

## “PTOLEMY’S CANON” DEBUNKED?

JULIA NEUFFER

Berrien Springs, Michigan

After the Greek-Alexandrian astronomer, geographer, and mathematician Claudius Ptolemaeus (fl. ca. A.D. 150) wrote his *Mathēmatikē Syntaxis*, better known as *Almagest*, he wrote another work as a sort of supplement to it, called the *Handy Tables*. This work includes a chronological table, or “canon,” of reigns, called “Ptolemy’s Canon,” or “royal canon.”<sup>1</sup>

This list of reigns, beginning with the year 1 of Nabonassar, a vassal king of Babylon under Assyria, covers a little over 900 years down to Ptolemy’s day. It includes the series of Babylonian and Persian kings, Alexander the Great and his Macedonian successors in Egypt (the Ptolemies), and the Roman emperors down to Antoninus Pius. With each name is given the length of the reign and the cumulative total from the year 1 of Nabonassar—beginning, according to the Egyptian calendar, from noon on February 26, 747 B.C. (in astronomical terms, -746, since astronomers use a year 0 in place of 1 B.C.).<sup>2</sup>

The Canon (as well as the *Almagest*) employs the ancient Egyptian calendar year of 365 days, with no leap year (not the 365¼-day Julian year already in use in Ptolemy’s day as the Alexandrian civil year). This uniform 365-day year had been adopted by Hellenistic astronomers, even outside Egypt, long before Ptolemy; for astronomical theory requires observational data over a long period and a scale of years to measure long intervals—a necessity in a dating system that numbered years only as “the such and such year of King So-and-So.” Babylonian chronicles and king lists giving the number of years in each reign were available to astronomers for compiling such a time scale, and

<sup>1</sup> In Theon’s commentary on the *Handy Tables*, in vol. 6 of Halma’s edition of *Oeuvres de Ptolémée* (Paris, 1822), 1:139-148 (with continuation of the Canon past Ptolemy’s time). English trans.: R. Catesby Taliaferro, in *Great Books of the Western World*, vol. 16: *Ptolemy [Almagest and Canon], Copernicus, Kepler* (Chicago, 1952), p. 466; also in Siegfried H. Horn and Lynn H. Wood, *The Chronology of Ezra 7*, 2d ed., rev. (Washington, 1970), p. 128.

<sup>2</sup> Horn and Wood, pp. 27-29.

the use of the unvarying 365-day Egyptian year allowed computing intervals in an exact number of days—an impossibility in the Babylonian, Greek, and other lunar calendars with variable months and years.<sup>3</sup> “Ptolemy’s” Canon was such a time scale.

In his recent book, *The Crime of Claudius Ptolemy*,<sup>4</sup> Robert R. Newton of Johns Hopkins University not only credits Ptolemy with compiling the Canon; he accuses him of fabricating regnal dates, in the absence of records, to suit his own purposes. This accusation concerning the Canon occurs only in a brief section (about 4½ pages) of his final, summary chapter and is apparently an extrapolation from the book’s main thesis: namely that Ptolemy manipulated his astronomical data and computations in the *Almagest* to support his theories of celestial mechanics.

As to Newton’s astronomical argument, the book has met with some dissent. One reviewer points out specific flaws, concerning which I am not qualified to judge; another expert, in response to my inquiry, declines to give his opinion, though his brief letter unmistakably conveys emphatic dissent.<sup>5</sup> But whatever the verdict as to Ptolemy’s astronomical fraud, Newton unquestionably leaps to a *non sequitur* when he concludes, without adducing specific evidence of erroneous or fraudulent dating, that since Ptolemy “fabricated many of the aspects of the lunar eclipses,” possibly “all of them,” he could have claimed verification for his chronology even with an erroneous king list.

Newton then proceeds to the sweeping declaration “that Ptolemy’s king list is useless in the study of chronology, and that it must be ignored”; hence that “all relevant chronology must now be reviewed” in order to remove “all dependence upon Ptolemy’s list,” because “much Babylonian chronology is based upon” it; further, that “all research in either history or astronomy that has been based upon the *Syntaxis* must now be done again.”<sup>6</sup>

<sup>3</sup> O. Neugebauer, *A History of Ancient Mathematical Astronomy* (Berlin, New York, 1975), pp. 1064, 617 (hereinafter cited as *HAMA*). On the gradual shift of the 365-day year, see Horn and Wood, pp. 36-38; also Julia Neuffer, “An Egyptian Time Scale and Old Testament Chronology,” sec. 3, in L. T. Geraty, ed., *The Archaeology of Jordan and Other Studies* (Berrien Springs, Mich., forthcoming).

<sup>4</sup> Baltimore, 1977, 411 pp.

<sup>5</sup> Barnard R. Goldstein, book review, *Science*, 24 February 1978, p. 872; O. Neugebauer to Julia Neuffer, 29 November [1977].

<sup>6</sup> Newton, pp. 374-375, 379.

This alarm is sounded nearly a hundred years late, as Newton might have known if he had consulted some of his Johns Hopkins colleagues in the Department of Near Eastern Studies. He could have learned that "much Babylonian chronology" once was (not is) dependent on Ptolemy's regnal dates in the sixteenth-century beginnings of the modern chronology of antiquity,<sup>7</sup> but from the 1880s to about 1960 archaeology has furnished Babylonian and other records paralleling and corroborating "Ptolemy's king list."

It is not surprising to read that he has "not attempted to study the evidence available from sources other than Ptolemy for earlier years." However, he is aware of the astronomical fixes on Nebuchadnezzar's and Cambyses' reigns and therefore concedes that "any error in Ptolemy's list" is likely of "no more than a few years for dates after -603" (604 B.C., Nebuchadnezzar's year 1); but he expects errors of "any size" before then.<sup>8</sup>

However, the Canon figures for every reign in that same earlier period (Nabonassar through Kandalanu) are, contrary to Newton's expectations, completely in harmony with the ancient Babylonian records. These are worth examining:

The Babylonian King List A (published 1884) and the first Babylonian Chronicle (published 1887) both have lacunae, but between them they furnish the lengths of all but the last two of these early reigns. Both agree except in one case (5 versus 4 years), which could be a mere reflection of opposing parties: Mushezib-marduk was taken captive to Assyria in his year 4 when Sennacherib destroyed Babylon. In such an upheaval, one scribe recognizing Sennacherib immediately and another continuing the captive king's dating into year 5 could account for the differing records.<sup>9</sup> The Canon, like the Babylonian Chronicle, ends the reign in year 4.

Obviously the Canon is not derived directly from either of these documents, but perhaps from a common source or sources. Although its Greek spellings of the royal names are not always recognizable in the Babylonian forms, it agrees in the lengths of the reigns. Its com-

<sup>7</sup> O. Neugebauer, *HAMA*, p. 1071; Neuffer, par. 2.

<sup>8</sup> Newton, pp. 375-376.

<sup>9</sup> Compare "5" in Babylonian King List A (of which sec. iv covers this period; trans. in *ANET*, p. 272) with "4" in the Babylonian Chronicle iii.19-24. This chronicle is translated in part (beginning with Belibni) in *ANET*, pp. 301-303; but it appears entire, rechristened Chronicle 1 ("From Nabonassar to Shamash-shuma-ukin"), one of several called collectively the Babylonian Chronicle series, in A. K. Grayson, *Assyrian and Babylonian Chronicles*, Texts from Cuneiform Sources, vol. 5 (Locust Valley, N.Y., 1975), pp. 69-87; on Mushezib-marduk's 4 years, see pp. 80-81.

bined "Chinzer and Porus [Pul] 5 years" is the equivalent of the Babylonian Chronicle's 3 and 2 years, respectively, for (M)ukin-zer(i) and Tiglath-pileser (Pulu in King List A). This is not a discrepancy, nor is its omission of kings whose reigns do not extend to New Year's Day (on which the official "year 1" would have begun); a reign without a year number is irrelevant, even misleading, in a scale of whole regnal years used for a chronological rather than historical purpose.<sup>10</sup>

The Canon's one apparent discrepancy in the figures is its 13 years for "Asaradin" (Esarhaddon) versus the Chronicle's 12. This is, however, not an error but a necessary adjustment to avoid leaving one year, following year 12, unnumbered. In his year 12 Esarhaddon died in Marchesvan (month 8) and left the thrones of Assyria and Babylonia, respectively, to his two sons. In Assyria, Ashurbanipal's accession year lasted from Kislev (month 9) to the New Year (but his Assyrian regnal years are not discussed here, being irrelevant to the Babylonian Chronicle, the King List A, or the Canon). In Babylon, Shamash-shum-ukin's accession year obviously did not begin until after the New Year; the Babylonian Chronicle records for that year (as does also the Akitu Chronicle) an event in Iyyar, the *second* month); there was no month 2 between months 8 and 12 of year 12. Further, another document, the Esarhaddon Chronicle, ends with three consecutive years: (a) the year 12, (b) the accession year of Shamash-shum-ukin (unnumbered), and (c) the year 1 of the latter. The Canon numbers that middle year as "year 13" and thus avoids throwing the Babylonian count a year off.<sup>11</sup>

<sup>10</sup> J. A. Brinkman (*A Political History of Post-Kassite Babylonia, 1158-722 B.C.*, *Analecta Orientalia*, 43 [Rome, 1968]) speaks of these small differences, but also of the "praiseworthy accuracy" of the Canon and its "almost total agreement" (p. 35) with the "meticulously accurate Babylonian Chronicle" (p. 73), and discusses the variant names and the fractional reigns omitted (pp. 60-67). Grayson emphasizes the differences in "content" (which might be misread as differences in chronology), but reaches the conclusion that the source or sources of the "Ptolemaic Canon" "had a different point of view" from the Chronicle series (pp. 11, 12). Precisely—a chronological rather than a historical purpose. He cites only one actual numerical difference, which will be explained next.

<sup>11</sup> The Babylonian Chronicle iv. 30-38, i.e. Chronicle 1 in Grayson, pp. 81-82; the Esarhaddon Chronicle, 28-30, 30-44, i.e. Chronicle 14 in Grayson, pp. 127-128 (both in *ANET*, p. 303); the Akitu Chronicle, 5-7, i.e. Chronicle 16 in Grayson, p. 131. See also Waldo H. Dubberstein in *JNES* 3 (1944): 38.

Grayson (pp. 12, 240) supposes that the Canon gives Esarhaddon 13 years by allowing only 7 years for the preceding 8-year interregnum. But the Canon, like the Chronicle, has 8 years, not 7. Grayson's conjecture is in direct conflict with clear statements in three of the Chronicle texts, cited above, that show the year 13 to be the otherwise unnumbered year after year 12.

Here the chronicles end, but Shamash-shum-ukin's 20 years are clearly indicated by a tablet that lists eclipses, dated by month and day, at 18-year intervals thus: accession year of Shamash-shum-ukin; year 18 of the same; year 16 of Kandalanu. Modern computation dates these eclipses in 668/7, 650/49, and 632/1 B.C.<sup>12</sup>

A posthumous year number for Kandalanu is attested by business tablets dated respectively "year 21 of Kandalanu," "year 21 *after* Kandalanu" (i.e. after his death), and "year 22 after Kandalanu." This last is obviously the year of "no king in Babylon" mentioned in another chronicle as preceding Nabopolassar's accession.<sup>13</sup> This posthumous dating shows that the parallel "year 13" of Esarhaddon is not an error or an anomaly. The eclipse tablet that dates Kandalanu's year 16 thus locates Nabopolassar's accession in 626 B.C. and puts his reign, including the eclipse dated in his year 5 by Ptolemy, in exact alignment with Nebuchadnezzar's astronomically fixed reign. Thus every reign in the period of Newton's worst distrust checks perfectly with the Babylonian records.

Are we to believe that Ptolemy, nearly 800 years later, actually fabricated this early section of the list, or parts of it, to suit his own theories and yet arrived at 100 per cent accuracy?

The Neo-Babylonian reigns (i.e. Nabopolassar to Nabonidus' year 9) appear, exactly as in the Canon, in the more complete form of the Nabonidus Harran Inscription, supplemented by two chronicles plus commercial tablets and, for the last reign, by the Nabonidus Chronicle.<sup>14</sup> Further, the whole is dated by the astronomical tablet that fixes Nebuchadnezzar's year 37 at 568/7 B.C. by its multiple observational data, through that year. Says O. Neugebauer: "A text which contains many positions of sun, moon and stars is within many thousands of years uniquely fixed." This tablet is pivotal.<sup>15</sup>

<sup>12</sup> Tablet transcribed as no. 1417 in *Late Babylonian Astronomical and Related Texts*, ed. A. J. Sachs (Providence, R.I., 1955), p. 223; cf. p. xxxi.

<sup>13</sup> See Richard A. Parker and Waldo H. Dubberstein, *Babylonian Chronology, 626 B.C. - A.D. 75* (Providence, R.I., 1956), p. 11; Chronicle 2 ("Early Years of Nabopolassar"), lines 14-15, in Grayson, p. 88; see also D. J. Wiseman, *Chronicles of Chaldaean Kings* (London, 1956), pp. 89-90.

<sup>14</sup> Nabonidus' Harran inscription concerning his mother on Stela H<sub>3</sub>B, col. 1, lines 1-2, 29-32, col. 2, lines 40-46, col. 3, lines 1-10, in C. J. Gadd, "The Inscriptions of Nabonidus," *Anatolian Studies* 8 (1958): 46, 47, 50, 51 (also in *ANET*, pp. 560-561); Chronicle 4 ("Later Years of Nabopolassar"), lines 27-28, and Chronicle 5 ("Early Years of Nebuchadnezzar II"), lines 1, 9-11, in Grayson, pp. 98-100; Chronicle 7 ("Nabonidus Chronicle") iii. 5, 12-19, in Grayson, pp. 109-110 (*ANET*, p. 306); Parker and Dubberstein, pp. 11-14.

<sup>15</sup> Tablet VAT 4956 in the Near Eastern Department of the Berlin Museums, German trans. in Paul V. Neugebauer and Ernst F. Weidner, "Ein astronomischer Beobachtungstext aus dem 37. Jahre Nebukadnezars

Cyrus, the Persian conqueror of Babylonia, is locked in place between Nabonidus and Cambyses, whose reign, like Nebuchadnezzar's, is fixed by similar multiple data on an astronomical tablet of his seventh year, which includes a record of an eclipse dated to the same seventh year by Ptolemy (*Almagest* v. 14). Darius I is linked to Cambyses by the Behistun Inscription and to Nabonidus by the 18-year intervals of the "Saros" Tablet, which also attests several later reigns.<sup>16</sup>

The next four Persian reigns (Xerxes to Artaxerxes II) are firmly held in place—and, like the others, in agreement with the Canon—by a number of Aramaic papyri unearthed in Egypt that can be pinpointed, within a day, by their double date lines written in two calendars. Synchronizing the variable lunar-calendar dates with their equivalents in the known Egyptian 365-day calendar enables us to find the B.C. year for each.<sup>17</sup>

The last three Persian reigns are locked in place by the 18-year intervals of the above mentioned "Saros" Tablet (which bridges Alexander's reign into the Seleucid era), by a papyrus attesting 2 years for Arses, and by the alignment of Alexander's death with the Greek Olympiad scale.<sup>18</sup>

With Alexander the accession-year, or postdating, system was abandoned, even in Babylonia, for the Macedonian antedating system, in which the fractional "beginning of reign" was called "year 1" and the first New Year's Day began "year 2." In contemporary scribal practice, each year of a change in kings had two numbers, but in a chronological scale the old king's last, partial year was ignored in the numbering.<sup>19</sup> The Canon apparently antedates hereafter.

II. (-567/66)," *Berichte über die Verhandlungen der Königl. Sächsischen Gesellschaft der Wissenschaften zu Leipzig*, Phil.-Hist. Klasse, 67/2 (1915): 28-89. For an extract in English, trans. by Siegfried H. Horn, see *S.D.A. Bible Students' Source Book* (Washington, 1962), no. 452 and note. On the fixed date, O. Neugebauer to Julia Neuffer, 26 March 1963.

<sup>16</sup> J. N. Strassmaier, Cambyses, no. 400, *Inschriften von Kambyses* (Leipzig, 1890), p. 231; id., reports on the "Saros" Tablet, *ZA* 7 (1892): 200-201, and 8 (1893): 106 (see Horn and Wood, pp. 96-97 and notes 12, 14); Behistun Inscription, secs. 11, 13, in *The Sculptures and Inscription . . . on the Rock of Behistun* (London, 1907), pp. 8-9, 12-13.

<sup>17</sup> Horn and Wood, pp. 129 and note 2, 133-134; see also Neuffer, sec. 9.

<sup>18</sup> "Saros" Tablet, in *ZA* 7 (1892): 201; Dāliyah Papyrus I, in F. M. Cross, "Papyri of the Fourth Century B.C. from Dāliyah," in *New Directions in Biblical Archaeology*, ed. D. N. Freedman and J. C. Greenfield (New York, 1969), p. 44. On the Olympiad date (114.1) see Diodorus of Sicily xvii. 113.1, 117.5; Arrian *Anabasis* vii.28.1.

<sup>19</sup> On Alexander, see Parker and Dubberstein, p. 19, note 4; on postdating and antedating, Edwin R. Thiele, *The Mysterious Numbers of the Hebrew Kings*, 2d ed. (Grand Rapids, Mich., 1965), pp. 17, 23; Horn and Wood, pp. 16-21.

The regnal reckonings of the Ptolemies vary, but the Canon continues antedating to 1 Thoth in the old Egyptian calendar,<sup>20</sup> and at the death of Cleopatra it synchronizes with Roman datings, which eventually lead into our A.D. scale.<sup>21</sup>

In my first study of the Canon, years ago, I sought to trace "Ptolemy's" method—of postdating or antedating—for the Neo-Babylonian and Persian reigns. By the time I finished it, I strongly suspected that Ptolemy did not have to construct the Canon reign by reign, but most probably had access to complete lists handed down from his predecessors in Egypt.<sup>22</sup> The evidence from my more recent study has been even more convincing.

One evidence is the change in method from postdating to antedating in different periods. If Ptolemy had compiled the whole Canon as one work, he would be expected to employ the current Egyptian regnal method (antedating) throughout. However, the Canon uses both regnal systems.

Another is a difference in Ptolemy's treatment of Babylonian eclipse dates cited by Newton as evidence of fabrication. He says that Ptolemy nearly always omits the Babylonian month and day and gives only the Egyptian. Hence he assumes that Ptolemy had no Babylonian record of the eclipse and therefore probably fabricated the date from an Egyptian record.<sup>23</sup> The omission of the Babylonian month date might be taken rather as evidence that the record that had come down to Ptolemy's time had already been "translated" into an Egyptian calendar date long before he saw it, and the variable lunar-month date was considered no longer relevant.

The earlier data, as has been shown, betray their Babylonian origin, but in the Persian period, from Cambyses on, there was no need to "translate" into Egyptian dates. Egypt was by then under the rule of Persian kings, and therefore the regnal years of those kings, as reckoned in the Egyptian calendar, were the official Egyptian year reckoning. Scribes sometimes dated the same document in both the

<sup>20</sup> Alan E. Samuel, *Ptolemaic Chronology* (Munich, 1962), pp. 4, 64-65, 88-89, 138.

<sup>21</sup> *Ibid.*, pp. 159-160; on the Alexandrian Era of Augustus see Robert L. Odom, "Vettius Valens and the Planetary Week," *AUSS* 3 (1965): 115-117; Censorinus (*De Die Natale* 18.12; 21.6-11) equates several different era dates. On the Diocletian Era, and A.D. dating, see Horn and Wood, p. 26.

<sup>22</sup> Several recent writers are inclined to trace the "Ptolemaic" (or "Royal," or "Astronomical") Canon to Hellenistic astronomers or Babylonian sources. See E. J. Bickerman, *Chronology of the Ancient World* (Ithaca, N.Y., 1968), p. 107; O. Neugebauer, *HAMA*, p. 1071; J. A. Brinkman, p. 60, note 300.

<sup>23</sup> Newton, pp. 397, 373-374.

Egyptian calendar and the Semitic lunar calendar, as shown by the double-dated Aramaic papyri already mentioned. Thus the full date in either form would have been available.

The Canon apparently follows, in each period, the contemporary method of regnal year numbering. That is, it indicates the postdating pattern in the Babylonian reigns, but either method for the Persian reigns, depending on the month date of the king's accession, just as the contemporary scribes in Egypt numbered them.<sup>24</sup> That is the sort of dating that would have been handed down to Ptolemy's day in the Egyptian archives.

Then for the reigns of the Ptolemies and the Roman emperors, all of whom were rulers of Egypt, the Canon follows, wherever checked, the customary Egyptian antedating. Thus, the changing pattern tends to corroborate the origin of the earlier parts of the Canon in the records as they would have come down through the various periods to astronomers in Egypt, and eventually to Ptolemy. The correspondence between the Canon usage and the changing earlier usages is too close to allow the supposition that Ptolemy devised the whole pattern of the Canon.

Of course, the strongest evidence is the complete agreement of the Canon with the extant ancient records. O. Neugebauer refers to the long sequence of dated eclipses and other observations, along with a known and undisturbed local calendar, that were handed down "through the archives of the Late-Assyrian and Neo-Babylonian kings, archives maintained through the Persian and Greek period" (to which Ptolemy was heir). "For chronology," he writes, "this means that an accurately known astronomical system had established a sequence of fixed points, distributed over some 900 years and dated in a uniform (the Egyptian) calendar."<sup>25</sup> Evidently included in that heritage were the sources of the still surviving 900-year time scale, now called "Ptolemy's Canon." Astonishingly, after centuries of transmission of the text, it is still in agreement with the long-buried ancient documents now brought to light by modern archaeology.

<sup>24</sup> Richard A. Parker, "Persian and Egyptian Chronology," *AJSL* 58 (1941): 298-301.

<sup>25</sup> O. Neugebauer, *HAMA*, p. 1071.