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## Nahshon Gaon: Calendar Scholar or Pseudo-author?\*

**Abstract:** This article studies Nahshon Gaon's association with the Jewish calendar. Nahshon ben Zadok Gaon, a ninth-century head of the academy of Sura, is credited with developing a system of calendation known as the Iggul of R. Nahshon, which is considered the Gaon's most reliably attributable work. Based on a corpus of more than 200 medieval and early-modern sources, this article questions the historicity of this attribution. It identifies six different calendar schemes ascribed in the sources to Nahshon Gaon under the title Iggul and demonstrates that such attributions are pseudoepigraphic and predominantly Ashkenazi. Nahshon Gaon's name first appears in late 12th-century Ashkenazi calendar sources, linked to a reiterative calendar for 247 years. Other schemes copied under the title Iggul are later, and their attribution to Nahshon Gaon reflects the fact that the Gaon came to be perceived as a calendar authority.

**Key words:** Nahshon Gaon, Jewish calendar, historicity.

### Introduction

Nahshon ben Zadok was a *gaon* of the Academy of Sura ca. 865–873.<sup>1</sup> Known for his responsa and commentaries on the Bible and on several talmudic tractates, he is credited with developing a system of calendation known as the Iggul of R. Nahshon Gaon.<sup>2</sup> His authorship of many responsa

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1 The precise dates of Nahshon Gaon's incumbency are controversial; these follow Robert Brody, *The Geonim of Babylonia and the Shaping of Medieval Jewish Culture* (New Haven: Yale University Press, 1998) 344.

2 On Nahshon Gaon, see Salo W. Baron, *A Social and Religious History of the Jews* (18 vols.; New York: Columbia University Press, 1952–83) 6.42; 8.25, 192, 372 n. 59. Louis Ginzberg, *Geonica* (2 vols.; New York: Jewish Theological Seminary, 1909) 1.154–59. Phillip Ackerman-Lieberman, "Nahshon bar Zadok Gaon," in *Encyclopedia of Jews in the Islamic World*, ed. Norman A. Stillman (online); Meir Havazelet, "Nahshon Bar Zadok," *Encyclopaedia Judaica*, ed. Michael Berenbaum and Fred Skolnik (Macmillan Reference USA, 2007) 14.757. Solomon Wertheimer, *Sefer Gaon ha-Geonim* (Hebrew;

and traditions is disputed,<sup>3</sup> but the calendar system is often said to be his most reliably attributable work.<sup>4</sup>

This paper examines the association of Nahshon Gaon with the Jewish calendar. It is based on a corpus of more than 200 medieval and early-modern sources, in Hebrew, Judaeo-Arabic, Samaritan Hebrew and Latin, which contain calendar schemes associated with Nahshon Gaon. The majority of these sources are manuscripts copied before the end of the 16th century, although some later manuscripts, as well as works printed in the 16th through 19th centuries, are also included. The paper describes all identified calendar schemes ascribed to Nahshon Gaon, often under the title *Iggul*,<sup>5</sup> and studies the historicity of such attributions.

## 1. Calendar Schemes Attributed to Nahshon Gaon

The name of Nahshon Gaon appears in medieval and early-modern sources on the Jewish calendar in connection with various calendar schemes. For a list of sources, see Appendix.

### 1.1. Reiterative 247-year calendar

In the normative rabbinic calendar, years can be of 14 different types, and the type of each year must be established by calculation. Different types of year occur in a sequence that does not repeat itself exactly until it has run for 689,472 years.<sup>6</sup> The arithmetic procedure for establishing the types of years is cumbersome. It would ease the setting of calendar if the calculation could be replaced by a calendar cycle, calculated once and used forever. The cycle of 689,472 years is obviously too long for this purpose. Of more practical value is the period of 247 years, after which the rabbinic calendar

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Jerusalem: Zukerman, 1925) 3–14. Shraga Abramson, *Topics in Geonic Literature: Investigations in Geonic Literature and Responsa in Print and Manuscript* (Hebrew; Jerusalem: Mossad ha-Rav Kook, 1974) 36–39.

3 Louis Ginzberg, *Genizah Studies in Memory of Dr. Solomon Schechter* (3 vols.; New York: Jewish Theological Seminary, 1929) 2.611; Neil Danzig, *Introduction to Halakhot Pesukot* (Hebrew; New York: Jewish Theological Seminary 1993) 110 n. 8.

4 Ginzberg, *Geonica*, 154; Ackerman-Lieberman, “Nahshon bar Zadok Gaon”; Havazet, “Nahshon Bar Zadok.”

5 The word *iggul* connotes a “circle.”

6 For a detailed explanation of the workings of the Jewish calendar, see Rahamim Sar-Shalom, *Gates to the Hebrew Calendar* (Hebrew; Netanyah: R. Sar-Shalom, 1984), esp. 52, 131–140.

repeats itself almost exactly: if a calendar for 247 years is re-used for the following 247 years, it will produce mistakes in no less than two and no more than 17 years.<sup>7</sup> Although the approximate nature of this cycle was known already in the 12th century,<sup>8</sup> many medieval and early-modern Jewish sources include 247-year calendars that claim to accurately repeat themselves forever (*hozer halilah*), with no mistakes.

The 247-year cycle is the scheme that is most commonly associated with Nahshon Gaon in both primary and secondary literature, and it is attributed to him in at least 60 sources.<sup>9</sup> The attribution is predominantly Ashkenazi, but is also relatively frequent in Italian manuscripts; it is rare in Sefardi, Provençal and Oriental sources. Although the 247-year cycle occasionally bears the title *Iggul* if attributed to Nahshon Gaon, its more widely attested designations are Thirteen Cycles (*mahzorim*) and Thirteen Rows (*shurot*). This is because 247 years can be represented as 13 19-year cycles of intercalations.<sup>10</sup> The title *Iggul* is never given to 247-year cycles that are not attributed to Nahshon.

Sources that endorse the 247-year cycle represent Nahshon Gaon as an enlightener of the Diaspora who supplied Jews dispersed over different parts of the world with a reliable and easy-to-use calendar. For instance:

R. Nahshon Gaon determined this calendar for future generations. *Until the earth endures, it will not cease* (cf. Gen 8:22) and will not leave off from the mouth of the holy seed because it repeats itself forever, from the beginning of the first line, which is the 19-year cycle 262, until (the end of) 13 lines, which is the 19-year cycle 274,<sup>11</sup> so that nobody will err *until the moon is no more* (Ps 72:7). And this Gaon is well remembered because he enlightened the eyes of his people in the

7 On the 247-year cycle, see Yosef Tobi, *The Jews of Yemen: Studies in Their History and Culture* (Leiden: Brill, 1999) 211–226; Hayyim Yehiel Bornstein, “The Later History of the Calendar, Part One” (Hebrew), *Ha-Tequfah* 14–15 (1934) 354–58 and *The Dispute between Rav Saadia Gaon and Ben Meir* (Hebrew; Warsaw, 1904) 141–44; Nadia Vidro, “The Origins of the 247-year Calendar Cycle,” *Aleph* 17 (2017) 95–137; Eran Raviv, “Mathematical Studies in the Hebrew Calendar” (PhD diss., Bar Ilan University, 2015) 53–111. On the accuracy of the 247-year cycle, see Raviv, “Mathematical Studies,” 57–62.

8 See, for example, Abraham Ibn Ezra’s critique of the 247-year cycle in *Shalosh Sheelot*, ed. Moritz Steinschneider, *The Book of Two Luminaries* (Hebrew; Berlin: Zaretsanski, 1846) 1. For another 12th-century critique, see Vidro, “Origins,” 124–26.

9 See, for example, Oxford, Bodl., Mich. 74 (14th century, Ashkenaz), fol. 12v; London, BL, Or 2674 (15th century, Italy), fols. 139v–140r.

10 In the Jewish calendar, years are divided into groups, or cycles, of 19 years counted from Creation: cycle 1 stands for years 1–19 Anno Mundi, cycle 2 for years 20–38 AM, and so on. In each 19-year cycle, 12 “plain” years have 12 months and seven “intercalated” years have 13 months.

11 This corresponds to a 247-year cycle that started in 1199 CE and ended in 1446 CE.

Diaspora, *where they were scattered* (Ezek 29:13). *He who scattered Israel will gather him!* (Jer 31:9).<sup>12</sup>

Iggul that was established by R. Nahshon Gaon, the enlightener of the Diaspora<sup>13</sup>

In texts that refute the cycle, it is sometimes speculated that Nahshon Gaon was aware of the cycle's deficiency but, deeming its strengths greater than its weaknesses, made it available to the people to be adjusted as necessary by contemporary calendar makers:

Some say that the 13 cycles set up by R. Nahshon do not repeat forever ... But it is possible that the Gaon was not strict in this matter because it is a matter of concern in few years only, and he imposed the matter on the computists in each generation.<sup>14</sup>

But learned people know that it is incorrect. It is possible that the Gaon knew about the shortcoming, but because it is a matter of concern in few years only, he did not abstain from passing on the good table to the world and gave the matter to learned people as mere signs.<sup>15</sup>

## 1.2. Fourteen types of the Jewish year

A Jewish year has three main characteristics: the day of the week of Rosh Hashanah, the length of the variable months Marheshvan and Kislev, and the number of months in the year (12 in a plain year and 13 in an intercalated year). These characteristics determine the year's type and are usually recorded in calendars in the shape of a shorthand notation.<sup>16</sup> For various calendrical and halakhic reasons, only 14 types of years are possible. To obtain from the shorthand the complete roster of a year's dates, one must refer to a separate text that outlines the course of liturgical events in years of all 14 types. This text contains information on the beginnings of months and on days of the week of festivals and fasts, as well as (though not always) on how the Bible is divided into weekly portions, depending on the number of Sabbaths in a year of each type.

The description of the 14 year-types is sometimes attributed to Nahshon Gaon, mainly under the title Iggul, but also called *luah/luhot* (table/s), *seder* (order), *ibbur* (calendar) and *halila/halilot* (round/s). I am aware of around

12 Oxford, Bodl., Canon Or. 1 (14th century, Ashkenaz), fol. 81r. This passage is preserved with some variations in at least seven other Ashkenazi and Italian manuscripts.

13 Milan, Ambrosian Library, X 123 Sup (ca. 1479, Ashkenazi hand in Italy), fol. 167v.

14 Berlin, Staatsbibliothek, Or. Oct. 352 (ca. 1300, Ashkenaz), fol. 20r.

15 New York, JTS, 9487 (1552, Ashkenaz), fol. 32v. This text is included in many of the early-modern Ashkenazi calendar manuals known as *sifre evronot*.

16 For details, see Sar-Shalom, *Gates*, 42–43.

25 sources, both manuscript and printed, in which this is the case.<sup>17</sup> The preserved manuscripts date from the late 13th century onwards, and are mainly Ashkenazi, although a small number of versions are in Sefardi, Provençal, Italian and Byzantine hands. The early-modern printed sources include two bilingual Hebrew-Latin books on the Jewish calendar.<sup>18</sup>

In some Ashkenazi manuscripts, especially those carrying earlier calendars, the composition entitled *Iggul* and ascribed to Nahshon Gaon consists of the 247-year table together with the description of the 14 year-types and an occasional explanation of the shorthand notation.<sup>19</sup> In such cases, the title *Iggul* and the attribution to Nahshon are found in a closing formula at the end of the composition, often embellished by a rhyme to the name Nahshon, e. g., *nishlam iggul ha-Gaon Rav Nahshon shevah le-el aharon ve-rishon* (Iggul of the Gaon R. Nahshon is completed, praise be to God, the last and the first)<sup>20</sup> or *nishlam iggul de-Rav Nahshon H' yishmereni ke-ishon* (Iggul of R. Nahshon is completed, may God guard me like the pupil of an eye).<sup>21</sup> Within this composition, the 247-year table itself may have another explicatory text on its structure, connecting it with Nahshon as the authority who established the reiterative calendar.<sup>22</sup> In later manuscripts, the 247-year table and the description of the 14 year-types are often copied separately, but both can be attributed to Nahshon Gaon.<sup>23</sup>

### 1.3. Cycles of *Tequfot*

In the Jewish calendar the calculation of equinoxes and solstices (*tequfot*) follows a well-established 28-year cycle traditionally attributed to the Babylonian Amora Samuel. The 28-year cycle determines the day of the week

17 See, for example, Paris, BNF, heb. 1077 (15th century, Ashkenaz), fols. 42r–48v; Parma, Palatina Library, Cod. Parm. 2000 (14th–15th century, Sefarad), fols. 286r–291v.

18 Sebastian Münster, *Kalendarium Hebraicum* (Basel: Münster, 1527) 153–65 and Uri ben Simeon, *Calendarium Palaestinarum Et Universonum Iudaeorum, Ad Annos Quadraginta supputatum* (Frankfurt: Kopf (Wechsel), 1594) 123–150.

19 This has parallels in other texts on reiterative calendar not attributed to Nahshon; see Vidro, “Origins,” 100–102.

20 Oxford, Bodl., Mich. 569 (13th century, Ashkenaz), fol. 94v.

21 New York, JTS, 4246 (late 13th–early 14th century, Ashkenaz), fol. 11r and Paris, BNF, heb. 1032 (14th century, Ashkenaz), fol. 11r.

22 E. g., New York, JTS, 4246, fol. 1v, Zurich, ZB, Heid. 51 (14th–15th century, Ashkenaz), fol. 3r.

23 E. g., Moscow, RSL, Guenzburg 107 (1329, Sefarad/Provence), fol. 264r contains a 247-year cycle attributed to Nahshon, and fols. 272r–275r have a description of 14 year-types attributed to him, with other calendar material copied in between.

and time of the day of a *tequfa*, but does not specify its day of the month. Separate tables have been developed that indicate the day of the month of the four *tequfot* in each year of the 19-year cycle of intercalations. Such tables are always approximate, because the day of the month of a *tequfa* does not recur exactly after 19 years. Sources that present them usually specify that *tequfot* take place on or after the day of the month determined by the 19-year cycle, on the day of the week determined by the 28-year cycle. In some medieval sources the 19-year cycle of *tequfot* is copied without this disclaimer and appears to have been understood as a proper cycle.<sup>24</sup>

In one medieval source the 28-year cycle and the 19-year cycle of *tequfot*, explicitly said to repeat forever, are attributed to Nahshon Gaon.<sup>25</sup> In early-modern Ashkenazi calendar books called *sifre evronot* (a genre that developed in the middle of the 16th century in Germany),<sup>26</sup> cycles of *tequfot* began to be regularly attributed to Nahshon Gaon. These books often contain moveable circular devices called wheel charts or volvelles (Hebrew *iggul*). The volvelle that represents both the 28-year cycle of *tequfot* and the 19-year cycle of *tequfot* is called Iggul of R. Nahshon (without the title Gaon in the corpus of manuscripts I examined) and is said to repeat itself forever.<sup>27</sup>

#### 1.4. Other volvelles

In 17th–19th-century *sifre evronot*, different volvelles are called Iggul of R. Nahshon Gaon: one to calculate the mean conjunction (*molad*) of any month in any year from Creation and one to calculate the discrepancy between the lunar and the solar year in the four different seasons of any year from Creation.<sup>28</sup> These are not expected to produce cyclical results and must have been called *iggul* simply because of the physical shape of a volvelle.

<sup>24</sup> All such sources that I am aware of come from Ashkenaz or Italy, e.g., Jerusalem, NLI, Heb. 34°1114 (1419, Ashkenaz), fol. 248r; Paris, BNF, heb. 263 (1482, Italy), fols. 62v–63r.

<sup>25</sup> Parma, Palatina Library, Cod. Parm. 1902 (15th century, Ashkenaz), fol. 280r. This is the only one I know of.

<sup>26</sup> See Elisheva Carlebach, *Palaces of Time: Jewish Calendar and Culture in Early Modern Europe* (Cambridge: Belknap, 2011).

<sup>27</sup> See, for example, New York, JTS, 9487 (1552, Ashkenaz), fol. 22r.

<sup>28</sup> See, for example, Moscow, RSL, Guenzburg 1380 (1717, Ashkenaz), fols. 19r–19v; Frankfurt, UB, Oct. 167 (1777, Ashkenaz), fols. 29v–30r, printed *sefer evronot* (Lublin: Kalonymus Jaffe, 1615), fols. 27v–28r.

### 1.5. Schemes for deriving the type of a year from a single *molad*

To establish the type of a year by calculation, one must follow a multi-step arithmetical procedure calculating a number of *moladot* (mean conjunctions), which involves dealing with sets of large and often cumbersome numbers. In order to ease the process, various schemes have been developed that allow establishing the type of a year by calculating just one *molad*. A number of such schemes exist, known as the Four Gates, the Seven Gates and the Nineteen Rows.<sup>29</sup> All such schemes are sporadically attributed to Nahshon Gaon,<sup>30</sup> although their more common attribution is to Saadia Gaon.

### 1.6. Commentary on chronology

In two unpublished 15th and 16th-century manuscripts, a very different text on the calendar is attributed to Nahshon; in one, the text is entitled “From the Iggul of R. Nahshon;”<sup>31</sup> in the other, it begins “It has been found in the Iggul of R. Nahshon Gaon of blessed memory.”<sup>32</sup> It is a commentary on a mnemonic poem on Jewish chronological eras, followed by a discussion of the date of the Crucifixion. Very similar texts are also found without ascription to Nahshon.<sup>33</sup>

<sup>29</sup> These schemes differ mainly in the arrangement of the material – by the four allowed days of the week of Rosh Hashanah, the seven days of the week or the position of a year in the 19-year cycle, respectively.

<sup>30</sup> For the Seven Gates, see Moscow, RSL, Guenzburg 107 (1329, Sefarad/Provence), fol. 260v. For the Nineteen Rows and the Four Gates, see Hamburg, SUB, Cod. Hebr. 37 (1434, Ashkenaz), fols. 124v and 125v.

<sup>31</sup> Frankfurt, UB, Oct. 94 (a late autograph version of *Sefer Maharil*, 1460, Ashkenaz), fols. 264v–265r. Frankfurt, UB Oct. 94 is the only manuscript of *Sefer Maharil* known to me that includes this Iggul and also refers to it in its section on the laws of Tammuz and Av, para. 4, marginal add. fol. 73r. See Israel Pelles, “The Book of Maharil (Customs of Maharil) According to its Autograph Manuscripts and Its Specialty as a ‘Multi-Draft Versions’ Work” (Hebrew; PhD diss., Bar Ilan University, 2005) 240–41. (Pelles misinterprets the marginal comment as referring to the 247-year table, which is found in the manuscript on fol. 219v; p. 369 n. 9).

<sup>32</sup> New York, JTS, 2547 (1583, Ashkenaz), fols. 9r–9v.

<sup>33</sup> Oxford, Bodl., Opp. 613 (15th century, Ashkenaz), fols. 63r–63v and the Bible commentary of Hayyim Paltiel, most likely composed in 1300. The commentary in Oxford, Bodl., Opp. 613 was partially published in Adolf Neubauer, *Medieval Jewish Chronicles and Chronological Notes* (2 vols; Oxford: Clarendon, 1887) 1.193–94. On the date of Paltiel’s commentary, see Isaac Samson Lange, “On the identity of R. Hayyim Paltiel” (Hebrew), *Ale Sefer: Studies in Bibliography and in the History of the Printed and the Digital Hebrew Book* 8 (1980) 140–46, esp. 146.

The mnemonic poem is as follows (found in the manuscripts with minor variations):

2448 (begins the era) of the descent	בתמ"ח לירידה
2488 (begins the era) of the entering	בתפ"ח לכניסה
2502 (begins the era) of the sabbatical year	בתק"ב לשמיטה
2928 (begins the era) of the building	בטכ"ח לבניה
3338 (begins the era) of the ruination	גשל"ח להריסה
3408 (begins the era) of the building	גת"ח לבניינה
3448 (begins the era) of our counting	גתמ"ח למניינא
3828 (begins the era) of the destruction	גתתכ"ח לחורבנה.

A line-by-line commentary explains the events: the *descent* of the Shekhinah on Mount Sinai; the *entering* of Jews to the Land of Israel; the beginning of the *sabbatical year* count; the *building* of the First Temple; the *ruination* of the First Temple; the *building* of the Second Temple; the beginning of the *counting* of the Seleucid Era; and the *destruction* of the Second Temple.

Then begins the second part of the text, with another set of mnemonics:

בשנת תתכ"ח שירי נשכח בשנת קע"ב לחורבן הבית נשלמו ד' אלפי]ם [לכריאת עולם  
בשנת תשכ"ד ישו נלכד בשנת תקל"ב ישו נצלב

In the year 828 my song was forgotten. In the year 172 of the era of the destruction of the Temple, 4000 (years) from the Creation of the World were completed.

In the year 724 Jesus was seized; in the year 532 Jesus was crucified.

The first line of this poem refers to the destruction of the Second Temple, and the beginning of the eponymous era in the year (3)828 AM, 172 years before the end of the fifth millennium from the Creation of the World (year 4000 AM).<sup>34</sup> The second line contains mnemonics for the date of the Crucifixion: 724 and 532 in the mnemonic are discussed in the ensuing commentary, where a conclusion is reached that the Crucifixion took place seven 532-year intervals after the Creation of the World, that is, in the year (3)724 AM (36 BCE) ( $532 \times 7 = 3724$ ).<sup>35</sup>

34 The destruction of the Second Temple is characterized as the time when “my song was forgotten.” This may be a loose reference to Psalm 137, which speaks of the Babylonian exile and is often recited in commemoration of the destruction of the First Temple: “How shall we sing the Lord’s song in a strange land? If I forget thee, O Jerusalem, let my right hand forget her cunning” (Ps 137:4–5). Another suggested explanation, which, however, seems less likely, is that the destruction of the Second Temple is referred here as an event since when “the inspiration for the writing of Hebrew poetry might be said to have been forgotten” (Jeremy Schonfield, Raphael Loewe, and British Library, *The North French Hebrew Miscellany (British Library Add. MS. 11639)* (2 vols.; London: Facsimile Editions, 2003) 2.259.

35 Published in Neubauer, *Medieval Jewish Chronicles*, 1.193–94. For a detailed discussion of the 532-year cycle and its use for establishing the date of the Crucifixion, see Simcha

## 2. Historicity of the Attributions to Nahshon Gaon

The question of the historicity will be studied here on the assumption that the name Nahshon Gaon used in calendar literature refers to the 9th-century head of the academy of Sura. Theoretically, the reference could be to a different person named Nahshon, who may or may not have had the honorary title *gaon*<sup>36</sup> and could have been later conflated with the 9th-century *gaon* of Sura due to the rarity of the name Nahshon.<sup>37</sup> Since this scenario is purely hypothetical, the consensus view that the authority in question is Nahshon Gaon of Sura will be addressed here.

### 2.1. The 247-year cycle

Nahshon Gaon's connection with the 247-year calendar cycle has been discussed by a number of scholars. According to H. Y. Bornstein, the cycle was either proposed<sup>38</sup> or promoted and handed down<sup>39</sup> by Nahshon Gaon at a time when the calendar calculation had not yet become standardized. Assuming that Nahshon's calendar was an accurate cycle, Bornstein calculated that it must have been based on a different length of the lunar month. He posited that this alternative lunation was chosen by Nahshon because it produced a reiterative calendar and was later rejected in favor of a more accurate lunation, even if cyclicity had to be sacrificed. However, the lunation value suggested by Bornstein is not attested in any sources, and the entire argument is speculative.

Equally hypothetical is Tz. H. Yaffe's suggestion that Nahshon Gaon was not the institutor of the cycle, but, on the contrary, one of those who realized that the cycle was based on an inaccurate lunation and effected

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Emanuel, "Chronology and Eschatology: A Jewish-Christian Debate, France 1100," *Journal of Jewish Studies* 64 (2013) 264–82, and Sarit Shalev-Eyni, "Cosmological Signs in Calculating the Time of Redemption: The Christian Crucifixion and the Jewish New Moon of Nissan," *Viator* 35 (2004) 265–87.

36 On the title *gaon* given to scholars outside of Babylonia in the post-geonic period, see Brody, *Geonim*, 347; Jehoshua Brand et al., "Gaon," in *Encyclopaedia Judaica*, ed. Michael Berenbaum and Fred Skolnik, vol. 7 (Macmillan Reference USA, 2007) 380–386. For Ashkenaz, see Max Weinreich, *History of the Yiddish Language*, transl. Shlomo Noble (Chicago: University of Chicago Press, 1980) 346.

37 Some sources seem to imply that Nahshon Gaon lived much later than the 9th century: in a *piyyut* commentary preserved in 14th–15th-century Ashkenazi manuscripts, Nahshon Gaon is said to have observed that Redemption did not come by 1085 (Emanuel, "Chronology and eschatology," 277–78).

38 Bornstein, "Later History," 356.

39 Bornstein, *Dispute*, 142–44.

its abrogation.<sup>40</sup> S. Stern doubted the attribution of the cycle to Nahshon, because this cycle is not mentioned in any geonic sources, while also suggesting that if it is historical, the cycle may have been composed by Nahshon as part of an attempt by the Babylonians to infer the calendar system in use by the Palestinian court.<sup>41</sup> N. Danzig included the Iggul of R. Nahshon in the group of geonic works with uncertain attributions, on the ground that we do not possess any works that can be reliably attributed to *geonim* before Saadia Gaon.<sup>42</sup>

Nahshon's association with reiterative calendar was questioned already in the pre-modern period, but not for historical reasons. The 247-year cycle is not a fully accurate way of setting the Jewish calendar and can lead to violating commandments related to holidays. Since calendar is an important area of Jewish law and a *gaon* is a high halakhic authority, Nahshon Gaon's assumed authorship of an accessible but imprecise method of calendation was perceived as problematic. As a consequence, texts that refute the cycle sometimes attempt to dissociate it from Nahshon by claiming that the reiterative calendar was proposed by anonymous others:

This is the Iggul of R. Nahshon of blessed memory, which consists of 13 19-year cycles, about which they said that it repeats itself forever *until a priest stands up to consult Urim and Tummim* (Ezra 2:63). Be careful with it that you do not err, because it is not like that.<sup>43</sup>

In the beginning I should say that this Iggul, which they said was made by R. Nahshon, is a lie because it is not true that the same Iggul repeats itself forever.<sup>44</sup>

Studies of extensive corpora of manuscripts containing 247-year cycles support the pre-modern intuition. Not a single piece of evidence can be identified confirming that the cycle was known in the 9th century, and it is most likely that it did not yet exist.<sup>45</sup> The 247-year cycle is not mentioned in in-depth discussions of calendar procedures in the correspondence relating to the dispute between Saadia and Ben Meir (921–922 CE),<sup>46</sup> and it is equally

<sup>40</sup> Zvi Hirsch Yaffe, *The History of Calendar Reckoning* (Hebrew; Jerusalem: Darom, 1930) 159.

<sup>41</sup> Sacha Stern, *Calendar and Community: A History of the Jewish Calendar, 2nd cent. BCE–10th cent. CE* (Oxford: Oxford University Press, 2001) 193 n. 151, 264 n. 188.

<sup>42</sup> Danzig, *Introduction*, 109–10 and n. 8.

<sup>43</sup> Obadiah ben David on *Mishne Torah, Sanctification of the Moon*, ca. 1340. Cited according to Oxford, Bodl., Poc. 182 (14th century, Oriental), fol. 69v.

<sup>44</sup> Moscow, RSL, Guenzburg 365 (17th century, Italy), fol. 134r.

<sup>45</sup> Raviv, "Mathematical Studies," 63, 86; Vidro, "Origins."

<sup>46</sup> Personal communication from Sacha Stern, who is compiling and editing the entire corpus of texts related to the dispute. On this project, see Marina Rustow and Sacha Stern, "The Jewish Calendar Controversy of 921–22: Reconstructing the Manuscripts

absent from Abu Rayhan al-Biruni's comprehensive and well-informed section on the Jewish calendar in his *Chronology of the Ancient Nations*, completed in 1000 CE.<sup>47</sup> The earliest traceable 247-year cycles, accompanied by a description of the 14 year-types, appear to have been put together in the middle of the 10th century, before the 980s.<sup>48</sup> These calendars do not mention Nahshon Gaon, but are attributed to Josiah b. Mevorakh (ibn) al-Aquli, a scholar of Babylonian descent, who is best known in connection with the 247-year cycle but may have also authored a Bible commentary on Lamentations and the Song of Songs preserved in a 1009 manuscript, at which time he was still alive.<sup>49</sup>

Although calendrical and historical considerations indicate that the 247-year cycle was first put together in the middle of the 10th century, no 10th or 11th-century copies of reiterative calendars survive. In contrast, a number of early and mid-12th-century cycles and discussions of the reiterative calendar do exist, some in contemporary manuscripts, others in later copies. These sources are from many different geographical areas: Egypt and Maghreb, Byzantium, Provence, Ashkenaz.<sup>50</sup> This demonstrates that by the middle of the 12th century the cycle had spread and became widely known. However – significantly – none of the early and mid-12th century sources ascribe the 247-year cycle to Nahshon Gaon or use the title *Iggul*.

The earliest identified sources that associate the reiterative calendar and the 14 year-types with Nahshon either contain or discuss calendars starting in 1180 or 1199. All such late 12th-century calendars are preserved in manuscripts from Ashkenaz.<sup>51</sup> This localized late 12th-century evidence of

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and their Transmission History," in *Time, Astronomy, and Calendars in the Jewish Tradition*, ed. Sacha Stern and Charles Burnett (Leiden: Brill, 2014) 79–95. On the dispute, see also Stern, *Calendar and Community*, 264–275 and Bornstein, *Dispute*.

47 See Abu Rayhan al-Biruni, *The Chronology of Ancient Nations* 7; trans. C. Edward Sachau (London: W.H. Allen, 1879) 141–175. A new annotated translation is in preparation by François de Blois, whom I thank for drawing my attention to al-Biruni's silence on the 247-year cycle.

48 Vidro, "Origins," 120–22.

49 Fragmentarily preserved in T-S Ar.1b.5; see Vidro, "Origins," 122–24.

50 For the Orient, see an early 12th-century critique of the 247-year cycle (Vidro, "Origins," 124–26) and Oxford, Bodl., e. 45/45–56, with a calendar starting in 1142; for Byzantium, see Vatican, Biblioteca Apostolica, ebr. 303, fol. 190v, with a calendar starting in 1142; for Provence, see Abraham Ibn Ezra's critique of the 247-year cycle composed in Narbonne ca. 1148 (Steinschneider, *Two Luminaries*, 1). For Ashkenaz, see Moscow, RSL, Guenzburg 481, fol. 102r, with a calendar starting in 1123, and Parma, Palatina Library, Cod. Parm. 2295, fols. 101v–103r, with a calendar starting in 1161.

51 E. g. Oxford, Bodl., Canon Or. 1, fol. 81r, Paris, BNF, heb. 1032, fol. 1r (the attribution is on fol. 11r).

first attributing the 247-year cycle to Nahshon Gaon contrasts with the wide geographical spread of the cycle by the middle of the 12th century.

In the full corpus of ca. 200 medieval and early-modern sources on the cycle examined here, only about 30 percent associate it with Nahshon Gaon. This attribution is predominantly Ashkenazi: among the manuscripts, 44 out of 64 associating the cycle with Nahshon Gaon are in Ashkenazi hands, while just three are from the Orient, the native area of the *geonim*.<sup>52</sup> Ashkenazi attributions, which start in the late 12th century, are also by far the earliest; Nahshon's name is not found in Sefardi or Oriental calendar texts from before the 14th century or Italian calendar texts from before the 15th century.

In sum, all available evidence suggests that the attribution of the 247-year cycle to Nahshon is unhistorical and its origins lay in Ashkenaz.

## 2.2. The 14 year-types

E. Raviv conjectured that the calendar text actually authored by Nahshon Gaon was the description of the 14 year-types, and the procedure of using the 247-year cycle together with the 14 year-types became known as the Iggul of R. Nahshon by extension.<sup>53</sup>

This conjecture is not supported by textual evidence. Descriptions of the 14 year-types on their own are not consistently attributed to Nahshon Gaon, and most copies are not attributed to any authority. The attribution is not known at all in Oriental manuscripts, making it less likely that the text is by Nahshon Gaon. In European manuscripts, the attribution to Nahshon Gaon of the 14 year-types on their own is relatively late and predominantly Ashkenazi. Since the 247-year cycle is also most commonly attributed to Nahshon in Ashkenaz, it seems more probable that the separate attributions of the two schemes are reflexes of the late 12th-century Ashkenazi tradition of attributing to Nahshon Gaon the entire Iggul – viz., the 247-year cycle together with the description of the 14 year-types.

## 2.3. *Tequfot*, *volvelles*, single *molad* schemes, chronological commentary

The attribution to Nahshon Gaon of the 28-year and 19-year cycles of *tequfot* (item 1.3.), of the *volvelles* for the calculation of *moladot* and of the

<sup>52</sup> Twelve Italian and four Sefardi and Provençal manuscripts also attribute the cycle to Nahshon Gaon. The attribution is not attested in the four Byzantine, three Latin and one Samaritan sources on the 247-year cycle that are known to me.

<sup>53</sup> Raviv, "Mathematical Studies," 74, 86.

discrepancy between lunar and solar years (1.4.), and of schemes for calculating year types on the basis of just one *molad* value (1.5.) is either late or sporadic or both, and is largely limited to Ashkenaz, whereas the same schemes are ubiquitous in Jewish calendar literature from different geo-cultural areas without a fixed attribution, or attributed to other authorities.

The chronological commentary (item 1.6.) is found in four 14th-to-16th-century Ashkenazi sources, only two of which mention Nahshon. The earliest version, found in Hayyim Paltiel's commentary on Gen 5:29, claims that the dates of the beginning of different eras were calculated by *geonim* and can be found in "Seder Olam,"<sup>54</sup> presumably the geonic composition *Seder Olam Zutta*.<sup>55</sup> Although some eras mentioned in the mnemonic poem are indeed found in *Seder Olam Zutta*, others are not.<sup>56</sup>

Whether Nahshon Gaon contributed to the calculation of the remaining eras and to the development of mnemonics included in the poem is difficult to ascertain, but there is no evidence for it apart from the attribution of the text in two late Ashkenazi manuscripts.<sup>57</sup> The second part of the text, on the Crucifixion, can be dated with relative certainty to the 13th century. First, 13th-century dates are mentioned in the manuscripts.<sup>58</sup> Second, the interpretation of the 532-year period as relevant for establishing the date of

54 Hayyim Paltiel on Gen 5:29: "R. Samuel b. Meir of blessed memory posed the question why we need to count the years of evil persons mentioned in the *parasha*. He resolved it (by saying) that this is the way of the prophets, (to mention) one after the other in order to know the number of years from Creation until their time. But the *geonim* made mnemonics to speak according to explicit years. This is what is found in Seder Olam: 2448 (begins the era) of the descent"; Isaac Samson Lange, *Bible Commentaries of R. Hayyim Paltiel* (Hebrew; Jerusalem: Keren Wurzweller, 1981); Bar-Ilan University Online Responsa Project.

55 Generally, *Seder Olam* on its own stands for the rabbinic chronology, *Seder Olam Rabba*. However, *Seder Olam Rabba* does not mention the eras discussed in the chronological commentary; see Chaim Milikowsky, *Seder Olam: Critical Edition, Commentary, and Introduction* (Jerusalem: Yad Ben Zvi Press, 2013). On *Seder Olam Zutta* and its editions, see Günter Stemberger, *Introduction to the Talmud and Midrash*, trans. Markus Bockmuehl (Edinburgh: T. and T. Clark, 1996) 327.

56 See Solomon Schechter, "Seder Olam Suta," *Monatsschrift für die Geschichte und Wissenschaft des Judenthums* 39 (1895) 23–28.

57 A related but shorter and better rhymed poem is attributed in some sources to an unspecified Frenchman; see, for example, Isaac Israeli, *The Foundation of the World* (Book 4, Ch. 2, 18), ed. Baer Goldberg and Loeb Rosenkranz, *Liber Jesod Olam* (Berlin: Sumtibus editorum, 1846–48) 2.5a, 33a.

58 All versions except Paltiel's commentary contain a section in the Crucifixion part that mentions that the year 1240 has already passed. In addition, Frankfurt, UB, Oct. 94 and Oxford, Bodl., Opp. 613 conclude the mnemonic poem on different eras with a reference to the year 1224: "4984 from Creation, 1156 in Exile." This most likely gives the date when some earlier copy of this commentary was produced, clearly before 1240,

the Crucifixion is relatively common in 13th-century Ashkenazi sources, whereas in the late 11th century, the 532-year cycle was discussed in connection with the Nativity, and the Crucifixion was not mentioned.<sup>59</sup> None of these 13th-century sources mention Nahshon Gaon.

On the whole, it is highly unlikely that any of the schemes 1.3.–1.6. can be genuinely attributed to Nahshon Gaon. The use of his name must be an extension of the earlier tradition of attributing to him the Iggul as comprising the 247-year cycle and the description of the 14 possible types of the Jewish year.

Ascribing texts and traditions to famous *geonim* was a common practice in the Middle Ages, attested in different geo-cultural areas, including Ashkenaz.<sup>60</sup> For calendar, the most common authority is Saadia Gaon,<sup>61</sup> but the reiterative calendar is never attributed to him. It is not clear why Nahshon, one of the less prominent *geonim*, was chosen by 12th-century Ashkenazi Jews. Although some responsa and numerological traditions were transmitted in Ashkenaz in his name,<sup>62</sup> none of these materials that are known to me are calendrically relevant.<sup>63</sup> It has been tentatively sug-

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suggesting either that the reference to 1240 is a later addition or that the two parts originated as two separate compositions.

59 See Emanuel, "Chronology," 268–75, Shalev-Eyni, "Cosmological signs," 272–76.

60 See, for example, Brody, *Geonim*, 223, 224, 269–70 and Danzig, *Introduction*, 441–45, on the unfounded Ashkenazi attributions of various texts to Yehudai Gaon and Hayya Gaon.

61 See, for example, Rashi on BT Rosh ha-Shanah 20b, Rabbenu Tam as quoted in *Shibbole ha-Leqet*, ch. 28 (Bar-Ilan University Online Responsa Project), and the calendar treatise by Rashi's disciple, Jacob b. Samson, composed c. 1123 CE (see Oxford, Bodl., Opp. 317, fols. 93r–v, 95r, 96v, 97v and 98v–99r). I thank Sacha Stern and Ilana Wartenberg for these references. Calendar schemes are also commonly attributed to Saadia Gaon in anonymous medieval and early-modern calendar treatises.

62 For Nahshon Gaon's responsa included in some versions of *Mahzor Vitri*, see Simha Emanuel, *Newly Discovered Geonic Responsa and Writings of Early Provençal Sages* (Hebrew; Jerusalem: Ofeq Institute, 1995) 273–76. For a numerological tradition transmitted in Nahshon's name in *Seder Amram Gaon*, see Ernst Daniel Goldschmidt, *Seder Rav Amram Gaon* (Hebrew; Jerusalem: Mosad ha-Rav Kook, 1971) 10. For other numerological traditions, see a commentary on Gen 32:15–16 transmitted in Nahshon's name by Abraham Azulai (1570–1644), which presumes the Gaon's familiarity with amicable numbers; Bornstein, *Dispute*, 142 n. 1 and Meir Bar-Ilan, "A Pythagorean Commentary on the Bible by Nahshon Gaon" (Hebrew), *Shmaatin* 158 (2004) 40–44. An assessment of the historicity and date of this tradition is beyond the scope of this paper.

63 Some comments about the calendar can be found in Nahshon Gaon's commentary on BT Sanhedrin 12a preserved in the Cairo Genizah, T-S G 2.18r; see Simha Assaf, *Geonic Responsa* (Hebrew; Jerusalem: Rotenberg, 1942) 154). It is unclear to what extent this commentary could have been known in Ashkenaz.

gested that the ascription of the reiterative 247-year calendar to Nahshon may have to do with the Gaon's name, which is cognate with the Hebrew word *nahash* (serpent).<sup>64</sup> A serpent biting its own tail, known as *ouroboros*, is an ancient symbol of cyclicity, of death and rebirth, and has astronomical and astrological significance as a celestial dragon that encircles the world.<sup>65</sup> Since the 247-year calendar is said to repeat itself forever, it may have been found fitting to link it to a Gaon whose name was reminiscent of the serpent as a symbol of cyclicity. If so, it is perhaps not a coincidence that in one of the earliest 247-year tables,<sup>66</sup> the table's grid has the shape of a serpent with the serpent's head and tail drawn close to each other.

## Conclusions

This paper has identified six different calendar schemes attributed in medieval and early-modern sources to Nahshon Gaon, often under the title Iggul, and demonstrated that all such attributions are unhistorical and predominantly Ashkenazi. It appears that the composition initially attributed to Nahshon Gaon under the title Iggul consisted of the 247-year calendar table together with the description of the 14 types of the Jewish year. First attested in late 12th-century Ashkenazi sources, this attribution was probably introduced in order to give authority to a way of setting the Jewish calendar that had already become popular. All other schemes copied under the title Iggul are later, and their attribution to Nahshon Gaon is secondary, reflecting the fact that Nahshon had started to be perceived as a calendar authority.

At the same time, the association of Nahshon Gaon with the 247-year cycle, a mode that was liable to result in a violation of commandments related to holidays, posed geonic authority questions. Some sources that refuted the cycle attempt to safeguard the Gaon's authority by claiming either that he knew of the cycle's imperfections or that he never proposed the reiterative calendar at all.

<sup>64</sup> This was proposed by Roni Shweka in response to my presentation at the 17th World Congress of Jewish Studies, 9 Aug 2017.

<sup>65</sup> See Marc Michael Epstein, "Harnessing the Dragon: A Mythos Transformed in Medieval Jewish Literature and Art," in *Myth and Method*, ed. Laurie L. Patton and Wendy Doniger (Charlottesville: University Press of Virginia, 1996) 352–89, esp. 372 and 380 n. 42; Aryeh Kaplan, *Sefer Yetzirah* (York Beach: S. Weiser, 1991) 231–39; Andrew Sharf, "'Tli' and 'Jawzahr' in the Macrocosm of Shabbetai Donnolo," in *Jews and Other Minorities in Byzantium*, ed. A. Sharf (Ramat-Gan: Bar-Ilan University Press, 1995) 178–89, esp. 180–87; and Attilio Mastrocinque, *From Jewish Magic to Gnosticism* (Tübingen: Mohr Siebeck, 2005) 94–97.

<sup>66</sup> London, BL, Add 27205 (late 12th–13th century, Ashkenaz), fol. 175r.

## Appendix: Sources that attribute calendar schemes to Nahshon Gaon

The indicated calendar schemes are either contained or mentioned in the sources. In the manuscripts, 247-year tables are not always complete.

### *Manuscripts*

- Berlin, SBB, Or. Oct. 352 (ca. 1300, Ashkenazi): 247-year cycle (fols. 13r, 17r–v, 20r)  
 Berlin, SBB, Or. Oct. 3150 (1649, Ashkenazi): 247-year cycle (fol. 45v)  
 Berlin, SBB, Or. Qu. 826 (16th c., Italian): 247-year cycle (fol. 36r)  
 Budapest, MTAK, Kaufmann, A418 (16th–17th c., Italian): 247-year cycle (p. 127)  
 Budapest, MTAK, Kaufmann, A513 (16th c., Italian): 247-year cycle (p. 209)  
 Budapest, MTAK, Kaufmann, A516 (15th c., Ashkenazi): 14 year-types (pp. 3–9)  
 Budapest, MTAK, Kaufmann, A520 (16th c., Ashkenazi): volvelle of *tequfot* (p. 104), 247-year cycle (p. 115)  
 Cambridge, Trinity College, F 12 21 (14th c., Ashkenazi): 14 year-types (fols. 6v–10v)  
 Cambridge, UL, Add. 635 (1465, Ashkenazi): 247-year cycle (fols. 210r, 214v)  
 Cincinnati, HUC, 389 (1314, Ashkenazi): 14 year-types (fols. 119r–122v)  
 Cincinnati, HUC, 436 (1435, Ashkenazi): 247-year cycle (fol. 191r–v)  
 Cincinnati, HUC, 717 (17th c., Ashkenazi): 247-year cycle (fol. 9r)  
 Copenhagen, KB, Cod. Sim. Hebr. 37 (1749, Ashkenazi): 247-year cycle (fol. 61r–v)  
 Florence, BML, Laur. Plut. I. 08 (1553, Sefardi): 247-year cycle (fol. 43)  
 Frankfurt, UB, Oct. 31 (1663, Ashkenazi): 247-year cycle (fols. 38v–39r)  
 Frankfurt, UB, Oct. 35 (end 13th c., Ashkenazi): 247-year cycle with 14 year-types (fols. 29v–41r)  
 Frankfurt, UB, Oct. 94 (1460, Ashkenazi): 247-year cycle (fols. 271v, 219v), chronological commentary (fols. 73r, 264v–265r)  
 Frankfurt, UB, Oct. 120 (1640, Ashkenazi): 247-year cycle (fols. 19v–20r)  
 Frankfurt, UB, Oct. 167 (1777, Ashkenazi): volvelles of *moladot* and of discrepancies between lunar and solar years (fols. 29v, 30r)  
 Hamburg, SUB, Cod. Hebr. 37 (1434, Ashkenazi): 247-year cycle (fols. 122r, 125v), Nineteen Rows (fol. 124v), Four Gates (fol. 125v)  
 Jerusalem, Ben Zvi Institute, 1236 (17th c., Oriental): 247-year cycle (fol. 15v)  
 Jerusalem, Mossad ha-Rav Kook, OL 246 (1850, Oriental): 247-year cycle (fols. 1v–2v)  
 Jerusalem, NLI, Heb. 8°1997 (ca. 1580, Italian): 247-year cycle (fol. 73r)  
 Jerusalem, NLI, Heb. 8°2380 (1716, Ashkenazi): 247-year cycle (fol. 51r)  
 Leiden, UB, Cod. Or. 4730 (ca. 1465, Italian): 247-year cycle (fols. 14v–15v)  
 Leiden, UB, Cod. Or. 4736 (1557, Ashkenazi): volvelle of *tequfot* (fol. 26r)  
 London, BL, Add 18684 (marginal note ca. 1428, Ashkenazi): 247-year cycle (fol. 48r)  
 London, BL, Add. 26970 (1308, Ashkenazi): 14 year-types (fols. 179r–181v), possibly with 247-year cycle (fol. 182r)  
 London, BL, Add. 27201 (1242, Ashkenazi): calendar (*piske ha-luah*, fol. 263r)  
 London, BL, Or. 2674–1 (15th c., Italian): 247-year cycle with 14 year-types (fols. 139v–147r)  
 London, BL, Or. 2674–2 (marginal note, Sefardi): 247-year cycle (fol. 138r)

- Milan, Ambrosiana, X 123 Sup (ca. 1479, Ashkenazi): 247-year cycle (fol. 167v)
- Moscow, RSL, Guenzburg 107 (1329, Sefardi/ Provençal): Seven Gates (fol. 260v), 247-year cycle (fol. 264r), 14 year-types (fols. 272r–275r)
- Moscow, RSL, Guenzburg 365–1 (17th–18th c., Italian): 14 year-types (fol. 129r), 247-year cycle (fol. 134r)
- Moscow, RSL, Guenzburg 365–2 (15th c., Provençal): 247-year cycle (fols. 147r–148r)
- Moscow, RSL, Guenzburg 705 (15th–16th c., Italian): 247-year cycle (fol. 48r)
- Moscow, RSL, Guenzburg 821 (ca. 1352, Sefardi): 14 year-types (fols. 231r–237v)
- Moscow, RSL, Guenzburg 1068 (16th c., Italian): 247-year cycle (fol. 47r)
- Moscow, RSL, Guenzburg 1379 (17th c., Ashkenazi): 247-year cycle (fol. 12r–v), volvelle of *tequfot* (fol. 20r)
- Moscow, RSL, Guenzburg 1380 (1717, Ashkenazi): 247-year cycle (fol. 9v), volvelles of *moladot* and of discrepancies between lunar and solar years (fol. 19r–v)
- Munich, BSB, Cod. hebr. 394–1 (1677, Ashkenazi): 247-year cycle (fols. 11r–12r), volvelle of *tequfot* (fol. 19r)
- Munich, BSB, Cod. hebr. 394–2 (1566, Ashkenazi): 247-year cycle (fol. 72v)
- New York, JTS, 2547 (1583, Ashkenazi): chronological commentary (fol. 9r–v), volvelle of *tequfot* (fol. 36r)
- New York, JTS, 2582 (17th–18th c., Italian): 14 year-types (fols. 30r–37r)
- New York, JTS, 2588 (1720, Italian): 14 year-types (fol. 73v)
- New York, JTS, 2641 (16th c., Italian): 247-year cycle (fols. 16v–17r)
- New York, JTS, 4246 (end 13th–beginning 14th c., Ashkenazi): 247-year cycle with 14 year-types (fols. 1r–11r)
- New York, JTS, 4479 (15th c., Ashkenazi): 14 year-types (fols. 75v–77v)
- New York, JTS, 9487 (1552, Ashkenazi): volvelle of *tequfot* (fol. 22r), 247-year cycle (fol. 32v)
- New York, JTS, Rab. 532 (1473, Ashkenazi): 247-year cycle and 14 type-types (fols. 459r, 462v)
- New York, JTS, Rab. 689 (1437, Ashkenazi): 247-year cycle (fols. 121v–122r)
- Oxford, Bodl., Canon Or. 1 (14th c., Ashkenazi): 247-year cycle (fols. 81r, 88r)
- Oxford, Bodl., Laud. Or. 166 (1470, Ashkenazi): 247-year cycle (fol. 147r)
- Oxford, Bodl., Mich. 2 (1457, Sefardi hand): 14 year-types (fol. 76v ff.)
- Oxford, Bodl., Mich. 74 (14th c., Ashkenazi): 247-year cycle (fol. 12v)
- Oxford, Bodl., Mich. 152 (17th c., Ashkenazi): volvelle of *tequfot* (fol. 191r), 247-year cycle (fol. 201v)
- Oxford, Bodl., Mich. 260 (16th c., Ashkenazi): 247-year cycle (fol. 83r), 14 year-types (fols. 83v–90r)
- Oxford, Bodl., Mich. 292 (1450, Ashkenazi): 247-year cycle? (fol. 152r)
- Oxford, Bodl., Mich. 330 (1559, Ashkenazi): 247-year cycle (fols. 11r, 21r)
- Oxford, Bodl., Mich. 484 (16th c., Italian): 247-year cycle (fol. 169r)
- Oxford, Bodl., Mich. 548 (ca. 1308, Ashkenazi): 14 year-types (fols. 145r–152r)
- Oxford, Bodl., Mich. 569 (13th c., Ashkenazi): 247-year cycle with 14 year-types (fols. 89v–94v)
- Oxford, Bodl., Opp. 336 (1394, Sefardi): 14 year-types (fol. 60v)
- Oxford, Bodl., Opp. 614 (14th c., Ashkenazi): 247-year cycle with 14 year types (fols. 50v–55r)
- Oxford, Bodl., Opp. 642 (14th c., Ashkenazi): 247-year cycle (fols. 308v–309v)

- Oxford, Bodl., Opp. 701 (1586, Ashkenazi): volvelle of *tequfot* (fol. 22r), 247-year cycle (fol. 33r)
- Oxford, Bodl., Opp. 758 (14th c., Ashkenazi): 247-year cycle with 14 year-types (fols. 338r–345)
- Oxford, Bodl., Poc. 182 (14th c., Oriental): 247-year cycle (fols. 68v–71v, esp. 69v)
- Paris, AIU, H 21 A (1475, Ashkenazi): 247-year cycle (fol. 142r)
- Paris, AIU, H 148 A (15th c., Ashkenazi): 14 year-types (fols. 32r–36v)
- Paris, BNF, heb. 642 (15th c., Sefardi/ Provençal): 247-year cycle (fols. 183v–184v)
- Paris, BNF, heb. 1032 (14th c., Ashkenazi): 247-year cycle with 14 year-types (fols. 1r–11r)
- Paris, BNF, heb. 1077 (15th c., Ashkenazi): 14 year-types (42r–48v)
- Paris, BNF, heb. 1480 (15th c. secondary hand, Ashkenazi): 247-year cycle (fol. 203r)
- Parma, Palatina, Cod. Parm. 1902 (1470, Ashkenazi): 247-year cycle (fol. 276v), 28- and 19-year cycles of *tequfot* (fols. 277r–280r)
- Parma, Palatina, Cod. Parm. 2000 (14th–15th c., Sefardi): 14 year-types (fols. 286r–291v)
- Parma, Palatina, Cod. Parm. 3004 (15th c. secondary hand, Ashkenazi): 247-year cycle (fol. 317v)
- Prague, NK, F 47390 (32) (17th c., Ashkenazi): volvelle of *tequfot* (fol. 55r)
- Prague, NK, F 46892 (33) (18th c., Ashkenazi): 247-year cycle (fol. 39v)
- St. Petersburg, IOS, B 265 (1480, Byzantine): 14 year-types (fols. 83r–91v)
- Vatican, BAV, ebr. 387 (15th c., Italian): 247-year cycle (fol. 162v)
- Vienna, ONB, Cod. hebr. 75 (1468, Ashkenazi): 247-year cycle (fol. 154r)
- Vienna, ONB, Cod. hebr. 175 (1470, Ashkenazi): 247-year cycle (fol. 6r–v)
- Zurich, Jeselsohn, 16 (14th c., Ashkenazi): 247-year cycle with 14 year-types (fol. 147r ff.)
- Zurich, ZB, Heid. 51–1 (14th–15th c., Ashkenazi): 247-year cycle with 14 year-types (fols. 3r–5v)
- Zurich ZB Heid. 51–2 (1439, Ashkenazi): 14 year-types (fols. 142v–149v)

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- Daniel ben Perahya, *Sheerit Yosef* (Salonika: Joseph Jabez, 1568): 14-year types (fols. 81r, 82r–87r)
- Joseph b. Shem Tov, *Sheerit Yosef* (Salonika: Judah Gedaliyah, 1521): 247-year cycle (fols. 34v–35v), 14 year-types (fols. 35v–43v)
- Meir ha-Kohen of Rothenburg, *Haggahot Maimuniyyot* (Venice: Daniel Bomberg, 1524; Bar-Ilan University Online Responsa Project): 14 year-types (*hilchot tefilla*, 13:100)
- Sebastian Münster, *Kalendarium Hebraicum* (Basel: Münster, 1527): 14 year-types (pp. 153–65)
- Uri ben Simeon, *Calendarium Palaestinarum Et Unversorum Iudaeorum, Ad Annos Quadraginta supputatum* (Frankfurt: Kopf (Wechsel), 1594): 14 year-types (pp. 123–50)
- Sefer Evronot* (Lublin: Kalonymus Jaffe, 1615): 247-year cycle (fol. 14r), volvelles of *moladot* and of discrepancies between lunar and solar years (fols. 27v–28r)

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