



Materia giudaica

Rivista dell'associazione italiana
per lo studio del giudaismo

XXV (2020)



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Questo volume è stato pubblicato anche grazie a un contributo
del Dipartimento di Beni Culturali dell'Alma Mater Studiorum
Università di Bologna, sede di Ravenna



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DIPARTIMENTO DI BENI CULTURALI

MATERIA GIUDAICA

Rivista dell'Associazione italiana per lo studio del giudaismo.

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Gli articoli sono sottoposti a peer review tramite blind refereeing.

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ISSN 2282-4499

ISBN 978-88-8057-903-8

THE *BARAYTA DE-ŠEMU'EL* IN THE HISTORY OF JEWISH ASTRONOMY*Introduction*

The *Barayta de-Šemu'el* is a small treatise divided into nine chapters dealing mainly with cosmology, astronomy, astrology and calendrics. The *Barayta* appeared in several printed editions that were published in a span of few years between the second half of the nineteenth century and the first third of the twentieth.¹ Traditionally, it has been attributed² to Šemu'el ha-qaṭan, a *tanna* who lived in the first century, whose connection with astronomy is described in the Babylonian Talmud (bSanhedrin 11a), where he is said to know the secret of the *'ibbur* (i.e. the intercalation). Yet, there is no reference to rabbi Šemu'el ha-qaṭan in the *Barayta* itself, but rather several of its traits are in common with the doctrine attributed the more famous rabbi Šemu'el, the third century *amora* from the Mesopotamian city of Nehardea. The latter was indeed considered a great astronomer, at the point that the Babylonian Talmud (bBerakhot 58b) attributes him the claim according to which the paths of heavens were as clear to him as the streets of his home city. He also gained the nickname of *Yarḥinaah* ("lunar astronomer")³ and one of the two ancient systems of reckoning the seasons is named after him. The *tequmat* Šemu'el establishes the length of the year in exactly 365 days and 6 hours, which is the value given in the *Barayta* as well. Incidentally, the other reckoning method, called *tequmat* Ada, which was devised

later and keeps into account the movement of the Moon as well, is a bit more precise but still not precise enough.⁴ A talmudic passage (b'Eruvin 56 a) attributes to r. Šemu'el the claim according to which each *tequfah* always falls exactly in exact times of the day, i.e. at 6 a.m., at noon, at 6 p.m. or at midnight. As Beller has shown,⁵ several other elements of the astrological doctrine contained in the *Barayta* can be found scattered throughout the Talmud, in sayings that are attributed to r. Šemu'el. In the same talmudic passage, r. Šemu'el explains different climatic conditions, especially related to the wind, that can take place if the Spring equinox falls when Jupiter is the ruler of the hour. All of these elements, namely the attention to the planet ruling the first hour of the season, the correlation between Jupiter and the winds and the main concern with the forecast of future weather conditions instead of other kinds of events, are among the main concerns of the *Barayta*. Thus, the identification of the eponymous author of the *Barayta de-Šemu'el* with r. Šemu'el of Nehardea, while still pseudepigraphical, seems more fitting than the attribution to Šemu'el ha-qaṭan. In any case, since the text was probably composed in the eighth century (as we shall see shortly), the attribution to either of them is spurious, unless we hypothesize a later redaction of earlier material.

Regarding the dating of the treatise, the fifth chapter contains a reference to the year 4536, corresponding to years 775-776⁶ CE, so

¹ Thessaloniki 1861, Frankfurt 1863 and Jerusalem 1932. The *Barayta* appears also as part of Eisenstein's collection *Oṣar midrašim* (New York 1915, vol. 2, pp. 542-546). The present study is based on the 1863 edition, edited by Nathan Amram.

² See, for example EISENSTEIN 1915, p. 542.

³ bBava Meši'a 85b.

⁴ See: E. BELLER, *Ancient Jewish Mathematical Astronomy*, in «Archive for History of Exact Scien-

ces» 38/1 (1988), pp. 51-66: 60, ff.

⁵ BELLER, *Ancient Jewish Mathematical Astronomy*, cit., pp. 65-66.

⁶ Or one year earlier, depending on which reckoning was used. See: S. STERN, *Fictitious Calendars: Early Rabbinic Notions of Time, Astronomy, and Reality*, in «The Jewish Quarterly Review» 87, No. 1/2 (Jul. - Oct., 1996), pp. 103-129: 119.

that can be assumed as a *terminus post quem* for its composition or redaction. Due to the imprecision of the calendar described in the *Barayta*, which would have been correct only in a time-span of 28 years, Stern suggests that the treatise could have been composed while the discrepancy was still not noticeable, which means at the latest at the beginning of the ninth century.⁷ Several technical terms which appear in the *Barayta* and which are still used nowadays, such as *tequfah*, *molad*, *maḥzor*, are indeed typical of the gaonic era.⁸ Due to the later date of composition, the attribution to the *textus receptus* of the title of *Barayta*, which indicates rabbinical opinions which are external (thus coeval) to the Mishna, is used improperly.

The Barayta de-Šemu'el, the Barayta de-Mazzalot and the Pirqe de-rabbi Eli'ezer

The complex redactional history of the *Barayta de-Šemu'el* and its intricate relation with other astronomical texts such as the *Barayta de-mazzalot* and chapters 6-8 of the *Pirqe de-rabbi Eli'ezer*,⁹ are yet to be fully reconstructed and clarified. For example, what in a Florentine testimony¹⁰ is presented as a citation from the *Barayta de-Šemu'el* does not appear in its print version but is to be found in the thirteenth chapter of the *Barayta de-mazzalot* instead, meaning either that the citation has been misattributed or that the *textus receptus* of the *Barayta de-Šemu'el* does not correspond to

the version that circulated in the Middle Ages. Moreover, a large part of the *B. de-Šemu'el* that spans from the half of the fifth chapter to the end of the text corresponds sometimes almost word by word with chapters 1,7-12 and 14-15 of said *B. de-mazzalot*,¹¹ although sometimes with a different terminology. For example, while in the *B. de-Šemu'el* the unit of measurement for angles is called *ḥayil*, the *B. de-mazzalot* prefers the term *ḥeleq*.¹² It can be speculated that the *B. de-Šemu'el* could have drawn from the *B. de-Mazzalot*,¹³ but it can not be ruled out that both *Baraytot* could have used the same, or similar, source material. Moreover, the *B. de-Šemu'el* also present strong parallels with the astronomical and astrological chapters (6-8) of the early medieval¹⁴ midrash known as *Pirqe de-rabbi Eli'ezer*. One hypothesis that has been presented by Sarfatti¹⁵ suggests that the current recension of the *B. de-Šemu'el* represents only a part of a lost original, which in turn constituted one of the sources of the *Pirqe*, while another part has been lost. Further research will hopefully clarify the relations between the *B. de-Šemu'el*, the *B. de-mazzalot* and the *Pirqe de-rabbi Eli'ezer* and maybe redefine the nature of the ties between those works, e.g. whether one derives from another or they represent independent elaborations of heterogeneous material. Such a text-critical endeavour is beyond the scope of the present preliminary paper, which will briefly outline some of the ties between the *Barayta* and Persian and Indian astronomical and cosmological works.

⁷ STERN, *Fictitious Calendars*, cit., p. 111.

⁸ G.B. SARFATTI, *Mathematical Terminology in Hebrew Scientific Literature of the Middle Ages*, Magnes Press, Jerusalem 1968 (in Hebrew), p. 50.

⁹ At the point that Leicht defines it a «textkritische Chaos»: R. LEICHT, *Astrologumena Judaica. Untersuchungen zur Geschichte der astrologischen Literatur der Juden*, Texts and Studies in Medieval and Early Modern Judaism 21, Mohr Siebeck, Tübingen 2006, p. 84.

¹⁰ Biblioteca Medicea Laurenziana, Plut. 88.58, fol. 92 recto, 20-25. The manuscript appears to have been written in Italy between the XV and the XVI century (LEICHT, *Astrologumena*, cit., p. 84).

¹¹ LEICHT, *Astrologumena*, cit., p. 83.

¹² SARFATTI, *Mathematical Terminology*, cit., p. xiii.

¹³ G.B. SARFATTI, *An introduction to "Barayta de-Mazzalot"*, in VV.AA., *Annual of Bar-Ilan University. Studies in Judaica and the Humanities III*, Kiryath Sepher, Jerusalem 1965, pp. 56-82: 77 (in Hebrew). See also SARFATTI, *Mathematical Terminology*, cit., p. 53.

¹⁴ R. ADELMAN, *The Return of the Repressed: Pirqe de-Rabbi Eliezer and the Pseudepigrapha*, Brill, Leiden - Boston 2009, p. 3. For a recent bibliography on the *Pirqe*, see K. KEIM, *Cosmology as Science or Cosmology as Theology? Reflections on the Astronomical Chapters of Pirke DeRabbi Eliezer*, in S. STERN - CH. BURNETT (eds.), *Time, Astronomy, and Calendars in the Jewish Tradition*, Brill, Leiden - Boston 2014, pp. 41-64: 41, n. 1.

¹⁵ SARFATTI, *Mathematical Terminology*, cit., p. 54.

The chapters

As mentioned above, the *Barayta de-Šemu'el* consists of nine chapters, which deal with the following topics:

1. cosmological introduction;
2. the calculation of the *roš hodeš*;
3. the movement of the Sun and the change of seasons;
4. determining the beginning of the seasons;
5. a) more on the calculation of the seasons;
b) the planets and the constellations;
6. more on the planets and the constellations;
7. the seven heavens and their measurements;
8. exaltations and falls of the planets;
9. characteristics and dominion of the planets.

The textual units into which the text can be divided do not necessarily follow the structure of the chapters. In fact, the calculation of the beginning of the *tequfot* takes the whole fourth chapter and part of the fifth, which also deals with an introduction to the planets and the constellations, which would have fitted better in the following chapter. The sudden change in style and content in the middle of the fifth chapter marks a division of the text in two independent halves (here named 5a and 5b) which probably derive from two different sources. Chapters 1-4, after a short cosmological introduction, briefly explain the change of seasons and the movement of the Sun during the year and are mainly concerned with the measurement of time and with calendrical calculations. The part formed by chapters 5b-9, which has a lot in common with the *Barayta de-mazzalot*,¹⁶ deals with the theory of the seven heavens, their measurements and with astrological theory. In other words, the first half is more “scientific” and practical in nature, while the second half is more speculative. Sarfatti¹⁷ further divides the first half of the treatise into two parts, namely the one constituted

by the first four chapters and the other by the first half of the fifth. While chapters 1-4 deal mainly with cosmology and calendrics, chapter 5a presents a series of instructions on how to calculate the *tequfot* and their governing planets and constellations. The material contained in 5a is strictly connected with chapters 6-8 of the *Pirque de-Rabbi Eliezer* and it was composed, according to Sarfatti, in a later time.

The cosmology of the Barayta

In the first chapter, the world is imagined as a dome or tent, shaped as an exedra, with its Northern side closed and arched and the Southern side open. The text seems to consider the Earth as flat, as in biblical and talmudic cosmographies.¹⁸ One clue in that sense could be represented by the term used for the seven heavens, *ma'alot* (literally “stairs”) which seem to point to a flat cosmos. The treatise provides also the measurements of these seven *ma'alot*.¹⁹ For each heaven, which correspond each to a planet or luminary, the text enumerates the distance from the lower one, or from the earth, in the case of the lowermost one. The distances are given in a unit of measurement called “celestial rope” (*hevel ha-šamayim*). Each *hevel ha-šamayim* equals to a number of “earth ropes” (sing.: *hevel ha-areš*) that differs from heaven to heaven. Additionally, the distance between earth and the uppermost heaven is not only calculated in a way that does not take into account the equivalences between “earth ropes” and “celestial ropes” that were given earlier in the text itself, but the distance is also expressed in days of walk, namely in five hundred and fifty four and a half days. Contrarily to what we find in the *hekhalot* literature,²⁰ though, the sizes of the heavens do not increase exponentially but they seem to vary randomly, or at least with no apparent cri-

¹⁶ See the comparison in SARFATTI, *An introduction*, cit., pp. 18, ff.

¹⁷ SARFATTI, *Mathematical Terminology*, cit., p. 54.

¹⁸ *Ibid.* See also SARFATTI, *An Introduction*, cit., p. 59.

¹⁹ Other texts use the same term for the degree-

es: see SARFATTI, *Mathematical Terminology*, cit., p. xiii, p. 48 and p. 51.

²⁰ PH.S. ALEXANDER, *The Dualism of Heaven and Earth in Early Jewish Literature and its Implications*, in A. LANGE, E.M. MEYERS, B.H. REYNOLDS III, R. STYERS (eds.), *Light Against Darkness. Dualism in Ancient Mediterranean Religion and the*

terion, between one heaven and the other. Moreover, the value of a few hundred days of walk is similar but at the same time several orders of magnitude smaller than the five hundred years that are required to reach the first heaven only, according to bHagigah 13a. Other texts, such as the *Massekhet Hekhalot*,²¹ present even larger values for the distances between firmaments, in order to stress the physical impossibility of reaching the *maqom* i.e. the Place *par excellence*, which is where the Godhead is believed to dwell. These latter works, though, are mystical in nature, which means that, by emphasizing the huge physical distance between man and the heavens, they imply that the visions of the Palaces and of the Throne of Glory described in the texts are spiritual and not physical in nature. *The Barayta de-Šemu'el*, on the other hand, does not concern itself with spiritual matters such as how to reach God, but simply aims to provide dry and, as it were, matter-of-fact measurements of the cosmos and only little speculation is dedicated to cosmology. In the context of the *Barayta*, the reference to the days that it would take to walk from the earth to the uppermost heaven looks more a way to better convey the idea of a merely physical measurement than an implication that such a journey would be actually possible.

In the *Barayta*, ropes are referenced not only as a unit of measurement, but also as cosmological elements that seem to tie together the stars, the planets and a certain Dragon (*tly*), which is said to be stretched across the sky and is held responsible for the solar and lunar eclipses. According to the first chapter of the *Barayta*, the motion of the sky is originated by what has been identified as the Great Bear, then to a not better specified Yoke, which transmits the motion to the constellation of Orion and to the asterism of the Pleiades. Except for the Yoke, these groups of stars (namely, the Great Bear, Orion and the Pleiades) are in fact the only ones mentioned in the Bible and, regarding the latter two, they are indeed described as tied to the

firmament in Job 38:31. Incidentally, the identification of the Yoke (*'wlh*) is problematic in the frame of Hellenistic astronomy, since it does not seem to correspond to any known constellation. It could refer to the asterism that corresponds to the foremost part of the Chariot, i.e. of the Great Bear, but astronomical treatises usually do not single it out as a stand-alone constellation or asterism. The motion of the sky dome is transmitted to the Dragon, which in turn transfers it to the wheel of the Zodiac and the planets and luminaries that cross it.

It is implied that this Dragon is invisible because the treatise shows how to calculate, instead of telling how to spot in the sky, the position of its head and tail, in order to predict the eclipses. Removing the mythological imagery, the head and tail of the Dragon are the names of the two imaginary points, called “nodes”, of intersection between the lunar orbit and the ecliptic, which is the apparent orbit of the Sun in a geocentric view. In modern-day astrological nomenclature, the two nodes, the ascending and the descending, are still sometimes referred to as *Caput* and *Cauda draconis*, respectively, and astronomically they represent the two points in which the eclipses, both lunar and solar, take place. In the *Barayta*, the head is said to be connected with the Sun and the tail to the Moon, but that claim has no apparent astronomical significance.

Calendar

As already mentioned, chapters 2 and 4 and the first part of chapter 5 describe mathematical methods for calculating the future positions of the Sun and the Moon in order to determine the *roš ḥodeš* and the *tequfot*. The seasons are delimited by the two equinoxes and the two solstices and, in chapter 5, they are also associated with the zodiacal sign with which they begin, namely Aries, Cancer, Libra and Capricorn,

Contemporary World, Vandenhoeck & Ruprecht, Göttingen 2010, pp. 169-185 (175): «[...] the distances between the various stages increase exponentially, so that the nearer he apparently gets to his goal, the further in fact he still has to go!».

²¹ A. JELLINEK (hrsg.), *Sammlung kleiner Midraschim und vermischter Abhandlungen aus der ältern jüdischen Literatur. Nach Handschriften und Druckwerken gesammelt und nebst Einleitungen*, vol. 2, Leipzig 1853, p. 41.

in that order. Other terms, especially related to relative aspects and positions of planets and constellations, such as *trigon* and *sterigmos*, are obviously loanwords from Greek.

It is worth noting that the year, according to the *Barayta*, is made to begin in Tišri, instead of Nisan.²²

Although the treatise prescribes calendric calculations, it shows that the Mishnaic practice of observing the New Moon in order to declare the beginning of the new month was still being carried out at the time of its redaction. Since apparently there was not a precise time in which mathematical methods for the calendar replaced the observational ones, it can be assumed that a gradual shift took place and in different places in different times. It can be inferred that the *Barayta* was composed in a time in which both systems, empirical and mathematical, were used for the definition of the calendar,²³ although the calendar described in the treatise was probably not actually used, because its flaws made it impractical. Specifically, since, according to the book of Genesis, the Sun and the Moon were created on the fourth day, rabbinic tradition has reckoned that moment as the beginning of time and thus of its computation. The ideological necessity of making each season start on the fourth day²⁴ forces the calendar described in the *Barayta* to create an ever increasing mismatch between it and the actual seasons. Such a calendar would have worked for a period of time only at the beginning of the common era,²⁵ so if it was actually used, it would have needed a correction

soon enough. Since it does not contain any correction, it can be speculated that the calendar in the *Barayta* was fictitious or ideal, but it is not possible to determine with certainty whether its author (or authors) considered it as such.²⁶

In the fifth chapter of the *Barayta*, different sequences for the seven planets are provided, each with a different purpose. Mnemonics are used to remember those sequences and are based on the first letter of the Hebrew names for the planets. The basic sequence enumerates the planets from the farthest to the closest orbits to Earth or, in other words, from the slowest to the quickest: Saturn, Jupiter, Mars, Sun, Venus, Mercury and Moon. Different sequences are used for the calculation of the planet and the constellation “governing” the day, the night or a whole *tequfah*.²⁷

Astrology

At the beginning of the second half of the treatise, the lists of the twelve constellations, the two luminaries and the five planets are presented. The planets and luminaries are divided into masculine (Sun, Saturn, Jupiter, Mars), feminine (Moon and Venus) and one androgynous (Mercury), that can be masculine or feminine depending on its aspect (i.e. relative position) with the others. The twelve signs of the Zodiac are also divided into masculine (Aries, Gemini, Leo, Libra, Sagittarius, Aquarius) and feminine (Taurus, Cancer, Virgo, Scorpio, Capricorn,

²² bRoš Ha-Šanah 12a, but see also: A.A. AKAVIA, *Baraita de-Shemu'el ke-Te'udah le-Toledot ha-'Ibbur*, in «Melila» 5 (1955), pp. 119-132 (in Hebrew).

²³ S. STERN, *Calendar and Community. A History of the Jewish Calendar, Second Century BCE–Tenth Century CE*, Oxford University Press, Oxford 2001, p. 180. On observational astronomy in the Late Antiquity and the Middle Ages, see also W. HARTNER, *The Rôle of Observations in Ancient and Medieval Astronomy*, in «Journal for the History of Astronomy» 8 (1977), pp. 1-11.

²⁴ STERN, *Fictitious Calendars*, p. 106.

²⁵ *Ivi*, p. 109.

²⁶ *Ivi*, pp. 110-111.

²⁷ One typical example in European languages of different sequences of planets is the one that corre-

sponds to the days of the week. The sequence: Sun, Moon, Mars, Mercury, Jupiter, Friday and Saturn, does not correspond to the actual sequence of the planetary orbits, but it derives from a division of the twenty-four hours into seven and then the assigning of a planet to each of the hours. A certain planet is said to “rule” a certain day if it governs the first hour of that day. See S. GANDZ, *The Origin of the Planetary Week or The Planetary Week in Hebrew Literature*, in «Proceedings of the American Academy for Jewish Research» 18 (1948-1949), pp. 213-254: 228, ff. See also D.H. KELLEY and E.F. MILONE, *Exploring Ancient Skies. A Survey of Ancient and Cultural Astronomy*, Springer, New York - Dordrecht - Heidelberg - London 2011, p. 96.

Pisces), and they are also grouped into triangles according to the four classic elements: Fire (Aries, Leo, Sagittarius), Earth (Taurus, Virgo, Capricorn), Air (Gemini, Libra, Aquarius) and Water (Cancer, Scorpio, Pisces). Each sign is the domicile of a planet, which means that, when the planet crosses it, it can have an influence stronger than usual. The Sun and the Moon have only one domicile, Leo and Cancer respectively, while Saturn has Capricorn and Aquarius, Jupiter has Sagittarius and Pisces, Mars has Aries and Scorpio, Venus has Taurus and Libra and Mercury has Gemini and Virgo as their domiciles. In addition to the domicile, each planet or luminary is influenced by areas of the Zodiac that can either increase (exaltation) or decrease (fall) its effect on the sublunar world.

Parallels

One of the peculiar elements of the cosmology of the *Barayta*, as we have seen, is the Dragon (*tly*), with its head and tail, which was believed to obfuscate the Sun and the Moon during the eclipses. Although the etymology of the word *tly* can be traced to the Akkadian *attalu* with the meaning of “eclipse”, its later association with a dragon still remains unclear.²⁸ In Hindu mythology, a monster was believed to be responsible for the eclipses. It was the beheaded demon whose head and body, named Rahu and Ketu, wander across the ecliptic and occasionally swallow the luminaries for a short period of time. Exactly like the *Barayta*, medieval Hindu astronomical and astrological works calculate the positions of the two parts of the demon, which obviously correspond to the lunar nodes, the position of which can be determined mathematically.

²⁸ A. PIRTEA, *Is There an Eclipse Dragon in Manichaeism? Some Problems Concerning the Origin and Function of ātālyā in Manichaean Sources*, in *Zur Lichten Heimat: Studien zum Manichäismus, Iranistik, und Zentralasienkunde im Gedenken an Werner Sundermann*, Harrassowitz, Wiesbaden 2017, pp. 535-554: 537.

²⁹ The source material could be even earlier: see PANAINO, *Tessere il cielo. Considerazioni sulle Tavole astronomiche gli Oroscopi e la Dottrina dei Legamenti tra Induismo, Zoroastrismo, Manicheismo e*

Another cosmological element found in the *Barayta* and which can not be explained with Hellenistic astronomy is the idea of planets and constellations being tied through ropes. This idea is attested in late antique (3rd-4th century)²⁹ Sanskrit texts, such as the most recent version of the *Sūryasiddhānta*, the *Bhuvanavinyāsa* and the *Viṣṇupurāṇa*. In the *Bhuvanavinyāsa*, for example, Dhruva, the North pole, is said to rotate and to transmit its movement to the constellations, to the planets and to the “wheel of fire” (presumably the Zodiac) through “ropes of wind” (*vāyuraśmibhiḥ*).³⁰ In the *Viṣṇupurāṇa*, we read:

As Dhruva revolves, it causes the moon, sun, and stars to turn round also; and the lunar asterisms follow in its circular path; for all the celestial luminaries are in fact bound to the polar-star by aerial cords.

[...]

I have thus described to you, Maitreya, the chariots of the nine planets, all which are fastened to Dhruva by aerial cords. The orbs of all the planets, asterisms, and stars are attached to Dhruva, and travel accordingly in their proper orbits, being kept in their places by their respective bands of air. As many as are the stars, so many are the chains of air that secure them to Dhruva; and as they turn round, they cause the pole-star also to revolve. In the same manner as the oil-man himself, going round, causes the spindle to revolve, so the planets travel round, suspended by cords of air, which are circling round a (whirling) centre. The air, which is called Pravaḥa, is so termed because it bears along the planets, which turn round, like a disc of fire, driven by the aerial wheel.³¹

Whether Dhruva is considered the North pole or the North star,³² that does not change the fact that, just like in the *Barayta de-Šemu’el*, the movement of the celestial dome is believed to

Mandeismo, Istituto Italiano per l’Africa e l’Oriente, Roma 1998, p. 57.

³⁰ PANAINO, *Tessere il cielo*, cit., pp. 54-55.

³¹ *Viṣṇupurāṇa* II,9; II,12. H.H. WILSON, *The Vishnu Purana: A System of Hindu Mythology and Tradition. Volume 2: Book I & II*, London 1865, pp. 230, 304-305.

³² A. PANAINO, *Uranographia Iranica II: Avestan hapta.srū- and mərəzu-: Ursa Minor and the North Pole?*, in «Archiv für Orientforschung» 42/43 (1995/1996), pp. 190-207.

be transmitted from the North to the rest of the celestial bodies. The planets are said to be nine instead of seven because, like the *Barayta* occasionally does regarding the head and the tail of the Dragon, the *Višṇupurāṇa* considers the head and the tail of the demon as two actual, although invisible, celestial bodies.

The transmission of the from third or fourth century (or earlier) India to eighth century (or later) Near East was possible thanks to Sasanian mediation. In fact, we find the same doctrine of the planetary ropes (*zīg*, of uncertain etymology)³³ in the Zoroastrian account of creation called *Bundahišn*. The earlier manuscript of the *Bundahišn* has been dated to the late eighth century,³⁴ thus, the text is at least coeval with the *Barayta de-Šemu'el*, if not earlier. This is what the *Bundahišn* says regarding the creation of Haftōreng (Ursa Maior) by Ohrmuzd:

He appointed Ursa Major in the north, where hell would be established after the Adversary's onslaught. In order to arrange the continents during the Mixture, a band ties each of the seven [*haft*] continents to it. That is the reason why it is called Ursa Major [*Haftōreng*].³⁵

In the ninth century apologetic Zoroastrian text *Škand-gumānīg wizar* (IV, 39, ff.) the planets are said to be tied through ropes to the Sun and the Moon and so are their two "adversaries".³⁶ The celestial ropes are mentioned not only in Zoroastrian astronomy, but in Manichean and Mandaean texts as well,³⁷ although

with significant variations. For example, in some Manichaean texts of the Turfan collection, such as M 7984 II V I and V II, the ropes tie not only planets and constellations, but also demons and other beings.³⁸ As for Mandaeism, one of the most important texts belonging to this tradition, namely the *Ginza* (also known as *Book of Adam*, first third of the first millennium CE), when describing the act of creation, before mentioning the five planets tied with ropes, it also describes the sky as a tent and mentions a "great dragon" (*tālyā rabbā*).³⁹

Between the eighth and the ninth centuries, the study and research in the field of astronomy was developed by the new Islamic rule, that used the old cultural centers of the sasanian kingdom.⁴⁰ During this time, direct translations from Sanskrit to Arabic were carried out, especially of astronomical and astrological texts.⁴¹ Arabic mediation could have been the reason for the presence of the unidentified Yoke that the *Barayta* mentions in a context dealing with the transmission of the movement of the celestial bodies from the North pole to the ecliptic. The Arabic term *ribāṭāt*, the primary meaning of which indicates a yoke or a tether, was also used in Arabic astronomy to refer to these imaginary ropes that were believed to tie the planets and the stars and to transmit the motion from the North pole to the ecliptic. The idea did not spread further in Arabic astronomical texts probably because it received strong criticism by authors such as Al-Bīrūnī, who attributed it to the Persians.⁴²

³³ PANAINO, *Tessere il cielo*, cit., pp. 43, ff.

³⁴ D.N. MACKENZIE, *Bundahišn*, in *Encyclopedia Iranica*, IV, 5, 547-551, available online at: <http://www.iranicaonline.org/articles/bundahisn-primal-creation> (visited on 11th January 2020).

³⁵ *Iranian Bundahišn* II,9: D. AGOSTINI, S. THROPE (eds.), *The Bundahišn. The Zoroastrian Book of Creation*, Oxford University Press 2020, p. 19. See also PANAINO, *Tessere il cielo*, cit., p. 71.

³⁶ J. DE MENASCE, *Škand-Gumānīk Vičār. La solution décisive des doutes. Une apologétique Mazdéenne du IXe siècle*, Freiburg en Suisse 1945, pp. 52, ff. It could be speculated that the idea of these two adversaries called *Drūj* being tied to the Sun and the Moon could have inspired the idea of the head and the tail of the Dragon which, in the *Barayta*, can darken the two luminaries to which they

are somehow tied.

³⁷ PANAINO, *Tessere il cielo*, cit., p. 52.

³⁸ *Ivi*, p. 87.

³⁹ *Right Ginza*, Book III; Book II 20th and 21st parts. in PANAINO, *Tessere il cielo*, p. 131, ff. The identification of this dragon with the eclipse Dragon is uncertain, although it can not be ruled out.

⁴⁰ See PANAINO, *Tessere il cielo*, cit., p. 38. See also D. PINGREE, *Astrology and Astronomy in Iran*: <http://www.iranicaonline.org/articles/astrology-and-astronomy-in-iran-> (consulted: January 9th 2020; originally published in E. YARSHATER (ed.), *Encyclopedia Iranica* II, 8, London - New York 1987, pp. 858-871.

⁴¹ PINGREE, *Astrology and Astronomy in India and Iran*, cit., p. 243.

⁴² PANAINO, *Tessere il cielo*, cit., pp. 53, 57, ff.

For several aspects, the *Barayta de-Šemu'el* appears to be strictly connected with the Jewish tradition. Its several quotes, in a midrashic style, from the Hebrew Bible seem to show a willingness to connect the astronomical treatise to the Scriptures and to present a worldview that unites science and religion, if we are to use modern categories. We have also seen the close relationship between astrological ideas found in the *Barayta* and the ones that the Babylonian Talmud attributes to r. Šemu'el. That conveys a sense of continuity between the treatise and the religious tradition. Together with the necessity of “canonicity”, so to speak, the *Barayta* also appears to use material which is external to Jewish culture. For example, much of the astrological doctrine found in the last chapters ultimately derive from the first book of Ptolemy's *Tetrabiblos*⁴³ and it presents Greek loanwords, as we have seen. Other peculiarities are to be found in astronomical and cosmological works that do not belong to Judaism. The reckoning of the year from the Anno Mundi, the dragon of the lunar nodes, the ropes that tie the planets, the sky seen as a tent are elements that recur in earlier or coeval Indian, Mandaic, Manichaean and Zoroastrian sources.

It can be hypothesized that the redactor of the *Barayta de-Šemu'el* operated in a milieu where he could easily access such sources, which allowed him to create a synthesis of Hellenistic, Indian and Mesopotamian astronomy, in a time in which Arab astronomy was yet to be fully developed. Whoever composed or redacted the treatise harmonized foreign astronomical concepts which fit well with the Bible – such as the ropes or chains that tie Orion and the Pleiades, hinted to in the book of Job (38:31) – as well with the Talmud. It would be tempting to attribute the origins of this cosmological element present in

Job to previous Zoroastrian works, but the virtual absence of astronomical sources from pre-Sasanian Persia⁴⁴ prevents any further investigation in that direction for the time being. The suggestion of a Babylonian milieu for the composition of the *Barayta* would easily explain its peculiar cosmological elements, that are generally not to be found in “classical” (i.e. Hellenistic) astronomy and astrology or in earlier Jewish works. A prominent example of the role of the Jews in the history of astronomy during Sasanian rule is represented by the Jewish astronomer Māšā'llāh, who used sources derived from sasanian astronomy and Zoroastrian cosmology and astrology. In fact, since «virtually nothing is known of the astronomy and astrology of pre-Sasanian Iran», his role in the reconstruction of history of astronomy of that time is invaluable.⁴⁵ The *Barayta* could represent another example of Jewish mediation between Indian, Persian, Arabic and Greek cultures regarding astronomy. Deeper research is required to better clarify its ties with both Jewish and non-Jewish texts.

The *Barayta de-Šemu'el*, with its synthesis of cosmological, astronomical and astrological lore stemming from different cultures and different epochs, was cited in several medieval Jewish texts, such as the *Sefer Ḥakmony*,⁴⁶ written in tenth-century byzantine Southern Italy by Šabbetai Donnolo. It was also commented in the *Sefer ha-mazzalot*, another astronomical work that has been attributed to the same author.⁴⁷ In spite of its small size, it might have played a role in the transmission of astronomical knowledge across the Mediterranean that could be larger than previously thought.

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⁴³ SARFATTI, *An Introduction*, cit., pp. 66-70.

⁴⁴ D. PINGREE, *Astronomy and Astrology in India and Iran*, in «Isis» 54, 2 (Jun., 1963), pp. 229-246: 240.

⁴⁵ E.S. KENNEDY - D. PINGREE, *The Astrological History of Māšā'allāh*, Harvard University Press, Cambridge 1971, p. v; 69, 74 and *passim*.

⁴⁶ P. MANCUSO (ed.), *Shabbatai Donnolo's Sefer Hakhmoni. Introduction, Critical Text, and Anno-*

tated English Translation, Brill, Leiden - Boston 2010, p. 230 and *passim*.

⁴⁷ S.D. LUZZATTO, *Mikhtav gimel*, in «Kerem Hemed» 7 (1843), pp. 60-67. P. MANCUSO *Il Sefer ha-mazzalot di Šabbatai Donnolo*, in P. CORDASCO, F. PAPPALARDO, N. SURICO (curr.), *L'umanità dello scriba. Testimonianze e studi in memoria di Cesare Colafemmina*, Messaggi Edizioni, Cassano delle Murge 2015, pp. 103-143.

SUMMARY

This preliminary study presents a working hypothesis that aims to re-evaluate the role that the text known as *Barayta de-Šemu'el* played in the history of astronomy, and specifically, in the transmission of some astronomical concepts from India, through Persia, to Europe. The ties between the *Barayta de-Šemu'el* and Persian and Indian texts are investigated from the point of view of the astronomical concepts that they present, showing an apparently unbroken continuity.

KEYWORDS: Barayta de-Shemu'el; History of astronomy; History of science; Bundahishn; Indian astronomy.

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Per l'ebraico si deve utilizzare esclusivamente la font *SBL Hebrew*, e per la traslitterazione si segua il sistema sotto indicato. La trascrizione dell'ebraico indica solo la qualità delle vocali e non rende la pronuncia fricativa delle *BeGaDKeFaT* se non nella ב – b/v e nella פ – p/f e l'articolo va prefisso alla parola con un trattino: es. *ha-šamayyim*. Per il greco si usi Greek e per i diacritici dell'ebraico (*ḥ ṭ ṣ ś e š*) le font *Times New Roman normale* (TNR normale) e *Times New Roman Special* (TNRSp) *G1* e *G2*; per *g²* e *Ḍ* si usi *Timlj* per il tondo e *Timljita* per il corsivo. I passaggi per inserire correttamente un diacritico nella trascrizione – pena il mancato inserimento – sono i seguenti: dal documento di testo seleziona nella finestra delle fonti quella per il diacritico > “inserisci simbolo” > nella finestra delle lettere selezionare la font per il diacritico, ad es. *TNRSpG1* o *G2*, *Timlj* o *Timljita* > trovare il diacritico e inserirlo con doppio clic o, per comodità, con un tasto di scelta rapida. Se a video per i diacritici compare una disomogeneità non importa, perché nella stampa scomparirà. Chi non possedesse le fonti richieste, le chieda alla redazione. I testi non composti secondo queste norme, non saranno accettati.

Traslitterazione dei caratteri ebraici e segni adottati

א	' (non iniziale nè finale)		
ב	b/v	מ	m
ג	g	נ	n
ד	d	ס	s
ה	h	ע	'
ו	w	פ	p/f
ז	z	צ	š
ח	ḥ	ק	q
ט	ṭ	ר	r
י	y	ש	ś
כ	k	שׁ	š
ל	l	ת	t

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Ordinazioni e abbonamenti: Casa Editrice Giuntina, Via degli Artisti 6/i, I-50132 Firenze, Tel. +39 055.2476781; Fax +39 055 2009800, e-mail: info@giuntina.it; www.giuntina.it



€ 50

ISBN 978-88-8057-903-8



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