the world—or it never existed! If such an international “plot” ever took place it was so successful that of all the tens of thousands of documents unearthed from the Neo-Babylonian era there is *not one, not even a line in any of them*, that indicates that such a twenty-year period ever existed. We can safely conclude, then, that the Watch Tower Society’s chronology is unquestionably in error.

But if this is the conclusion of our study, how are we to harmonize this fact with the Biblical prophecy of the seventy years, during which the land of Judah and Jerusalem would lay desolate according to the Watch Tower Society? And how are we to view the year 1914, the supposed terminal date for the times of the Gentiles according to the prophetic time scale of the Watch Tower Society? Do not world events clearly show that Bible prophecies have been fulfilled since that year? These questions will be dealt with in the following chapters.