**Abhandlung**

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# Babylonian Astro-Historiography of the Late First Millennium BCE

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**Abstract:** In modern scholarship, Babylonian astral science (astronomy, astrology, celestial divination) is commonly perceived as being oriented towards the future. In this paper, we argue that Babylonian scholars also used astronomical prediction to study, interpret, order, and reconstruct the past. In particular, developments in astronomical and astrological prediction during the first millennium BCE engendered a new approach to historiography. This approach involved retro-calculating phenomena of the ancient sky in order to explain events that had happened in those distant times. By backwardly projecting predictive schemes on historical data found in received texts, these scholars developed a new historiographic method based on archival research and astral science.

## The Esagil temple of Babylon and its vast repositories of knowledge

Evidence for these activities comes from the Esagil temple of Babylon in the last centuries of the first millennium BCE. Thousands of cuneiform tablets, many written by astronomers employed by the temple, were retrieved from what is sometimes called the "Esagil library", although much remains unclear about the conditions of their discovery in the late 19th century. The active lifespan of this corpus of texts runs from the Late Achaemenid, through the Seleucid and Parthian periods into the first century AD (Clancier 2009, 159–213). Most emblematic of the work of Esagil's scholars are the Astronomical Diaries which record monthly observations of celestial phenomena and of events that happened on earth, such as the water level of the Euphrates river, market rates of agricultural commodities, and various types of human activity in and around the city.[1] It has long been suspected that in the margins of their work on the Diaries, the astronomers of Babylon engaged in the compilation of chronicles of Babylonian history.[2] The Esagil library also holds several pieces of newly composed literature about ancient kings, which further testifies to the historical interests of the scholarly community that used this library.[3]

In this environment, legacy data were widely available for enquiry. For historical events, the scholars of Esagil probably relied mostly on (copies of) original royal inscriptions as well as chronicles that were kept on the premises and that had been compiled in the past by their professional predecessors.[4] The transmission history of Babylonian chronicles is a complex matter; not all chronicles whose existence is known today, were available in this community (Waerzeggers 2012). It is quite certain, however, that the astronomers of Esagil had access to (a copy of) the chronicle known as "ABC 1a" or "the Babylonian Chronicle", as we will see below. In a roughly year-by-year fashion, this text treats the major events in Babylonia's transregional conflicts with Elam and Assyria since the mid-eighth century.[5] Only the first chapter of this multi-tablet composition is known today, and it takes us from the reign of king Nabonassar to Šamaš-šuma-ukīn in the mid-seventh century. At least one more chapter followed, but how much of history was covered is unknown. The copy that is preserved today was written during the reign of Darius I, which gives us an end-date for this recension although it is of course possible that later authors continued to update the chronicle to their lifetime.

1 On the Astronomical Diaries, see the contributions collected by Haubold [e. a.] (ed.) (2019).
2 Van der Spek 2008; van der Spek [e. a.] 2025.

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3 De Breucker 2015; Jursa/Debourse 2017; Debourse 2022; Frazer 2024.
4 Van der Spek 2008; Glassner 2019, 236–240; van der Spek [e. a.] 2025.
5 Levavi 2021; Waerzeggers 2021.

For celestial events, the scholars in Babylon had access to a vast amount of legacy data reported in Astronomical Diaries and related texts. As pointed out by John Steele (2019a, 47), the selection of phenomena reported in these texts gradually expanded from lunar eclipses from ca. 747 BCE (Nabonassar) onward to a widening range of other lunar and planetary phenomena after ca. 650 BCE. Apart from individual reports and monthly diaries, legacy data were available in long-term compilations with up to centuries of data for a single phenomenon, for instance lunar eclipses, planetary phenomena, and conjunctions.

If legacy reports were not available, the Babylonian scholars could, in principle, reconstruct past astronomical phenomena with the help of predictive methods. In the course of the first millennium BCE, several methods had been developed for predicting the phenomena of the moon, the sun and the planets based on knowledge of the underlying periods. The earliest known technique is known as the Goal Year method, which emerged during the late seventh century BCE. According to this method, lunar and planetary phenomena repeat near the same celestial position and Babylonian calendar date after a number of years depending on the planet. On that assumption, historical astronomical events reported in the Astronomical Diaries and related texts could be repurposed as predictions for a future year – the "Goal Year" – by adding a period reckoned in years to the reported date. The Goal-Year periods which were used for this purpose range in length from 8 years (Venus) to 83 years (Jupiter). After the fourth century BCE, Babylonian astronomers developed computational methods, known in modern times as "mathematical astronomy", for predicting, by and large, the same lunar and planetary phenomena that were predicted with the Goal Year method. Unlike the Goal Year method, which requires for each prediction an earlier record of the same phenomenon, these new methods, which are based on much longer and more accurate periods than the Goal Year periods, can predict very long sequences of lunar or planetary phenomena, setting out from a single initial date and celestial position of the phenomenon under consideration.

## Astronomy as a historical discipline

Modern imaginations of the Babylonian astronomer often fuse the figure of the scientist engaged in observation and calculation with the figure of the diviner engaged in prediction. We are less accustomed to think of these scholars as historians, even though the past was an essential area of their expertise. The predictive methods that they developed in the course of the first millennium BCE reflect empirical knowledge about the periodic motion of the moon and the planets that can only have been acquired through an analysis of historical records such as the Astronomical Diaries and related texts. Furthermore, each prediction requires initial data that ultimately derive from historical records.

It is likely that the awareness of astral periodicity allowed for time being perceived of as a continuum that could be explored backwards and forwards. For example, the corpus of mathematical astronomy includes ca. 40(?) so-called "template tables" with lunar or planetary positions but no corresponding dates. They most likely served as *Vorlagen* for so-called synodic tables, which do include dates. Since the tabulated positions were known to repeat cyclically, a template table could be matched with different sets of dates, not only in the future, as was usually the case, but, in principle also from the past.

While most tablets with astronomical predictions pertain to future dates, there are exceptions. Several tables from the corpus of mathematical astronomy contain computed data for past dates. A well-known example from Uruk is A 3405 (Steele 2000), an unusual compilation of computed planetary and lunar data for SE 60–70, which was written in SE 120 (190 BCE) by the scholar Anu-aba-utēr.[6] The tablet was probably compiled with the purpose of producing horoscopes for individuals born in SE 60–70, perhaps including one for Anu-aba-utēr's father Anu-bēlšunu (Beaulieu/Rochberg 1996). It is an open question whether the data were retro-computed or compiled from existing tables for each planet. It is very likely that at least some data were retro-computed, because no planetary data appear to be missing.

Another example is "Text S", preserved in two undated copies most likely originating from Babylon.[7] In addition to reports of solar eclipse possibilities between Xerxes year 11 and Artaxerxes I year 8 (a period of 18 years) it contains computed data pertaining to these eclipses. The tablet was obviously written after Artexerxes I year 8 (457/6 BCE). Moreover, the computed data include zodiacal positions and numbers identifiable as values of the quantity Φ known from lunar system A, which implies a date of writing after

**6** For the date of writing of this tablet see Ossendrijver (forthcoming), no. 211.

**7** BM 36599+36941 and the duplicate BM 36737 (+) 47912 were originally published by Aaboe/Sachs (1969, 11–22; Texts B–D). BM 36850 which joins BM 36737 was published by Aaboe [e. a.] (1991, 69–71; Text G). The text was named Text S by Britton (1989, 29–46). For a discussion of this text see also Steele (2000a, 442–443), and Ossendrijver (2018, 155–158).

ca. 420 BCE.[8] It follows that this table is a retro-computation.

A third example is BM 36301, a compendium with computed tables for Mars, Venus, and the Moon. The Venus data probably pertain to Artaxerxes II years 21–22 (384–382 BCE), the Mars data to the period from Artaxerxes II year 45 (360/359 BCE) until Artaxerxes III year 17 (342/1 BCE). Since the Mars data include regnal years, the tablet was most likely written after ca. 342/1 BCE.[9] This suggests that the data were retro-computed from a later date. Especially intriguing is the lunar table. It contains two sections with values of the quantity Φ known from lunar system A. The first section (obv. ii 24–28, iii 1–5) contains ten values pertaining to full moons. They are accompanied by an oblique reference to Kandalānu, a Babylonian king who reigned in the seventh century BCE. As shown by Brack-Bernsen and Steele (2011, 119–129), three possible ranges of dates can be assigned to the Φ values: 638–540 BCE, 429–330 BCE, or 133–35 BCE.[10] The third range is implausibly late. The second one is plausible because it overlaps with the planetary tables. In that case, the Φ values were probably at least partly retro-computed. The first range of dates includes the reign of Kandalānu. In that case, it is virtually certain that the Φ values were retro-computed.[11]

The Astronomical Diaries and related texts contain further evidence that astronomical prediction was used for reconstructing and interpreting the past. For many lunar and planetary phenomena, namely those for which predictive methods were available, these texts contain an essentially complete record, that is, if a phenomenon was not observed due to bad weather or for other reasons, it was replaced by a prediction, which was marked as “not observed”. These predictions were probably often made already before the event, but some after the event. The aim was to generate a complete sequence of these phenomena, partly because only then could their complete future sequences be predicted with Goal Year methods. As a byproduct, these complete sequences of past phenomena enabled the scholars to study potential correlations with past developments in other phenomena reported in the Diaries such as market prices and weather.

Moreover, the Babylonian scholars also used their knowledge of astronomy to obtain new insights in historical events that were part of the historiographic canon. In this paper we present two texts that support this claim.

## ADRT 5, 5

ADRT 5, 5 (BM 38357) is a fragment of a multi-columned tablet from one of the British Museum’s acquisitions that contains much material originating in the Esagil library (80-11-12).[12] In view of its likely provenance, the tablet probably dates from the post-Achaemenid period, perhaps much later. Its use of the remark *ḫe-pí* betrays that it was copied from another tablet.[13] When that earlier text was drafted and whether it was the original or itself a copy, is unknown. The interest of this fragment for our present purposes is twofold. First, it deals with events that happened in the late seventh century; from the point of view of the copying scribe and perhaps also of the compiler, this constituted considerably “ancient” history. Second and more importantly, the text combines two types of legacy data that scholars of the Esagil could have found in two different types of texts.

ADRT 5, 5 lists lunar eclipses and planetary phenomena that happened at the time of certain political events said to have taken place in the reign of king Nabopolassar.[14] The preserved fragment of the text is thought to cover his regnal years 14 or 15 to 19 (612–607 BCE) but much of the content matter is lost and only the 16th year is securely that

**8** For the date of introduction of the uniform zodiac see Britton (2010, 638–649).

**9** Originally published by Neugebauer/Sachs (1967), Text C. For corrected readings and a new interpretation of the lunar table see Brack-Bernsen/Steele (2011, 119–129). For a new edition and study of the tables for Mars and Venus see Ossendrijver (forthcoming, No. 209). Since the Mars table mentions regnal years of Artaxerxes III, probably until year 17, the tablet must have been written after the latter year (342/1 BCE).

**10** The Φ values are not successive monthly values of the zigzag sequence for Φ, but values separated by multiples of 14 months. For a possible explanation see Brack-Bernsen/Steele (2011). The first range of dates and the third one are obtained if the values belong to the increasing branch of the zigzag sequence, the second range if they belong to the decreasing branch. Only the latter option was considered by Neugebauer/Sachs (1967, 199).

**11** It is not precisely known when Φ was introduced. If the lunar tables mentioned here contain retro-computed values then Φ may not have existed before ca. 400 BCE. Another early attestation of Φ is the lunar table BM 36822, which was computed with a precursor of system A (Aaboe/Sachs 1969, Text A). It contains values of Φ for successive new moons for Artaxerxes II years 6–7 (399–397 BCE); see also the discussion by Britton (2010, 647).

**12** The 80-11-12 collection comprises ca. 2173 tablets and fragments from the excavations of Hormuzd Rassam (Reade 1986, xxx), including ca. 200 tablets and fragments about astral science. For many of them the museum registers mention Babylon as the provenance. For the present tablet (80-11-12, 251) they mention Babylonia, but it most likely originates from Babylon (Leichty [e. a.] 2019, 381).

**13** Hunger 2001, 22; Steele 2019a, 47.

**14** The identity of the king was restored by Steele *apud* Hunger 2001, 25.

of Nabopolassar. The astronomical phenomena reported are three lunar eclipses and several planetary phenomena including a conjunction of Mars, Venus and perhaps Jupiter. This is a selection of information that is typical for legacy data reported after ca. 650 BCE; several tablets listing such data have been discovered among the remains of the Esagil library (Steele 2019a, 46–7). As to the historical sections, these show great affinity with the chronicle tradition, but indeed not directly with the chronicles that we currently know of Nabopolassar's reign (ABC 3 [years 10–17] and ABC 4 [years 17–20]), as John Steele already remarked (2019a, 47). Rather, the entries in ADRT 5, 5 fit in the tradition of ABC 1a, with which it shares certain topics of interest. At the same time, it displays some novelties that raise the question when the text contained on ADRT 5, 5 saw the light of day.

## The historical sections of ADRT 5, 5

Four sections with historical data are preserved. Section 1 (i 11′–17′) is thought to relate to the 14th year of Nabopolassar:

i 11′ … month VIII, the 22nd day, the judge …
i 12′ … Assyria many?
i 13′ … their … months IX–X–XI
i 14′ … the *šangû* of Dēr
i 15′ … and the *šandabakku* died.
i 16′ … month II they died …
i 17′ … there was famine.
(translation adapted from Hunger 2001, 23)

None of this content comes close to the information given for Nabopolassar's 14th year in ABC 3. Not only the bare facts, but also the kinds of facts do not line up. ABC 3 is strongly focused on military history and only gives agency to kings and anonymous groups of opponents and armies (Boivin 2023, 18). It does not single out individuals except for royals: Nabopolassar himself, his ally Cyaxares and the Assyrians Sîn-šarra-iškun and Aššur-uballiṭ. The cast of figures who appear in ADRT 5, 5 is much wider and includes a judge, the *šandabakku* (of Nippur) and the *šangû* of Dēr. This set of individuals appears in sections of ABC 1a and ABC 14 that deal with the reigns of Esarhaddon (*šandabakku*, ABC 1a iii 43, iv 1 and ABC 14: 10) and Šamaš-šuma-ukīn (judge, ABC 1a iv 38, ABC 14: 39). The *šangû* of Dēr does not appear in ABC 1a and ABC 14, but the city of Dēr and its gods do. Hence, if this section of ADRT 5, 5 indeed relates to year 14 of Nabopolassar, it is likely to have relied on a continuation of ABC 1a or ABC 14, or on a chronicle that stands in this tradition. It is also possible that the first column of ADRT 5, 5 does not relate to the reign of Nabopolassar but to an earlier episode in the seventh century. The conclusion that ADRT 5, 5 relies on the tradition of ABC 1a and ABC 14 would not be affected by this alternative scenario.

Of section 2 (ii 3′), which presumably relates to Nabopolassar's 15th year, only the very brief comment "there was famine" is preserved (Hunger 2001, 23). This repeats the last line of section 1. Again, we find no parallel for this entry in ABC 3. But neither is there a parallel in ABC 1a or ABC 14. In fact, famine is not at all a topic of interest in Babylonian chronicles of the seventh and sixth centuries. It is, however, a staple of omen texts. Astronomers of Esagil were also interested in this topic and they reported famine in several Astronomical Diaries between 374 BCE and the early Parthian period.[15]

Section 3 (ii 4′–6′) is better preserved:

ii 4′ Year 16, month II, the 20th …
ii 5′ went in order to do battle. Month III …
ii 6′ captives from the land Ruṣāpu …
(translation: Hunger 2001, 23)

The 16th year of Nabopolassar was of great historical significance because it saw Nabopolassar defeat the last remnant of the Assyrian empire, held by Aššur-uballiṭ in Ḫarrān. ABC 3 contains a lengthy description of that year, but again we are hard-pressed to find similarities with the text presented in ADRT 5, 5. The remark about [the king or army] setting out for battle in the month of Ayyāru (II) fits the account of ABC 3 only in a most general way. Curiously, ADRT 5, 5 does offer an accurate date for the march out, which is a level of detail not found in ABC 3. In other words, ADRT 5, 5 is brief on the military details but specific on chronology. Its report for the next month talks about captives from the land of Ruṣāpu, which was located on the way to Ḫarrān. This episode does not feature in the extensive account of ABC 3; however, a similar event appears in ABC 3's entry for Nabopolassar's 14th year.

Again, it is hard to explain the divergences with ABC 3 in any other way than that the author(s) of ADRT 5, 5 must have had another source at their disposal. Unless the Babylonian king took captives in Ruṣāpu in multiple years (which is not impossible), an event that happened in the 14th regnal year was moved to the 16th year, and the start date of the military campaign that led to the final defeat of Assyria

15 For references, browse the online corpus of Astronomical Diaries at https://oracc.museum.upenn.edu/adsd/ (accessed 04/12/2024). An example is AD -373B, discussed by Pirngruber (2013, 203–204).

was added. It is impossible to know whether these changes were made by the author(s) who composed the text of ADRT 5, 5 or whether these features were already present in the source with which they worked.

The fourth historical section of ADRT 5, 5, relating to the 18th year of Nabopolassar, is much damaged and does not allow for an in-depth discussion, but enough of it is preserved to conclude that it again diverges significantly from what ABC 3 has on offer for this year. Whereas ADRT 5, 5 mentions "Elam" (Hunger 2001, 25), the episode recounted in ABC 3 talks about Nabopolassar setting out on a campaign towards the Anatolian highlands.

## The composition of ADRT 5, 5

The preceding analysis of the historical sections in ADRT 5, 5 shows that the author(s) who composed this astronomical-historical text did not rely on chronicles like ABC 3 and ABC 4, with their strong focus on the military power of the Neo-Babylonian kings, but that they rather emulated the tradition of ABC 1a. The chronicle of which ABC 1a is the first chapter was probably a product of the early Persian period,[16] which raises the possibility that the text of ADRT 5, 5 was composed long after Nabopolassar. The inclusion of two entries on "famine" points in that same direction: this topic was of concern to Esagil's astronomers, from c. 375 BCE onwards, but it was not at all a matter of interest to the chroniclers working in the seventh and sixth centuries BCE.

The two types of data present in ADRT 5, 5 could have been brought together from two sets of legacy data that were available to the scholars of the Esagil temple in the late first millennium BCE. The astronomical data could have been sourced from tablets similar to e.g. ADRT 5, nos. 1, 4, 6 and 7, whereas the historical data could have been sourced from one of ABC 1a's continuators. If this is correct, ADRT 5, 5 represents an innovative method of historical enquiry, which consisted of bringing sets of data, originally recorded and transmitted separately, in relation with each other in order to study which celestial phenomena prevailed at the time of certain historical events. That this was a creative process that went beyond the passive combining of existing knowledge is borne out by the fact that new knowledge was added in compliance with the scholars' contemporary interests. One of these innovations was the inclusion of "famine" as a topic of study (section 1 and 2); another innovation consisted of dating certain events of the past more precisely than before (section 3: the date when captives were deported from Ruṣāpu, and the date when the Babylonian army set out on its final victory over the Assyrians). Because the source text for the historical data is not known to us, it remains difficult to assess with precision the innovative character of ADRT 5, 5 in relation to its sources.

16 Levavi 2021; Waerzeggers 2021.

## ADRT 5, 52 (side A)

ADRT 5, 52 (BM 41222) is also a fragment of a multi-columned tablet in a collection of the British Museum with materials from Esagil's library (81-4-28).[17] The text gives dates followed by celestial events. Of the first column visible on side A, the dates are broken off. The celestial events reported in that column concern the position of Saturn with respect to nearby reference stars known as Normal Stars, which it passes by. Saturn was viewed as a malefic planet, triggering unfavorable predictions. The second column of side A is better preserved. A section of thirteen lines offers enough information to understand what the text is about. Table 1 offers a schematic rendering of its contents. The horizontal rulings are those on the tablet.

The celestial information for the first two entries is broken. They relate to the 8th year of Ḫumban-ḫaltaš and the 2nd year of Esarhaddon. Next follows a section of three years in the reign of Šamaš-šuma-ukīn. The astronomical data in this section are three conjunctions of Mars and Mercury. The next section deals with the first, 12th and 16th years of Kandalānu. The astronomical data are again conjunctions of Mars and Mercury. The last preserved section concerns the 7th year of Nabopolassar. This section probably also mentioned conjunctions of Mars and Mercury.

At first sight, this looks like a straightforward list of conjunctions of Mars and Mercury, but there is more going on. Due to the rapidly changing motion of Mercury it experiences up to three conjunctions with Mars within the timespan of several months. The average period between two such clusters of conjunctions is about 26.5 months (see the Appendix). However, less than half of the conjunctions are visible. The main reason for this is that Mercury is always close to the sun and Mars, being less bright on average than Mercury, is often in its phase of invisibility whenever it is in conjunction with Mercury. The only conjunctions between Šamaš-šuma-ukīn year 14 and Nabopolassar year 7 that

17 The 81-4-28 collection comprises ca. 1086 tablets and fragments, including numerous astronomical ones originating from Babylon. According to the museum registers, the present tablet also originates from Babylon.

**Tab. 1:** Tabular rendering of the information in ADRT 5, 52 side A ii′ 1′-13′; translation adapted from Hunger 2001, 149. 151. The numbers in the left column are the Julian years BCE corresponding to the Babylonian regnal year.

| | | |
|---|---|---|
| 681/0 | Year 8 of Ḫumban-ḫaltaš, […] | broken |
| 680/79 | Year 2 of Esarhaddon, 16/VIII | broken |
| 653/2 | Year 14 of Šamaš-šuma-ukīn, 4/XII | Mercury's first appearance in the west in the area of the Swallow. When it became high, it was balanced 6 cubits above [Mar]s, Mercury […] |
| 651/0 | Year 17, 19/II | Mars was in [the area] of the Old Man to the right of Mercury by 2 cubits […] |
| 649/8 | Year 19, 4/VII | Mercury stood for ⅔ cubit above Mars, Mercury […] |
| 647/6 | Year 1 of Kandalānu, 28/III | Mercury was in the back of Mars … |
| | 29/III | it was 14 fingers above Mercury in the area of the Lion […] |
| 636/5 | Year 12, night of 8/I | Mercury, in the area of Pleiades, was 2 ⅔ cubits above Mars […] |
| 632/1 | Year 16, night of 20/III | Mercury stood 1 cubit 4 fingers behind Mars |
| 619/8 | Year 7 of Nabopolassar, […] | Mercury was balanced 6 fingers above Mars |
| | Year […] | […] 1 ½ cubits above Mars |
| | broken | broken |

were visible are those of Šamaš-šuma-ukīn years 14, 15, 17, 19, Kandalānu years 1, 10, 12, 14, 16, 18, and Nabopolassar years 5 and 7 (Appendix). Usually only one, sometimes two conjunctions from the cluster of up to three conjunctions is visible. What is striking about the conjunctions reported in ADRT 5, 52 is that none of them was invisible. Secondly, four conjunctions that were visible between Šamaš-šuma-ukīn year 14 and Nabopolassar year 7 are lacking from the tablet (Kandalānu years 10, 14, 18, Nabopolassar year 5). Thirdly, no visible conjunctions are reported at all for the more than twenty years between the second year of Esarhaddon and Šamaš-šuma-ukīn's 14th year, but the three conjunctions reported for Šamaš-šuma-ukīn years 14–17 form a complete set. In view of the lacunary rendering of the conjunctions, it seems plausible that the target of the inquiry were the historical dates and not the conjunctions themselves.

Indeed, when we consider these dates more closely, we notice that at least some, if not all, were of great significance in the historiographic tradition of Babylonia. The first date gives the historiographic interest of the author(s) away most clearly. The Julian years 681/0 BCE correspond to the "8th year of Ḫumban-ḫaltaš". This was not the king of Assyria or Babylonia, but the king of Elam. Why would the author(s) of ADRT 5, 52 have decided to include an Elamite king in a text concerned with historical skies over Babylonia? 681/0 BCE was a fateful year in the history of Babylonia. Eight years earlier, Sennacherib had destroyed Babylon, a sin for which later historians condemned him by counting the remainder of his reign as "kingless".[18] This tradition is known, among others, from ABC 1a, the same chronicle that had inspired the compilation of ADRT 5, 5 as we discussed above. These eight kingless years came to an end when Sennacherib was murdered in 681 BCE and succeeded by his son Esarhaddon. However, our text neither refers to Sennacherib or Esarhaddon nor to a kingless era, but to Ḫumban-ḫaltaš, the king of Elam. This is an explicit reference to ABC 1a, where a peculiar anecdote is told about this king in the entry for 681/0 BCE:

> "The eighth year of there not being a king in Babylon: (…) on the 23rd day of Tašrītu Ḫumban-ḫaltaš king of Elam fell ill at noon-hour and died at sunset. For eight years Ḫumban-ḫaltaš ruled Elam. (…) On the 20th day of Ṭebētu Sennacherib, king of Assyria, was killed by his son in a rebellion" (ABC 1a iii 28–35; translation adapted from Grayson 1975, 81)

ABC 1a treats Ḫumban-ḫaltaš's death with a peculiar relish for detail. It is the most specifically dated event of the entire chronicle tradition, as not only the day of the Elamite king's death is recorded, but even the precise hour (Steele 2020, 102). ADRT 5, 52 is the only text besides ABC 1a to refer to this Elamite king, which betrays the former text's reliance on the chronographic tradition.

Other entries of ADRT 5, 52 also relate to the chronographic tradition. The second year of Esarhaddon is described

**18** Brinkman 1984, 69; Frame 1992, 54, 61; Waerzeggers 2021, 295.

in ABC 14 as a year of military confrontations which involved the sacking of Arza and the subsequent capture of its king. In the chronicle, which belongs to the same tradition as ABC 1a,[19] no date for this event is given, so it is possible that the author of our text established a date through astronomical retro-calculation. This implies that the celestial event was somehow considered relevant to understand the received tradition about this long-gone year in history.

The final years of Šamaš-šuma-ukīn's reign, for which ADRT 5, 52 provides a complete sequence of conjunctions, are also of great significance in the historiographic tradition. These are the years of the so-called brother war when Šamaš-šuma-ukīn, the king of Babylonia, rebelled against his brother Assurbanipal, king of Assyria.[20] This rebellion led to a bloody civil war that ended in great tragedy for Šamaš-šuma-ukīn and terrible suffering for the population. The events had a lively literary reception in the Near East, not only in Mesopotamia, but also in Egypt as seen in Papyrus Amherst 63 which includes a novella on the brother war.

As no chronicle for the reign of Kandalānu is currently known, it is difficult to evaluate the historiographic significance of his regnal years 1, 12 and 16. Based on the preceding discussion, we assume that the authors of ADRT 5, 52 used a continuator of ABC 1a for sourcing historical data. The existence of several astronomical texts with retro-calculations made by Esagil's astronomers in the Seleucid era targeting years in Kandalānu's reign–including BM 36301 with lunar data for unknown years, and the astronomical report ADRT 5, 3, with lunar eclipses and eclipse possibilities for his 16th year–show that the reign of this king was a subject of investigation. Why the years 1, 12 and 16 were singled out in ADRT 5, 52 is, however, unclear. We similarly tap in the dark as to the significance of the seventh year of Nabopolassar, as it falls in a period of three years without adequate sources (Fuchs 2014, 38), in between the chronicles reporting his early reign (ABC 2) and the later part of his reign (ABC 3 and 4).

## ADRT 5, 52 (side B)

Of the other side of ADRT 5, 52 only two sections are somewhat preserved. Again, we find the familiar structure of (historical) dates followed, this time, by Normal Star passages of the planet Mars. The dates in column ii′ relate to days 2, 28 and 29 of the IXth month of the 19th year of an unknown king. As argued by Hunger, the data rule out year 19 of Kandalānu but are consistent with year 19 of Šamaš-šuma-ukīn (649/8 BCE). More can be read of the next section of column ii′. It treats dates in (at least) three consecutive years of Nabopolassar's reign, and like in the preceding section, it offers several dates per year: 15-V-year 12, 18-IV-year 12, 13-VI-year 12, III-year 13 (no exact day), 03-V?-year 13, 27-I-year 14 [remainder broken off]. These dates were of great importance in the history of Babylonia. In the Vth month of his 12th year, Nabopolassar's ally Cyaxares accomplished the defeat of Ashur (ABC 3: 24–30). In his 13th year, fighting continued and culminated in his 14th year in the destruction of Nineveh. It is striking that ADRT 5, 52 mostly lists day-dates, whereas the chronicle mostly works with month-dates. ABC 3 was probably written not long after the events in the late seventh or early sixth century and there is no evidence that the scholars of Esagil had access to it, as we have seen. Instead, they could have relied on a continuator of ABC 1a. Whether that source already contained these exact dates, or whether these were newly derived by the authors of ADRT 5, 52 is impossible to say.

## Contextualising ADRT 5, 52

Based on the preceding analysis, and despite missing data, we propose that the author(s) of ADRT 5, 52 confronted landmark events from the canon of Babylonian historiography with a specific type of celestial event. Their concern may have been with the patterns and regularities of history and with causation. The years treated in the text (and for which we have sufficient data) were times of civil war and bloodshed; in all these years the same celestial phenomenon is said to have happened. It is highly significant that the author(s) correlated these events with Normal Star passages of Saturn and Mars, and with conjunctions of Mars and Mercury in particular. In the older tradition of Mesopotamian celestial divination, as represented by the omen series Enūma Anu Enlil, predictions for king and country were predominantly derived from phenomena of single planets, the moon, the sun, stars, and weather phenomena, and only rarely from conjunctions between planets. In the first millennium, however, Babylonian scholars increasingly focused on the planets as carriers of signs for king and country. We can follow the development tentatively from ca. 650 BCE (in a few Astronomical Diaries) and more firmly from ca. 450 BCE. A particularly striking innovation is the use of planetary conjunctions, which is very rare in

19 On the affinity between ABC 1a and ABC 14, see Brinkman 1991.

20 Frame 1992, 131–190. Note that ADRT 5, 52 begins the sequence in the 14th year of Šamaš-šuma-ukīn (rather than in the 16th year when the rebellion actually began), which follows a chronographic tradition known from ABC 15.

the tradition of Enūma Anu Enlil. The use of single planets also increased, while the role of fixed stars decreased. The Normal Star passages of Saturn reported in col. i′ of side A and those of Mars reported in col. ii′ of side B can be viewed as manifestations of this trend. Both are malefic planets that signify unfortunate events for king and country, consistent with the historiographical interpretation of this text. The increasing use of planetary conjunctions is particularly well attested in procedures for predicting weather and market rates. To quote two Late Babylonian procedures for predicting market rates:

> SpTU 1, 94 obv. 1–4: "If you want to make a prediction for (…) the market rate of barley: (…) you investigate the course of the planets and you observe the (first) appearance, the last appearance, the station, the 'balancing' (conjunction), the (close) approach, the faintness and brightness of the planets, and the zodiacal sign in which they begin to ascend and descend, and then you make a prediction for your year, and it will be correct."

> BM 47494 obv. 12–14:[21] "If Jupiter is faint or it takes up a low position or it disappears (after its last appearance) and Mars is bright or takes up a high position or Mars is 'balanced' (in conjunction) with Jupiter: the market rate will strongly decrease and the people will experience a large famine."

The market rate of a commodity is the amount that can be bought for a fixed amount of silver. A high market rate, which corresponds to a low price in modern terms, was considered favorable, a low market rate, i.e. a high price, was considered unfavorable, being associated with famine. Another expression of the increasing importance of planetary conjunctions are commentaries on Enūma Anu Enlil in which fixed stars are equated to planets, so that omens about fixed stars could also be applied to planetary phenomena, including conjunctions.[22] Why conjunctions between Mars and Mercury? No explicit answer is provided in the extant sources, but we may note that Mercury was the planetary manifestation of Nabû, the god of writing and accounting. More importantly, in the Neo-Babylonian period Nabû was closely connected to kingship, (partly) replacing Marduk in this function. Mars was a malefic planet and signified unfavorable events (Rochberg 1988). It could therefore make sense for a Babylonian scholar in this period to interpret conjunctions of Mars and Mercury as signs for fateful events in the life of king and country (with Mercury replacing Jupiter as the planet associated with kingship). Further evidence for the importance of conjunctions of Mars and Mercury is found in the Late Babylonian procedures for predicting weather:

> AO 6449 rev. 15–19: "Mercury and Mars stand in the west in the Old Man, then rain, flood, lightning and thunder ('cry of Adad'). They stand in the Twins in the west, then rain and flood. They stand in Pabilsag or Tails, then rain and flood. They stand in the Swallow in the east or in the west, then rain and flood. They stand in the Pleiades, the Goat-Fish, in the east or in the west, then strong cold."

At least some of these predictions are clearly unfavorable (rain, flood, lightning and thunder, "strong cold"). But what was the source of the Mars-Mercury conjunctions in ADRT 5, 52, legacy reports or retro-calculation based on the Goal Year method? In order to answer this question, several factors must be taken into account. As mentioned earlier, the available textual evidence indicates that Babylonian scholarly interest in planetary conjunctions did not take off until the 5th century BCE, with the onset of long-term compilations. In principle the Babylonian scholars were capable of retro-computing such conjunctions. Successive conjunctions separated by 26.5 months occur at shifted positions in the sky, such that they repeat near the same position after 15 periods of 26.5 months, corresponding to 32 years. The 32-year period for conjunctions of Mercury and Mars is mentioned in a Babylonian compendium about conjunctions (Ossendrijver 2017) and could have been used for predicting or retro-computing them. That is, later conjunctions were projected backwards into the time window of the text by subtracting the appropriate Goal-Year period of 32 years. However, the fact that all of the reported conjunctions were observable probably speaks against this option. At face value it is more plausible that the conjunctions were copied from legacy reports made during Kandalānu's reign that had been preserved on archival copies.[23]. We nevertheless want to leave open the possibility that the Mars–Mercury conjunctions were retro-predicted with the Goal Year method. Some or all of the Normal Star passages of Saturn of Mars on side B may likewise have been predicted by means of the Goal Year method, either forwards from earlier dates or backwards from later dates.

21 Hunger 2004; Ossendrijver 2019, 62.

22 For instance, the following commentary on Enūma Anu Enlil Tablet 55 from Seleucid Uruk (VAT 7830 obv. 9–10): "If the Black One is visible in front of the Yoke star means: Mercury is visible in front of Jupiter. If the [Yoke] star stands in the position of the sun means: Jupiter will set and Mercury will be visible." (Frazer/Frahm 2016).

23 A set of Saturn observations covering (at least) years 1 to 14 of Kandalānu is known from BM 76738 + 76813 (Walker 1999). See also Steele (2019b, 32) for other compilations of planetary observations from the mid to late seventh century.

## Implications

As a final point we discuss the possible conceptual implications of the emergence of astronomical historiography in Babylonia. As we have argued, Babylonian historians used astronomical phenomena with a twofold purpose: to reconstruct the chronology of historical events and to explain these events by associating them with celestial phenomena. It is important to note that the celestial phenomena that were used in this endeavor were fully predictable, in contrast with earlier practices of celestial divination. For instance, the omen series Enūma Anu Enlil and the composition Mul.Apin, both attested from the Neo-Assyrian period onward, contain only rudimentary knowledge of the periods of eclipses and planetary phenomena, and no evidence of Goal Year periods. With the exception of eclipses, which were known to occur at intervals of five or six months, celestial phenomena are treated in traditional celestial divination as isolated signs, and therefore also the events which they signify. Late Babylonian astral science is premised on a new paradigm in which lunar and planetary phenomena are conceived of as periodic and predictable and, moreover, each phenomenon is conceived of as one instance of an endlessly repeating sequence stretching from the remote past into the remote future. Since each planetary phenomenon repeats with its own period, the aggregate effect is a dense, multi-periodic, endlessly repeating web of celestial signs that underlies all history.

As indicated above, the new astro-historiographical approach was not only applied to historical events, but also to weather phenomena and market prices, which were reported and studied by Babylonian scholars along with astronomical and historical data. In particular, several astrological procedure texts contain long-term predictive methods for market prices (Ossendrijver 2019) and weather phenomena (Ossendrijver 2021) that combine astronomical prediction using planetary Goal Year periods with inference-based rules. However, the complete absence of textual evidence for actual predictions of market rates and weather phenomena for future dates raises doubts about the predictive use of these procedures. Even though they are formulated as predictive rules, their purpose may rather have been to explain phenomena in the past. No lists of predictions or computed tables, as they exist for lunar and planetary phenomena, are attested for the non-astronomical phenomena reported in diaries. Such predictions might theoretically have escaped our attention, but a more plausible, although still hypothetical explanation is that the rules for predicting market rates and weather served a different purpose, namely to "explain" past developments, as recorded in diaries and chronicles, by associating them with predictable planetary phenomena (Ossendrijver 2021). All of this indicates that we can probably speak of a far-reaching conceptual shift in the Babylonian understanding of the way in which celestial and historical phenomena are linked through the continuum of time, from past to future (Ossendrijver 2025). An example of a historiographic work that probably presents reconstructed data on ancient market prices is ABC 23. Although it is not known which calculations were applied to arrive at this sequence, it seems nonetheless possible that the prices for wool, copper, barley and sesame that ABC 23 reports for such ancient kings as Hammurabi were retro-calculated by applying some scheme based on astronomical periods to data from the Astronomical Diaries.[24] Possibly, the exact dates that the so-called Religious Chronicle (ABC 17) reports for ominous events that happened in the eleventh and tenth centuries BCE may have been obtained through similar methods.

The roots of this practice are still to be investigated. There is some evidence for astronomical interpretations of history in texts written during the long sixth century BCE. For instance, the Neo-Babylonian school text BM 22115 (Leichty/Walker 2004, no. 1) combines a list of Jupiter phenomena on the obverse with a historical anecdote about Šulgi on the reverse, whereas BM 29440 (Leichty/Walker 2004, no. 2), from the same context as BM 22115, combines a chronicle about anarchy in the reign of Apil-Sîn with a section on the four planets Venus, Saturn, Mercury and Mars.

As a final point it may be noted that the Babylonian astro-historiographical approach, including the doctrine of conjunctions, had an afterlife in the Greco-Roman world and beyond (Tolsa 2020). Inspired by Greco-Roman astrology, Islamic scholars practiced astrological historiography and produced horoscopes of past kings in order to explain their fate, often assigning an important role to conjunctions (Samsó 2019, 372–373).

24 Note that whereas wool, barley and sesame are among the standard six commodities covered by the Diaries, copper is an anomaly. One Diary reports the buying of copper coins from Ionia (AD -273B; see http://oracc.museum.upenn.edu/adsd/adart1/corpus).

## Appendix

The following table lists all conjunctions of Mercury and Mars that occurred in the period 655–619 BCE. They were obtained by searching for dates at which both planets have identical longitudes according to synthetic data computed from the NASA JPL DE 406 ephemeris.[25] However, it sometimes happens that Mercury approaches Mars to within a distance of a few degrees before turning around and moving away from Mars, without achieving a conjunction in longitude. In fact, the tablet ADRT 5, 52 includes events at which there is a distance between Mercury and Mars of up to several degrees. For this reason closest approaches to within a few degrees are included in the table and marked by an asterisk (*). Dates after 647 BCE were converted to the Babylonian calendar based on the following sequence of intercalary months published by Britton (2007): Kandalānu years 2, 10, 13, 16 and 20, and Nabopolassar years 2 and 7 contain an intercalary month $XII_2$; Kandalānu years 5, 8 and 19, and Nabopolassar year 5 contain an intercalary month $VI_2$. Some of these intercalations are uncertain (Britton 2007). Conjunctions that were visible are shown in boldface. The main factor determining the visibility of the conjunctions is the invisibility of Mars between its last and first appearances. As it turns out, the invisibility of Mercury between its last appearance as an evening star and its first appearance as a morning star, or vice versa, does not result in a further reduction of the number of visible conjunctions. For this reason the intervals of invisibility are included only for Mars.

| Julian dates | Babylonian dates | Mars invisible |
|---|---|---|
| 655 BCE 5/3, 28/4, 29/5 | Ššu 12–13 | 655 BCE 18/1–13/6 |
| **653 BCE 25/2***, 14/5, **31/7*** | **Ššu 14–15** | 653 BCE 25/3–10/7 |
| **651 BCE 28/4**, 10/6, 19/7 | **Ššu 17** | 651 BCE 9/5–8/8 |
| **649 BCE** 2/7, **9/9, 20/9** | **Ššu 19** | 649 BCE 11/6–9/9 |
| **647 BCE 20/6,** 21/7, 9/9 | **Kan 1 26/III**, 27/IV, 18/VI | Kan 1 16/IV–28/VII |
| 645 BCE 26/8, 12/10, 24/11 | Kan 3 26/V, 15/VII, 28/VIII | Kan 3 7/V–15/IX |
| 643/2 BCE 15/11, 27/12, 17/2 | Kan 5 10/VIII, 23/IX, 16/XI | Kan 5 7/$VI_2$ – Kan 6 18/I |
| 640 BCE 3/2, 19/3, 2/5 | Kan 7 23/XI, 8 9/I, 24/II | Kan 7 22/IX – Kan 8 23/III |
| **638 BCE** 17/4, **2/7*** | **Kan 10** 29/I, **17/IV*** | Kan 9 12/XII – Kan 10 15/IV |
| **636 BCE 2/4**, 27/4, 23/6 | **Kan 12 7/I**, 3/II, 1/IV | Kan 12 27/I–5/V |
| **634 BCE** 6/6, 5/8, **27/8** | **Kan 14** 5/III, 5/V, **27/V** | Kan 14 29/II–27/V |
| **632 BCE 4/6***, 12/8, **28/10*** | **Kan 16 26/III***, 5/VI, **23/VIII*** | Kan 16 22/IV–27/VII |
| **630 BCE 30/7,** 11/9, 24/10 | **Kan 18 14/V**, 28/VI, 11/VIII | Kan 18 13/V–5/IX |
| 628-7 BCE 12/10, 27/11, 15/1 | Kan 20 22/VII, 9/IX, 29/X | Kan 20 8/VI–12/XII |
| 625 BCE 3/1, 12/2, 4/4 | Kan 22 9/X, 19/XI, Npl 1 11/I | Kan 22 1/VIII–Npl 1 24/II |
| 623 BCE 20/3, 18/5, 11/6 | Npl 2 18/$XII_2$, 3 18/II, 12/III | Npl 2 4/XII–Npl 3 19/III |
| **621 BCE 11/3***, 27/5 | **Npl 5 1/I***, 19/III | Npl 5 26/I–10/V |
| **619 BCE 11/5,** 29/6, 1/8 | **Npl 7 24/II,** 14/IV, 18/V | Npl 7 2/III–2/VI |

25 The NASA JPL data were processed with the software package stellam (Fortran 77) which was developed by Mathieu Ossendriver.

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